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NON-WOOD FOREST PRODUCTS

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Report of the International Expert Consultation on Non-Wood Forest Products

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Report of the International Expert Consultation on Non-Wood Forest Products

Yogyakarta, Indonesia

17-27 January 1995

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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FOREWORD

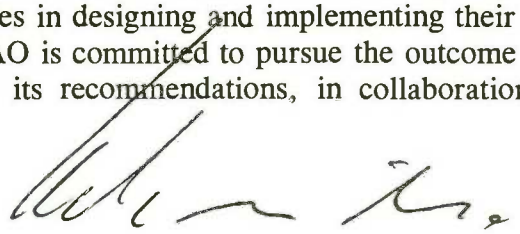
The International Expert Consultation on Non-Wood Forest Products, hosted by the Ministry of Forestry, Government of Indonesia, was held in Yogyakarta, 17-27 January 1995. This was the first world-level meeting exclusively to draw attention on the problems and potentials of non-wood forest products.

A number of national and international agencies, namely, Appropriate Technology International, CATIE, Conservation International, CIFOR, CSIRO-Australia, GTZ, Herbarium Bogoriense, ICIMOD, ICRAF, IDRC-Canada, IITA, IUCN, NORAD, NRI-UK, ODA-UK, ORSTOM-France, PROSEA, Unesco, UNIDO, US-AID, USDA-Forest Service, and WWF collaborated in the effort by providing background materials and papers, by sponsoring participants and/or by direct attendance. Further, support was received from the different departments of FAO, FAO Regional Offices and field projects.

The outcome of the meeting was substantial, with clear recommendations for action. We have pleasure in sharing it with all interested persons and institutions.

I wish to take this opportunity to gratefully acknowledge the contributions of all those who attended the Consultation and their active participation in the discussions, which made this meeting an outstanding success. I wish also to record my thanks to all those who collaborated with and supported the efforts of FAO and the Government of Indonesia in organising this meeting. My thanks are due to all the resource persons for introducing the different topics for discussion. The chair persons of the different plenary and group sessions (Wangari Maathai, John Coppen, Ana Sittenfeld, Toga Silitonga, Sami Khalid, John Joseph, Elizabeth Widjaja, Marco Palacios Mendez, and Wim Bergmans) and the respective rapporteurs (Ann Koontz, Madhav Karki, Ousseynou Ndoye, Julio Ruiz Murrieta, Bruce Campbell, Pitamber Sharma, Alec Chang, Manuel Ruiz Perez, and Barry Evans) deserve a special word of thanks for their additional efforts to give a proper order and shape to the Consultation report; as also David Taylor for supporting and coordinating the reporting task. I am very grateful to all the members of the secretariat for their devoted service, particularly to Gusti Tantra, the Director, and Sri Murniningtyas, the Liaison Officer. Finally, I have to say a special word of appreciation and thanks to C. Chandrasekharan, Secretary of the Consultation, for the methodical and meticulous manner in which he planned and organised the meeting.

No doubt, the perspectives on conservation, management and utilization of non-wood forest products as they emerged from the discussion at the Consultation and the light they throw on how to address the socio-economic, environmental, institutional and policy issues will help the national and international agencies in designing and implementing their action programme on non-wood forest products. FAO is committed to pursue the outcome of the Consultation and support implementation of its recommendations, in collaboration with partner agencies and countries.



Karl-Hermann Schmincke
Director
Forest Products Division
Forestry Department

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ABBREVIATIONS

ACIAR	Australian Centre for International Agricultural Research
ACT	Australian Capital Territory
ADB	Asian Development Bank
ADMADE	Administrative Management Design
AFC/EFC/NEFC	Committee on Mediterranean Forestry Questions
AIDAB	Australian International Development Assistance Bureaux
ANMAP	Asian Network on Medicinal and Aromatic Plants
ANU	Australian National University
APAN	Asia Pacific Agroforestry Network
ASEAN	Association of Southeast Asian Nations
ATI	Appropriate Technology International
ATSC	Australian Tree Seed Centre
BAPPENAS	Badan Perancanaan Pembangunan Nasional, National Development Planning Board
CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
CARICOM	Caribbean Community Secretariat
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CBOs	Community-based organisations
CCAB	Central American Convention on Forests
CCCN	Customs Co-operation Council Nomenclature
CCF	Chief Conservator of Forests PROAFT (Programa de Accíon Forestal Tropical)
CGIAR	Consultative Group on International Agricultural Research
CI	Conservation International
CIF	Cost, insurance and freight
CIFOR	Centre for International Forestry Research
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CN	Combined Nomenclature
COICA	Confederation of Indigenous Peoples of the Amazon Basin
CPC	Provisional Central Product Classification
CPRs	Common Property Resources
CRC	Collaborative Research Centre
CSC	Commonwealth Science Council
CSIRO	Commonwealth Scientific and Industrial Research Organization - Australia
CTO/DTO	Crude Tall Oil and/or Distilled Tall Oil
DBH	Diameter at breast height
DGF	Director General of Forestry
DNA	Deoxyribonucleic acid
EMAS	European eco-audit and management scheme
ERDB	Ecosystems Research and Development Bureau - the Philippines
ESCOP	European Scientific Cooperative for Phytotherapy
EU	European Union
F/FRED	Forestry/Fuelwood Research and Development
FAO	Food and Agriculture Organization of the United Nations
FB-SSEs	Forest-based small-scale enterprises

FOB	Free on board
FONESSA	Forest research networking in sub-Saharan Africa
FORIS	Forest Resources Information System
FORSPA	Forestry Research Support Programme for Asia and the Pacific
FORTIP	Forest Tree Improvement Project
FRDC	Forest Research and Development Centre - Indonesia
FRIM	Forest Institute of Malaysia
FRSC	Forest Research and Survey Centre
FSIV	Forest Science Institute of Viet Nam
GDP	Gross Domestic Product
GEMINI	Growth and Equity through Microenterprise Investments and Institutions Project
GIS	Geographic Information System
GMP	Good Manufacturing Practices
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH
HATUSA	Harmonized System Tariff USA
HKH	Hindu Kush-Himalaya
HS	Harmonised Commodity Description and Coding System
IAEA	International Atomic Energy Agency
IBPGR	International Board for Plant Genetic Resources (changed to IPGRI)
ICIMOD	International Centre for Integrated Mountain Development
ICRAF	International Centre for Research in Agroforestry
ICUC	International Centre for Underutilized Crops
IDRC	International Development Research Centre of Canada
IER	income equivalent ratio
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IFRA	International Fragrance Association
IIED	International Institute for Environment and Development
IITA	International Institute for Tropical Agriculture
ILO	International Labour Organization
IMF	International Monetary Fund
INBAR	International Network on Bamboo and Rattan
INBio	National Biodiversity Institute of Costa Rica
IPGRI	International Plant Genetic Resources Institute
IPR	Intellectual Property Rights
IRA	Institute of Resource Assessment
ISIC	International Standard Industrial Classification of All Economic Activities
ISNAR	International Service for National Agricultural Research
ISO	International Organization for Standardization
ISTC	International Standard Trade Classification
ITC	International Trade Centre
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature (World Conservation Union)
IUFRO	International Union of Forestry Research Organizations
JECFA	Joint FAO/WHO Expert Committee on Food Additives
kg	kilogramme
KMTNC	King Mahendra Trust for Nature Conservation
KPH	an Indonesian acronym for forest district

LER	Land equivalent ratio
MAB	Man and Biosphere programme
MFP	Minor Forest Products
MPT	Multipurpose tree
NCI	National Cancer Institute
n.e.c.	Not elsewhere classified
NFTA	Nitrogen Fixing Tree Association
NGOs	Non-governmental organisations
NORAD	Norwegian Agency for Development Cooperation
NPV	net present value
NRI-UK	Natural Resources Institute
NSW	New South Wales
NTFP	Non-timber forest product
NWFP(s)	Non-wood forest product(s)
ODA	Overseas Development Administration - UK
ODI	Overseas Development Institute - UK
OECD	Organisation for Economic Cooperation and Development
OFI	Oxford Forestry Institute
OLAFO	Conservation for Sustainable Development in Central America
ORSTOM	French Institute of Scientific Research for Cooperative Development
PNG	Papua New Guinea
PPF	Plan Piloto Forestal
PRA	Participatory rural appraisal
PROAFT	Programa de Accíon Forestal Tropical
PROSEA	Plant Resources of South East Asia Foundation
QFRI	Queensland Forest Research Institute
R&D	Research and development
RAPA	Regional Office for Asia and the Pacific
RDFN	Rural Development Forestry Network of ODI
RECOFTC	Regional Community Forestry Training Centre
RFD	Royal Forest Department - Thailand
RIFM	Research Institute of Fragrance Materials
RLAC	Regional Office for Latin America and the Caribbean
ROSTSEA	Regional Office for Science and Technology for South East Asia
SAF	Society of American Foresters
SAM	Standard Air Mancur
SEEA	System of Environmental Economic Account
SFO	Senior Forestry Officer
SITC	Standard International Trade Classification
SNA	Systems of National Accounts
STOL	short take-off and landing (aircraft)
TCDC	Technical cooperation among developing countries
TFAP	Tropical Forests Action Programme
TFT	Tropical Fruit Trees
TREEDAT	Tree performance database
TRIFED	Tribal Cooperative Marketing Development Federation of India Limited
TRIPs	Agreement on Trade-Related Intellectual Property Rights
UNAC	Upland NGO Assistance Committee at the Philippine Uplands Resource Centre
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme

UN-ECE	United Nations Economic Commission for Europe
UNEP	United Nations Environmental Programme
Unesco	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNSW	University of New South Wales
US-AID	United States Agency for International Development
USDA	United States Department of Agriculture
WA	Western Australia
WCED	World Commission on Environment and- Development
WCMC	World Conservation Monitoring Centre
WHO	World Health Organization
WRI	World Resources Institute
WWF	World Wide Fund for Nature

EXECUTIVE SUMMARY

In recent years, non-wood forest products (NWFPs) have attracted considerable global interest. This is due to the increasing recognition that NWFPs can provide important community needs for improved rural livelihood; contribute to household food security and nutrition; help to generate additional employment and income; offer opportunities for processing enterprises; contribute to foreign exchange earnings; and support biodiversity conservation and other environmental objectives.

The International Expert Consultation on Non-Wood Forest Products which met in Yogyakarta, Indonesia, 17-27 January 1995, considered the relevant aspects relating to the development of NWFPs.

The Consultation observed that the different roles and contributions of NWFPs are complementary to each other. This complementarity can be enhanced through community participation. It would call for clear policies and improved technologies.

The Consultation further noted that: NWFPs can prove to be an important key to the sustainable management of forest resources; sustainable management and harvesting of NWFPs especially of those occurring among the biological diversity of natural forests is extremely complex; their post-harvest treatment involves complex technology; variation in the level of processing of NWFPs is considerable with corresponding variation in process technology; marketing of non-wood goods and services of forests calls for higher level of capabilities; quality standards for internationally-traded NWFPs tend to be rigid; sustainable management and utilization of NWFPs are highly demanding on scientific knowledge, statistical information, technology, skills and research support. It acknowledged that the development of NWFPs is a challenging field, because it involves a fundamental change in the approach to ecological, socio-cultural, technological, trade and institutional issues associated with forestry.

The Consultation urged that concrete actions should be taken for realising the potentials fo NWFPs. In that regard, it underlined the need for: managing NWFPs as part of total ecosystem; rational use of biodiversity including biodiversity inventories and information management; ensuring "eco-efficiency", social equity and sustainability. These have to be achieved through rational policy measures and strategies, economic incentives, cost-effective technology and community participation.

The Consultation discussed the issues to be addressed and actions to be pursued for promoting NWFPs, in terms of the following broad areas: socio-economic benefits, processing and marketing, resource management and environment, and institutional considerations including definition and classification.

In most countries, no policies specifically govern the management, harvesting, processing and marketing of NWFPs. This results in lack of adequate and appropriate provisions for: community participation including tenurial rights and incentives, usufruct rights, investment and involvement of private sector, credit facilities, regulations relating to processing and trade, evaluation of social and environmental values and establishment of relevant standards. The Consultation strongly felt that there is need to develop a general

policy framework on NWFPs suitable to serve as a model to be adapted by countries and integrated into their national forest policies.

The Consultation took note of the fact that the value of non-wood forest goods and services are not adequately quantified or recorded. This has resulted in NWFPs being given much less importance and priority than they deserve by planners and decision-makers. The lack of a proper classification of NWFPs harmonised with the existing system of product and activity classifications also makes it difficult for developing a statistical system for these products and thereby to gain recognition in the system of national accounts. For this purpose the scope of NWFPs was proposed to be defined as "goods of biological origin other than wood, as well as services derived from forests and allied land uses".

There is also paucity of information of non-statistical nature: distribution of resources, kinds and variety of products, their potential uses and values, harvesting and production technology, production and trade options, product demand and prices, market chains, research activities and results and so on. There is no adequate mechanism for disseminating available information within and among countries. The Consultation stressed the need for better information and for mechanisms to facilitate free flow of information. In this connection, it is necessary to recognize and assimilate the existing traditional sources of knowledge on NWFPs, their uses and management.

Increasing information flows requires action at all levels: local, national, regional and international, including development of methods and mechanisms for collecting, analyzing and comparing information as well as strengthening of existing systems.

An important aspect, which the Consultation considered in this context, was the rights of countries over the value of information on biological and chemical diversity of forests. It strongly felt that there is need to protect the right over the information (for example, resulting from chemical and biological prospecting), as is the case of other intellectual properties. Sovereign rights over biodiversity have been recognised internationally by the 1992 Biodiversity Convention.

The need for providing an appropriate value for environmental and socio-cultural functions of forests is equally important. Economic gauges alone are not adequate for planning sustainable use of NWFP resources. The Consultation agreed that economic objectives must be developed in conformity with the larger context of ecosystem and community dynamics.

The Consultation identified an important basic requirement for sustainable management of NWFP resources, i.e. organised participation of local community in decisions and actions on management and use of these resources. Effective participation would call for improved support services such as extension and credit, coherent policies and strategy measures and access to information and resources. Government agencies, NGOs, credit institutions and the private sector can all help to facilitate informed and organised participation.

Another important requirement relates to research and technology development relating to the different aspects of NWFPs such as resource development, domestication of species, conservation measures, environmentally sound harvesting, product development and processing and marketing and trade.

The Consultation underscored the need for strengthening research capabilities in countries as well as establishment of research networks for exchange of research results and experience. South-South and North-South collaboration needs to be promoted for research and development of NWFPs. The Consultation also identified several priority areas.

Lack of institutional capability is often a major constraint to NWFP development and weaknesses in the interrelated aspects discussed above is a symptom of an underlying lack of institutional capacity. Institutional strengthening involving clear policies, rules and regulations, development of skills, improved strategic planning, organisational systems and structures, decentralisation of activities and mechanisms for committed participation was flagged as an area requiring urgent attention.

Based on intensive discussions, the Consultation made recommendations addressed to government policy-makers, international organisations, donor agencies, NGOs and financial services, in order to: enhance socio-economic benefits of NWFPs; promote their sustainable management, marketing and utilization; improve scientific knowledge, technology and skills relevant for developing NWFPs; develop appropriate policies and strategies to support their development; improve and expand basic statistical and other information on production, value addition, and trade in NWFPs; enhance institutional capabilities; establish networks for exchange of information; introduce rules and regulations to promote decentralization of resource management through active community participation; establish other institutional mechanisms, including access to resources and credit; and strengthening research capabilities.

The Consultation, in its recommendations, specifically requested FAO, in collaboration with other relevant agencies, to:

- develop and provide guidelines for sustainable management of NWFPs;
- promote establishment of information networks on NWFPs:
- compile a directory of available databases, as well as of institutions working on NWFPs;
- draft a policy framework on NWFPs, suitable to be integrated within the overall forest sector policy, in order to serve as a model to be adapted by countries;
- collaborate with relevant agencies/institutions in addressing specific trade issues such as of information about chemical and biological diversity of forests;
- develop a system of classification of NWFPs, harmonized with the existing international systems such as International Standard Industrial Classification (ISIC) and Standard International Trade Classification (SITC), in collaboration with the UN Statistical Office.

It further requested international funding and technical assistance to support new initiatives in the area of NWFPs, and looked forward to exciting new developments. The Government of Indonesia indicated interest in establishing a facility for international exchange of information on NWFPs, with international support.

The Consultation concluded that, within an overall strategy of sustainable forest management, NWFP activities hold potential for local livelihood improvement and maintenance of forest ecosystems, as well as economic growth. Realizing the opportunity requires long-term commitment by everyone.

Hon. Djamaloedin Soeryohadikoesoemo, Minister of Forestry, Government of Indonesia, opening the Expert Consultation in the traditional style by striking the gong.

Participants at the Expert Consultation.

INTRODUCTION 1

THE CONSULTATION

At the invitation of the Government of Indonesia, an International Expert Consultation on Non-Wood Forest Products was held in Yogyakarta from 17 to 27 January 1995. This was the first world-level meeting exclusively to draw attention on non-wood forest products (NWFPs).

The Consultation was inaugurated by Hon. Djamaloedin Soeryohadikoesoemo, Minister of Forestry, Government of Indonesia, at the opening ceremony on 17 January 1995.

In all, 102 participants attended the Consultation. These included 60 experts and 42 observers from 45 countries/organisations. There were 28 participants from international development organisations and NGOs and nine from international research institutions (see list of participants in Appendix 1). Participation reflected a wide range of expertise, from resource conservation to sociology, anthropology, ecology, bio-chemistry, pharmacology, nutrition, planning, economics, statistics, industrial development, trade and marketing and research management.

BACKGROUND

The use of NWFPs is as old as human existence. In subsistence and rural economies the role and contributions of NWFPs are crucial because of their richness of variety, as sources of food, fodder, fibre, fertilizers, herbal potions, construction materials and cosmetic and cultural products. They support village-level artisanal and craft activity. NWFPs provide raw material to support processing enterprises. They include internationally important commodities used in food products and beverages, confectionary, flavourings, perfumes, medicines, paints, polishes and more.

Some 80 percent of the population of the developing world depend on NWFPs for their primary health and nutritional needs. Several millions of tribal people all over the world depend on these products for meeting their subsistence consumption and income needs. In many countries NWFPs form an important component of forest products exports.

It is paradoxical that, in spite of their real and potential value, most NWFPs remain grouped as *minor* products of forests. These products rarely feature in statistics and are hardly studied or researched.

There are several constraints affecting their development.

Most NWFPs are often associated with traditional uses that are not widely known and/or they are linked to the problem of poverty and subsistence.

Transactions related to NWFPs largely take place in households and small-scale units, mostly outside the established marketing systems/channels, thus forming part of unorganized, informal sector. Operations are often seasonal. For these reasons, they are often overlooked by planners. Their local uses go unrecorded.

Timber-orientation of forestry profession, and the bias of planners in favour of large-scale enterprises, often leave NWFPs at a disadvantage. Their production, at best, was considered incidental or subsidiary. A wrong perception still exists that forests which do not produce timber are of low or no value. In timber forests, non-timber plants are often treated as weeds. This causes conflicts in resource use between wood and non-wood products, and also between the concerned user groups.

Sustainable management of NWFPs, especially of those occurring among the biological richness and ecological diversity of natural forests is extremely complex. This has resulted in its being left out from management prescriptions, and preference being given to comparatively easier timber management.

There is also overlapping of uses and sources. Same product can be produced from different non-wood raw materials; and same non-wood raw materials can provide different products. This adds to the complexity of managing and utilizing the resource.

All these constraints are capped by lack of knowledge about the potential of NWFPs to support sustainable and remunerative enterprises. Statistical information to underpin their importance is sorely lacking. There is only very limited information about their resource base. Being considered *minor*, there was hardly any attention paid to it in terms of inventory, management, conservation and related research. Nor has the necessary skill base been developed.

Some of these constraints, in one way or other, are related to the characteristics of the products. NWFPs as a group is extremely heterogenous, requiring a mix of different skills, technology and research support in their management. Resources of these products are often dispersed and vary considerably in their concentration. This, to some extent, leads to their localized importance. Knowledge on NWFPs to a significant extent is local, empirical and often linked to local culture. This makes information gathering or exchange more difficult.

Recently, however, the significant environmental and economic roles of NWFPs have come into focus through better understanding of their importance. The new market preference for natural products and emphasis on efficient and sustainable use of natural resources have helped this development. It has also become apparent that with responsible use and proper husbandry, the NWFPs hitherto largely confined to subsistence use can also support sustainable and remunerative enterprises and increase the contribution of forestry to development. Consequently, there has been an increasing interest on NWFPs. They received notable attention at the United Nations Conference on Environment and Development (UNCED) 1992.

In most cases, this new interest is yet to be transformed into commensurate and consistent action. There is need to correct the technological and institutional inadequacies in order to increasingly realise the socio-economic potentials of NWFPs and to bring them into the main stream of modern economies, while retaining their accessibility of traditional societies.

The core of all issues affecting NWFPs is that it is considered as *minor*. It is a fallacy; and the central challenge is to remove that fallacy.

To help understand and realise the potentials of NWFP development and the challenges involved in this regard, FAO collaborated with other interested agencies and

conducted regional expert consultations in Asia and the Pacific, Africa and Latin America and the Caribbean. These regional consultations strongly highlighted the need for: interregional exchange of information on NWFPs; a generally-accepted international definition and classification; national and international initiatives for resolving problems common to many countries; and broad guidelines and directions for post-UNCED actions in forestry related to NWFPs.

The International Expert Consultation on Non-Wood Forest Products, held in Yogyakarta, 17-27 January 1995, represented the culmination of a series of regional expert consultations. This meeting of experts facilitated interregional sharing of experiences and views on how the issues and needs of the NWFP sub-sector should be addressed.

OBJECTIVES

The International Expert Consultation on Non-Wood Forest Products had the following objectives:

- to gain better insight into the problems and issues to be addressed and the potentials for developing NWFPs in an environmentally sound manner;
- to identify and propose priorities for action in promoting development of NWFPs, taking into consideration their socio-economic, technological, environmental and institutional dimensions;
- to develop a broad strategy framework and guidelines for sustainable development of NWFPs;
- to provide suggestions/recommendations for action at various levels to support national efforts on NWFPs.

INAUGURAL ADDRESS

The opening ceremony of the Consultation was addressed by Hon. Djamaloedin Soeryohadikoesoemo, Indonesian Minister of Forestry; Prof. Dr. Sujudi, Minister of Health; Prof. Emil Salim, President of the Indonesian Biodiversity Foundation; and Mr. K.H. Schmincke, Director of the FAO Forest Products Division. The Minister of Forestry indicated the increasing importance of NWFPs for Indonesia both from the socio-economic and environmental points of view. He underlined the significance of these products in supporting sound and sustainable management of forest resources for overall national benefit.

The Minister of Health highlighted the important contributions of NWFPs towards improved nutrition and health of the rural population. He also stressed the need for scientifically managing the medicinal plant resources.

Prof. Emil Salim outlined the principles to be considered in the management and utilisation of NWFP resources, in order to sustain the physical and socio-cultural environment: stability of the ecosystem and maintenance of bio-diversity; eco-efficiency to produce more with least drain on the resource; sustainability of the resource base by confining their use within the threshold of renewability; cost-effectiveness and cost-benefit balancing incorporating the benefits of NWFPs which are not currently captured in the

calculus of benefits and costs; equity in distribution of socio-economic benefits, particularly for local people. To implement these principles, he called for a three-pronged approach through: appropriate government policy and regulations; economic incentives that use market mechanism to guide resource utilisation in a sustainable direction; and community participation.

Speaking on behalf of FAO, the Director of the Forest Products Division welcomed the participants and thanked the Government of Indonesia for hosting this important meeting. He also expressed the wish of FAO to strengthen the cooperation with the Government of Indonesia in the many fields of forestry in which Indonesia is successfully engaged.

CONSULTATION PROGRAMME

The Consultation programme consisted of field visits and discussion sessions. Off-session programme of video shows and slide presentations were also organised (see Appendix 2).

FIELD VISITS

The participants were taken on field visits, 18-20 January 1995, to observe activities related to the subject of the Consultation — growing, managing, harvesting, processing and utilization of NWFPs. NWFPs included in the field visits were indigenous herbal medicine, rattan products, cayuput (*Melaleuca leucadendron*) oil, honey, cocoons/silk, rosin and turpentine (see Summary of Field Visits in Appendix 3).

DISCUSSION SESSIONS

The Consultation discussed the problems and prospects of NWFPs under each of the following topics of concern: socio-economic benefits, processing and product refinement, marketing and trade, resource management, environmental aspects, institutional considerations, definition and classification.

Socio-Economic Benefits

A better understanding of NWFPs' overall socio-economic contributions to the subsistence and income of local communities and to national economies facilitates better programme response. NWFPs play an important role in food security, nutrition and community health. Their benefits are relatively more important for poorer households, women and disadvantaged groups; this has important consequences for planning NWFP activities. Interventions need to involve people's participation in the development process and the equitable distribution of benefits to different groups. Other issues to consider include changing patterns in local NWFP use and access to resources, and factors affecting the large informal sector of small NWFP enterprises.

Processing and Product Refinement

Often environmental and economic viability of NWFP activities depend on the nature of harvesting and processing techniques employed. NWFPs and their various markets involve a wide range of primary and downstream processing. More of an NWFP's value can be captured by producers through local processing or semi-processing. This involves knowledge about the requirements for consistent supply and quality of raw materials, energy needs and

technology of processing. Improved pre- and post-harvest technology can help improve these gains, along with greater processing efficiency. Producers can effectively explore these options collectively and with technical and marketing support.

Marketing and Trade

Most failures of NWFP programmes result from inattention to markets. With increasing pressure on forest resources, well-informed NWFP marketing strategies could be crucial for maintaining the resource. Producers need better information on the nature and volume of existing NWFP trade, markets and product standards. With the increase in green consumerism, knowledge of international market concerns and quality standards of products is needed. More rational and transparent market transactions throughout the production/market chain are needed for producers to receive a more equitable share of the product value. In general, a greater appreciation of marketing and market information is needed by producers, NWFP-programme planners and NGOs.

Resource Management

Management of NWFP resources is critical to the future of remaining natural forests. A first step is better assessment of the resource and what represents a sustainable harvest level of different forest produces. NWFPs can play a role in more sustainable forestry through multiple use management for wood and non-wood products. Sustainable NWFP harvesting can also take place in forest reserves and buffer areas. Resource management needs to include mechanisms for resolving conflicts in land-use objectives. Domestication of species (e.g. through agroforestry) is one alternative for minimizing the impact of increasing NWFP demand. Research is needed to assess and learn from local knowledge and to improve management systems, and to improve harvesting and post-harvest technologies.

Environmental Aspects

Given the historic trends of undervaluing forest resources and products, it is especially important that planners understand the real value of NWFPs and find ways for framing economic aims within a context of environmental integrity. Issues that require study include: the amenability of NWFPs for sustainable management; contribution of NWFP resources to biological diversity; resource sustainability in NWFPs' transition from subsistence to market economy; improved valuation of environmental functions in environmental impact assessments; and the impacts of over-exploitation. Other measures to reduce adverse environmental impacts include reducing waste in processing industries and promotion of service benefits such as ecotourism.

Institutional Considerations

Success of programmes for development of NWFPs ultimately hinge on real commitment to addressing entrenched institutional blindspots. This requires greater awareness of issues on the part of policy-makers, to gain policy and legislative support. Institutional support for NWFP activities needs better coordination and emphasis on research, technology transfer, human resource development, and improved information systems. It is also necessary to ensure more flexible credit services for producers, support for local producers' organizations, and local participation in NWFP development. International agencies and networks can support national initiatives in these areas and suggest guidelines for national action.

Definition and Classification

Lack of clear definition and consistent classification for NWFPs has perpetuated the long-standing institutional neglect of NWFPs. To address this, nomenclature and definition need to be rationalised, first at the international level. A scheme for standard international classification of NWFPs can build on, and be harmonised with, the existing classification systems, such as the International Standard Industrial Classification (ISIC) and Standard International Trade Classification (SITC). Acceptance of such a classification can help to build linkages for better statistical systems and databases on NWFPs and better recognition of their importance.

Grouping of Theme Areas

Based on their linkages, the seven topics were grouped into four interrelated theme areas, to facilitate discussion: socio-economic benefits; processing and marketing; resource management and environment and institutional considerations.

Organisation of Discussions

There were five days of discussion sessions (21, 23-26 January 1995). The first four days were devoted to the four theme areas, and the fifth day for considering the reports of the theme sessions and drawing up of recommendations. Seven theme papers and eleven satellite papers were presented in plenary sessions (see Appendix 4). Many additional reference materials related to the topics of discussion were also distributed (see Appendix 5).

Each day's sessions had plenaries and group discussions. For each of the theme sessions, after introduction of the theme and general discussions at the first plenary, the participants were divided into five regional/organisational groups (Africa, Asia-Continental, Asia-Insular and the Pacific, Latin America and the Caribbean, and donors/development assistance agencies), for in-depth discussion. These groups reported the outcome of their deliberations to a second plenary (see group reports in Appendix 6). On the fifth day subject matter groups were formed, each to revisit the four themes based on the regional/organisational group reports. This provided opportunities to examine issues under all possible points of view.

SUMMARY OF OUTCOME

The Consultation emphasized the importance and major role of NWFPs for: meeting the basic needs of indigenous and rural communities for a variety of goods (including foods) and services and providing them with income and employment, thereby contributing to household food security and nutrition; supporting environmentally-sound management of forest resources; contributing to value addition through downstream processing and foreign exchange earnings. It noted that the development of NWFPs is a challenging field, because it involves a fundamental change in approach to ecological, silvicultural, socio-economic and trade issues associated with forestry. In fact, NWFPs are not just a group of products. They comprise some of the vital elements of a concept of integrated and sustainable management of forest resources. There is need that they be given adequate recognition in the system of national accounts.

The Consultation further noted that: NWFPs can prove to be an important key to the management of forest resources in a sustainable way; sustainable management of NWFPs,

especially of those occurring among the biological richness and ecological diversity of natural forests, is extremely complex; harvesting of medicines, phytochemicals, edible products, honey, gums and resins, mushrooms, etc., and their post-harvest treatment involve complex technology; variation in the level of processing of NWFPs is considerable with corresponding variation in process technology; marketing of non-wood goods and services of forests calls for higher level of capabilities; quality standards for internationally-traded NWFPs tend to be rigid; sustainable management and utilization of NWFPs are highly demanding on scientific knowledge, statistical and other information, technology, skills and research support.

The Consultation focused on concrete actions for realising the potentials of NWFPs and the outcome of the discussions offer guidelines for future action at international, regional and national levels.

At international level, a number of issues and actions required were well highlighted regarding the various needs of international cooperation in the development of NWFPs including: (i) properly featuring NWFPs in the international agenda and including them as an important component of UNCED follow-up in forestry; (ii) encouraging policy measures that would heighten the status of NWFPs in national economies and specifically in forest economy of interested countries; (iii) integrating NWFPs in the research, education and extension programmes (the role of CGIAR was highlighted as well as the responsibility of regional intergovernmental organizations); (iv) generating funds for the development and promotion of NWFPs through appropriate mechanisms; regional banks have an important role to play in this.

At regional level, it was generally thought that countries should endeavour to create regional or sub-regional clearing houses to promote collection, processing and dissemination of information and for transfer of technologies. Technical cooperation among developing countries came high under this. The discussions in regional groups did actually help in better identifying regional problems and issues. Some specific eco-regional/geographic needs were highlighted: the highlands and mountains especially by Asia and Latin American groups; the drylands by the African group. The relevance of special efforts for forest dwellers or local isolated communities came strongly in all groups.

At national level, many problems were highlighted but some issues were referred to with special strength; these related to (i) an articulated policy for NWFPs; (ii) the promotion of income generation and contribution to food security by NWFPs; (iii) the significance of NWFPs for local communities and importance of the local/indigenous knowledge developed by these populations; (iv) the need to protect this local knowledge and technology from oblivion and/or "plunder"; and (v) the urgency to get national institutions organized and to be fully informed to cater for the related needs that encompass the protection of their biological riches, genetic resources and intellectual property of local people.

Report by theme areas is given in the following pages. It is expected that this report will help to promote appropriate action by national and international agencies to promote development of NWFPs. It aims to serve the information needs of policy-makers and planners, and to help stimulate entrepreneurial interest. Although the formal study of NWFPs is still young, the informal base of experience is vast. This report aims to reflect this wealth with examples that illustrate discussion points, presented as text boxes.

CLOSING OF THE CONSULTATION

The meeting was declared closed by Dr. Toga Silitonga, Senior Advisor to the Minister of Forestry. The participants expressed appreciation and thanks to the Government of Indonesia and FAO for organising this important Consultation and specially commented the organisers for the efficient manner in which the meeting was conducted.

SOCIO-ECONOMIC BENEFITS 2

INTRODUCTION

Discussion on socio-economic benefits of NWFPs was based on one theme paper and three satellite papers (see Appendix 4.1). The resource person, Mr. Arnold, introduced the subject and presented his paper: "Socio-Economic Benefits and Issues in Non-Wood Forest Products Use".

Local Importance of NWFPs: Viet Nam

The Than and Tai ethnic groups in Viet Nam spend up to 235 days per year hunting and collecting forest products. In Viet Nam and Laos, NWFP often provide more income than agricultural products, such as rice.

In the Bat Xat district of Lai Chau province, Viet Nam, Speth (1991) recorded the following range of products:

Food: Vegetables collected in the forest supplement nearly every meal. Villagers collect wild honey for local consumption, and use the wax to make textiles shiny. They also hunt wild boar, deer, goat, monkeys and birds.

Medicines: A wide range of bark, resin, fruit, roots, and flowers from local trees and herbs provides local medicines.

Income: Local growers of the herb Tao qua (*Amomum aromaticum*) can obtain up to 300 kg/ha of fruits; 1 kg of dried fruit can fetch US$ 1.00-2.50 across the border in China, where the seeds are used as a spice and in medicines. Villagers also sell a very valuable mushroom (possibly *Lentinus edodes*) at roughly US$ 3.00-5.50/kg dry weight, and an unidentified herb called Co thom at roughly US$ 6.20, both for resale over the China border.

Jenne H. de Beer, 1993. *Non-wood forest products in Indochina: focus — Viet Nam.* FAO, Rome.

The Consultation reviewed the socio-economic significance of NWFPs. These products play a crucial role in supporting community welfare as significant sources of edible product, fodder, fuel, fertiliser (mulch), fibres, medicines, gums and resins, oils and construction materials. Millions of people around the world living in the vicinity of forests, subsist on these products. They help to provide opportunities for additional employment and income. Activities related to the collection and primary processing of NWFPs lend themselves suitable for equitable participation of women and indigenous people.

While some of the NWFPs have entered national and international trade, they tend to have comparative advantage in supporting development of rural and backward areas.

The Consultation noted that planning for development of NWFPs should consider the trends and patterns in their use and their overall socio-economic contributions. In its

discussion, the Consultation considered the pattern and dynamics of NWFP use from different angles.

NWFP USE IN HOUSEHOLDS

NWFPs are important in household food security. They supplement household agricultural production (see Table 1). They are particularly important in reducing the shortages suffered during the "hunger periods" of the agricultural cycle. They help to even out seasonal fluctuations in availability of food. They often contribute essential inputs for household nutrition. They are also valued as components of social and cultural identity. However, these uses and values vary enormously from one area to the next.

Table 1: General contributions of forest foods to human nutrition

Type of forest food	Nutrient
Fruits and berries	Carbohydrates (fructose and soluble sugars), vitamins (especially C), minerals (calcium, magnesium, potassium); some provide protein, fat or starch
Nuts	Oils and carbohydrates
Young leaves, herbaceous plants	Vitamins (beta-carotene, C), calcium, iron
Gums and saps	Proteins and minerals
Invertebrates (insects, snails)	Protein, fat, vitamins
Vertebrates (fish, birds, mammals)	Protein

Source: Food and Nutrition Division, FAO 1994.

NWFPs and Human Nutrition: *Parkia* in Asia, Africa and South America

The seeds of *Parkia* species, a tree legume, provide food to rural communities of three continents.

In Southeast Asia, villagers in Thailand, Malaysia, and Indonesia eat the whole pods of *Parkia speciosa*, which is popular either raw or cooked as a vegetable in other dishes.

In West Africa, the beans of the Savannah species are widely fermented, from Gambia to Cameroon, to a nutritious traditional food that provides protein and fat. Children eat the pericarp raw, and gain Vitamin C.

In the semi-arid Chaco region of South America, the fruit of the related carob tree is made into a flour or beverage with a high level of absorbable calcium.

With its deep roots that reach underground aquifers, *Parkia* provides a reliable crop even in drought years.

Source: Food and Nutrition Division, FAO, 1995. Non-Wood Forest Products and Nutrition (in this volume).

Fodder is an important requirement in the rural areas which indirectly is a protein source for rural households. Apart from the forest grazing, there are a large number of forest species which help to meet fodder requirement.

Medicinal plants are important in the primary health care systems particularly in rural areas. The indigenous people have developed interesting, and often sophisticated knowledge systems about the use of a vast variety of plants for medicinal purposes.

Apart from meeting the subsistence needs, the potential of NWFPs for poverty alleviation is particularly important. The weight of poverty falls heavily on certain groups — among whom are tribal communities who depend on forests for employment and income derived through collection and processing of a range of NWFPs. Millions of rural workers process NWFPs at home or in local shop-floors to earn the incomes which enable them to survive.

NWFP-related activities can provide employment during slack periods of the agricultural cycle and provide buffer against risk and household emergencies. These activities, often, constitute only a part of the household activity. However, in several cases some of these activities such as rattan and bamboo harvesting, resin tapping, gum production and crocodile farming comprise the main source of income.

NWFPs IN NATIONAL ECONOMIES

At the national level, NWFP production and use, both in the informal and formal sectors, involve large numbers of people in harvesting, collecting, processing, marketing and in some cases even exporting. The informal nature of NWFP-transactions often result in the rural producers not receiving an equitable share of the benefits/profits, especially in situations where exploitative trade relationships exist.

NWFP activities are in may situations perceived as a sponge, and their use transitional, giving way to other enterprises and products as economy improves. Much of the production and trade in NWFPs are local in nature. Rural markets for most NWFPs do not grow rapidly if it caters only to local needs. Generally, growth of rural markets for NWFPs depends on growth in urban demand, which often tend to grow faster. Urban markets for NWFPs tend to encompass a narrower range reflecting competition from alternative products and changing consumption patterns, even though there is increasing demand for some products like traditional medicines and some forest foods.

Products used as industrial raw materials are often subject to competition from cultivated supplies or substitutes. This partly explains the boom-bust cycle of many NWFPs that enter international markets. As domestic economies grow, markets for NWFPs are likely to shift from being supply driven (where producers influence the market with low quality products) to demand-driven (where demands are diversified and quality requirements are high).

These are some of the constraints to be faced in developing NWFPs. Their competitiveness in an emerging economic situation depends on continuously enhancing the quality and range of uses of the products through organized and sound approaches. And there are successful examples. The dynamics of NWFPs will be influenced by the dynamics of the type and nature of support they receive. The Consultation strongly felt that the potential of NWFPs for providing increased social benefits calls for support and attention.

Organised development of NWFPs as a people-oriented enterprise activity with emphasis on efficiency can go a long way in enhancing benefits including employment and income, and contributing to a better socio-economic situation.

RESOURCE AVAILABILITY AND ACCESSIBILITY

The Consultation noted with concern that with depletion and degradation of forest resources supply of NWFPs both for direct consumption as well as raw material for processing would become scarce. Also, as NWFP resources become more valuable with commercialisation, the poorer sections would tend to get excluded due to increased competition for the resource, interference of influential middlemen and entry of new business interests. Through proper balancing of participation and providing secure access, it will be possible to improve the resilience of the NWFP sector. Rattan production and processing in Indonesia have proven to be relatively stable for these reasons. The Consultation stressed the need for, and importance of, appropriate policies and regulations in this regard.

PARTICIPATION AND BENEFIT SHARING

The Consultation discussed the issue of people's participation in NWFP activities and in benefit sharing, as distinct from commercial development of the products. Women, rural poor and indigenous communities were identified as specific target groups to benefit from the socio-economic contributions of NWFPs.

Women tend to get more heavily involved than men in NWFP-related activities, including higher return activities, especially at the rural level. As market demand for a product increases and size of activity expands, men often displace women in certain aspect of the activity.

Women in processing NWFPs: Brazil

In Acre, women have responsibility for processing all plants intended for human and animal consumption: foods, beverages, spices, medicines, and animal feed. Women in the area have refined skills in managing and exploiting some 150 species. Plants for food include wild and domesticated fruits and nuts, and field and garden crops. Processed products range from jams to chocolate, to cooking oil, to coffees and herbal teas. The women use over 50 plants for medicines. Pest repellents also come from the forest. In crafts, both men and women make baskets, brooms, and hats.

More than half of a group of women interviewed replied enthusiastically that if a market existed, they would make time to regularly prepare items for sale.

Karen A. Kainer and Mary L. Duryea, 1992. Tapping women's knowledge: plant resource use in extractive reserves, Acre, Brazil. *Economic Botany* 46(4):408-425.

Poor households and indigenous communities tend to be particularly dependent on NWFPs for subsistence and supplementary income. Even where they are involved in market-oriented production on NWFPs, it is often undertaken as a part-time activity. They tend to receive low return and are vulnerable to competition. One or more of the several issues such as access to resources, secure tenurial rights, access to market, remunerative prices for products, facility to upgrade skills of the workers and right to an equitable share of

benefits/profits need to be adequately addressed to enhance the socio-economic contributions of NWFPs to an acceptable level. The Consultation noted some interesting cases in this regard, i.e., the system of extractive reserves in Brazil and Guatemala and joint forest management in India.

The Consultation emphasised that it is dangerous for planners to look only at the income-generating benefits of NWFPs. In order to assess long-term viability, it is necessary to look at the impact of NWFP activities on the entire socio-economic system in which they occur. Accordingly, the importance of safeguarding the interests fo the local community was stressed. It needs to be appreciated that communities sometimes value the social and cultural importance of certain NWFPs more highly than their economic value.

ECOSYSTEMS AND DEVELOPMENT ALTERNATIVES

The Consultation recognised that strategies for developing NWFPs need to look at the ecosystem characteristics and the related management alternatives. Accordingly the nature and scope of socio-economic contributions of NWFPs would vary, for example, between mountain/upland ecosystems, lowland forests, mangroves, dry and arid lands, buffer zones and so on.

The Consultation heard the observations of participants on the potential role of NWFPs in the development of mountain regions, based on Nepal's experience. Mountain regions are often marginalised by mainstream development. Influenced by global and regional economic changes, Nepal's mountains have experienced population growth, depletion of common property resources, and disappearance of traditional institutions. Under these conditions, well-managed NWFP activities can offer the possibility of integrated mountain development through: more suitable use of renewable mountain resources; uses that do not compete with agriculture and that can conserve biodiversity; contribution to income generation and employment; providing a measure of bargaining control by mountain communities in valuing their resources; and help in developing participatory institutions that can ensure equitable distribution of benefits to mountain communities.

The case of Nepal's cross-border trade in high-value medicinal plants was mentioned as an example. Use of NWFPs for crop substitution for drug abuse control in the uplands of some Latin American countries and Thailand illustrates a different aspect of their contribution.

The Consultation also received a brief overview of a conceptual study on the socio-economic role of NWFPs in a logging concession in East Kalimantan, Indonesia, covering the socio-economic impacts on the people living in or near the concession (including indigenous communities, concession staff and their families, and recent settlers in the area), as well as the possibilities for downstream processing and marketing of the NWFPs from the area. In developing methods and framework for assessing the role of NWFPs in each specific eco-social system, research can help to ensure that important but economically invisible considerations (e.g. poverty alleviation, biodiversity conservation) are factored into development programmes.

The Consultation was further appraised of a systems approach being promoted by the International Network on Bamboo and Rattan (INBAR) for assessing the impact of developing these products using a "5 Es" (equity, employment, environmental harmony, enterprise and economic efficiency) methodology.

The Consultation also considered several related aspects such as rights and privileges of indigenous forest-dwelling communities, communal management of NWFP resources and the role of NGOs and extension agencies.

STRATEGIES FOR IMPROVING SOCIO-ECONOMIC BENEFITS

The Consultation proposed several strategic measures to improve the socio-economic benefits from NWFPs:

RAISING AWARENESS OF POLICY-MAKERS

In order that policies and related legislation reflect the needs of sustainable management of NWFPs, policy-makers need to be made aware of their importance. This can be done by: quantifying, monetizing and valuing the NWFPs; estimating employment benefits derived from these products; assessing local market and export potentials; and documenting the contribution of NWFP development to forest and biodiversity conservation.

A danger is that in the effort to gain policy-makers' attention, commercial values of NWFPs are likely to be readily quantified than their environmental and local values. This would help to attract policy attention to NWFPs, but with an unbalanced picture of priorities between the commercial and non-commercial values of NWFPs, resulting in a bias towards large-scale market-oriented operations. This highlights the need for a holistic framework approach, rather than a strictly market-driven approach, which leads to pressure for unsustainable exploitation of the resource.

To guard against this danger, the Consultation urged that research and development emphasise the value of NWFPs to the rural communities closest to the forest.

R&D SUPPORT

Given the limited data on critical aspects of NWFP development, appropriate assumptions need to be developed as clearly as possible and tested using improved methodologies.

People will naturally shift to better options, when they appear. Researchers and development workers therefore have to investigate on how to determine the best NWFP interventions while keeping in mind the broader social values and needs of the people.

LEGISLATIVE PROTECTION

It is necessary to have adequate legal instruments to safeguard the rights of the people and to protect them from exploitation by commercial interests. Experience in several African countries shows that without explicit legislative protection, local communities are exploited by urban industries, which have more information about the high potential value of many NWFPs.

SUPPORT FOR NWFP ENTERPRISES

In order that more of a product's value is retained near the source and to add to their economic benefits, it is necessary to develop local processing enterprises. This calls for increased local access to: the resource base; appropriate technology; markets; and

information. Care must be taken to ensure that in promoting enterprises, rural producers are not exposed to unacceptable risks. This would require that these enterprises be of appropriate scale. Also, these enterprises would need policy support and protection if they are to survive the competition from larger and sophisticated units. A policy of upgrading the technology and scale of local NWFP enterprises by phases would appear rational.

A concern is often expressed that in most cases local NWFP enterprises are low-technology/low-return activities and do not facilitate development. It is to be noted that people depend on low-return activities only when better alternatives are lacking or remain unknown. What is important is to understand why people undertake low-level NWFP activities, and to identify and support opportunities with growth potential that are environmentally and economically sustainable. NWFPs can thus become a vehicle for developing rural/local entrepreneurship.

Risk Analysis

Production of NWFPs for urban markets and exports are subjected to risks such as market instability, discriminatory trade practices, entry of cheaper substitutes and so on. It is necessary that the risk involved are fully considered before embarking on such ventures.

Consideration of Social Objectives

Social objectives such as provision of employment opportunities, improvement of health and nutrition, equity in income distribution, respect for customary rights of local and indigenous people, provision of local needs for forest products, and promotion of local community participation are all important considerations in NWFP development. It will not be possible to achieve sustainable management of NWFP resources and their utilisation if social considerations are ignored. Physical and environmental sustainability depends on social stability.

Organised Participation of People

Organised and collective approach (e.g. cooperatives/cooperative networks) in developing NWFP enterprises involving collection/production of raw material, processing, and marketing will help to provide bargaining strength, acquire improved technology and information, generate local entrepreneurship and support empowerment of the people.

Exchange of Experiences

At higher planning and policy levels, knowledge about the experiences of other countries in developing NWFPs will be very helpful. Experiences of industrialised countries in NWFP resource conservation and utilisation will be particularly interesting, not because they provide models, but because they offer case histories of policy effects.

Change in Perception

Perception about NWFPs in many quarters is that they essentially are subsistence products valued only by poor people. This perception leads to inadequate attention and low priority for conserving and managing NWFP resources. The wrong perception has harmed the cause of NWFPs.

Both the poor and rich sections of society value NWFPs, even though the end-uses may vary. For the poor, the primary products for subsistence are more important. The rich tend to use the sophisticated secondary products derived from NWFPs (e.g. perfumes, flavours, pharmaceutical products, exotic foods, decorative items) and services which add to the quality and comforts of life. When all the sections of society benefit from NWFP resources and they are made aware of the real value involved, it will facilitate better recognition of the importance of managing and conserving these resources.

RECOMMENDATIONS

The Consultation made several recommendations aimed at enhancing the socio-economic benefits of NWFPs. These are included in the Summary of Recommendations given in Section 6 of this report.

PROCESSING AND MARKETING 3

INTRODUCTION

The documentation for facilitating the discussion of this subject consisted of two theme papers and three satellite papers (see Appendix 4.2). The resource persons, Dr. Tuley De Silva and Mr. Leo Lintu, introduced the subject and presented their papers; "Processing, Refinement and Value Addition of Non-Wood Forest Products" and "Trade and Marketing of Non-Wood Forest Products", respectively.

The Consultation recognised that NWFPs are consumed by people of varying social levels — from shifting cultivators and subsistence farmers to affluent urban populations. Consumption takes place in the raw (immediately after harvest), semi-processed and processed forms. Some go through several stages of processing. Forest fruits, herbal medicine, bamboo mats, turpentine, food additives and fragrances are indicative of the range. Use of some NWFPs are primarily local in nature. Some are well-known. Some others suffer from lack of promotion. Some products meet bulk demand, others reach specific niches.

Utilisation of NWFPs generally consists of three major stages: harvesting of the produce, processing and marketing of the products for intermediate and/or final consumption. These activities are closely related, having intimate forward and backward linkages. The nature and scope of NWFP enterprises and the technological alternatives available are often influenced by these linkages.

There is considerable variation in the way in which NWFPs are harvested and utilised. This causes differences in the nature of linkages and these differences vary from product to product, region to region and even locality to locality. For rational and sustainable development of NWFPs, it is necessary to clearly understand these linkages and their implications; and there is need for mechanisms for information exchange between all parts of the chain.

The Consultation dealt in detail with the different aspects related to the utilisation of NWFPs.

HARVESTING

NWFPs are an extremely heterogenous group. The harvesting tools and techniques vary considerably for the various NWFPs.

Harvesting is the activity linking resource management and resource utilisation and thus influences resource sustainability.

The Consultation noted that harvesting of NWFPs of both wild and cultivated sources is different from wood harvest in terms of the use of tools and equipment, technology, pre-harvest preparations, post-harvest treatment and requirement of intermediate processing. Harvesting often does not involve a whole tree or plant, but only parts thereof. It varies from collection of nuts and leaves to tapping of latex, harvesting of palm hearts, extraction of medicinal plants and plant materials, honey hunting, extraction of wax and collection of

decorative plant materials. The cycle of harvesting also varies from a few weeks (e.g. for tender shoots), to longer periods as in the case of mature fruits or rhizomes.

Since volume involved for individual NWFP is in most cases small, the attention devoted to their harvesting also tends to be less. The collectors are mostly unskilled and untrained in scientific methods. As a result the harvesting standard of many NWFPs are poor and rudimentary, and hence wasteful, destructive and unsustainable. Efforts are also not made, usually, to harmonise harvest of wood and non-wood products.

There are variations in the system of organizing NWFP harvest. One common system is the collection by local people under rights bestowed, for sale in the local market, or with some form of patronage and financial help from the purchasing agent. Another is by the employment of casual or contract labour by those who have obtained collection rights on lease. The collectors of NWFPs are often exploited by middlemen who control access to the market, or by those who control access to the resource. Thus the millions of NWFP collectors have no adequate incentive for practising properly controlled and sustainable harvesting.

Post-harvest care is also poor in most cases, and wastages are high. Wastage happens in quantitative and qualitative terms during collection, transport and storage. Physical infrastructure is more important when harvested products are delicate or perishable compared to those which can stand rough handling and long storage.

The Consultation stressed that planning and control harvesting operations by introducing more efficient harvesting methods and systems, establishing incentive systems for NWFP collectors, reducing harvesting waste and keeping overall costs of operations at the lowest possible level, improving post-harvest treatment, and providing for training and skill improvement are essential for utilising forest resource on a sustainable basis.

PROCESSING

NWFPs cover a wide range — plaiting materials and utility items to food and food additives, gums, resins, aroma chemicals and medicinal extracts. NWFP-based industries are generally less polluting, less destructive of environment, neutral of scale and amenable for vertical and horizontal integration.

The Consultation considered production and processing in respect of NWFPs in its broadest sense — as a physical process[1/] carried out by institutional units[2/] that use labour and assets to transform inputs of goods and services into outputs of other goods and services. The output of goods and services are products.

Primary and downstream processing adds value to a product. In respect of NWFPs for subsistence and local use, processing involved is mostly in the form of post-harvest treatment or intermediate processing such as cleaning, shelling, heating, cooling, drying, fumigation, grading, bundling and storage.

1/ The production technology may vary from simple to complex.

2/ Institutional units could be households or other units of varying size, producing for profit or otherwise.

Organising for local processing: the Philippines

The Kalahan Educational Foundation of northern Luzon, founded in 1973, represents members of the Ikalahan tribal communities. Through the first-ever community forest stewardship agreement with the Philippine government, the foundation secured legal rights to the Ikalahan ancestral forest lands. Thus motivated to protect their watersheds and obtain a good livelihood from the land, the community decided to produce needed cash from forest produce, rather than converting the land to agriculture.

The foundation selected two wild forest fruits to develop into three products: jelly, jam and butter. From that start, they have developed 15 recipes of preserves of wild and cultivated fruits.

With the help of the Asian Institute of Management, the foundation identified markets in Manila and preferences for packaging, container size, and volume. Their product line now includes jellies made from a small grape-like fruit, as well as others from ginger, tamarind and passion fruit.

The processing operation has required much planning, capital and storage space, as well as careful attention to quality control and product standardisation. Recipe development varies from year to year as variable weather conditions affect fruit contents of acid, sugar and pectin.

The enterprise has enhanced the local value of the forest, encouraged enrichment planting, and provided local employment for skilled labour.

Delbert Rice, 1994. Marketing multipurpose tree products: the Ikalahan experience. In Raintree, J.B. and Francisco, H.A., eds., *Marketing of multipurpose tree products in Asia*. Proceedings of an international workshop held in Baguio City, the Philippines, 6-9 December 1993. Winrock International, Bangkok.

Market oriented production often goes through several levels of processing. The higher the level of processing carried out at or near the source, more of the products value can be retained locally. This offers the prospect for improving local employment, income and livelihood. At the national level this can support production of consumer articles in which NWFPs are used as components (e.g. perfumes, cosmetics) and help increased foreign exchange earnings.

However, in a developing country situations, harvested products reach the market, local or foreign, either after some intermediate processing in the form of cleaning and grading or after primary processing.

Market oriented downstream processing, for export markets, is highly specific on quality and stresses on reliability of supply. But due to the lack of technology, skilled manpower, management expertise, capital for investment and marketing arrangements, coupled with inadequate information on resource and resource development, sophisticated or refined downstream processing is limited in most developing country situations and often export is confined to primary products.

The Consultation took note that the range of variation in the level of processing of NWFPs is considerable. Most processing of NWFPs for local use is carried out in units which are small, dispersed, financially weak, primitive in technology and managerially poorly served. The lack infrastructure. They employ persons without any training, often working

on part-time basis. The products of comparatively larger establishments carrying out primary processing for export, undergo further processing/refinement in developed countries. These impact adversely on enterprise survival rates.

Most traditional NWFP activities are labour intensive and cheap, and they tend to become early casualties in the process of economic development, and succumb to competition, unless measures are taken to improve them, capable of meeting the new needs and situations.

The Consultation pointed out that a national industrialization strategy to add value to the non-wood materials of the forests does not exist in most countries. Subject to feasibility based on stable supply of suitable NWFPs and analysis of economic and market factors, development through value-addition on NWFPs will call for appropriate process technology. Process technology for medicinal plants, for example, helps to isolate pure active compounds for formulation into drugs, to isolate intermediates for production of semi-synthetic drugs and to prepare standard galenicals (extracts, powders, tinctures, etc.).

Before launching on actual production, pilot trials are necessary. Polyvalent pilot plants, such as the one designed and developed by UNIDO, can be used to carry out operations in extracting flavour, aroma and medicinal constituents from plant material, such as aqueous or solvent extraction, continuous extraction, preparation of solid extracts and oleoresins, distillation of essential oils, fractionation of essential oils and processing of other economic plant-derived products.

Provided that appropriate management capability, skills and technology are available, several developing countries have the potential to install improved facilities for processing of NWFPs, including for export. However, it is necessary to know the specific market needs as well as the product specifications and standards required, before deciding to venture into export-oriented production. There is also need to link the production to a reliable and captive source of raw material supply. More efficient modern technology can cause more destruction if tied to inconsistent supply. The Consultation warned that although adding value locally is important, attempting to produce end-user commodities without adequate preparation or studies will be risky.

FUTURE PROSPECTS

Prospects for promoting NWFP-based processing enterprises appear bright in view of a number of developments worldwide. These, among others include:

- Commitment by governments to implement UNCED (1992) recommendations relating to forestry which proposed priority attention to non-destructive uses of forests and NWFPs.

- Growing recognition of the need to address socio-economic disadvantages faced by communities living near forests.

- Creation of new markets due to "green consumerism" and growing demand for natural products.

- Economic policies favouring open market that encourage private sector involvement and relaxation of trade regulations.

- New research and development initiatives by industries into new drugs, agro-chemicals, natural pesticides and fragrances.

CONSIDERATIONS FOR DEVELOPMENT OF NWFP PROCESSING

The Consultation discussed about some important factors and steps involved in developing NWFP-based processing industries, encompassing materials, means and methods, management, manpower, and market.

Same raw material can provide different products (e.g. food additive and medicine), and acceptability of raw material resources for specific uses depends on their nature, extent, quality and other significant aspects. Knowledge about these aspects is essential to plan for their utilisation.

It is necessary to have a clear idea about the options for production based on the potential demand or felt need for products. This could cover the need to develop new products or improve old products.

Market assessment to obtain information about price levels, quality and safety standards, packaging and handling requirements and appropriate level of production is an essential prerequisite.

Another aspect to be considered is the capacity of the supply source to provide raw material on a stable and sustainable basis, from natural and/or domesticated sources.

Assessment of existing technology relating to harvesting, handling, post-harvest treatment and processing and the need for their improvement is yet another step in establishing NWFP-based processing units. Complex technology is required to produce refined and high-value products. The emphasis should be to reduce environmental stress of consumption without affecting consumer satisfaction by improving competitiveness of natural products with environmental advantages. Ways and means of developing or acquiring improved technology is an issue to be addressed in this regard.

The role of research and allied institutions is very important to provide producers with information on potential processing options, taking all relevant aspects into consideration. Producers also need information on real threats posed by substitute products and trends of change in consumer preferences.

Access to information, particularly about new uses, whether generated locally or acquired from outside, is vital for improved utilisation of resources. In the case of some plants which were not considered important as providing NWFPs, new uses are being identified and products commercially developed. An example is neem (*Azadirachta indica*). A range of products including neem oil, neem soap and an insecticide (*Azadarachtin*) have been developed from the seeds of neem tree.

Pilot scale processing trials, before embarking on full-scale production, will help to indicate the strengths and weaknesses of the system and the needed modifications/improvements along the production chain.

Training and human resources development (including training in enterprise management for local people), generation of needed skills, improvement of infrastructure and

institutional support including credit facilities through financing institutions are other aspects requiring serious consideration.

The Consultation reiterated that policy environment can play a decisive role by facilitating development of NWFP-based processing through: appropriate regulatory controls, providing research and extension support, strengthening linkages with private sector, promoting participation of local communities and NGOs, encouraging (by providing incentives) exports and import substitution and establishing credit and marketing facilities.

Consideration of all the above factors will help to indicate the feasibility of developing NWFP-based processing enterprises from the social, economic, commercial, technological and environmental points of view.

The Consultation highlighted the importance of freer flow of information, transfer of technology and financial assistance from developed to developing countries to promote NWFP enterprises. Also, regional cooperation is particularly relevant for sharing expertise and facilities for improved and sustainable utilisation of NWFPs.

The consultation noted with interest the INBio-Merck collaboration on bio-diversity prospecting in Costa Rica and the new initiatives taken on developing sustainable NWFP enterprises by Conservation International, Appropriate Technology International and WWF/USA.

MARKETING

A market is created whenever potential sellers of a good or service are brought into contact with potential buyers, and a means of exchange is available. The medium of exchange may be money or barter. Exchange agreements are reached through the operations of the laws of supply and demand.

The terms marketing and trade are often used interchangeably. Trade, in its limited sense is the act of exchange of products for money or other products, i.e. the transaction. Apart from agreement relating to price, trade transactions are influenced by policies, regulations, legal restrictions, controls and standards. International trade, particularly, is affected by tariff and non-tariff barriers, quality specifications, terms of importation and exportation and exchange mechanisms.

For all intents and purposes, market is the seat of trade in time and space. And, marketing is the process of creating markets, comprising of several related actions or steps. Marketing offers a set of technologies that producers can use to identify market opportunities, analyze competition, develop appropriate approaches to obtain market access and make profit. Marketing involves product, place (including channels of marketing and distribution), promotion, and price.

In sustainable forestry, the role of marketing is to help create better linkages among resource management, processing, and the end-use. Marketing can reinforce sustainable forest management by indicating the kind of products and raw materials required, and by providing incentives through income distribution.

Some lessons in green marketing

Tagua Initiative of the Conservation International, launched in 1990, aims at marketing "vegetable ivory" from the tagua palm of Ecuador and Colombia to garment manufacturers in the United States for use as buttons. In its first year, the project generated sales for an amount of US$ 500,000. The project promoted tagua as a high-quality material and its sale as a way to conserve tropical forests through sustainable community development.

After almost three years, lessons learned included:

1. The conservation impact is greatest when production is integrated with community development, scientific research, education, and policy work.

2. International marketing of biodiversity products brings together at least two very different cultures and economies. To succeed, projects must be carefully designed to accommodate the distinct needs of these disparate worlds, and good communication among all parties is a must.

3. Community-level enterprise development must be geared to local development.

4. Biodiversity products must be profitable for every player in the economic chain.

5. Local enterprises should be supported with loans rather than grants, wherever possible, to encourage a sense of ownership and responsibility.

6. Options for local processing need to be pursued on a continuing basis.

7. Opportunities should be explored in local and national markets, in addition to international markets.

From Laura Tangley, 1993. *Marketing Biodiversity Products: The Tagua Initiative*, Conservation International, Washington DC.

Cultural Survival Enterprises, also begun in 1990, has worked with groups in the Brazilian Amazon to market NWFPs to companies in the United States. In its first two years it averaged 400 percent growth. Further lessons in green marketing from its experience include:

- Start with products already on the market. Introducing new products can take up to five years for foods, 10 for personal-care products, and 20 for pharmaceuticals.

- Organise for strength in numbers.

- Monitor the sustainability of production. Green-market consumers are interested in protecting ecosystems, not necessarily the people who live in them.

From J.W. Clay and C.R. Clement, 1993. *Selected species and strategies to enhance income generation from Amazonian forests*, FAO, Rome.

The Consultation recognized that the nature/type, size, spatial spread and scope of markets would vary. Thus it is possible, based on their special characteristics, to distinguish: local/rural, urban, national and international markets; markets for goods and services such as recreation and tourism; bulk and niche markets.

For orderly, efficient and equitable functioning of markets, and to facilitate healthy competition, information relating to product specifications and quality, safety and hygienic requirements, packaging specifications, consumer preferences and concerns, price levels, supply and demand outlook is vital. Lack of information results in market distortions. Marketing studies and research are relevant in this regard.

With specific reference to product information, the Consultation identified some additional considerations: perishability vs. durability/storability of the products; consumer preference for natural products and influence of green consumerism; income and price elasticity of products; cultural and social factors influencing demand and consumption; and potential substitutes and their likely impact.

However, those at the production end of the marketing chain often do not have access to information. In the absence of a transparent institutional link between the input sector, exacerbated by lack of market information, the cultivators, collectors and resource owners of NWFPs do not get a fair share of the value added. More often they are served by traders/middlemen who collect products from widely dispersed producers and sell them in the market or supply the products as inputs to processing units. Though the middlemen serve an important function in developing countries, they tend to exploit the market asymmetries and the weaknesses of primary producers. This results in a distorted incentive system where huge profits are made by trader middleman. In such a system efficiency in resource management becomes a casualty.

By promoting producers cooperatives or associations, small-scale producers can be helped to gain access to information, greater negotiating strength and economies of scale to be competitive with larger enterprises. This calls for strong policy support and regulatory instruments to correct market imbalances and distortions.

Market strength through cooperatives: India

The Agroforestry Federation of Maharashtra, headquartered in Nasik, consists of 25 district-level tree-growers' cooperatives. It provides marketing and technical support to its member cooperatives and individual farmers, mainly in the marketing of eucalyptus wood and seeds of *Jatropha curcas*.

The Nasik Tree Growers' Cooperative Society already gives its members a rate of return 30-40 percent higher than what they could get individually in the market. Other benefits that members gain through collective organisation include:

- advice on demand and supply conditions at the district, region, and national levels;
- lower transportation costs through combined loads;
- technical advice on harvest timing and methods;
- greater responsiveness to changes in regulations;
- economies of scale for storage of produce at optimum locations;
- collective bargaining and even cash advance during periods of storage.

Ranjit Issar, 1994. Development of market intelligence and infrastructure for agroforestry in India, in Raintree, J.B. and Francisco, H.A., eds., *Marketing of multipurpose tree products in Asia*. Proceedings of an international workshop held in Baguio City, the Philippines, 6-9 December 1993. Winrock International, Bangkok.

SPECIAL FEATURES OF NWFPS

The Consultation noted several special features on NWFPs which impact on their market: heterogenous nature of products, seasonal nature of harvests and availability of raw materials, multiple uses and multiple sources of raw products, amenability for production in small-scale/household units, feasibility of producing different end products from the same source material, influence of socio-cultural factors on its use, and widely dispersed and ephemeral nature of the markets. In additon, other important features include higher environmental externalities (e.g. biodiversity), and complex nature of resource tenure. Furthermore, NWFPs are not limited to the conventional concept of a physical product; apart from services, they also consist of rare microorganisms and other biological research materials.

Local markets and related trade involve less risk than either national or international markets. Local NWFP markets, although often "invisible" in accounting records, are vitally important to local communities. However, the conditions by which many NWFPs traditionally benefit local economies (often household-based, diverse range of products, seasonal, labour-intensive) tend to be disadvantages in efforts to gain wider markets and increased rural income. This requires creative management solutions.

Urban markets in most countries tend to involve growing numbers of people migrating to the city, who bring their rural cultural preferences and uses of NWFPs with them. These markets provide a growing prospect for items like traditional medicines. The patterns of these urban markets deserve more study since they can often be large.

International markets for NWFPs are more sophisticated and involve more risk, particularly since NWFPs that gain international demand quickly are subject to competition from synthetic substitutes or cultivated materials, and are sensitive to consumer preferences and quality considerations.

Regional and sub-regional markets comprise another level that have received little attention. But in these cases shared preferences and common tastes often would make it feasible to develop products for a larger market.

Women in NWFP markets: Ghana

In Ghana's largest daily urban market, in Kumasi, more than 90 percent of the traders are women. There, trade in NWFPs involves some 700 people on a full-time basis. Among then:

- 100 leaf traders (for wrapping foods for sale); monthly sale value exceeds US$ 47,000;
- 100 medicine traders (mostly women);
- 25 full-time basket traders (selling 1,000-5,000 baskets/month);
- 50 full-time traders of smoked bushmeat and 15 for fresh meat (annual sale value of US$ 209,000).

Julia Falconer, 1992. Non-timber forest products in southern Ghana: a summary report. ODA Forestry Series No. 2, ODA, London.

Market Situation of NWFPs

Because of the range of variety of NWFPs, ranging from fruits and nuts to aroma chemicals and phytopharmaceuticals, they find use in a wide range of markets at the local, national and international levels, as well as for bartering in subsistence economy. Globalisation of economies has opened up further opportunities for producers of NWFPs. Since they are natural products, however, they are intrinsically variable in both quality and supply, and this can impose some limitations on their use.

A large number of vendors are involved locally in selling NWFPs. Many of them sell products collected by them for making extra income; others are supported by a network of merchants and several levels of buyers. The main products locally sold include fruits, leaves, tubers, bags, baskets, thatch and other building materials, meat and skins, palm oil, and medicinal plants.

In cases where NWFPs are sold outside the locality, local traders and merchants are the main intermediaries who buy the products cheaply from collectors and sell it to exporters or processors or their agents at a high price. Because of the absence of cooperative organisations of collectors, non-availability of market and price information, and lack of access to credit to meet operational needs, these collectors are at the mercy of the intermediaries. Traditionally, the supply of NWFPs has thus involved networks of local collectors and intermediaries bound by long-term, often debt-based, relationships. It is a trader-dominated system and it is not conducive for the birth and growth of enterprises. The system is often exploitative and not supportive of sustainable development.

There are only rare cases where processing units are supported by captive sources of NWFPs or other formal arrangements for collection and supply of raw materials.

NWFPs are an important source of foreign exchange for many countries. A recent FAO study identified 116 items of NWFPs as commercially important in international trade, considering the group of medicinal plants as one item. Available information suggests that 500 to 600 different medicinal plants enter international trade.

The Consultation deemed it necessary, especially in respect of commercially important products, to have a marketing orientation rather than simple production orientation. Simple production orientation have the effect of creating increased supply, thus reducing price and profitability. A successful marketing orientation for forest products, on the other hand, should increase demand and value, thus allowing more of the products to enter the market without reducing the overall price of the concerned commodities. Market analysis and research, product development, and market development are important in this regard. The Consultation noted that lack of information is a major constraint in carrying out trend and outlook studies and analysis of factors involved in price changes; also to see whether the prices and costs reflect the true values and whether production controls can improve the situation.

Strategic Market Development Considerations for NWFPs

Markets for goods and services can be sustained through maintenance of high quality standards and stable and reliable supply.

It is true in any market that products of better quality will attract higher demand and better prices. Quality of primary NWFPs is influenced by post-harvest handling, processing and storage conditions. Most producers lack skills and knowledge in this regard. The situation needs correction. There exists a problem of quality control for NWFPs at the primary producer level. There are no guarantees in conventional harvesting/processing/marketing of NWFPs for ensuring quality.

Regulations for grading and standards exist in many countries for traded products. General quality standards for internationally-traded products are established by the International Organization for Standards. Quality and safety/sanitary regulations, including packaging standards, established by food and drug administrations and consumer protection groups of importing countries are often rigid in respect of items such as medicinal extracts, phytochemicals, food colorants and additives. Inability to meet the standards would normally lead to loss of market.

Basic requirements by consumer markets include sustainable and continuous product availability; reliable and predictable supply; and stable quality of products. Recognizing these, and distinguishing the differences among geographic aspects of markets (i.e. local, urban, international) are key to successful marketing of NWFPs.

The Consultation noted that there has been, over the years, an erosion of international market share of NWFPs. In many instances, cheaper substitutes have been developed. As a result, prices have fallen. The vulnerability of NWFPs have been attributed to unstable supply, inconsistent quality and unreliability of their source.

The role of information is vital in this regard. Marketing is essentially a "software-based" function where knowledge and information are important ingredients along with attitudes and skills of those who are involved in market development. Production and product marketing involve several loops forming a chain, from commodity production to marketing of consumer products. Although primary producers are influenced by all the repetitive loops, they usually manage only the first loop. It is essential to know well enough the whole chain of these loops and one's own position in the full chain, as well as the particular role and importance of the NWFPs concerned in the final product, to claim, and justify getting, a "fair" share of the total wealth created between the extraction of NWFPs and the sale of the final consumer goods. The need for an appropriate marketing information system for NWFPs thus becomes vital. The Consultation pointed out that NWFPs need to be promoted as natural products, free from chemical insecticides and fertilizers. The benefits of environmentally sound business practices associated with NWFPs need to be highlighted.

Probably the most important factor in sustaining a market is the price level of products, which should be remunerative to the producer and equitable to the consumer. However, this aspect is often ignored in respect of NWFPs where the traders and middlemen (unlike entrepreneurs) seem to have a tendency to maximise windfall as long as the opportunity lasts. There is need to improve the economic benefits and incentives to the local producer if supply is to be stabilised in terms of quantity and quality.

One aspect which gives some indication about the possibility of rationalising and improving efficiency of the marketing system is the vast difference between the price paid to the collector or local producer and that obtained for it in the market. It has been reported that for several items of NWFPs, the local producer receives only a negligible portion of the price for it in the developed country markets. As an example, it was noted that one crude

drug *sarsaparilla (Smilax)* commanded a price 200 times as much in New York as the Amazon collector received for the root. *Sarsaparilla* is just an over-the-counter herb, not a finished pharmaceutical prescription. Finished pharmaceuticals are often several magnitudes more expensive than the crude plant products from which they are derived.

The participants were informed of the experience from the Natural Resources Institute (NRI) of the United Kingdom, which illustrated both the central importance of the commercial aspect of NWFP enterprises and the potential for strategic production and marketing of NWFPs to reduce over-exploitation of forest resources.

An ODA-funded project for sustainable forestry in the Amazon basin, managed by NRI and executed by Brazilian institutions, is based on the idea of promoting commercial production of an oil for which there is known demand, but from a sustainable plant source alternative to present destructive harvesting of wild tree species in Brazil, China and Viet Nam. Production of a safrole-containing leaf oil from an Amazonian *Piper* species was chosen because:

- there was substantial market potential with no immediate threat of synthetic substitution;
- the species can be managed sustainably over multiple harvests through coppicing;
- market acceptability depends mainly on safrole content, which is determined largely by intrinsic plant characteristics and less by demanding producer skills.

Other examples highlighted the benefits of a market-led (rather than supply-driven) approach to development projects involving NWFPs, and the ways in which the entrepreneurs can play an important role in the development work undertaken by public institutions.

Development of those NWFPs which enter trade requires a market-led approach but this must not disrupt local and subsistence use or lead to other adverse socio-economic consequences; nor should it compromise sustainable management of the resource.

Considerable research efforts are needed to rationalise market development for NWFPs (new products and new uses for known products) covering both formal and informal sectors, together with appropriate mechanisms for disseminating the research results.

The variety of NWFPs and the range of their markets (from local to international) means that producer groups dealing with several products need some familiarity with the full range of marketing practices. This requires considerable training to develop knowledge and marketing skills. Appropriately trained extension services can help to develop local marketing capabilities.

Related to the need for skills in processing and marketing is the need for better entrepreneurial skills among producers. This is a problem for small enterprises everywhere. Failure rates of small enterprises is comparable in respect of both advanced and developing countries.

Proper deal-making is a special skill required by producers and producer groups involved in marketing their products; yet enterprise programmes often overlook it. Training in this area is needed. An example is the initiatives by the Biodiversity Support Programme,

sponsored by the US Agency for International Development, which has linked small-scale enterprises and cooperatives in southern India with sources of information on business management, biological resources, and social issues. In many developing countries, an underlying need in enterprise development is for funding agencies to assume a share of the small-scale enterprise risk.

In addition to improving entrepreneurial skills among small producers, programmes on NWFPs should raise the awareness of existing businesses regarding the long-term benefits of environmentally sound NWFP ventures. The new attitude towards consumption resulting from the concern for environmental conservation and the consequent preference for natural products is providing a new advantage and acceptance for NWFPs.

The Consultation considered that given the new interest in developing "green consumer" markets, there is considerable potential to cultivate this young market through educating the consumers about the advantages of NWFPs and their production. Training materials and informal education systems should be developed which will improve marketing skills and entrepreneurship of NWFP producers, including those of cooperatives. At the national level, government officials also need to have more familiarity with the market forces that affect communities, and policy-makers need an understanding of these basics in order to know which polices create a conducive business environment for sustainable exploitation of NWFPs. Workshops and seminars can help to target these groups.

Collective or cooperative institutions are poorly developed at the producer/collector level and this hinders access to knowledge about resource stocks, processes and markets. It also gives producers little bargaining power in the marketing of NWFPs. Producer cooperatives or similar organisations which will assist the processing and marketing of NWFPs need to be strengthened or developed.

Also, national institutions concerned should formulate guidelines and monitoring systems to ensure that production of NWFPs is subject to sustainability conditions. Trade channels need to be rationalised and made more efficient and transparent. Risk-averting strategies are required to minimize the effects of fluctuating markets on producers and processors of NWFPs. National standards institutions should , where possible and appropriate, develop quality control and certification procedures for NWFPs in accordance with market requirements. Measures need to be taken to increase awareness within financial institutions of the social and economic benefits which accrue from production of NWFPs in order to encourage investment and greater willingness to extend credit and other services to entrepreneurs and other groups.

The physical infrastructure for marketing and trade in NWFPs (which is critical to service industry, such as eco-tourism, as well as to the rapid movement and handling of items of trade) is often deficient and needs to be improved.

The Consultation further pointed out that the NWFPs' marketing environment is affected by the macro-level environment, including international conventions and agreements (e.g. the Biodiversity Convention, the Convention on International Trade of Endangered Species or CITES) and national regulation, as well as those at the micro-level, namely the community conditions.

ACCESS TO INFORMATION

The producers of NWFPs need better information on the various markets for their products. There needs to be a better flow of information and technology among producers/collectors, processors, and end users supported by a strong knowledge base. This should include information on quality, grades, and prices of products, processing requirements and marketing structures. Producers also need to know the real threats posed by competing sources and substitutes.

Marketing studies are ways to collect comprehensive and detailed information for specific purposes. Where these are needed (e.g. to study an urban market for a product), it would be cost-effective for producers to group together to share the cost of the study.

Local market information systems are also needed to track trends in available markets. Producer groups could tap available information systems (e.g. agricultural marketing services) and set up their own systems where possible. Market monitoring and early warning systems for certain types of NWFPs will help to reduce producers' risks.

The Consultation emphasised that the knowledge base of the informal sector would also need review in order to identify and establish support mechanisms. Indigenous production practices also need to be documented and improved as necessary.

Support of governments at national and local levels and of NGOs will greatly help to improve the transfer of knowledge to all parts of the marketing chain as well as to strengthen links between research institutions and producers of NWFPs. Also, support of international agencies and donors will help to improve the dissemination pathways between countries.

Trade fairs, newsletters and bulletins are some of the vehicles to disseminate information on costs and values, uses, quality standards, environmental implications, etc. Guidelines and handbooks for ready reference are important early steps to promote and support development of NWFPs. These, along with other technical and resource information would help: categorize as many types of NWFPs as possible, indicating their end uses; list specific examples of items within each category with an indication of the level of trade which they reach (local, regional, international) and where they enter international trade; indicate the main suppliers and markets; describe options for value-added processing; indicate likely problems to be encountered and risks involved; adopt steps to be followed to reach the identified markets; and provide a list of institutions/organisations with knowledge/expertise in particular areas from which further information can be obtained.

The participants were informed that recently FAO has collaborated with several national governments to draft guidelines for use by local producers of NWFPs. These have been tested in the Philippines, Uganda, Peru and the Solomon Islands, and will soon be published by FAO as *Guidelines for the creation of community-managed marketing information systems for non-wood forest products.* Other forthcoming publications on this subject include: *Manual on markets and marketing in agroforestry and community forestry systems* and *Compendium of computer-based databases of relevance to forest products marketing*.

The Consultation considered several other issues, among them:

- Impact of globalisation of trade on NWFPs;
- Trade dimensions of natural heritage and intellectual property rights of source countries on information related to the biological and chemical characteristics and uses of NWFPs;
- Trade in wild fauna and faunal products;
- Role of international technical assistance;
- Facilitating role of regional country groupings in promoting sustainable use and trade in NWFPs;
- Support of donor agencies in providing prioritized funding to those NWFPs with high market potential;
- Relevance of eco-labelling and certification of NWFPs and their implications;
- Role of national governments to promulgate policies and strategies to develop NWFPs including improved financial support and incentives.

RECOMMENDATIONS

Recommendations made by the Consultation relating to processing and marketing can be seen in Section 6 of this report.

RESOURCE MANAGEMENT AND ENVIRONMENT 4

INTRODUCTION

Discussion on this subject area was based on two theme papers and two satellite papers (see Appendix 4.3). The resource persons, Dr. Mauro Reis and Prof. Herman Haeruman, introduced the subject and presented their theme papers "Resource Development for Non-Wood Forest Products" and "Environmental Dimensions of Non-Wood Forest Products", respectively.

Socio-economic benefits, processing and product development for value addition and increased gains through marketing of NWFPs are all conditional to the availability, integrity and stability of forest resources as well as their sound and sustainable management. Plants and animals providing NWFPs to a great extent represent the biological wealth and variety of forests. Their conservation is part of a much wider and fundamental concern, and is an investment towards sustainable development.

More than 80 percent of the plant species providing NWFPs occur in the tropical forests of Asia, Africa and the Americas. Tropical forests are ecologically complex and biologically diverse ecosystems and provide for a variety of human needs. This fact has two implications:

- These forests should be managed for multiple uses to benefit from their great variety of products and services;
- They should be managed with ecological sustainability as an explicit and prominent objective, because their complex interdependencies make them vulnerable to irreversible degradation.

The Consultation considered the various aspects of sustainably managing the flora and fauna of the different forest ecosystems.

RESOURCE MANAGEMENT

FOREST RESOURCE INVENTORY

There is a general absence of inventory of NWFPs, and their planning often lacks scientific basis. The extent of variation in the nature, quality, characteristics and uses of the products compounds the problem. An assessment of resources by appropriate categories and a detailed prospecting for specific products (e.g. phytochemicals) in selected priority areas is an essential step. This will help to identify candidate species and suitable areas to be developed for specific products. This will in addition serve as a sound basis for planning.

Most flora and fauna, providing NWFPs are found in the primary forests. Some of them can only thrive within natural habitat and do not lend themselves to domestication. Those plant species that can be grown in plantations, or as pure or mixed corps, are heavily dependant on regular infusion of germplasm from wild gene reservoirs. Only the continued existence of species variability in the wild will afford plant breeders a better chance for

creating new disease-resisting and high-yielding varieties for the future. Thus the genetic wealth and variability are crucial for future development of NWFPs.

From the management perspective, a sustainable system is one from which various products can be harvested on a predictable basis. This requires thorough knowledge of the forest resource.

The Consultation underlined the need to enlarge the scope of forest resources assessment and the need to develop appropriate methods. Inventories need to consider the dynamics of forest-human relationships, and not to be simple static gauges. This would involve, in addition to inventory of wood resources, detailed investigation and prospecting of non-wood forest resources for fibre, phytochemicals, aromatics, gums, resins, etc. Only a small percentage of species have been examined for their attributes and uses. Work involved in scientific screening of forest resources for valuable ingredients is enormous. These investigations have to consider the nature and extent of distribution of specific plant resources, their density of occurrence, their potential yield/supply from wild sources, their suitability to be grown under multi-species environment (e.g. enrichment planting under natural forest cover and agroforestry) or under monoculture. Traditional knowledge and ethno-biology can contribute to provide indications of how to proceed for developing NWFPs.

Full inventories are costly and require multidisciplinary field teams and research support. They can provide decision-makers with a valuable insight about the potentials of sustainable forest management. This is an area which deserves financial support from the Global Environmental Facility.

Inventorying forests with local practices: Nicaragua

In the Si-a-Paz, or International Peace Park, uniting Nicaragua and Costa Rica, researchers are studying two systems of natural forest management: varying extraction, involving controlled felling and extraction; and post-harvest silviculture. Within stratified random sub-subplots, all the useful plants are inventoried with the help of a knowledgeable local informant. Data includes utilization and plant community characteristics.

For comparison, local forest management practices are being studied using transects and subplots of the same size, with the same data taken.

The study to date shows that the variety of useful plant resources is greater in the locally managed areas than in secondary forest growth, confirming that local management can be an important resource in developing management guidelines.

Summarised from Jan Salick, 1992. The sustainable management of non-timber rain forest products in the Si-a-Paz Peace Park, Nicaragua, in Plotkin, Mark, and Famolare, Lisa, eds., *Sustainable harvest and marketing of rain forest products*. Conservation International, Washington, D.C.

Key questions that forest inventories should address include: What NWFP resources are available in the management area? What are their ecological, biological and chemical characteristics? What products can they produce? How abundant are they, and what is their capacity for regeneration? What are the social and cultural values associated with their use? The criteria and techniques for measuring these factors currently used in forestry are

insufficient for NWFPs since conventional forestry methods were developed for assessing only timber.

Inventories are important not only for humid tropical forests, but also for other systems. In the fragile semi-arid and arid systems, gauging yield capacity is especially important and requires regular monitoring. Inventories in these systems need to include yield characteristics of the resource base in years of poor rainfall or drought.

Inventory to Include Fauna

Increasingly it must be recognised that forests consist of both flora and fauna. Wildlife is particularly important to communities in Africa.

The diversity of forest insect life as well as micro-organisms are gaining economic importance. The pharmaceutical industry is interested in forest insects as sources of molecular and chemical compounds.

The Consultation heard an account of the activities of INBio (National Biodiversity Institute of Costa Rica) on prospecting of biodiversity in collaboration with Merck, a pharmaceutical company, involving inventory and analysis of a number of forest plants, insects and micro-organisms for biologically active compounds.

Forest Resource Management

Sustainable use and management of forests has emerged as a high priority in the development agenda of nations. NWFPs are seen by many as an important key to the management of forest resources in a sustainable way. Historically, the focus of wood as the principal forest product is a development which was fostered by industrial revolution. Return to a more balanced view of the variety of products, wood and non-wood, which can sustainably be removed from well-managed forests will be a significant improvement.

Under natural conditions, non-wood products can be managed along with wood in an integrated manner, thus increasing overall productivity. Non-wood products can be sustainably harvested without causing damage to the ecosystem and they are therefore environmentally friendly. The Consultation noted that NWFPs often are of a higher value per unit weight or volume. It has been reported that in some Brazilian forests one tonne of non-wood products generates a monetary value equivalent to that of 25 tonnes of wood. Under appropriate management schemes they are compatible with the conservation of biological diversity. Overall, non-wood products have strong linkages and complementarities with component activities of environmentally sound and sustainable development.

Integrated multipurpose management of forest resources under a holistic ecosystem approach for wood and non-wood products and benefits is an essential strategy in many situations. Foresters have been developing and refining silvicultural techniques of managing tropical forests for over 100 years. These systems, however, have been specifically designed to maximize the production of commercial timber. Silvicultural systems for enhancing the growth of non-wood resources in forests such as wild fruits, edible nuts, mushrooms, gums and latex which can be harvested non-destructively and in combination with timber, have received much less attention. This is not to say that such systems are unknown or do not exist. Many indigenous or other local communities in the tropics have developed their own form of "silviculture" for managing their non-wood resources. Such systems of forest

management have been little studied, largely because of the lack of economic interest in many non-wood resources, but also due to the relative "invisibility" of these indigenous practices. Both indigenous silvicultural practices and conventional forestry can contribute in designing or improving systems for managing non-wood forest resources on a sustainable basis.

The Consultation stressed that there is urgent need to develop proper scientific and situation-specific management systems. Another and equally important need is adequate institutional arrangements, considering that without such arrangements commodity-based natural resource management, if solely left to market forces, could lead to fast depletion of resources. It is necessary in this connection to understand that: trees and plants yielding wood and non-wood products can co-exist in the forests; many non-wood products are available from timber species; harvesting of wood and non-wood products is not mutually exclusive and needs to be carried out with great care; wood harvesting, if improperly done, can be deleterious to production of NWFPs; and, production of some non-wood products may substantially affect production of others. These suggest the need for appropriately balanced and integrated systems of forest management combining ecological and economic prudence. Planning in this regard should take into consideration the limits of sustainable supply of goods and services involved. Supply offered to the market can be so adjusted as to help the achievement of conservation objectives, including conservation of plant genetic resources.

In situ genetic conservation in areas with the greatest number of plant varieties of known economic value, as well as of those with potential, should be part of integrated forest management. The Consultation recognised that it may often be a compatible objective of management to allow controlled extraction of NWFPs from natural forests which are included as part of protected area systems, especially in the buffer zones of protected areas.

Harvesting, the Weak Link

Harvesting as a process in the production and utilisation chain was considered earlier under processing and marketing. It links resource management with resource utilisation, and impacts on both.

Harvesting of NWFPs, of both wild and cultivated sources, is different from wood harvest in terms of the use of tools and equipment, technology, pre-harvest preparations, post-harvest treatment and requirement of intermediate processing.

Harvesting is particularly a weak link in the utilization of NWFPs due to the variety of tools, techniques and situations involved. The existing systems do not have adequate technological and management back-up. Poor harvesting results in product wastages and resource damages. Efforts are also not made, usually, to harmonize harvest of wood and non-wood products. Its linkage to a chain of middlemen and traders is not conducive to sustainable resource use.

Some specific issues to be addressed in this regard are: compatibility of resource management systems for different products, and the need for compromises — e.g. tapping of latex and the quality of timber from tapped trees; conflicts likely to arise in situations where rights are separately assigned for extracting wood and non-wood products; compatibility of certain harvests (e.g. extracting tubers/roots) and services such as conservation of genetic resources and watershed protection; and the minimum needs of forest-dependent communities for NWFPs vs. commercial harvest.

The Consultation emphasised the need to develop and publish guidelines for sustainable management and utilisation of NWFP resources. It further stressed that the socio-economic and environmental dimensions of NWFPs need to be included in the discussions defining the criteria and indicators for sustainable forest management.

SPECIES DOMESTICATION

The Consultation discussed the impact of species domestication. Some of the plant species providing NWFPs can be grown as pure or mixed crops or under agro-forestry systems. Over the years, several of them have moved up to the status of intensively managed agricultural or horticultural corps (e.g. oil palm, rubber, cashew, coffee, cocoa, pepper, etc.).

The objectives of natural resource conservation and protection of biodiversity can be served at least partially by cultivation of species. Domestication of wild plants yielding non-wood products, involving their genetic improvement, and growing them under intensive cultivation practices is considered as a means of ensuring efficiency in production. It has been the experience that once a product achieves commercial importance, its supply from wild sources tends to be replaced by cultivated sources with a view to bringing production, quality and cost under control. Productivity of cultivated crops can be enhanced through improved agro-technology. This would indirectly help to support resource sustainability by facilitating conservation of genetic resources in the natural forests. And, the domesticated species are dependant on regular infusion of germplasm from wild genetic reservoirs for improving their performance. Agro-forestry systems are particularly suitable for certain NWFPs (e.g spices, aromatic plants) and for certain situations (such as land scarcity). Development of NWFPs in agro-forestry systems has the advantage of diversifying the economic base and enhancing the supply of products for household use, as well as for markets.

It may, however, be noted that many plant and animal species cannot be grown outside their forest habitat; and those grown in intensive crops will have increased susceptibility to pests and diseases.

The decision on when, where and to what extent the production of NWFPs could be linked to domesticated resource base would call for considerable research. The domestication programmes should also recognize the community needs, preferences and sensitivities.

INDIGENOUS KNOWLEDGE

The Consultation pointed out that in respect of both natural and domesticated resources, some of the indigenous systems of management provide interesting possibilities. Study of several indigenous systems in Southeast Asia and South America reveals several common characteristics: low-intensity management for a variety of products; light canopy opening; enrichment planting of preferred species; and selective thinning. In these, they resemble the current scientific thinking on sustainable harvesting of NWFPs.

In some cases, indigenous groups have codified their land management systems. For example, the Confederation of Indigenous Peoples of the Amazon Basin (COICA), which consists of more than 400 indigenous organisations representing some four million residents of the Amazon, has prepared a Plan for Amazon Conservation and Development based on local systems. This plan considers NWFPs as a main element in sustainable development.

ISSUES RELATING TO SUSTAINABLE MANAGEMENT OF NWFP RESOURCES

The Consultation discussed the various issues to be addressed in relation to sustainable management of NWFP resources. Among them:

- Use of biological resources and emerging importance of biotechnologies; the identification of potentially important drug producing plant resources, the development of appropriate biotechnologies to tap these potentialities and the related equity and environmental considerations.

  This issue will remain highly sensitive for a long period to come and will need the continuous attention of international organisations.

- Biodiversity inventories and information management (biological, taxonomic and related information on living species and systems) to increase the value, and improve the sustainable use, of raw biological resources and their implications in terms of cost and know how.

- Role and importance of lower plants, insects and micro-organisms in the forest ecosystem and their contributions to human welfare.

- The need to define and retain intellectual property rights on NWFP-based discoveries and traditional knowledge, and to develop collaborative arrangements between potential economic users and source communities and countries, in order to guarantee profit-sharing (typically through royalties), if commercial products are forthcoming as well to provide for adequate technology transfer.

- The level and nature of interdependence between NWFP resources, native wildlife and eco-tourism.

- The need for increased financial resources and improved technical capabilities for managing NWFP resources.

- The need and scope of general and specific (e.g. for products, species) guidelines for sustainable management of NWFP resources.

The Consultation took cognisance of the ITTO Guidelines for Sustainable Forest Management, the briefing note on NWFPs prepared by FAO's Tropical Forests Action Programme and the draft Manual for Local Planning of NTFP Development prepared by Appropriate Technology International (ATI).

Collaboration agreement between INBio, Costa Rica and MERCK & Co., Inc.

Parties to this unique agreement which became effective on 1 October 1991 are:

1. Asociación Instituto Nacional de Biodiversidad, a non-profit organisation existing under the laws of Costa Rica ("INBio")
2. Merck & Co., Inc., a corporation organized under the laws of the State of New Jersey, USA ("Merck")

INBio is interested in collaborating with private industry to create mechanisms to help preserve Costa Rican conservation areas by making them economically viable.

Merck is interested in collaborating with INBio to obtain plant, insect and environmental samples for evaluation for pharmaceutical and agricultural applications.

On its part, INBio agrees to:

- establish facilities for the collection and processing of plant, insect and environmental samples from Costa Rica;
- hire and train an adequate staff to collect and process the samples;
- provide training to INBio staff in Merck facilities;
- supply Merck with a specified number of plant, insect and environmental samples per year over the initial two-year period of the Agreement as described in the workplan;
- maintain appropriate financial records relating to the project and to allow Merck to review such documentation;
- not to provide during an initial evaluation period of two years, to other parties for use in the field of human and animal health and agriculture, any samples that have been provided to Merck.

On its part, Merck agrees to:

- provide research funding of US$ 1.0 million during the first two years of the Agreement and to contribute to INBio laboratory equipment and materials needed to establish the processing laboratory at the University of Costa Rica.
- evaluate the samples provided by INBio in proprietary assays for potential activity as human health, animal health and agricultural compounds; advise INBio of confirmed and reproducible activity that has been identified in any INBio samples;
- assign unique identification numbers to all INBio samples and to maintain an identification system which will allow Merck and INBio to identify all products which may be subject to royalty under the Agreement;
- pay a royalty to INBio on any human or animal pharmaceutical product or agricultural chemical compound which is isolated initially from or produced by a sample provided to Merck by INBio;
- maintain accurate records which will allow Merck and INBio to identify all products subject to royalty and to enable INBio to confirm the accuracy of Merck's royalty reports;
- indemnify INBio from any claims arising from the use of the samples, except for any claims resulting from the negligence or other wrongful act of INBio;
- comply with all regulatory and other requirements which apply to the use of the samples;
- provide additional funding in an agreed amount to support INBio's work during any extension period.

Note: This Agreement was renewed with appropriate modifications in mid-1994.

[For information of a non-confidential nature relating to the working of the agreement, contact: Rodrigo Gámez, Director General, INBio, AP 22-3100, Santo Domingo de Heredia, Costa Rica; Fax: +506 2362816 or Merck & Co. Inc., P.O. Box 2000, Rahway, NJ 07065, USA.]

ENVIRONMENTAL DIMENSIONS OF NWFPs

The environmental dimensions of NWFPs cover a wide range of roles and aspects such as: generally non-destructive nature of NWFP harvests supporting sustainable management of forest resources and conservation of biodiversity; their contributions to the socio-economic welfare of communities living in uplands and watershed areas; their amenability to be integrated with the management of protected areas and buffer zones and compatibility of management objectives, allowing controlled extraction of NWFPs; eco-tourism and other services which are environmentally sound and safe and which can generate income especially in marginal areas and for local populations; intellectual property and heritage values as well as intrinsic values of several NWFPs to the communities and their cultural diversity; their intricate linkage to forest biogeochemical cycles and food systems; their ability to incorporate both economic and ecological objectives.

In order to take advantage of these environmental dimensions, it would require considerable planning, investment and infrastructural development. For example, potential for wildlife and nature-based tourism exists in most countries, but the development of the potential is hampered by lack of financial resources, skills and facilities.

It is the usual assumption that harvests of NWFPs are benign in environmental terms. This is not always true. Unplanned harvest of NWFPs without adequate knowledge about their resource base, appropriate tools and techniques to be used, the regenerative capacity of species and their silvicultural requirements, the seasonal variations in productivity, and the local subsistence demands, can result in severe environmental damages. The Consultation emphasised that capacity to determine optimum levels and methods of harvesting is very important.

The lack of compatible forest management systems, combining ecological and economic prudence, suited to the various situations encountered, do present serious problems. And, the situation poses many challenges as we still know only very little about the stand dynamics, ecology and silvicultural requirements of many of the forest ecosystems, especially in the tropics. There are also the traditional dilemmas encountered in balancing operational efficiency (cost of production) with considerations of conservation in order to achieve eco-efficiency. Apart from technological improvements, these it will call for new arrangements of access, ownership, control and management, and a clear understanding of the role of local people, management agencies, industry and governments.

Sustainability has become a catch-all word, with different meanings to different groups and in different situations. Ecological sustainability refers to the continuing functions of ecological life support systems, in this case the forest ecosystem. Economic sustainability, on the other hand, refers to continuing functions that support economic growth. Particularly in planning NWFP activities, these two forms of sustainability needs to be addressed and harmonised.

The Consultation underlined that institutionalising sustainable NWFPs development will require attention to: poverty alleviation, appropriate policies and strategies, generation of scientific skills, balancing of techno-economic systems with social value systems, and adequate financial instruments.

NEW RESPONSES

New pressures on forest resources, and particularly those affecting NWFPs, call for new responses. We need to know more about the behaviour of both the ecosystems and social systems involved in NWFP activities; and we need to understand the viability of production of NWFPs.

In terms of the responses by both social and natural systems to increasing scarcity of forest resources, it is possible that increasing scarcity can lead to technological innovation for more efficient management and harvesting, or to substitution by other products. However, historical experience shows that the time lag between resource depletion and such technological innovation can be environmentally disastrous for complex systems like tropical forests. Likewise, scarcity does not necessarily lead to substitution, as evidenced by the case of rhinoceros horn, which, although extremely scarce, continue to be sought after, threatening the survival of the species. Better environmental impact assessment of existing technology and strategy will help to promote improvements and innovations covering: research, education and extension for the development of NWFPs; information gathering; statistical and accounting systems; community participation; involvement of private sector; multidisciplinary approach to resource management; exchange of experience and knowledge; regional and sub-regional mechanisms to create centres of excellence.

RECOMMENDATIONS

Recommendations made by the Consultation relating to management and conservation of NWFP resources and their larger environmental implications are included in the Summary of Recommendations given in Section 6 of this report.

INSTITUTIONAL CONSIDERATIONS 5

INTRODUCTION

Institutional considerations relating to NWFPs including a common definition and classification was discussed based on two theme papers and three satellite papers (see Appendix 4.4): the resource persons Mr. El Hadji Sène and Dr. C. Chandrasekharan introduced the subject and presented their papers "Non-Wood Forest Products: The Institutional Aspects" and "Terminology, Definition and Classification of Products other than Wood" respectively.

A healthy institutional system is essential to provide an atmosphere conducive for development. One of the major ills afflicting the NWFP sector, more than any others in forestry, is the institutional neglect relating to policy, strategy and plans, legal rights and arrangements, incentives, development of skills, access to and availability of information and support from public administration. The Consultation considered that often there is a policy bias against NWFPs.

Most of the issues, constraints and problems affecting NWFPs are to a great extent institutional in nature, and linked to institutional deficiencies. These are exemplified by low priority and recognition for the socio-economic contributions of NWFPs, over-emphasis on timber values, inappropriate resource management and lack of incentives for better management, unplanned land use changes, backwardness of technology and wasteful use of NWFPs, lack of statistical and other information, and neglect of NWFPs in the system of national accounts.

The historical reluctance of modern institutions to recognise the large informal sector of NWFP activities stems in part from the lack of appreciation about the dynamics of ecosystems and their interlinkages with socio-cultural and economic systems. There is need to redefine the whole linkages and the role of institutions and institutional instruments in supporting development of NWFPs as an integral part of the forest ecosystem.

POLICY SUPPORT

The Consultation reviewed the present situation with regard to policy support for developing NWFPs. The lack of recognition of NWFPs as an important sub-sector, in their own right, contributes to the lack of clear policies for their development.

SECTOR POLICIES

In most forest sector policies, wherever they exist, NWFPs get a mention in passing, but without clear objectives, targets and strategies for development. In other cases, some of the component elements relevant to NWFPs can be found scattered under other sectors. This deficiency leads to the lack of appropriate plans, programmes and projects related to NWFPs, and inadequacy of investment. Because of this, there is hardly any emphasis on developing and maintaining a database on these products. There has been initiatives to improve the situation in some countries, but a lot more needs to be done, and urgently.

The Consultation stressed that a comprehensive and well-articulated policy is vital for development of NWFPs. Such a policy, among others, should specify the relative role of non-wood forest goods and services in supporting socio-economic development, poverty alleviation and environmental conservation, suited to the situation of the country concerned. It should also consider their externalities and the likely risks of unplanned utilisation of NWFPs.

The policy should provide an objective and balanced view of the sector. Rather than being overly obsessed with commercial interests or subsistence needs, it should address such issues as incentives, development of technology, level and nature of resource use and management, product development and promotion and institutional arrangements. It needs to provide a new legal and ethical framework to manage and regulate the different uses of NWFPs. Also, the policy objectives should be capable of being translated into action; in order to allow resources to be sustainably used.

In formulating such policies cognisance should be given to the role of NWFPs, of both plant and animal origin, in the subsistence and market economy.

The Consultation recognised the urgency to develop holistic policies that consider the need to protect the forest resources to benefit local communities, to meet their cultural and spiritual needs, to promote the development of NWFP-based enterprises and to enhance service contributions such as ecotourism. In developing such policies, it is necessary to use the services of multidisciplinary and multisectoral groups/task forces and to involve all interested parties. This can be facilitated by international organisations by providing a policy frame work to serve as a model to formulate national policies. The need for as clear a definition as possible, indicating the scope and boundaries of NWFPs to facilitate policy development was also emphasised by the Consultation. It was further noted that gaining the support of policy-makers for NWFP development requires careful awareness-raising efforts by development and research agencies, NGOs and universities. It requires more intensive efforts to evaluate all benefits of NWFP use in order to gain institutional recognition for the socio-economic roles of NWFPs.

Strategy

Translating the policy objectives into action call for several strategic components including laws and regulations, technology and entrepreneurial development, involvement of stake holders, incentive systems, intersectoral coordination, adequate information base, trained human resources, improved planning capabilities and so on. A comprehensive strategy should ensure that these institutional measures appropriately cover resource inventory and management, harvesting, processing, utilisation and marketing. Policy instruments such as taxation, often, can influence development. Taxes on exports of unprocessed raw materials can encourage local processing and provide funds for investment. On the other hand, undeserved subsidies often serve as a disincentive for improving efficiency.

Legislation and Regulations

In many countries, existing forestry regulations are more control-oriented and not conducive to sustainable development. They do not adequately address key issues such as tenurial rights, access to resources, financial incentive systems, credit mechanisms, decentralisation of resource management, involvement of local communities and private sector in NWFPs development, protection from exploitative trade relations, intellectual property rights on resource information, contractual negotiations, and sectoral structure related to

production, processing and trade. Improved and comprehensive legislation and regulations are needed regarding all aspects of NWFPs. In many cases contradictory laws need to be harmonized, and biases corrected. In reviewing and formulating legislation, rules and regulations, the countries in the various regions and sub-regions could collaborate and exchange experiences for mutual benefit.

SECTORAL BODIES

A number of sectoral bodies, governmental and non-governmental, are involved in the wide range of activities related to NWFPs. The Consultation observed that broad-based involvement and collaboration of all concerned institutions and entities appears to be a rational and desirable approach. This will help to pool resources and knowledge in order to address the urgent issues affecting the NWFPs sector. Households, local communities and organisations, private sector, business establishments, financing agencies, research and academic institutions, public administrative bodies and non-governmental organisations, all can play important roles in accelerating a healthy development of NWFPs. It is also necessary to curtail or eliminate some of the erstwhile practices which have lead to depletion of natural resources, e.g. role of exploitative middlemen, and debt-based relationship between traders and collectors/cultivators of NWFPs. The actual situation, in most cases, is far from the desirable.

Forest Administration Agencies

The need for effective public forest administration to implement the national policies and to enforce related rules and regulations was highlighted by the Consultation. It noted that such of organisations are often weak. Moreover, structures within the existing system of public forestry administration do not provide for separate identify for NWFPs nor for promoting linkages with various public and private institutions. In this regard the lack of a proper identity and a system of classification for NWFPs are bottlenecks in defining the role and missions of the relevant organisations.

Within the overall sectoral policy relating to NWFPs, the organisations/agencies should have specified missions, and they could include some or all of the following: provide guidelines for resource management and monitoring of management activities; ensure appropriate harvest levels and standards; enforce regulations relating to production, processing and trade; provide information services and other supports to decentralized units; carry out sectoral planning and intersectoral co-ordination; collect and aggregate statistics on NWFPs for use in the system of national accounts. In order to carry out these functions the national forest services would require reforms in their structure with clear lines of responsibility for NWFPs.

Local Community Groups

Local households and groups are major users of NWFPs for self consumption and income generation. Provided they have continued access and incentives for management of resources, they tend to take initiatives to develop sustainable harvesting practices with minimum support from government agencies. Examples include the extractive reserves of Brazil and community reserves elsewhere managed by local communities for sustainable NWFP extraction. Other examples are the management of *acacia* stands in Sudan and Chad, the management of sub-humid and dry woodlands in Africa, the extraction of *chicle* in Peten, Guatemala and joint forest management in India.

NON-GOVERNMENTAL ORGANISATIONS

With the flexibility in their functioning, NGOs could play a very important role in developing community-based organisations and in promoting the development of NWFPs at local and national levels. The Consultation took note of the interesting experiences of the NGOs represented at the meeting.

Local organizations and NGOs working together can help to avoid unsustainable extraction of NWFPs. Past extraction of NWFPs from developing countries to satisfy external demands have been called "economic booms". However, these booms benefited only external economies and a small local elite, with local communities and local environments paying a high price. This was the case of the "rubber boom" in Amazonia in the early 1890s, which benefited mainly industrialized countries, and was accompanied by genocide of indigenous groups.

During the 1970s and 1980s a similar situation appeared again in Amazonia. Land-use conflicts between rubber tappers (in alliance with indigenous groups) and cattle ranchers resulted in the loss of hundreds of rubber tappers' lives. At the same time, strong, political and environmental community-based organisations (CBOs) emerged, and began to promote extractive reserves as forest managed by local communities for NWFPs, and as a means of improving the local standard of living while conserving the forest. Now there are in Amazonia many NGOs and CBOs, organised in structures that are at the same time political and environmental organisations, like the Confederation of Indigenous Peoples of the Amazon Basin (COICA), which comprises more than 400 indigenous organisations and plays an active role in forestry development in the region.

This illustrates how grassroots initiatives can help to resolve land-use conflicts.

INTERSECTORAL COORDINATION

As an integral component of the forest ecosystem, NWFPs have considerable interface with several other sectors and activities, such as agriculture, horticulture, animal husbandry, fishery, food security, rural development, industry, trade and environment. The Consultation underlined that coordination at various levels (eg: policy, programme, activity) and between the concerned groups and institutions (between sectoral ministries, between governments agencies and community groups etc.) is very important. Inter-sectoral coordination should be an important responsibility of the public agency in charge of forestry in a country.

PARTICIPATORY DEVELOPMENT

Broad-based, willing and organised participation encompassing local groups, women, indigenous communities and private sector is an essential means of strengthening the institutional structure for developing NWFPs for their economic and ecological benefits. Appropriate gender considerations can help to improve the effectiveness and benefits of NWFP programmes at the local level. The Consultation expressed the view that people dimension of NWFPs should come out clearly in policies and strategies; and this would call for appropriate legal provisions regarding tenurial rights and security, incentives, equitable sharing of benefits and so on. When the value of products accrue to the intermediaries and the people engaged in their production remain poor, there will be no incentive to conserve and sustainably manage the forests. It is necessary to ensure that the primary producer receives remunerative prices for the products.

Overcoming constraints in marketing medical plants: Nepal

In central Nepal, there are two projects aimed to develop markets for medicinal plants, in order to promote forest protection through local income generation. Project activities include harvesting to establishment of a district-level industry,

In the first project, 200 families organised into cottage industries and producer groups, supply materials to a factory that the project established to produce traditional Ayurvedic medicines. The factory advises producers on product standards and marketing requirements. The second project is aimed to develop a consumer market for Ayurvedic medicines.

Infrastructural obstacles faced by the projects were both physical (few roads) and social (lack of local knowledge on product standards, corrupt practices of some middlemen and officials, and an "underground" medicinal trade controlled by a few powerful people).

As in many countries, no legislation specifically governed NWFPs — they were subject to timber laws. Foresters were responsible for managing the resource, but usually had poor knowledge of NWFP marketing. They expected villagers to pay royalties on plants collected from their own land, because the medicinal species were on the list of forest/timber species.

Rules governing forest products should be organised by source of plant origin (e.g. collected from forest, or grown on farm) and the intended use, not by grouping all forest species with timber, thus assuming forest origin.

In developing local markets for Ayurvedic medicines, the project's analysis of the traditional medicine market showed a growing gap between the national medicines trade and local preferences and needs. Government policies regarding medicinal advertising and international institutions encourage the use of imported medicines and western methods, which are maladjusted for 85 percent of the population. The resulting devaluation of traditional medicine forced the project to use "modern" processing and marketing for its Ayurvedic products, and to devote a large portion of the budget to public awareness and advertising campaigns.

The project was the first to apply for credit from the country's Agricultural Development Bank for production of Ayurvedic medicine. Lack of established channels caused delays.

International NGOs were puzzled by the business aspect of the venture, and "afraid of the 'reality' of the business world".

With mutual respect, patience, and persistence, the projects and their community partners overcame these obstacles. The second project took only two years to break even.

Summarized from Isabel LeCup, 1994. The Role of marketing of non-timber forest products in community development projects: Ayurvedic medicinal plants in Nepal. In Raintree, J.B. and Francisco, H.A., eds., *Marketing of multipurpose tree products in Asia*. Proceedings of an International Workshop held in Baguio City, the Philippines, 6-9 December 1993. Winrock International, Bangkok.

Past emphasis on the part of governments on revenue and scepticism about local abilities to manage forests must give way to the recognition of the reality of local dependence on, and concern for sustainably managing, forest resources. The recent development of joint forest management in India provides an excellent example. Under the new policy, the state retains ownership of the forest resource, but local communities participate in its management

and receive 25-30 percent of the wood harvested, and 100 percent of NWFP harvests. This programme shows a recognition of increasing forest scarcity, and marks the shift from a revenue emphasis toward a priority of forest conservation through community involvement.

The scope of participation is not confined to economic benefits. It covers planning, knowledge sharing, and monitoring and evaluation of programme impacts. Local management objectives should be given adequate consideration. Knowledge on NWFPs to a significant extent is local, empirical and often linked to nature. Like in the case of planning, local people can give valuable inputs for identifying research problems.

The Consultation expressed strong view that in adding value to NWFP resources, each country has to design arrangements appropriate to its situation covering access, control, management and ownership of the resource and involving local people and groups, management agencies, industries and trade.

INSTITUTIONAL SUPPORTS

Development of skills and capabilities through education and training, research and extension are important institutional services. Efficiency of these services in relation to NWFPs, will be reflected in how far these products support socio-economic development and how far it succeeds in the market place, without jeopardizing their role in supporting local communities.

Capacity Building

The Consultation expressed concern that facilities for imparting skills and improving technological capabilities in the field of NWFPs are very limited in most developing countries. Because of the variety of products and processes involved, skills at various levels and covering different disciplines are essential.

Forestry education and training at all levels needs to be revised to include NWFPs as an essential component. It should be multidisciplinary and not dominated by the biological sciences. Special facilities are to be established for training of marginalised groups, such as indigenous people and women. Similar specialised facilities are also required for planners, entrepreneurs, NGOs and others.

Subjects related to NWFPs need to be included in forestry curricula at all levels, including in continuing education for resource managers, researchers, and extension workers. Forestry schools should encourage a multi-disciplinary selection of courses, including marketing, community organisations, and conflict resolution. Training of policy-makers and planners should take place through workshops, seminars, and trade fairs. Community-based organisations need training to strengthen their institutional capacity as well as technical abilities in NWFP activities like marketing and processing.

Research and Development

The generally poor situation of NWFPs in most producing countries is partly attributable to inadequate technology, extremely weak research support and/or lack of adequate attention to problems of NWFPs. Research needs for improving technology related to NWFPs are tremendous, touching upon all aspects of their management and development. This would cover among others: enhancing knowledge about NWFP resource; methods of

inventory for different NWFPs; gathering scientific data on the nature of the products; prospecting, screening, evaluating and classifying plant species (e.g. by pharmacological and toxicological studies on medicinal plants) and identifying candidate species for development of specific products; domestication and cultivation including aspects of monoculture and agroforestry; control of pests and diseases; on-farm experimentations such as species introduction trials; plant breeding and genetic improvement including use of germ plasm resources in the wild for improving yield and resistance of established crops to pests and diseases; improving of agronomic practices; improving harvesting methods and practices to reduce wastage and damages and to increase yield; adaptation of imported technology; improvements in processing, packaging and distribution of products; and product diversification including improvements of quality.

Considering the variety of NWFPs and the related management situations, and the need to address the complex array of problems, the urgent need for strengthening research support is obvious.

The Consultation reaffirmed that development of NWFPs depends on how far its succeeds in the market place. Therefore, to be effective, among others, research institutions need: competent and motivated scientists, support staff and research managers; ability to conduct continual strategic evaluation of market conditions and opportunities; autonomy and opportunities to be self-financing; means to interact directly with producers and users to influence production and marketing. Linkages and networking arrangements need to be established with related institutions (e.g. with botanical, phytochemical and pharmaceutical research organisations) to facilitate information exchange and transfer of technology.

Participants involved in or representing institutions carrying out research in different aspects of NWFPs — FAO Forestry Research Support Programme for Asia Pacific (FORSPA), Centre for International Forestry Research (CIFOR), FAO Asia-Pacific Agroforestry Network (APAN), International Centre for Research in Agroforestry (ICRAF), Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO), Appropriate Technology International (ATI), National Institute of Biodiversity of Costa Rica (INBio), Natural Resources Institute of UK (NRI), Veld Products Research of Botswana — shared their experiences with other participants at the Consultation. The importance of international collaboration, particularly at regional and sub-regional levels to address common research problems (eg. of arid zones, upland regions) and exchange information through regional networks was highlighted. The Consultation observed that regional agreements and structures could realize alliances for sustainable forest development. A recent initiative in this area is the Central American Convention on Forests (CCAB).

The Consultation noted that incentives for researchers remain geared toward academic accomplishments, and not enough to solving of real-world problems and "hard" topics, such as multiple-use management, product development, and market research. There remains much duplication of costly scientific effort. Social-science issues are mostly ignored. It agreed that institutions need to better focus their efforts on problem-solving approaches.

Multidisciplinary research should be encouraged based on community involvement and community-identified priority problems. Researchers should act as facilitators and problem-solvers, ensuring that their research produces solutions to the problems of target communities. The results of research should be made available in local languages or through innovative media.

The Consultation urged the international assistance agencies and industrialised countries to facilitate freer transfer of technologies and information to developing country institutions to improve their capacity to undertake research initiatives.

EXTENSION

The Consultation emphasized that extension, including delivery of inputs and technology, is an important task. An aspect further stressed is the importance of research-extension linkage which incorporates participatory research and demonstration.

INFORMATION BASE

TRADITIONAL KNOWLEDGE

Information on traditional systems of management and utilisation of resources often provides valuable insights for improving and upgrading these systems. Over centuries of close relationship with the forests and nature, the forest dwelling and rural communities have discovered innumerable natural products, many of them of non-wood origin. Their knowledge about medicinal and food plants are considered particularly interesting and valuable. However, hard information to underpin this statement is sorely lacking. With few exceptions, the NWFPs have never been studied in depth, neither in respect of quantities produced nor of their socio-economic importance. Except for few case studies, the situation is marked by an almost total lack of information particularly of those products that are consumed locally. Efforts are required to collect and compile such information. These can supplement technical information derived through research and scientific investigations.

Statistical database covering production, trade and utilization, and costs and prices is another component of the information system and these are essential for planning NWFPs development.

STATISTICAL INFORMATION

The Consultation recognised that planning and informed decision-making is highly demanding on both quantitative and qualitative information. It is necessary to delineate the organisational responsibility for data compilation and analysis. Researchers have a responsibility to provide information on technological aspects, biological characteristics, environmental implications and so on. Often the international conventions and agreements such as CITES, and attitudes and preferences of consumers have implications on the use and trade in NWFPs, and these would require detailed studies.

The need to enhance and expand the information base on NWFPs cannot be overstated.

While statistical information at the local and national levels are vital for planning, those at the international level help intercountry comparisons and analysis of trade. The Consultation was informed about the efforts of FAO in the area of forest products statistics at the international level and the need for developing a system of international statistics in NWFPs. To facilitate better statistical coverage, at national and international level, it is necessary to have an agreed system of classification for NWFPs.

The Consultation suggested that as a first step, consideration should be given to assembling and disseminating statistical data for selected groups of internationally traded NWFPs in a more concise and readable form than is presently available. Included with statistical data should be information on price movements, and supply and demand trends gleaned from trade sources.

PLANNING NWFPs DEVELOPMENT

Achievement of Development objectives call for proper and detailed planning.

In any complex institutional system, conflicts of interests are natural. But they are resolvable through compromises, if the development objectives are clear and well understood. For example, almost no one will argue that environmental conservation is to be achieved by halting economic progress. However, there is need for certain well-founded criteria as to how conflicts can be avoided in achieving different objectives. With regard to NWFPs, this is not an easy task. Each country will have to design criteria and related norms appropriate to its situation and this should incorporate national objectives of welfare and equity.

Improved Planning Capability

In this connection, proper planning is very relevant and crucial. Plans provide the basis for investment and development. And plans are only as good as the information on which it is based. Lack of adequate information makes plans on NWFPs weak.

The social costs and benefits involved in the use of NWFPs are not fully reflected in the market value, and it is therefore necessary to apply new tools and methods to estimate their true values as a means to support realistic planning for cost effective development. It is essential that the countries and concerned institutions acquire improved planning capability to support development of NWFPs.

Role of International Assistance

It was recognized by the Consultation that international assistance in key areas of NWFP development can play a very valuable and catalytic role. This role could include facilitating transfer of technology and know-how, dissemination of information, support for capacity building and provision of funds and market opportunities. In this regard it is necessary for international agencies and development banks to incorporate NWFPs as an important component in their policies and programmes.

TERMS, DEFINITION AND CLASSIFICATION

The Consultation kept this sub-theme to the last in order to obtain a better perception and feel, based on discussion of other related themes, about the importance of terms, definition and classification for clearly understanding what is involved in sustainable management of forest resources.

The meeting recognised that forest values include three specific components — wood products, non-wood products and externalities (i.e. non-transactable benefits).

TERMS

The Consultation reviewed the relative merits of the different terms used for referring to **forest products other than wood**. It agreed that the term **non-wood forest products** is more specific in its scope, precise and consistent, has greater universal applicability and incorporates components which are better quantifiable; and therefore, technically and scientifically more appropriate for general use. It may, however, be necessary to use other terms in special circumstances and contexts. In such cases, the terms need to be defined for the context of their use.

DEFINITION

A definition attempts to state the meaning of a term specifying its limits and scope, nature and distinctiveness as precisely as possible. The need for a clear definition of **non-wood forest products**, indicating scope and boundaries was emphasised by the Consultation. After discussing several alternative definitions the Consultation proposed the following to be adopted for general universal use:

> **Non-wood forest products consist of goods of biological origin other than wood, as well as services, derived from forests and allied land uses.**

The Consultation recognised that the definition of NWFPs includes both goods and services of plant and animal origin and confirmed that it should be so. One of the important purposes of product definition is to facilitate product classification, providing a framework for consistent accounting. Accordingly the boundary of NWFPs is defined to be in harmony with the accounting definition (used in the System of National Accounts — SNA) of production. Production is understood as a physical process carried out by institutional units that use labour and assets to transform inputs of goods and services into output of other goods and services. All products, both goods and services, are capable of being transacted. Thus the definition of non-wood forest **products** does not incorporate intangible non-transacted benefits such as cultural values and influence on climate.

The Consultation welcomed that the definition of NWFPs has recognised the increasingly important service functions of NWFP resources. For example, eco-tourism is the fastest-growing division of the world's largest industry, tourism. And, the forest/wilderness/wildlife component of eco-tourism should be recognized within the scope of NWFPs.

Likewise, biodiversity prospecting is now placing economic values on an environmental function. National sovereignty over biodiversity, as well as increasingly important intellectual rights for communities and countries where biodiversity is being prospected, have recently gained international recognition. National governments need to act decisively to secure these rights for their people.

CLASSIFICATION SCHEME

Classification refers to a rational system of relationships wherein distinction and coherence between elements are put into shape by logical structure and ordering, within defined boundaries. Classification is essential to help provide data by homogenous categories and to display interconnections between categories. Product classification, specifically helps

to trace the flow of goods and services through the economic system from the producers to the eventual users and facilitates systematic analysis to support development.

The Consultation noted that an internationally accepted classification and a common measurement system for NWFPs would help:

- Compilation and international comparison of statistical information;
- Planning for sustainable utilisation;
- Incorporation of NWFPs into the products and trade statistics as well as into the system of national accounts;
- Appropriate identity for NWFPs and recognition for their contribution to socio-economic development.

The lack of an internationally accepted classification for NWFPs has hindered the compilation of statistical information. Statistical information on NWFPs are not properly or regularly reported, and they hardly feature in national accounts. Few of the products on which information is available normally get reported under other sectors: agriculture, horticulture, etc. Thus, what we get is a distorted picture of the NWFP sector.

The tentative classification scheme for NWFPs given in the theme paper on the subject was accordingly intended to provide an identity and clarity to the diverse group of products, whereby NWFPs could enter into established international classification systems of economic activity and trade, and thereby enter the SNA. This is especially important for improved statistical compilation and aggregation, which in turn influence decisions on support for development.

The proposed system of classification builds on several systems already in place: the International Standard Industrial Classification of All Economic Activities (ISIC), the Standard International Trade Classification (SITC), the Harmonised Commodity Description and Coding System (HS), and the Provisional Central Product Classification (CPC) system. Particularly relevant is the proposal to treat NWFPs in an annex to ISIC, as has been done for the diverse components of the tourism industry.

The Consultation considered the classification scheme and recommended that the scheme be pursued for developing a comprehensive and refined system of classification, involving specialists in the field. It recognised that a classification for NWFPs, harmonised with other existing systems and adopting multi-digit coding are adequately flexible and therefore capable of being adjusted to the contexts within which different organisational units operate and to the specific situation of individual countries.

The Consultation agreed that improvements in the classification of NWFPs have to take place within an improved system for forestry as a whole. It was underlined that treating it in isolation will be artificial since forest benefits, wood and non-wood goods and services, are inextricably linked. Forest influences and many intangible benefits (for example, watershed values) cannot be classified either with (or as part of) wood or non-wood products.

FOREST ACCOUNTING

The System of National Accounts (SNA) provides a coherent, consistent and integrated set of macro-economic accounts, balance sheets and tables based on internationally-agreed concepts, definitions, classifications and accounting rules. All the other systems feed into SNA. It is thus harmonized with related statistical systems.

Proper forest accounting, based on a harmonized system of classification will facilitate its incorporation into SNA. As indicated earlier, forest accounting will have three components — wood products, non-wood products and externalities. The first two are normally quantifiable.

Wood products are reasonably well classified and, except in the case of fuelwood, are adequately covered by a system of statistical reporting. Unlike in the case of wood products, bulk of transactions of NWFPs takes place outside the formal and organised system. In such cases, national accounts and other statistical systems can accept estimates based on proxy measures and other valuation methods. The number of people benefitted, or the imputed value of unreported consumption of NWFPs such as fodder/forest grazing, traditional and herbal medicines, non-wood construction materials, food and edible products from wild sources are acceptable as a basis for estimation. Adequate efforts in that regard, however, are yet to materialize. A challenge is to plan and implement innovative approaches for measurement of non-wood values, which are equal to the magnitude and complexity of the problem involved.

Unlike the cases of wood and non-wood products, valuation of externalities has to be undertaken as a satellite accounting system. Satellite accounts generally stress the need to expand the analytical capacity of national accounting for selected areas of concern in a flexible manner. It helps to provide additional information on particular social concerns; it also helps the use of complementary or alternative concepts when needed to introduce additional dimensions to the conceptual framework. The latest edition (1993) of SNA has brought in environmental accounting in a satellite accounting framework, i.e. the System of Environmental Economic Account (SEEA). This makes it possible to deal with economic and environmental concerns in a compatible manner, as they apply to the concepts of sustainable growth and development.

There have been increasing number of attempts to improve and make use of economic techniques to value the externalities; and different techniques are being tried in different situations. These include methods such as replacement cost, shadow prices, surrogate market, compensation, sample questionnaire surveys, travel cost/travel time valuation, hedonic pricing, and contingent valuation.

The Consultation stressed that forest accounting and related aspects deserve greater attention.

RECOMMENDATIONS

Summary of Recommendations relating to institutional considerations for NWFPs development can be seen in Section 6 of this report.

SUMMARY OF RECOMMENDATIONS 6

The recommendations of the Consultation are divided into five groups, based on the audiences to whom they are addressed:

(A) General (addressed generally to several relevant agencies including governments, non-governmental organisations, private sector, international agencies and donors);

(B) National governments (particularly policy-makers and planners);

(C) Donor agencies and development assistance agencies;

(D) Research institutions, and

(E) FAO and other international organisations.

Recommendations under each group are further subdivided by the theme areas of the Consultation.

A. GENERAL

A.1 Socio-Economic Benefits

1. Governments, NGOs, private sector, donors and assistance agencies should place adequate emphasis on NWFP activities which have a high potential for poverty alleviation. They should, however, be cautious not to lock people into activities that do not have growth potential.

2. The contribution of NWFPs to food security and nutrition of rural people living in and near the forests should be given due recognition and attention by governments, donor agencies and financial institutions, NGOs and others when designing, implementing and evaluating development policies and programmes (e.g. forestry, health and nutrition) in forested areas.

3. Efforts should be dedicated by all concerned institutions/organisations to enhance the overall socio-economic benefits based on NWFPs.

4. Valuation of all benefits of NWFPs, also including specific non-market benefits and socio-cultural values, should be given increased attention by national governments, NGOs, international agencies, research institutions and universities.

5. Increased efforts are required on the part of all concerned agencies/institutions to help raise the awareness of policy-makers and planners on the real significance and importance of NWFP-based development, and to ensure that decisions regarding the use of NWFPs are placed in a context that recognises their values and consequences that currently go unrecorded.

6. To resolve land use conflicts over use of NWFP resources, stakeholders are to be encouraged to pursue mechanisms that bring together all parties involved to clarify

tenure, access, user-rights and benefit sharing issues; international and national organisations should help to identify and disseminate information about methods of conflict resolution.

7. National and international development agencies including NGOs should ensure that the environmental, economic and socio-cultural interests are adequately represented in the project teams for management of NWFPs.

8. Gender considerations should be given appropriate importance while implementing policies and programmes relevant to NWFPs.

A.2 Processing and Marketing

1. Given that resource management, raw material production, processing, marketing and trade and related policies are interlinked, all concerned agencies/organisations should promote and facilitate better and freer flow of relevant information among all parts of this chain with particular focus on primary producers who are often not adequately served.

2. Governments, NGOs, donors and agencies providing development assistance need to recognise the importance of market factors and informed marketing strategies. The NWFPs that enter into trade require a market-oriented approach, but without disrupting local use or causing other adverse socio-economic or environmental consequences.

3. In view of the potential role of NWFPs in trade and development, the concerned national and international agencies should help to raise awareness of business community about the long-term benefits of NWFP enterprises, and to improve the flow of relevant information on products and processes, resource availability, business opportunities, end-uses and so on.

4. Studies need be undertaken, by appropriate institutions, on the implications of international conventions and agreements such as CITES and TRIPs as they affect the trade and marketing of NWFPs with a view to avoid distortions in their application and to promote a harmonious balance in resource conservation and use.

5. Regional institutions such as ASEAN and CARICOM should promote and facilitate trade in NWFPs.

6. International agencies, donors, governments and NGOs should recognize the importance of setting up units for processing NWFPs in close proximity to the raw material resources in order to improve the economic benefits to the rural people.

A.3 Resource Management and Environment

1. As appropriate and feasible local knowledge on conservation and use of NWFP resources should be collected, documented and adopted as a basis for their management. This information should be fed into data bases and dissemination systems.

2. International agencies, donors, governments, NGOs, private sector, research institutions and universities should help the development and adoption of better methods of assessment/prospecting, planning, conservation and sustainable management and use of the resource base of NWFPs.

3. The service functions of forests such as conservation of bio-diversity, their value as a source of heritage value and bio-chemical information, and their potential for supporting nature-tourism and bio-technological development should be given due emphasis.

4. The hypothesis that development of NWFPs will facilitate and support sustainable management of forest resources needs to be confirmed through investigations and case studies.

A.4 Institutional Considerations

1. In order to clearly understand the scope and boundaries of NWFPs and for international comparisons, there is need for a commonly accepted definition. The Consultation agreed on the following definition for general use:

> **"Non-wood forest products consist of goods of biological origin other than wood, as well as services, derived from forests and allied land uses."**

When using terms other than NWFPs (e.g. non-timber forest products) for specific purposes and situations, those should be appropriately defined.

2. In assessing available options for developing NWFPs, all concerned parties should consider long-term resource sustainability, improvement of local livelihood, economic viability, socio-cultural values and effects on disadvantages groups.

3. National and international agencies/institutions involved in the field of NWFPs should contribute to the improvement of scientific knowledge, technology and skills relevant to all aspects of it.

4. Efforts should be made by all agencies/institutions to improve statistical information on resource base, production, value addition and trade and other information required to develop plans and strategies for development.

5. Governments, donors and international agencies should help to establish/strengthen training and education institutions at all levels to be capable of meeting the need for multiple skills for developing NWFPs as well as for improving the local capabilities in critical areas. Special programmes and modules should be developed for training of trainers.

6. Donors and international agencies should enhance support for research in the area of NWFPs.

7. Regional (and sub-regional) centres of excellence should be identified and strengthened to be capable of technology transfer, and regional and international cooperation be promoted through collaborative research and exchange of researchers. Regional networks should be established for major ecological regions using the existing international research facilities.

8. In view of the need for dissemination of information, support should be provided by governments, donors and international agencies for establishment of national information centres and international centre/network for information exchange on NWFPs.

9. As appropriate and feasible, national policy-makers, planners, NGOs, private sector institutions and others concerned should take advantage of the existing local knowledge and promote active community participation in NWFP activities including design of management plans, establishment of value adding enterprises, identifying research needs, etc.

10. Funding/financing agencies and organisations providing development assistance should provide financial and technical support to local communities to optimise their involvement in the area of NWFPs. This should include adaptation of credit mechanisms to recognise the circumstances under which small NWFP enterprises operate.

11. Intellectual property rights such as trade secrets, patents and trademarks can help to define and retain rights to NWFP-based discoveries. Efforts must be made to develop collaborative arrangements between potential economic users and source communities and countries, in order to guarantee future potential profit-sharing (typically through royalties), if commercial products are forthcoming as well to provide for adequate technology transfer based on equipment and know how.

12. There is need for South-South and North-South collaboration in reviewing and formulating policies, procedures, rules and regulations, collaborative arrangements, etc.

13. Better coordination is needed among international assistance agencies, between institutions managing information and knowledge, and between dissemination networks.

B. NATIONAL GOVERNMENTS

B.1 Socio-Economic Benefits

1. With regard to policies having impact on NWFPs, the national policy-makers should ensure that development benefits rural communities through provisions for improving their access to resources and employment opportunities, facilitating willing and organised participation, improved extension and financial services, promotion of local value-adding activities and so on. The policies and related plans and regulations

should acknowledge the social, cultural and economic practices and priorities of the communities.

2. Governments should identify and consider particular cultural groups that would require specific resource allocation and policy attention, based on socio-economic assessment of developments based on NWFPs, and provide support to them on a priority basis.

3. Participation of local communities in designing and implementing strategies for developing NWFPs should be facilitated through appropriate measures. The local communities and resource users should be helped to better assess their options considering long-term resource availability, technology, and economic viability.

4. Communities should be encouraged and helped to share the costs and benefits of managing NWFP resources, alongside government agencies, private sector and NGOs.

5. Tenure and usufruct rights are necessary ingredients of sustainable management of NWFP resources by local people. Governments should demonstrate greater innovative tenure reforms to encourage people's participation in sustainable forest management.

6. Wherever appropriate and feasible settlement programmes (e.g. of shifting cultivators) should incorporate a component of NWFPs to support conservation and economic objectives.

B.2 Processing and Marketing

1. Government policies should create conducive environment for development of NWFP-based enterprises, particularly for local processing. Considering the importance of NWFPs in local economy, biases against small-scale enterprises should be avoided.

2. National strategies should aim to add value to selected NWFPs through processing and marketing thereby increasing contributions to local and national economies. Such strategies should include, for example, technology and product development, promotion of export and import substitution.

3. National policies should foster more transparent transactions along the NWFP market chain. This calls for free flow of market information, regulations, measures to protect the interest of resource owners and so on.

4. NWFPs should be provided appropriate importance in the economic, industrial and trade policies of the government.

5. Processing and market development of NWFPs should not deprive the rights of local communities for goods and services such as forest food, fodder/grazing, medicinal plants, and construction materials.

6. Service-oriented, income-earning opportunities like nature tourism which are environmentally sound should be promoted.

7. Governments should promote the establishment of NWFP user industries such as cosmetics, paints, etc., so as to increase the local uses of NWFPs.

8. Governments should encourage institutions to conduct new product development and strengthen R&D.

B.3 Resource Management and Environment

1. Governments should identify critical ecosystems such as drylands, mangroves, wetlands and upland watersheds for policy attention and should develop appropriate strategies for development of NWFPs, consistent with the conservation and sustainable management of the respective ecosystems.

2. Measures should be taken to protect and profitably use the local traditional knowledge about the NWFP resources and their use.

3. The linkage between bio-diversity and sustainable use of NWFPs should be given due recognition and consideration in the plans and regulations at national and local levels.

4. Initiatives need to be undertaken for prospecting bio-diversity in forests for their chemical and biological values so as to derive legitimate benefits to the country and the people. Experiences of countries where such developments are taking place will be useful in this regard.

5. Investigations and actions on domestication of NWFP species and their integration into agroforestry systems should be taken up.

6. Governments should ensure that tenure policies decentralise resource management and encourage broad based participation (of people, private sector, NGOs) in sustainable forest management.

7. Environmental impact assessment of projects related to the use of NWFP resources should be carried out to ensure sustainability.

B.4 Institutional Considerations

1. As necessary, the governments should undertake formulation, review and/or revision of policies having direct impact on NWFPs, with clear orientation towards sustainable management of resources by:

   - Properly identifying and accounting the contribution of NWFPs in the system of national accounts;
   - Enhancing the investment and budgetary provisions for development of NWFPs;
   - Introducing appropriate pricing mechanisms;
   - Granting local organisations (e.g. cooperatives, user groups) and private sector a greater voice in management of the resources;
   - Recognising the socio-cultural importance/significance of the products and their resource base;

- Establishing strategies by clearly identifying priorities.

In the process of policy formulation/review it is necessary to involve multidisciplinary teams, with all interested groups represented. It will also be useful to collaborate with and learn about the experiences of other countries having a similar situation.

2. Policies relating to NWFPs should consider the broader policy environment and be made compatible with the objectives and measures of related policies, i.e., development, environment, land use, agriculture, industry, investment, trade, etc.

3. Governments should review existing rules and regulations having adverse impact on NWFPs and take suitable legislative action to make necessary changes.

4. Governments should establish clear identity for NWFPs by suitably incorporating it in the public forest administration system.

5. Public administration agencies having jurisdiction over (and/or financial interest in) forest resources should have clear mission and plans that proclaim and explicitly strengthen their commitment to stewardship of NWFPs and partnership with local resource users, NGOs, private sector and other stakeholders and financial institutions.

6. Planning, programming and intersectoral coordination (including development of relevant statistical information) should be explicit functions of the agency responsible for implementing forest/NWFP policy.

7. Governments should support the establishment/strengthening of research institutions having capability to conduct research on the different aspects of NWFPs and provided with funds, support facilities, trained researchers, and an effective mechanism for involving users of research results.

8. Adequate support for development of NWFPs in the form of training facilities at various levels, technology transfer, investment advice, extension services, credit facilities, marketing systems and information, and other institutional mechanisms should be ensured.

9. The government should develop institutional capabilities for imparting training and education on NWFPs at all levels if such capabilities do not exist and also build upon capabilities and capacities in existing institutions to take up education and training programmes, targeting various groups including local communities and NGOs. Training programmes and modules for trainers also need to be developed.

10. Information systems (statistical, technological/scientific and others) need to be established, covering resource inventories, resource distribution, production, processing, marketing, utilisation, trade, consumption and other vital aspects. For gathering information on traditional uses of NWFPs, participatory rural appraisal (PRA) methods, as appropriate be adopted.

11. National standards, where appropriate should be developed including quality control, and certification procedures for NWFPs according to market requirements.

C. DONORS AND DEVELOPMENT ASSISTANCE AGENCIES

C.1 Socio-Economic Benefits

1. Donors and development assistance agencies should provide increasing attention to the socio-economic issues relating to NWFPs and direct their support and facilitation efforts accordingly.

C.2 Processing and Marketing

1. Donors and development assistance agencies should facilitate transfer of technology/know how between developed and developing countries, as well as among developing countries.

2. Donor supported programmes for improved processing and marketing of NWFPs should carefully assess the risk to small producers compared to other alternatives through an initial phase of pilot trials or other means. Where the risk is high, it is necessary to establish mechanisms to avoid or share that risk.

3. Donors and development assistance agencies should support product development, market research and improvement of processing and marketing capabilities of producer groups.

4. Programmes on industrial use of NWFPs supported by donors and development assistance agencies should incorporate research on development of new NWFPs with economic potential.

C.3 Resource Management and Environment

1. Donors and development assistance agencies should support inventory/prospecting of NWFP resources and their sustainable management.

2. Industrialised donor countries should assemble and share their experiences in the management of NWFP resources and their utilisation.

C.4 Institutional Considerations

1. Donors and development assistance agencies should provide funding priority for projects on NWFPs and support adequate flow of investment capital into the sub-sector.

2. Donor agencies and development banks should incorporate NWFP activities as an important component in their policies and assistance programmes, and set apart adequate resources for providing financial and technical support to developing countries.

3. NWFP programmes of national and international research institutions should be given special consideration for enhanced support including for such activities as skill development, data base management and dissemination of information.

4. Donors and development assistance agencies should foster and facilitate South-South and North-South cooperation in aspects of common interest through mechanisms such as collaborative research, seminars, consultations and joint ventures.

D. RESEARCH INSTITUTIONS

D.1 Socio-Economic Benefits

1. Research on NWFPs should, among others, address socio-economic issues and help to improve their socio-economic contribution.

2. Research institutions at all levels should develop mechanisms for involving stakeholders in planning, implementation and monitoring of NWFP research. They should also recognise and adequately reward local know how and facilitate its refinement.

3. Research should capture fast-disappearing local knowledge on the management and use of NWFPs. This knowledge should be documented and disseminated.

D.2 Processing and Marketing

1. Research on new products and practices for diversifying production and for meeting changing demands should be undertaken as an important task.

2. Improvement of product quality through better harvesting, processing and handling should be one of the important research objectives.

3. Economic and market research are vital for development of NWFPs, including strategic evaluation of market conditions and opportunities.

4. In order to adapt and introduce emerging new technologies, R&D on process optimization, quality improvement and new formulations of NWFPs should be carried out on an ongoing basis.

5. Mechanisms should be developed by research institutions to transfer their research findings on new products and processes to the private sector industries.

D.3 Resource Management and Environment

1. International and national research institutes should investigate and confirm the validity of the hypothesis that development of NWFPs including services such as nature-tourism leads to sustainable management of forests. Comparison of case studies worldwide should be multiplied and coordinated by international research institutes.

2. Researchers should study management systems along with their environmental impact and socio-economic implications.

3. Researchers should study the ecology and biology of NWFP species, along with their domestication, agronomic practices, and integration in agroforestry systems.

4. The linkage of research and resource management for inventories and bio-diversity prospecting of NWFP resources should be strengthened.

D.4 Institutional Considerations

1. Research on impact of policy measures and regulations on the resource management and utilisation of NWFPs should be included as an important area of research.

2. Meaningful collaboration should be developed/strengthened with disciplines such as anthropology and ethnobotany which have carried out considerable research and published information relevant to NWFPs.

3. Research agencies should develop suitable mechanisms for involvement of users/stakeholders in planning, implementation and monitoring of NWFPs research; and recognize and adequately reward local technical know how, facilitating its refinement/improvement.

E. FAO AND OTHER INTERNATIONAL ORGANISATIONS

E.1 Socio-Economic Benefits

1. FAO and other international organisations working towards the development of criteria and indicators of sustainable forest management should consider socio-economic sustainability of NWFPs as one of the criterion.

2. Enhancement of socio-economic benefits of NWFPs should be an important objective of international assistance for forestry.

E.2 Processing and Marketing

1. FAO should establish a system of dissemination of information on the uses and markets of NWFPs.

2. FAO in collaboration with relevant agencies should assist countries in developing capabilities for marketing of NWFPs and in improving knowledge of local marketing practices, and should encourage the involvement of both private and public sectors in developing sound marketing practices.

3. FAO should provide assistance to countries for strengthening market information systems including the preparation of guidelines for developing such systems.

4. FAO in collaboration with other concerned agencies should promote trade in NWFPs and address such relevant/specific trade issues as rights of owners for the value of information about chemical and biological diversity of forests taken by or made available to interested parties.

5. FAO in collaboration with UNIDO should provide assistance to strengthen R&D institutions to develop additional industrial uses for NWFPs.

6. FAO in collaboration with relevant agencies should assist countries to improve income generation by introducing processing of NWFPs to yield value added products.

7. FAO in collaboration with UNIDO and other international agencies should provide assistance in establishing small-scale primary processing centres of NWFPs in rural areas.

8. FAO in collaboration with other concerned agencies, compile a "user-friendly" guidebook to be made available to grassroots organisations and local producer groups, on "good manufacturing practice". Such a document should enumerate simple ways of maximizing product quality through improved packaging, handling, storage, grading, etc., and also offer advice related to standards to be observed in trade.

E.3 Resource Management and Environment

1. FAO in collaboration with other interested agencies should prepare guidelines for sustainable management and utilisation of NWFP resources. These should consider, among other aspects, the importance of local communities in the overall context of resource development.

2. FAO should promote a holistic approach for wood and NWFPs under systems of integrated management of forests.

3. FAO in collaboration with concerned international agencies should develop systems for managing buffer zones of protected areas for NWFPs.

E.4 Institutional Considerations

1. FAO in consultation with other interested agencies such as IUCN and Unesco should develop a policy framework for NWFPs, suitable to be integrated within the overall forest sector policy, in order to serve as a guide and model to be adapted by countries.

2. FAO should initiate and facilitate action to collect and publish international statistical information on production, trade and consumption of major NWFPs on a regular basis. This could include information on price movements and supply and demand trends gleaned from trade sources.

3. FAO in collaboration with other interested agencies should compile a directory of available data bases covering the different aspects of NWFPs, as well as of institutions working in the area.

4. FAO in collaboration with other interested agencies and donors and in consultation with countries identify regional centres of excellence to serve as focal points for regional network on NWFPs to enable collaborative efforts, information exchange and technology transfer. FAO regional offices can play an important role in this regard.

5. FAO and other interested international organisations should promote the establishment of an international centre, working in collaboration with regional centres/focal points, for information exchange on NWFPs to serve as clearing house for important information (the Consultation noted the offer of Indonesia to host such a centre).

6. FAO in collaboration with other agencies should investigate and identify funding sources for implementation of a system of information network.

7. FAO, in collaboration with other international agencies, should develop a system of classification of NWFPs (within the overall system for forest products) that is harmonised with existing international systems such as ISIC, SITC, CPC and SNA. FAO should take action to incorporate NWFPs into these systems, particularly as an annex to ISIC. This should be done within a timeframe of three to four years. For this, donor support is needed.

8. FAO and other international organisations should facilitate and provide assistance to the developing countries for implementing programmes on NWFPs.

APPENDICES

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AGENDA

TUESDAY, 17 JANUARY

08.00 - 10.00 Registration
10.00 - 11.30 Opening ceremony at Natour Garuda Hotel, Yogyakarta
12.00 - 13.30 Lunch hosted by the Minister of Forestry
13.30 - 14.00 Break
14.00 - 16.00 Briefing session

WEDNESDAY, 18 JANUARY

07.30 - 17.00 Day trip to visit PT. Jamu Air Mancur (Indonesian traditional medicine industry) and rattan processing industry near Solo

THURSDAY, 19 JANUARY

07.00 - 18.30 Day trip to visit Cayuput (*Melaleuca leucadendron*) oil processing at Gundih and bee keeping and sericulture activities at Regaloh

FRIDAY, 20, JANUARY

08.00 - 17.30 Day trip to Sapuran to visit gum resin and turpentine industry

SATURDAY, 21 JANUARY

Agenda Item I Socio-Economic Benefits

08.00 Nomination of Chairpersons and Rapporteur for Plenary and Group Sessions
08.30 Introduction and Discussions in Plenary Session
10.30 Coffee break
11.00 Discussion in Regional Groups
12.30 Lunch break
13.30 Discussion in Regional Groups
15.00 Coffee break
15.30 Reporting of result discussions of Regional Groups and synthesis of findings
19.00 FAO reception

SUNDAY, 22 JANUARY

08.30 - 17.30 Free day.

MONDAY, 23 JANUARY

Agenda Item II Processing and Marketing

08.00 Introduction and Discussions in Plenary Session
10.30 Coffee break
11.00 Discussion in Regional Groups
12.30 Lunch break
13.30 Discussion in Regional Groups
15.00 Coffee break
15.30 Reporting of result discussions of Regional Groups and synthesis of findings
20.30 Video/slide presentations

TUESDAY, 24 JANUARY

Agenda Item III Resource Management and Environment

08.00 Introduction and Discussions in Plenary Session
10.30 Coffee break
11.00 Discussion in Regional Groups
12.30 Lunch break
13.30 Discussion in Regional Groups
15.30 Coffee break
16.00 Reporting of result discussions of Regional Groups and synthesis of findings
20.30 Video/slide presentations

WEDNESDAY, 25 JANUARY

Agenda Item IV Institutional Considerations

08.00 Introduction and Discussions in Plenary Session
10.30 Coffee break
11.00 Discussion in Regional Groups
12.30 Lunch break
13.30 Discussion in Regional Groups
15.30 Coffee break
16.00 Reporting of result discussions of Regional Groups and synthesis of findings
20.30 Video/slide presentations

THURSDAY, 26 JANUARY 1995

Summing up

08:00 Introduction and Discussions in Plenary Session
10.30 Coffee break
11.00 Formulation of conclusions, recommendations and guidelines in subject-matter groups (4)
12.30 Lunch break
13.30 Formulation of conclusions, recommendations and guidelines in subject-matter groups (4) (cont'd)
15.30 Coffee break
16.00 Presentation by subject-matter group
20.30 Video/slide presentations

FRIDAY, 27 JANUARY 1995

09.30 - 11.30 Closing ceremony

12.00 - 13.30 Farewell lunch hosted by the Ministry of Forestry

Departure

SUMMARY OF FIELD VISITS

The Consultation benefited from field visits in Java that illustrated the diversity of Indonesia's NWFPs, how they are managed, and how they contribute to human welfare. The visits were very carefully and capably arranged by the Ministry of Forestry's Bureau of International Cooperation and Investment, and Perum Perhutani, the state forestry enterprise in Java. Everywhere, during the field visits, the participants enjoyed the generous hospitality of the people of Central Java and their hosts of the Ministry of Forestry and Perum Perhutani.

Background

Java is the most heavily populated of Indonesia's 17,000 islands, with an estimated 1992 population of 112 million (62 percent of the national population). It is the most densely populated island in the world. Yogyakarta is located in the central part of Java. It is a special territory and a cultural centre of Indonesia.

Indonesia's rich forests contain the world's greatest biodiversity. Forest resource use provides a livelihood to about 6 million families, and forest-related employment accounts for 5.4 percent of the total work force. Indonesia is now a major world producer and exporter of forest products, notably plywood and rattan.

Rattan is Indonesia's most economically important NWFP, which brought in US$ 230 million in foreign exchange in 1993 (compared to US$ 4.5 billion for plywood, US$ 766.4 million for products of woodworking industry, and US$ 3.9 million for sawntimber). Other socially and locally significant NWFPs include medicinal plants, resins, essential oils, sago, nuts, raw silk, honey, and bamboo.

Herbal Medicine — PT Jamu Air Mancur

Manufacture of traditional medicine has been growing in Indonesia over the past 20 years, with the number of companies increasing from 176 in 1976 to about 350 in 1995. The industry cites an annual income of US$ 360 million, mostly from domestic sales. Exports amount to US$ 9 million.

PT Jamu Air Mancur is the third largest industrial producer of traditional medicine in Indonesia, with an annual income of US$ 10 million. Established in 1963, the Palur plant near Solo is the largest of the company's seven factories, employing 700 people. The company markets more than 100 products, in the groups of traditional medicine, phytopharmica, food and beverages, and cosmetics.

In 1980 the company began to export its products to Taiwan, Singapore, Malaysia, and Saudi Arabia. Occasional shipments also go to Europe. In 1987 the company received the Gold Star American Award for Quality, and in 1989 the National Upakarti Award for Industry Leadership from the Indonesian government.

The main products of traditional medicine, called *jamu*, come from the roots, tubers, stems, bark, leaves, flowers and fruits of more than 120 species, such as *Pluchea indica* (bluntas), *Tinospora crispa* (brotowali), *Graptophyllum pictum* (daun wungu), *Zingiber officinale* (jahe), and *Nigella sativa* (jintan).

The company's supply of raw material comes from farmers' fields and gardens, and from collections of wild plants from the forest, in roughly equal parts. Cultivation includes both

monocropping and intercropping systems. Farmers growing medicinal plants for the company receive a fixed price for their crop. The price is set, with a contract-like agreement, when the farmers start planting to supply materials to the company.

Jamu Air Mancur maintains a 7-ha garden for research purposes about 30 km away from Solo, where important and endangered species are grown. The Purchasing Division of the company works with the Agricultural Department, Forestry Department, and the farmers to ensure a steady supply of raw material for production. The Stock Division supervises quality control of the materials, using a standard known as Standard Air Mancur (SAM). Based on SAM, varieties are being tested for the best cultivation and post-harvest management methods.

In expanding its efforts, the company is working towards satisfying the stricter Good Manufacturing Practices (GMP) standards for raw material as well as for final products. In this effort, the company cites improved wastewater treatment standards and air effluent reduction measures at several of its plants. In 1995, the Extraction Division will receive particular attention and additional capital investment.

Jamu Air Mancur maintains about 50 outlet agencies in Indonesia, as well as some in Singapore, Malaysia, and Taiwan. To broaden its market, it also employs film, television and radio advertisements, and exhibitions.

In its human resource development efforts, Jamu Air Mancur maintains agreements of cooperation with all of its 1,800 employees. Managers must possess a university degree in a field related to their work. Salaries are all above the minimum wage and above the regional minimum salary. Benefits include a pension plan, bonuses, and retirement benefits.

Rattan Furniture for Export — PT Wirasindo Santakarya

Indonesia has the world's richest and most diverse rattan resources — some 600 species, of which the major ones are *Calamus manau* (manau), *C. caesius* (sega), *C. trachycoleus* (irit), *C. irops* (tohiti), and *C. scipionum* (semambu). Before the 1988 ban on exports of unprocessed rattan, Indonesia supplied 80-90 percent of world demand for raw rattan. Now it is being cultivated as a crop by communities living near forest areas.

The natural forests of Sumatra, Kalimantan, Sulawesi, and Irian Jaya are estimated to be able to sustain an annual harvest (all species) of almost 575,000 tonnes. Indonesia's production of rattan in 1993/94 was 88,149 tonnes.

Following the ban of unprocessed rattan export in 1988, Indonesia's rattan furniture industry has grown. Product marketing and quality control were problems experienced by the infant industry. To overcome these problems the government supported the "nucleus" approach, whereby a nodal unit took care of 100 or more small units which could be either households or group of households.

PT Wirasindo Santakarya, a private company, was established in 1991 as one such nucleus or node for production and export of rattan furniture. The company obtains export purchase orders, commissions village groups to fill the orders, and supplies them at least 50 percent of the raw materials, which come mostly from the islands of Sulawesi and Kalimantan. The company also supervises product quality control, and arranges export through trade associations in Jakarta and also directly to destinations based on arrangements with foreign agents. Products are shipped FOB.

Consultation participants viewed the finished products in the company's showroom in Solo, and visited the company's workshop in Sukoharjo (which produces 8-10 containers of furniture per month, or roughly 8 tonnes), and the home industries in Trangsan village. At the last mentioned, participants observed rattan being bent to shape under heat, lashed and woven, and assembled. Payment to workers is based on numbers of units produced and their complexity.

Cayuput Growing and Processing for Oil — KPH[1/] Gundih

Cayuput oil is extracted from the leaves of *Melaleuca leucadendron* (cayuput) for use as a local medicine. Perum Perhutani has established 12 distillation plants on Java for oil extraction from its 9,000 ha of *Melaleuca* plantations. The plants have a total intake capacity of 32,000 tonnes of cayuput leaf/year. In 1993, cayuput oil production was 279,808 kg, accounting for a considerable portion of Perum Perhutani's income.

KPH Gundih covers an area of 30,005 ha, including plantations of *Tectona grandis* (teak), *Melaleuca leucadendron*, and *Dalbergia latifolia* (rosewood). Other species in Perum Perhutani-managed forests of this part of Central Java include *Swietenia macrophylla* (mahogany), mulberry, and mangroves. The area of cayuput plantations is about 3,200 ha. Cayuput grows well on poor soils that, due to erosion, can no longer support teak. KPH Gundih has 43 forest villages totalling over 245,000 people.

Perum Perhutani works with farmers and encourages them to grow cayuput through agroforestry, which during 1992-1994 occupied 990 ha in Gundih and involved 63 local farmers. Farmers receive credit for seed purchases, subsidized fertilizer inputs, contract wage for their labour, and livestock for additional income. Perum Perhutani contracts with the farmers to manage the trees for three years, renewable year by year, during which they can grow annual crops between the trees (taungya system). The farmers are also entitled to the usufructs from fruit trees grown interspersed and along the boundaries of forest plantations. Fruit trees include *Mangifera indica* (mango), guava, and annona. These are marketed locally.

For leaf harvests, Perum Perhutani has entered into contracts with 306 farmers. Cayuput is coppiced at a height of 110 cm when it is about four years old; the leaves are stripped from branches of over 1 cm in diameter, and bagged for transport to the distillation plant.

The eight-boiler cayuput distillation plant at Krai was established in 1969 and produced 78,014 litres of oil in 1993, from 8,900 tons of cayuput leaf; 1994 production was expected to reach 91,315 litres. After boiling, the oil passes through separators. Waste leaves are used to fuel the boilers, and for organic manure. Wastewater is cooled and recycled through the condensers. The plant runs around the clock, operated by three shifts of workers. Most of the production is sold in the domestic market. The plant employs 67 people.

Sericulture

After a decline in indigenous silk production in 1968, due to a market downturn and pebrine disease affecting the silkworms, Perum Perhutani started its sericulture programme in 1974. It now manages seven mulberry plantations: three in Central Java and four in East Java. The participants of the Consultation visited the Central Java site of Regaloh, KPH Pati, which employs more than 1,000 people — about 540 at the silkworm-rearing house, 400 at the mulberry plantation, and 75 at the reeling plant. Species grown at the plantation include *Morus alba*, *M. multicaulis*, and *M. cathayana*. Farmers receive Rps 1,500 (about US$ 0.71) per kg of mulberry leaves harvested.

Very near the plantation are two silkworm rearing houses. Perum Perhutani staff raise the worms for the first 10 days, then local workers take care of the mature silkworms for 18-20 days in the rearing houses.

A small plant for separating the raw silk from the silkworm cocoons was established in 1972. The cocoons are boiled and then the silk is separated manually and threaded onto reels. Each cocoon

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1/ KPH is an Indonesian acronym for forest district.

yields 1,400 m of raw silk filament. From about 118 tons of cocoons per year, the plant reels 16,579 kg of raw silk and 900 kg of twist yarn.

Prospects for the future appear good, with upward trends in domestic and international demand for silk and stable environmental conditions locally in the area of the mulberry plantation.

Beekeeping Unit

Established in 1991, the Regaloh beekeeping unit is one of three under the authority of the National Beekeeping Centre, Bogor (the other two are in Sukabumi, West Java, and Tretes, East Java). Activities at Regaloh focus on beekeeper training, honey bee culture, and bee forage. The plants grown for honey pollen are *Ceiba pentandra* (kapok) and *Calliandra callothyrsis* (calliandra). The centre, a source of beekeeping information for Central Java (including stocking and marketing information) has trained more than 350 beekeepers.

Perum Perhutani has been providing loans for cooperative beekeeping ventures for more than 20 years. Loans are relatively small (totalling US$ 27,000). In 1994 about 430 beekeepers produced more than 84,000 kg of honey, valued at US$ 135,000 (sold mainly in the domestic market), about five times the total of loans.

Resin for Gum Rosin and Turpentine

Managed by Perum Perhutani, the KPH Kedu Selatan plantations provide resin for a nearby distillation facility for gum rosin and turpentine.

Plantations of *Agathis lauranthifolia* (agathis) were started in 1959 and now covers 44,700 ha. Pine planting began in 1981 and now extends over an area of about 125,000 ha. The soil in the area is dominated by litosol and latosol. The forest area of KPH Kedu Selatan is managed by 712 Perum Perhutani employees. About 8,000 local residents are involved in resin tapping, and 6,000 farmers are engaged in "taungya" farming in replanted areas, extending over an area of 6,800 ha.

Tapping begins when the trees (pine or agathis) reach 11 years of age, or a minimum diameter of 15 cm. Tappers work ten days per month, supplementing their farm income. In 1994, tapping yielded 9,600 tons of pine resin, and 142 tons of agathis resin. Various tapping methods have been tried, including the "rill" method and the Chinese "falling" method. Of these, the rill method appears better.

For timber, agathis is harvested at the age of 40 years, and pine at the age of 25.

The participants of the Consultation visited the gum rosin and turpentine plant in Sapuran. It began production in 1987. With a floor area of 750 m^2, it is the smallest of Perum Perhutani's four plants. In 1993, the plant processed 5,800 tons of pine resin into 3,984 tons of gum rosin (recovery rate of 69 percent) and 80 tons of turpentine oil (recovery rate of 13 percent).

Both the turpentine and gum rosin are forwarded to the Perum Perhutani unit in Semarang for storage and marketing. Ninety percent of the turpentine is exported. Seventy percent of the gum rosin is also exported, mostly to Japan, South Korea, India, Taiwan, Thailand, and several European countries. The other 30 percent of the gum rosin is sold to end-user industries in Indonesia for use in paper sizing, cosmetics, paints, emulsifier for synthetic rubber and varnishes.

DISCUSSION PAPERS

SOCIO-ECONOMIC BENEFITS AND ISSUES IN NON-WOOD FOREST PRODUCTS USE[1/]

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INTRODUCTION

This paper is concerned with the impacts of non-wood forest products (NWFPs) on people. Probably the majority of rural households in developing countries, and a large proportion of urban households, depend on forest products to meet some part of their nutritional, health, house construction, or other needs. Very large numbers of households also generate some of their income from selling forest products. The paper attempts to outline the extent and nature of these patterns of usage and dependency, how they vary spatially and over time, and the factors that appear to influence these differences and changes.

Most people are continuously adapting their livelihood strategies to changing circumstances, and this can mean that the role of NWFPs is changing, often very rapidly; some people turning to greater use of such products as their circumstances change, others moving to use of alternative products or materials, or to different activities. Knowledge just about the patterns of present use is therefore likely to be of only limited value in determining what interventions might be needed in order to maintain NWFP supplies, or to support important household-level subsistence and commercial activities in the future. It is necessary to be also able to identify the directions of these changes and the factors underlying them. The paper therefore pays particular attention to the dynamics of the relationships between people and the NWFPs they use.

Such an exercise is necessarily shaped by the extent and quality of the data available. As NWFP uses and activities in the subsistence and small enterprise sectors escape the attentions of statistical recording systems, quantitative information on their magnitude and structure is very sparse. There is a great deal of descriptive information, generally concentrated in narrowly situation-specific accounts. Few analytical studies relate the use of forest products to household livelihood strategies, and even fewer have attempted to synthesize the information available. Any review of this kind must therefore be taken as indicative rather than conclusive.

An added constraint is the difficulty in defining boundaries around the subject. A forest products activity usually constitutes just one activity within an agricultural household. It then becomes difficult to separate out that part of household time, costs, returns, etc., that is attributable to just that activity. Similarly, many NWFPs are gathered or harvested outside "forests" as normally defined; being produced in managed fallow or farm bush, or from trees managed as farm crops. This can make it difficult to identify the consequences of NWFP use for forest management. In this paper we have examined use regardless of origin.

1/ This paper draws on earlier studies for FAO carried out with Julia Falconer (Falconer and Arnold, 1989), and with Yacob Fisseha and Mafa Chipeta (FAO, 1987); and ongoing work at the Oxford Forestry Institute with Ian Townson (Townson, 1994), and with Carl Liedholm and Donald Mead of Michigan State University (Arnold *et al.*, 1994). An earlier version of some parts of the paper was presented at the IFPRI/NRI/CIFOR/ICRAF Workshop on Non-Timber Tree Product Market Research, Annapolis, 12-14 December 1994.

2/ Senior Research Officer, Oxford Forestry Institute, University of Oxford.

A related boundary problem arises from the definition of NWFPs. Many of the forest products that people produce and use from the forest are wood products. Many surveys and studies consequently look at the whole range of forest products being used, and it becomes difficult to separate out just those that are non-wood. Where necessary, therefore, some of the analysis in this paper takes account of all forest products that are important in understanding people's dependence on the forest.

The paper is organised as follows. Following a section that briefly considers the importance of NWFP use at the level of the national economy, the third section examines the significance of the main NWFP end uses (food, medicine, construction, income) at the household level. This explores differential degrees of dependence on the part of different sections of the community, and general trends in levels of use and dependency. In the fourth section, the nature of change, and the factors influencing change, in household incomes derived from NWFPs, are explored further. Four main issues that arise are then examined in more detail in the penultimate section: equity issues, adequacy of access to raw material supplies, tenure and control issues, and support programmes.

NWFP USE AND THE NATIONAL ECONOMY

The importance of NWFPs at the national level lies in the huge numbers of people involved in gathering, hunting, processing, trading and other aspects of their production and use[3/]. As noted earlier, most rural people use some forest products, and many obtain part of their income from forest-product activities.

The lack of information about the numbers involved in subsistence use, or about the value of that use at the household level, make it impossible to arrive at even rough estimates of the economic contribution of that component of production and use. Somewhat more information is available about employment in income-generating activities. Results from small enterprise surveys in six countries in southern and eastern Africa indicate that an estimated 408,000 forest product enterprise activities provide employment for 763,000 persons — an average density of 16 persons per thousand in the population (Arnold *et al.*, 1994)[4/]. Household surveys in high forest zones show much higher densities — e.g. 68 percent of households in areas surveyed southern Ghana (Falconer, 1994), and all households in selected areas from which the city of Iquitos in the Peruvian Amazon draws its supplies of NWFPs. Table 1 reproduces estimates of numbers involved in a selection of other activities and situations.

Even where absolute densities of forest product-based employment are low, they usually account for a high proportion of overall non-farm employment. In a review of small enterprise studies, Liedholm and Mead (1992) reported as follows:

> Around the world, three activities have consistently been identified as the most important categories among micro and small manufacturing enterprises: textiles and wearing apparel, food and beverages, and wood and forest products.

3/ This can give rise to flows of forest products through the market system which in aggregate generate very large monetary values. For information on the latter see the theme paper on Trade and Marketing of Non-Wood Forest Products.

4/ As forest products enterprises are defined in these surveys to include only those households that sell at least half of what they produce, and only forest products defined as such in ISIC codes (i.e. excluding such goods as forest foods and medicines), and the surveys excluded primary production of forest products, these data substantially under-represent the total numbers of persons obtaining some income from NWFPs. For instance, a similar survey of small forest-based enterprises in Zambia indicated the existence of a total of 4,350 persons employed in wood fuel enterprises at a time when localized studies suggested that probably 25,000 people were engaged in this activity (Fisseha and Milimo, 1986).

Table 1: Selected estimates of employment in forest based activities

Source (region)	Employment and activity
Tewari, 1982 (India)	Tendu leaf collection provides part time employment to 7.5 million people; a further 3 million people are employed in bidi processing; 3 million people are involved in lac (resin) production; 735,000 people earn income from sericulture; 550,000 people are employed in bamboo-based craft enterprises.
Jha and Jha, 1985 (India)	126,000 households are involved in Tassar silk cultivation.
Tandon, 1991 (India)	Match production by cottage industries employs 50,000 people, and small-scale factory production a further 195,000.
Fisseha and Milimo, 1986 (Zambia)	25,000 are involved in the fuelwood trade.
Marks, 1984 (Zambia)	48,000 people are employed in charcoal production (36,000 of them are part-time charcoal producers and traders); 11,500 people are involved with bee-keeping; 96,000 households earn income from handicraft production.
Peluso, 1986 (Indonesia)	83,000-100,000 people are engaged in collection, trade and processing of rattan.
Engel *et al.*, 1986 (Bo, Sierra Leone)	60 percent of the farm households in the region process palm fruit and kernels for sale.
Kaye, 1988 (Côte d'Ivoire)	Estimates 65,000 people are involved in rattan cane basketry part-time while 1,500 are involved full-time.
Schwartzmann *et al.*, 1987 (Amazon)	Estimates that half a million people depend on latex as their main source of income.
Browder, 1989 (Amazon)	Estimates 1.5 million people derive a significant proportion of their income from extractive activities.

This is found in countries with limited forest resources as well as in forest-rich countries. The estimated 90,000 persons employed in informal forest-based processing in the rural areas of Zambia in 1985, for example, accounted for one third of all rural manufacturing employment in the country (Fisseha and Milimo, 1986). Of the 51,000 persons found to be employed in craft activities in Rufiji District in neighbouring Tanzania, nearly a half were engaged in NWFP activities (Havnevick, 1980).

Small forest product enterprises can also account for a large part of overall employment in forest industry sector. Thus the estimate of 237,000 persons employed in small forest products enterprises in Zimbabwe in 1991 compares with a reported 16,000 employed in forestry and forest industries in the country in that year (Arnold *et al.*, 1994).

NWFPS AND HOUSEHOLD NEEDS

INTRODUCTION

Most households exist in a situation within which their activities are influenced by an array of interrelated objectives, constraints, and other factors. Household livelihood strategies are likely to include pursuit of secure provision of food and other essential subsistence goods, cash for purchase of outside goods and services, savings, and social security. Other factors are likely to include concern to reduce critical risk factors, and local social, cultural and spiritual considerations.

Social and Cultural Context

Forests and forest products are linked to household livelihood systems in a variety of different ways. Forest products commonly contribute to meeting food and other basic needs, are a source of income and of inputs into the agricultural system, help households control exposure to risk of various kinds, and constitute an integral part of the habitat and of the social and cultural structure of those living within that environment. In the present paper we are examining just some of these goods and services from the forest. However, as Levin (1992) has pointed out, in writing about southern Thailand:

> Villagers conceptualize non-timber forest products (benefits) as both concrete and intangible. The inclusion of conceptual as well as physical goods in discussions of NTFPs by farmers suggests that to rural communities forests are a product to be weighed and measured *in toto* and for which physical, extractable non-timber forest products are only a limited subset. The sum of the parts in this case is not worth near as much as the presence of the whole.

It is therefore necessary to consider how use or sale of material products such as forest foods are conditioned by this broader context of interrelationships between people and their forest environment. This broader framework is likely to reflect other important attributes of the forest, and the processes whereby people transform the forest into a productive system designed to meet their particular needs. In a recent study in Sierra Leone, Davies and Richards (1991) noted that for the local people:

> ... it would seem that high forest is seen to have little value in and of itself. In practical terms, the bulk of subsistence-oriented forest products derives from secondary successions, not from high forest. But the greater value placed on "bush", compared to high forest, depends on more than practical considerations alone. In rural Mende eyes, social life begins and ends at the edge of a forest clearing. The energy released by the conversion of forest to farm and bush is a major source of power in society.... the farmer about to fell trees to make a farm ... will invoke the patient understanding of the ancestors and spirits of the land for the necessary damage he must inflict on the bush. The recovery of the bush from a period of cultivation ... is a sign that ancestral blessing has not been withheld.

The role, and use, of individual NWFPs can be subject to these cultural and mystic values, that reflect a people's history, religion, art, and other aspects of its functioning as a society. For example, particular areas are often maintained as sacred groves or forests, in which harvesting of produce is banned or closely controlled. Individual species, both animal and plant, have spiritual or other cultural significance in many societies, and either cannot be used or are reserved for particular uses. Particular trees may have ceremonial roles, or are used to make artifacts for ceremonial use. Control of the use of others occurs because they provide products of special value locally. Certain foods are reserved for celebration of harvests and weddings. Religious prohibitions or ethnic values may result in a number of systematic food avoidances (taboos), which discourage the eating of particular animals and plants.

In many situations the strength and extent of cultural considerations has diminished, but many have persisted, despite the prevalence of "Western" ideas, practices and products. For instance, Table 2 shows how people in southern Ghana include both physical and conceptual values in assessing the benefits to them to be obtained from the forest. They therefore remain a potent factor in decisions about NWFP uses and values.

The differences from village to village reflected in that table underline another characteristic of NWFP use that should be kept in mind in what follows. That is the large variation in needs and practices that can and often does exist — between different communities, among households within a community, and within a household between men and women and members of different ages. This limits the extent to which conclusions that can be drawn from studies on this subject are likely to be of general application.

Table 2: The highest valued forest benefits in surveyed villages, South Ghana

Product	Village								
	Banso	Betinasi	Essamang	Nkwanta	Essuowin	Koniyao	Kwapanin	Nanhini	Number of people ranking product first in all villages
	(Percentage of people who rank the benefit first)								
Pestle	28	9	27	33	45	31	38	24	71
Bushmeat	40	9	27	38	37	26	36	13	68
Canes	48	18	33	48	29	15	15	10	56
Building materials	24	18	13	33	8	15	30	10	43
Chewstick	40	9	13	38	18	5	15	7	39
Timber	20	9	27	-	32	21	19	-	39
Water	4	9	7	5	11	33	6	10	27
Medicines	16	9	13	10	5	5	6	27	24
Sponge	16	-	27	5	18	3	15	-	24
Gods	-	-	-	-	16	-	-	50	21
Land bank	-	-	-	24	3	10	13	7	18
Wrapping leaves	-	-	-	5	3	-	32	-	17
Fuelwood	20	-	13	-	3	8	6	7	16
Mortar	12	-	-	-	5	10	11	7	16
Fertility	8	9	-	5	3	13	13	-	16
Rains	4	18	-	-	5	5	11	10	15
Forest food	16	-	-	14	3	3	11	-	14
Raffia	16	9	7	10	3	3	4	-	12
Others	8	18	7	10	24	18	17	3	25
Total number of people interviewed	25	11	15	21	38	39	47	30	226

Notes: Some people named more than one product as the most important

Source: Falconer 1994

NWFPs and Household Food Security

Another feature that needs to be recognised at this stage is the way that different NWFP activities are linked as components of livelihood strategies that households employ. The concept of food security for rural households in developing countries encompasses all factors affecting a household's access to an adequate year round supply of food. Thus it is concerned not just with the household's production of food crops, but with the availability of income to the household with which to purchase food, where this is necessary.

In examining household use of NWFPs, we therefore need to identify their effectiveness in both providing gathered foods that contribute to food self-sufficiency, and saleable products that could supplement income needed to purchase food. In doing so it is also necessary to consider whether, and if so how, income-generating activities based on forest products affect other aspects of a household's capacity to contribute to its food self-sufficiency.

Increased commercialization of forest food products could lead to over-exploitation of the resource, or to diversion of food needed for household consumption from local use to sale on the markets. Households may sell not only what is surplus to their requirements but also food needed in the household. Changes in use of agricultural or grazing land to favour production of NWFPs for sale could reduce the amount of land available to the household for producing its basic food crops. Introduction of time consuming NWFP gathering or processing activities could be at the expense of time women need to cook and look after their children (Longhurst, 1987).

SUBSISTENCE USES OF NWFPS

People rely on a wide range of forest products for their own use. In this paper we concentrate on the principal of these — food, medicinal uses, and construction materials. However, it needs to be kept in mind that there are many other materials and products that are used in lesser quantities[5/].

Forest Foods and Household Nutrition[6/]

There are many different kinds of food gathered from forests. Forests also provide the habitat for many commonly consumed wild animals and fish. Forest foods may also be smoked, dried or fermented, making them available over extended periods of time.

Importance in diets

For the majority of rural people, forest foods add variety to diets, improve palatability, and provide essential vitamins, minerals, protein and calories. The quantities consumed may not be great in comparison to the main food staples, but they often form an essential part of otherwise bland and nutritionally poor diets. Diet diversity is an extremely important element of nutritional well-being, in part because more vitamins and minerals are consumed, and also because it improves the taste of staple foods. The most common supplementary foods are leaves and wild animals, both of which are generally added to sauces and soups which accompany staple foods.

5/ For instance, common household and farm items made from NWFPs that are found in southern Ghana include: pestles and mortars, baskets and other storage containers, carved bowls and spoons, sleeping mats and pillows, sponges and brooms, tool handles, yam and cocoa harvesting stakes, fish and animal traps, and canoes and paddles (Falconer, 1994).

6/ For a more detailed discussion of the contribution of forest foods, and case material that illustrates the points summarised in this section, the reader is referred to the satellite paper entitled "Non-Wood Forest Products and Nutrition".

Some species are noteworthy as particularly rich sources of vitamins, minerals, proteins and fats. For example, many forest fruits and leaves are good sources of Vitamin A, shortage of which is a common cause of blindness in many developing countries. Forest foods can thus be used to combat nutrient related health problems (Table 3).

Forest and farm tree products are also valued throughout the year as snack foods. They are commonly eaten on the job: while working in fields, while herding and while gathering fuelwood. Forest fruits and nuts are the most common snack foods, especially for children.

Table 3: Some common nutrition problems and the potential role of forest food

Nutrient-related problems	Forest food with potential for combatting deficiencies
Protein-Energy malnutrition: due to inadequate food consumption causing reduced growth, susceptibility to infection, changes in skin hair and mental facility.	Energy rich food which is available during seasonal or emergency food shortages, especially, nuts, seeds, oil-rich fruit and tubers; eg the seeds of *Geoffroea decorticans, Ricinodendron rautanenil,* and *Parkia* sp.; oil of *Elaeus guineensis,* babassu, palmyra and coconut palms; protein-rich leaves such as baobab (*Adansonia digitata*); as well as wild animals (eg snails) including insects and larvae.
Vitamin A deficiency: in extreme cases causes blindness and death; responsible for blindness of 250,000 children/year.	Forest leaves and fruit are often good sources of Vitamin A; eg leaves of *Pterocarpus* sp., *Moringa olcifera, Adansonia digitata,* the gum of *Sterculia* sp., palm oil of *Elaeus guineensis*, bee larvae and other animal food; in addition fats and oils are needed for the synthesis of Vitamin A.
Iron deficiency: in severe cases causes anaemia, weakness and susceptibility to disease; especially women and children.	Wild animals including insects such as tree ants, mushrooms (often consumed as meat substitutes), as well as forest leaves such as *Leptadenia hastata, Adansonia digitata.*
Niacin deficiency: common in areas with a maize staple diet; can cause dementia, diarrhoea, and dermatitis.	Forest fruit and leaves rich in niacin such as *Adansonia digitata,* fruit of *Boscia senegalensis* and *Momordica balsamina*, seeds of *Parkia* sp., *Irvingia gabonensis* and *Acacia albida.*
Riboflavin deficiency: common throughout southeast Asia; among those with rice diets causes skin problems.	Forest leaves are especially high in riboflavin, notably *Anacardium* sp., *Sesbania grandiflora*, and *Cassia obtusifolia*, as well as wild animals, especially insects.
Vitamin C deficiency: common to those consuming monotonous diets; increases susceptibility to disease, weakness.	Forest fruit and leaves often supply the bulk of Vitamin C consumed, especially good sources include fruit of *Ziziphus mauritiana, Adansonia digitata* and *Sclerocarya caffra,* leaves such as *Cassia obtusifolia*, and the gum of *Sterculia* sp., are also good sources of this vitamin.
Source: Falconer and Arnold, 1988	

Seasonal importance of foods from forests

Forest and farm trees are most extensively used to help meet dietary shortfalls and to supplement household income during particular seasons in the year. Many agricultural communities suffer from seasonal food shortages generally known as "hunger periods". They commonly occur at the time of year when stored food supplies have dwindled and new crops are only just beginning. During this period the consumption of forest and tree foods increases. In many areas the consumption of wild animals and fish is also highly seasonal. Forest and farm tree products are also valued during the peak agricultural labour period, when less time is available for cooking and people consume more snack foods.

On the other hand, some favoured forest foods such as snails, mushrooms and honey have particular harvest seasons that do not necessarily correspond to food short periods. In these cases, foods are gathered for as long as they are available.

Home gardens (intensively managed farm systems combining tree and herbaceous crops) are widely designed to make use of variations in the timing of the harvest of different component tree crops, in order to supply foods and saleable produce during the period between harvests of staple crops. Another important feature of such gardens, and other systems incorporating trees, is that work on the latter can often be undertaken during the slack season, thus helping to even out the peaks and troughs in the demand for farm labour.

Forest foods and emergencies

Many studies indicate that forests have provided essential resources during emergency periods such as floods, droughts, famines, and wars. There is a wide range of forest resources used as emergency foods. Often they differ from resources exploited in other periods. In famine periods, roots, tubers, rhizomes and nuts are most sought after. They are characteristically energy rich, but often require lengthy processing.

Changes in consumption of forest foods

Changes in the role that forest food plays in household nutrition may reflect penetration of rural markets by new food products, changing tastes, or decreased availability. However, decreased availability may reflect changes in the availability or allocation of a household's supply of labour rather than physical shortage of the product. As the value of labour rises with increasing wealth, the opportunity cost of continuing to spend time gathering foods, rather than purchasing them, becomes increasingly unattractive. In areas where rural populations have achieved high incomes and easy access to purchased foods use of forest foods is likely to be very little.

Some studies indicate that emergency uses of forest resources are dwindling as people rely to a greater extent on food purchasing, or as famine relief programmes become more effective. In others improved supplies of food crops have diminished the need to depend on forest foods. In Vanuatu, for instance, the introduction of the sweet potato, which could be planted at any time and produce an edible crop within three months, and manioc, which can be left unharvested for up to two years, has made the traditional emergency foods of wild taro, arrowroot, wild yams and sago virtually obsolete (Olsson, 1991).

Many studies report that a decline in use of forest food accompanies reduced knowledge about its use. As children spend more time in school than in the fields and the bush, the opportunity to learn about wild foods is reduced. Sedentarization is another widespread change that distances people from the food sources they used to be familiar with (e.g. Melnyk, 1993). Poorer knowledge about which plants can be consumed, and which cannot, further constrains people's use of these foods, even when they are still available and important for dietary balance.

Another widespread trend affecting rural consumption patterns and levels is the diversion of foods available to rural households to burgeoning urban markets. This has been reported to be the case with bushmeat in the forest zone of Ghana (Falconer, 1994); in many cases, the loss of regular supply of bushmeat has not been replaced by domestic meat, but has simply meant that less animal protein is consumed. Forest fruits in parts of the Amazon form another example (Melnyk, 1993). It is often the poorest, forced to exploit this source of income because of lack of alternative opportunities, who are most likely to suffer nutritionally from this diversion of food supplies.

The impact of declining consumption of forest food is not clear. In some cases these changes do appear to have led to a poorer quality diet; most notably as greater reliance on purchased food reduces dietary diversity. But greater reliance on the latter does not necessarily result in adverse nutritional consequences. Perhaps the worst impact is that poorer people's food options are being progressively reduced, especially during seasonal and emergency hardship periods (Falconer, 1989).

In some areas forests still supply a readily available source of foods and fodder. Also, particular foods continue to be consumed for their traditional social value, or for their medicinal qualities. But even in these cases the diversity of gathered foods consumed may have decreased.

NWFPs and Health Uses

The use of forest products for medicinal and other health purposes is very widespread; often in urban as well as rural households. Very large number of forest plants, and often some animal products, are frequently used within a single community. For example, 214 instances of medicinal use of plants were reported in a community in Sierra Leone (Davies and Richards, 1991), and 150 medicinal plants were observed in a location in Vanuatu (Olsson, 1991). Even in the relatively species-poor sal forests of West Bengal, 47 species have been recorded as being used in 42 villages (Malhotra *et al.*, 1993).

Medicinal usage tends to overlap with that of forest foods; indeed particular items added to foods serve both to improve palatability and act as a health tonic or prophylactic. There are also often strong links between medicinal use and cultural values; for example, where illnesses are thought to be due to the spirits, or plants have acquired symbolic importance as treatments.

Such values often underlie the division between use of traditional and "Western-style" medicines that is widely observed at the present time. For example, it was found in southern Ghana that choices between the two were influenced by users perceptions of their effectiveness, but that the principal factor was the following:

> Diseases are regarded as either "natural" or "supernatural" problems. Natural health problems are generally physical ailments which people can treat themselves using plant medicines or which can be treated by Western-style medicines. Supernatural problems or mental and spiritual disorders, can only be dealt with by specialist traditional healers (Falconer, 1994).

Use of plant and animal medicinal products generally lessens as people move to towns, and in situations where changes in attitudes and practices favour more reliance on modern medicine, where supplies have become scarce or costly, and where knowledge of traditional uses has declined (with fewer or less effective traditional healers). But the striking feature emerging from contemporary studies is the high level of continuing use of traditional medicines in most situations.

NWFP Use in House Construction

Much house construction in the rural areas (and in many urban areas) in developing countries involves use of forest products. Although much of this is use of timber for door frames and poles for the frame of mud walls, this frame is typically bound together using canes, lianas, raffias or twines made from other fibrous plants, and roofs are commonly covered with grass, bamboo, reeds or leaves.

Where it is available, bamboo is heavily used. It is reported that in Bangladesh over 70 percent of rural dwellings use bamboo as the prime building material (Dunham, 1992, cited in Wells *et al.*, 1994).

A recent review study (Wells *et al.*, 1994) notes that such usage is closely associated with poverty:

> There is substantial evidence pointing to the fact that the vast majority of households in the rural areas build with unprocessed organic materials because they are available at little or no cost ... often gathered free of charge ... from the householder's own farm or from forest and common lands.

The same study reports considerable evidence of growing shortages of such materials, and of changes in building practices and usages, but notes that it is difficult to determine to what extent the latter is a response to increasing difficulties in users obtaining subsistence or low cost supplies, rather than other factors. Shifts to mud brick walls and corrugated iron roofing or roof tiles are frequently reflections of increased income, moves to upgrade the household's dwelling, or shifts in attitudes towards housing, rather than the result of shortage of poles, bamboo or thatch. "Modern" houses can offer a number of advantages to offset their higher cost — including longer life. Changes to building practices that require less labour can reflect reduced availability of labour rather than growing shortage or cost of the previously used building material (Wells *et al.*, 1994).

Nevertheless, there is evidence of practices that clearly do represent a loss of quality, or a deterioration in housing standards for those concerned as biomass construction materials become more difficult to obtain. These include reduction in size of the dwelling as materials supplies tighten, use of less durable species so that dwellings have to be replaced more frequently, and less frequent re-thatching and maintenance of existing structures so that their condition deteriorates (Wells *et al.*, 1994).

Forest Products and Household Incomes

Employment and income from small-scale non-farm enterprise activities are nearly everywhere becoming of growing importance in the rural economy of developing countries. In stagnant or slowly growing agricultural areas small enterprise activities provide employment to surplus labour; in conditions of growing agricultural incomes they contribute to the process of growth, diversification and the shift to more productive uses of rural resources (Haggblade and Liedholm, 1991).

It has been estimated that rural non-farm work provides 20-45 percent of full-time employment in rural areas and 30-50 percent of rural household income (Kilby and Liedholm, 1986; Haggblade and Hazell, 1989). As was noted earlier, results of surveys of the small enterprise sector have shown that small forest-products activities everywhere account for a substantial proportion of the total (Liedholm and Mead, 1992).

Characteristically, forest-products activities form only one part of a household enterprise. In Zambia, 64 percent of those enterprises operated by persons previously in farming were found to be run in conjunction with farming, and 30 percent of them with one or more other small enterprise activities. Of those where enterprise activity is the principal one, 56 percent also farm and 65 percent have other activities in addition to the forest based one (Fisseha and Milimo, 1986). As was noted earlier, this close integration with other household activities makes it very difficult to separate out income from the forest-products activity, and even more difficult to define how it contributes to rural household livelihoods. Few if any studies focus on how forest-products income is spent, nor on who spends it.

Importance of Forest Products in Meeting Household Income Needs

Income earning activities based on marketable forest products may be seasonal or year-round, or may be occasional when supplementary cash income is needed. The role of these forest-products activities varies depending on the availability and profitability of alternative employment, the seasonal availability of the forest products, the need for cash income, access to the forest resource, the composition and condition of the forest resource, and access to markets (Falconer and Arnold, 1989; Beer and McDermott, 1989).

For some, the forest based activity may be the sole or principal source of income. Rubber tappers in the Brazilian Amazon provide an example where this was until recently the case with a gathering activity. Sale of forest produce is also the principal source of income in many engaged in hunting. In the villages around the Korup National Park in Cameroon it was found that hunting is the single most important source of cash income for the majority of village households and for the village as a whole (Infield, 1988). The larger and more profitable processing activities, such as wood working, can also become the dominant household activity. In a recent study of six countries in Africa it was found that nearly half of those engaged in woodworking reported it as being their sole source of income, and for more than 60 percent it was their main source (Arnold *et al.*, 1994).

More widely, forest based activities are engaged in part-time by farm households which cannot raise enough to be food self-sufficient year round. A study of a lowland village in the Philippines found that 73 percent of the households could not generate enough food or cash income from agriculture to meet their basic needs. All village households collected forest products for supplementary and emergency income; with more than half depending on rattan collection and timber wage-labour as a primary source of livelihood (Table 4). The average earnings from rattan collection was greater than the average wage for agriculture or timber production labour (Siebert and Belsky, 1985).

Table 4: Forest product activity by household rice self-sufficiency[1] in a Philippine village (percent of households)

Forest product activity[2]	Use by household rice self-sufficiency status[3]			
	Low (n-14)	Middle (n-27)	High (n-22)	Total (n-63)
Rattan gathering	57	37	9	32
Employment as timber labourer	43	33	36	37
Either rattan or timber	79	48	41	52

[1] Household rice self-sufficiency refers to the ability of a household to meet its rice consumption demands through rice farming (whether irrigated or rainfed, or as owner-cultivators and sharecroppers).

[2] At lease one adult household member (15 years and older) gathers rattan on a weekly basis or accepts work as a timber wage labourer whenever work is available.

[3] Low: no rice production; Middle: up to 50% self-sufficiency; High: more than 50% self-sufficiency. Rice self-sufficiency is a measure of a household's economic situation.

Source: Siebert and Belsky, 1985

The evidence from the few studies that indicate levels of income indicate that returns to the practitioners varies greatly, with some activities providing only minimal returns to producers. A study in the Rufiji District of Tanzania (Havnevik, 1980) found returns from carpentry and carving activities

to be almost twice the level of the minimum wage, while those from mat and basket making amounted to only a third of that wage (Table 5). However, although basketry and mat-making tend to generate low returns to the producers in many situations, they are still important in terms of contribution to overall household income. In the six African countries surveyed, in which cane-based processing is the largest NWFP activity, over 40 percent of the entrepreneurs engaged in these activities stated that the enterprise accounted for 50 percent or more of their household's income, and nearly a quarter reported that it was their sole source (Arnold *et al.*, 1994).[7/]

Table 5: Distribution of crafts by labour return categories Rufiji District, Tanzania

	Labour return categories and crafts			
	I Up to Shs. 1/=	II Shs. 1-2	III Shs. 2-3	IV Shs. 3/= and above
Crafts:	Wooden beds Mortar making Mat making Basketry	Sawmilling Canoe making Masonry Pottery Salt production Shoe repair Fishnet production	Blacksmith Carpentry Carving Canoe Tailoring Coconut-oil Bicycle repair	Jaggery Watch repair
Average hourly return for the category	Shs. 0.48	Shs. 1.51	Shs. 2.45	Shs. 5.91
Monthly potential income 26 days (208 hrs/month)	Shs. 99.84	Shs. 314.00	Shs. 510.00	Shs. 1,229.00
Number of nominal participants	16,072	5,866	6,305	60
% of total nominal participants	56.8	20.7	22.3	0.2
Source: Adapted from Havnevik, 1980				

Forest Products Income and Seasonal Patterns

There are several dimensions to the seasonality of forest-based income generating activities. Some activities are seasonal largely because the crop or material can only be gathered at certain times of year. Fruits feature widely in this category. In Ghana, snails and mushrooms are available mainly in the wet season, and honey in the dry season (Falconer, 1994).

The seasonality of other forest product activities is directed by the seasonality of other activities, and the fluctuations in availability of labour. Many activities therefore decline in agricultural and planting seasons, or are phased to take advantage of slack periods. Others are governed by seasonally induced cash needs, such as school fees, or the need for income to buy food during the "hungry period" between harvests, or to purchase farm inputs.

7/ However, as noted in Footnote No. 4, only households selling more than half their output were included in the survey, so that many of those producers for whom it formed a smaller part of their income were likely to be excluded.

Often these pressures work in conjunction one with another. A study in Sierra Leone found that fuelwood selling provided the first cash income from land cleared for rice production. Subsequently fuelwood collection for the market was concentrated during the off-peak agriculture period, providing cash income in a period when food supplies are generally at their lowest (Kamara, 1986).

The collection and processing of babassu palm kernels in northeastern Brazil is another example of an activity geared to the seasonal slack period in agriculture, which is also the period of most severe cash needs. Income from sale of kernels was found to account for 39 percent of cash income and 34 percent of total household income during this season (May, 1985). The majority of farmers in the area are poor tenants, and kernel collection is one of the few ways they can supplement their cash income. Both men and women are involved with the collection of babassu fruit though it is primarily the women who are involved with oil extraction from the kernels. Many of the poorer farmers were dependent on this cash for purchasing seed and other inputs for the new season's planting.

Small manufacturing enterprises that produce for rural consumers are exposed to the additional seasonal constraint that incomes, being agriculture-based, have a short peak. Rural demand may also be linked to particular seasonal agricultural needs. Much of the demand for baskets in rural Ghana, for example, is to store particular agricultural products; and is therefore concentrated at the time of harvest of those products (Falconer, 1994).

The Buffer Role of Forest Income

The third role of forest-products activities, as a source of income that people can fall back on in times of crop failure or shortfall, or in order to cope with some other form of emergency, can be very important. Many reports recount how more people engage in the gathering and selling, or processing, of whatever forest product is traded locally during difficult times. It has been reported from south Ghana, for example, that:

> the greatest function that forests serve to those living near them is a buffer: both environmentally and economically. They provide products and opportunities for income earning at times when other options fail (Falconer, 1991).

Forest products can also provide a source of "windfall" income; a good crop providing a valuable injection of cash, enabling people to clear their debts or accumulate some capital (Beer and McDermott, 1989). Similarly, some forest products activities may be opportunistic, taking advantage of unexpected or periodic surges in availability of a product to generate additional income or savings.

NWFPs, the Poor, Women and Children

Where people have had relatively unrestricted access to forests, forest food is often particularly important for poorer groups within the community. While forest gathering activities are not restricted to the poor, the latter depend on these activities to a greater extent. They are also an important source of income to the poor. With generally easy access to the forest resource, poorer people have been able to exploit forests for marketable products. As most small-scale processing and trading activities require little in the way of capital or skills to enter, they also are usually accessible to the poor.

Numerous studies of different communities and situations confirm this greater degree of involvement and dependence by the poor. One of the largest bodies of information on the subject comes from Jodha's studies of the dryland plain areas of India. Table 6 shows how the poor in each of the areas studied depend much more heavily than their wealthier neighbours on both saleable produce and fodder and fuel for own use from adjacent common lands. At the case study level, dependence on NWFPs has been shown to be related to size of landholdings in Orissa, India, (Fernandes and Menon, 1987) and in Brazil (Hecht *et al.*, 1988), with family incomes in Sri Lanka

(Gunatilake *et al.*, 1993), and with levels of household rice self-sufficiency in the Philippines (Siebert and Belsky, 1985).

Table 6: Extent of dependence of poor and wealthy households on common property resources (CPRs) in dryland India

State	CPR contribution to				
	Household Category	Income (%)	Fuel supplies (%)	Animal grazing (%)	Days of employment per household
Andhra Pradesh	Poor	17	84	-	139
	Wealthy	1	13	-	35
Gujarat	Poor	18	66	82	196
	Wealthy	1	8	14	80
Karnataka	Poor	20	-	83	185
	Wealthy	3	-	29	34
Madhya Pradesh	Poor	22	74	79	183
	Wealthy	2	32	34	52
Maharashtra	Poor	14	75	69	128
	Wealthy	1	12	27	43
Rajasthan	Poor	23	71	84	165
	Wealthy	2	23	38	61
Tamil Nadu	Poor	22	-	-	137
	Wealthy	2	-	-	31
Source: Jodha, 1990					

A number of studies demonstrate that the dependence of the poor on income from forest products is often at the expense of supplies for household use. As has been noted earlier, the rapidly growing market for and price of bushmeat in west Africa has had this effect. A recent study of dependency on forest products in mountain communities in an area of north Viet Nam, found that the forest vegetables, bamboo shoots and mushrooms collected there were eaten in richer households, but in poorer households had to be sold in order to buy rice (Nguyen Thi Yen *et al.*, 1994).

The characteristics of easy access to the resource and low entry thresholds enable many women to also generate income from forest-products activities. Forest product processing may often be performed at or near home, allowing women to combine these income earning activities with other household chores (i.e. child care). In addition, as women traditionally use forest products to meet some of their household's basic needs (e.g. fuelwood, medicines, and foods), gathering of forest products for the market can often be accomplished in conjunction with other collecting activities.

Such activities are often an important source of the income that women need to meet the costs of feeding and clothing the family, and their other needs for cash. They therefore tend to rely more frequently than men on forest-products activities for the generation of income. This, and the need to fit these activities in with their other responsibilities, means that there can be marked differences in the kinds of forest product activities engaged in by men and women, as is demonstrated from the information from southern Ghana in Table 7 (Falconer, 1994).

Table 7: Income-earning forest products activities amongst men and women, south Ghana

Women	Men
Gathering	
Food-wrapping leaves Snails Mushrooms Other forest foods Seed collection Fuelwood Pestle Palm fruit (some wild) Plant medicine Resin	Hunting (game) Honey Chewstick logs Canes Building poles Roofing materials Pestle Palm wine
Processing	
Sponge production Smoked snails Plant medicines Chewsticks Palm oil Charcoal	Basket weaving Charcoal Akpeteshie distilling Carving stools/furniture Mortars Drying mats Sleeping mats Roof tiles Cane furniture Fish traps Canoes/paddles Crop guards
Trade	
Food wrapping leaves Plant medicines Mortars Pestles Sleeping mats (urban markets) Charcoal Akpeteshie Cane baskets Chewsticks Bushmeat (game) Fuelwood Sponge Snails Mushrooms Other forest foods Spices Other household goods	Food wrapping leaves (Northerners) Fetish medicines (eg hides) Mortars Pestles Sleeping mats (rural markets) Charcoal Stools Cane furniture
Source: Falconer 1994	

Women are also widely involved in small forest product enterprises, as entrepreneurs as well as employees (see Table 9). In the group of six African countries referred to earlier, 42 percent of the proprietors and 41 percent of the total workforce in small forest product enterprises were women. In grass, cane and bamboo activities these proportions rose to 79 percent and 76 percent. Women also dominated the numbers of persons in forest products trade (62 percent and 57 percent). In contrast, both proprietors and workforce in woodworking were overwhelmingly men (96 percent and 93 percent) (Arnold *et al.*, 1994).

The dependence of children on snack foods has already been mentioned. Income from forest products activities can also be important for them. It has been reported from Ghana, for example, that school children are widely involved in basket making outside school hours in order to make the money they need in order to meet school fees and other expenses (Falconer, 1994).

STRUCTURE AND CHANGE IN NWFP-BASED ACTIVITIES

People's dependence on, or involvement in, NWFP income-generating activities is affected over time by a whole complex of factors. Some of these are connected with the market, and include market growth or decline, and changing patterns of demand, access to markets, competition and shifts in prices. Others are more related to supply, the products collected varying with the composition and conditions of the forest resource. Much change is associated with changing opportunities as economies prosper, and the growing opportunity cost of engaging in labour intensive activities such as are associated with many NWFP activities.

The discussion is broken down into two parts — one dealing with activities that produce and trade into local and domestic urban markets, the other dealing with those activities concerned with products destined for industrial and often external markets. The categories overlap in many respects, but are distinguished by certain features of the respective markets and end-uses.

Local and Urban Markets

Although most studies focus on products gathered for urban and export markets, these may not be the most important in terms of contribution to rural income and employment, or of quantities involved. Case study material suggests that the bulk of trade in NWFPs is local — being sold between households or in village or other rural markets. Baskets, mats, household and farm implements, and forest foods tend to feature heavily at this level.

The concentration of small forest products processing enterprises in the rural areas also reflects this geographical orientation. Small processing enterprises predominate where there are factors that favour local processing, such as dispersed raw materials, small markets or high transport costs; where there are economies of small scale, such as in handicraft production; or where subcontracting is more efficient than are integrated operations. The large component of forest products activities in the rural sector reflects the size of rural markets for forest products, and the dispersion of these markets across large areas with a relatively poor transport infrastructure, so that they are more effectively supplied locally. They provide many of the products that farm households require at lower cost than can be achieved with supplies from the modern sector (FAO, 1987).

As they are tied to the rate of change in agricultural activity, rural markets for most non-timber tree products, though very large, in aggregate tend to grow only slowly. Market transactions in forest products grow as use of products that were not previously sold in rural areas, such as fuelwood and forest fruits, becomes increasingly commercialised. Most growth, however, is usually associated with expansion of urban demand. This tends to be based on a number of staple products that formed part of rural use patterns, and which continue to be consumed as people move to the towns — wood fuels, certain foods, medicinal products, building materials and furniture, packaging, etc.

The expanding domestic trade flows to supply urban markets have given rise to often complex structures of producers, traders, transporters, wholesalers and retailers, that employ very large numbers of people. A study of forest product markets in Iquitos in Peru identified approximately 5,000 vendors of various forest products in the city in 1986, with the number having grown by nearly a quarter over the previous year. These vendors were supplied by a network of wholesalers, large merchants and several levels of buyers and sellers down to the village. In 14 villages in the region that were surveyed, nearly all households gathered and sold some forest products; most selling to trading intermediaries in the village. The main products traded included fruits, leaves and palm hearts; bags, baskets and other handicrafts; thatch and other building materials; meat and skins; charcoal and fuelwood; medicinal plants and fish (Padoch, 1988 and 1990).

Similar patterns are found elsewhere. Table 8 shows the situation in Kumasi, in the Ashante region of Ghana, in which there were on average 650 traders selling forest products in the city's main market during the period it was being studied, with an average of 70 traders bringing supplies in to the city daily. The Kumasi market serves as a hub for trade throughout the region, drawing goods into a central point and redistributing them to other markets. It was found that 68 percent of those interviewed in villages in the region got part of their income from forest-products activities (Falconer, 1994).

Table 8: Non-timber forest products traders in Kumasi's Central Market, Ghana

NTFP Product	Number of traders	NTFP product	Number of traders
Chewsticks	145	Plant medicines	114
Chewing sponge	4	*Xylopia* sp.	92
Sponge	14	Guinea pepper	89
Pestles	2	*Monodora myristica*	92
Mortar	1	*Aframomum* sp.	91
Spoons (carved)	18	Other seeds	88
Wooden trays	1	Barks	51
Grinders	18	Leaves (medicine)	24
Tool handles	9	Animal	20
Baskets	25	Tonic	8
Woven mats	45	Bushmeat	47
Marantaceae leaves	82	Snails	48
Cola nut	25	Mushrooms	1
Spices	25	Fruit	3
Charcoal	2	Fuelwood	5
Note: Numbers are averaged from 8 censuses of full-time traders stationed at Central Market Source: Falconer 1994			

As quantities, and values, grow, urban traders and wholesalers tend to exercise closer control over their supplies by hiring people to collect on their behalf rather than buying from local gatherers. Changes are also discernible in the balance between gender roles. As trade in fuelwood, which was traditionally controlled by women in many situations, expands and becomes more complex it tends to be taken over by men. Thus, though the growing intrusion of organised trading systems into the rural areas as the value of forest products rises may create additional rural employment and income, it can also divert control and access from those who earlier benefitted from the production and trade of these products.

As was noted earlier, commercialization can result in the diversion of supplies of saleable forest products from use by the collecting household to the market, and a decline in their rural

subsistence use. Growth in trade of forest products also alters relationships and rights. As pressures on a resource rise, traditional rights of use tend to become circumscribed or removed. Some of the longer established trades, that were earlier based on barter and credit-based personal ties of mutual obligation, are increasingly based on short term competitively established relationships of expediency (Beer and McDermott, 1989).

The improvement in rural infrastructure that facilitates the flow from rural to urban areas also exposes rural producers to competition in rural markets from urban producers. Factory made furniture tends increasingly to replace the local artisanal alternative, and plastic mats and basketware displace similar products made from grass, canes and bamboo. A study in Indonesia, for example, found that home-made bamboo umbrellas and wooden clogs were rapidly displaced by mass-produced products using metal and synthetic materials once these became available in rural markets (Hadi, 1986).

The seasonal nature of rural demand, tied to the availability of agriculture-based income, further disadvantages small manufacturing units, which are less able to meet these surges in purchasing than larger enterprises with sufficient working capital to be able to hold stocks. Their practice of producing on a "one-off" basis in response to individual orders also hinders small enterprises in coping with a seasonal flush of demand that would require organised batch or flow-line production (Arnold *et al.*, 1987).

The position of many small enterprise activities tends to be further eroded by internal competition within the sub-sector. Because of very low capital and skill requirements for entry into many forest based activities, it is all too common for many more production units to exist than can be supported locally. The sheer smallness of most enterprises (see Table 9) not only renders them vulnerable to competition but hampers their transition to larger, more viable size. They depend heavily on inputs from the entrepreneur and his or her family. Too small to be able to draw on most rural credit facilities they are seldom able to absorb the costs of moving from the household to larger separate premises and powered equipment. Studies have shown that very small, generally one-person, activities are the least efficient; even small increases in size are often associated with significant increases in economic efficiency (Liedholm and Mead, 1987).

The information from six countries in southern and eastern Africa that is summarised in the box (Arnold *et al.*, 1994) illustrates some of the factors involved. It indicates a very high rate of attrition in forest product enterprises — enterprise birth and closure (death) rates are both very high. However, as is indicated in the information summarised in the box, different sub-sectors are evolving at different rates.

Case study as well as survey data suggest that the grass, cane and bamboo sub-sector, the largest forest products group in that region, is characterized by low barriers to entry, requiring only limited or widely-available skills and only little fixed or working capital (Townson, 1994). This commonly results in large numbers of very small enterprises, mainly run by and engaging women, most of them single person units, operating from the home, and concentrated in the rural areas.

Rates of growth are slow, with most of the growth in the sub-sector accounted for by start-up of new enterprises. Apart from the small part of the sub-sector that has upgraded its product to craft baskets and related items for urban and external markets, the products of grass, cane and bamboo serve a predominantly low income rural market. This market is likely to show little growth, and be subject to invasion by low cost factory made alternatives such as plastic containers and mats that undercut and displace artisanal products. Internal competition among excessive numbers of producers makes it difficult for individual enterprises to improve their situation.

Manufacture of furniture and other forms of woodwork, in contrast, requires certain skills, and is therefore less easily entered. Acquisition of tools and small machines can permit incremental increases in output and improvements in quality. Access to investment and working capital may therefore impose a further condition of entry, or expansion. Small enterprises can compete with

factory-made alternatives across a wide spectrum of situations, and demand for woodwork products exists in urban as well as rural markets. As a result, the sub-sector is commonly characterized by fewer but larger enterprises, dominated by men, many operating in premises outside the home, and constituting an important urban as well as rural activity.

Table 9: Characteristics of small forest products enterprises in selected countries

Attribute	Jamaica	Honduras	Zambia	Egypt	Sierra Leone	Bangladesh
Proportion of enterprises (%):						
One-person operations	58	59	69	69	--	36
Production at home, not workshop	52	72	81	76	--	--
Rural location: - enterprises - employment	 88 79	 100 100	 96 95	 80 65	 99 96	 97 --
Women's share: - ownership - labour force	 32 30	 10 6	 12 12	 65 31	 -- --	 (3) 21
% family members in - labour force (no.) - hours worked	 82 68	 51 57	 86 --	 89 89	 (41) 34	 73 --
Mean Values:						
No. of workers per enterprise	2.2	2.2	1.7	1.9	1.8	3.8
Total investment (US$)	3030	1055	--	--	431	255
Hrs worked annually per worker	990	1247	1205	1712	2004	836
Annual production value per firm (US$)	4979	2536	--	1501	1384	2362
Source: Fisseha, 1987						

Table 10: Share (%) of forest products enterprises that had grown, selected countries

Forest products sector	Botswana	Kenya	Malawi	Swaziland	Zimbabwe	Total
Grass/cane/bamboo	0	25.8	16.7	11.5	11.5	14.4
Woodworking	43.4	61.6	43.0	25.3	32.1	47.8
Other forest products manufacturing	0	55.3	32.0	3.4	10.4	22.9
Forest products trade	8.1	28.2	16.7	30.8	7.6	24.0
All forest products	10.2	38.7	22.2	12.1	13.8	22.8
Source: Arnold *et al.* 1994						

Such shifts in the structure form part of a broader pattern of change in the role of non-farm activities (Haggblade and Liedholm, 1991). In economies where population is growing faster than per capita incomes, growth in non-farm employment reflects its function as a sponge; absorbing people

unable to obtain employment, or sufficient employment, in agriculture in labour-intensive low-return, typically household based, activities such as collecting and mat making. In situations where per capita incomes are rising, small enterprise growth is likely to be in activities to meet growing and diversifying rural demands, and in higher-return activities such as vending, trading and other service roles; this is likely to be accompanied by a reduction in the share of low return activities[8/].

INDUSTRIAL AND EXPORT MARKETS

A considerable number of gathered and traded forest products are materials for industrial use — e.g. natural rubber and other exudates, fruits of various palms, and various vegetable oils — often for use in external rather than domestic markets. In contrast to the major products traded and consumed domestically, which are mainly staples of everyday use, most forest products gathered for sale for industrial use face uncertain market prospects. The history of such "extractive" products records that, once a product achieves commercial importance, industry seeks to bring production and production costs under control by replacing supplies from wild sources by plantation sources or by synthetics. The greater the success of a product the more likely this is to happen. The market for the forest product then declines, often rapidly, and prices fall to levels at which production is no longer remunerative (Beer and McDermott, 1989; Richards, 1992).

Oil palm and rubber are but two of the many forest products that have been largely displaced by production from cultivated sources. The babassu oil industry, once the largest oilseed industry in the world based on harvest from a wild plant, has declined rapidly since the mid-1980s due to substitution by synthetic detergents and less fatty edible oils (Richards, 1992). Synthetics have also replaced or greatly reduced the market for a long list of other extractive products of the forest that at one time figured prominently among the products of one or other of the tropical forest zones. A history of forest products trade by Penan communities in Sarawak, for example, records a succession of product trades that have been abandoned because of declining prices and rising costs (Brosius, 1992).

Extractive supply systems can also exhibit inelasticities of supply that undermine their viability. When, in the 1970s, demand for babassu oilseed from northeast Brazil was growing rapidly, expansion in production was constrained by the farmers' need to give priority to their rice crop; labour for nut extraction becoming available only when weeding of rice had been completed. Supply therefore proved inelastic in the periods of growth in demand, causing processors to shift from manual to industrial processing. This led to men displacing women as the main income earners from babassu (May, 1992; Richards, 1992).

The main trades in extractive products typically involve extensive production and trading networks. In the case of rattan production in Indonesia, for example, collectors sell to village intermediaries, who are commonly merchants or shopkeepers who provide goods to the collectors, often on credit to be repaid in rattan and other forest products. Village middlemen sell the rattan to river middlemen or trade boat operators who in turn sell to urban buyers who function as the link with industrial or export buyers. Traditionally supply has thus involved networks of local collectors and intermediaries bound by long-term (often debt-based) trading relationships (Peluso, 1986 and 1991). Very large numbers of people are involved in aggregate in this system (see Table 1), and in 1987 Indonesia exported 130,000 tons of rattan, valued at about US$ 200 million. In addition large quantities are used domestically (Beer and McDermott, 1989).

8/ For a more detailed discussion of the experience of small forest products manufacturing activities, the reader is referred to the satellite paper entitled "Making Non-Wood Forest Products Programmes Succeed: Lessons from Small-Scale Forest-Based Enterprises".

Patterns of growth in forest product enterprise activities in Africa

In six countries surveyed recently in southern and eastern Africa — Botswana, Kenya, Lesotho, Malawi, Swaziland and Zimbabwe — an estimated 763,000 persons were employed in 408,000 small enterprise units engaged in the following activities based on the transformation or commercialization of forest products:

activity	persons	units
grass, cane and bamboo products	321,600	203,300
woodworking	202,500	68,200
other forest product manufacturing	88,400	51,400
forest products trade	150,100	84,300

In the period covered by the surveys, the net number of new forest products enterprises was increasing. Enterprise birth rates were very high, but so were closure rates, particularly in the early years of an enterprise. Only about a half of forest products enterprise closures were reported as being for "bad business conditions". Many of the entrepreneurs who closed enterprises, particularly among those engaged in woodworking, subsequently start new enterprises.

Employment in those small forest products enterprises that had survived had been growing at 11.5 percent per year, with a much faster rate of growth for woodworking (30.6 percent) than in grass, cane and bamboo (3.1 percent), and in trade (18.5 percent). At the time of the surveys, about 80 percent of jobs existing in grass, cane and bamboo, and 78 percent in forest products trade, came from new start-ups. In woodworking, in contrast, 55 percent came from expansion of existing enterprises.

However, only a minority of enterprises grew at all. Of those that did grow by adding to the workforce, most grew only by small amounts. Only in woodworking did a substantial share (30 percent) of the growth in employment come from enterprises that graduated from being very small to intermediate sized enterprises.

Above average growth rates were more likely to be found in enterprises that are young, and those that started out small. Enterprises located in commercial districts were more likely to have higher growth rates than their counterparts operating out of the home. Female-headed forest products enterprises were likely to grow less rapidly than those operated by males.

Source: Arnold *et al.*, 1994.

The evolution of production and trade in rattan in Kalimantan has proved more resilient than that for most extractive products. Collection is just one of the activities practised by producers, being usually combined with agriculture. Collector-trader relationships were traditionally less exploitative than in the Amazon, and access to land and the resource was based on established local rights rather than landlord-tenant relationships. Rattan lends itself to smallholder cultivation and has widely been raised in individual rattan gardens as well as being harvested from the wild resource. The output, in addition to being sold to industry and exported, provides the raw material for a substantial household-based small enterprise activity in the manufacture of rattan carpets and other products (Weinstock, 1983; Peluso, 1986).

Nevertheless, the system has recently come under severe pressure. As demand for other gathered forest products declined in face of competition from synthetics, collectors became increasingly dependent on sale of rattan — demand for which has been growing rapidly. With

growing demand for rattan, and the opening up of the forests in order to exploit timber, short term traders entered the market, raising prices to producers and stimulating increased harvesting. The construction of industrial processing plants in Kalimantan has subsequently raised output to levels that observers consider are unlikely to be sustainable (Peluso, 1991).

Broader developments in the region have also contributed to the weakening of traditional production and trading systems for extractives in the Amazon basin. With improved links between the producer and market areas, trade in extractives became less dependent on networks of gatherers and intermediaries. Enhanced land values in areas opened up by roads lessened landowners' interest in extractive income, in favour of other land uses, so that gatherers were widely deprived of access and had earlier usufruct rights withdrawn. Increased commercialisation and access to markets also expanded the range of options open to gatherers. Agriculture became more attractive, and job opportunities in towns led to large-scale migration from the rural areas. The numbers engaged in extractive activities in the Brazilian Amazon have been steadily declining, as people reduce their dependence on low-margin activities and products facing unstable markets, and a way of life that was "often poorly remunerated, lonely and isolated" (Richards, 1992).

It has been argued that, as demands for new forest products are emerging at the same time as others are declining, forest dwellers can maintain incomes from forest products by shifting from one to another. Much attention in recent years has also focused on ways of making trade in these products more remunerative and stable to producers[9/]. However, the balance of the available evidence suggests that the range of products marketable in any quantity is limited, and that, except in the also limited areas rich in exploitable resource, these markets are likely to provide at best short duration incomes, and that their low-input low-output nature makes them poor livelihood systems. Although the typical boom-and-bust sequence may provide significant employment and income initially, in the longer term it can be very disruptive for rural economies, particularly where the trade has encouraged people to move away from more diversified and less risky agriculture-based livelihoods (Browder, 1992; Afsah, 1992; Richards, 1992).

DISCUSSION

This section explores in more detail four sets of issues that appear to be of particular importance in relation to socioeconomic benefits and constraints stemming from use of NWFPs. These are (1) issues involving the ability of the poor and women to benefit equitably from NWFP use and activities; (2) issues surrounding diminishing access to supplies of NWFP raw materials; (3) the related issue of the impact of systems of tenure and control on people's access and use of these products; and (4) issues relating to government regulation and support programmes.

EQUITABLE ACCESS TO BENEFITS

Access by the Poor

As was noted earlier, the characteristics of forest resources, and of many of the commercial activities based on them, render them accessible to and appropriate for the poor. While forest gathering activities are not restricted to the latter, they do tend to rely on these activities for meeting a greater share of their basic needs. Similarly, most small-scale forest-products enterprises appear to be relatively accessible to the poor, requiring little in the way of capital or skills to enter. As was documented in an earlier section, there is widespread evidence that they do rely more heavily on NWFPs than the less poor.

9/ See the theme paper entitled "Trade and Marketing of Non-Wood Forest Products".

However, the poor are not always able to exploit the opportunities available from forest-products activities. In a study in an area of Orissa (India) where production and trade in forest products formed an important part of rural livelihood strategies, it was found that the wealthier categories of household collected and sold larger quantities of most products, because they could spend more time on collecting (Fernandes *et al.*, 1988). The constraints the poor face in not being able to devote as much labour to gathering or trading NWFPs as their wealthier neighbours can has also emerged in studies in the Gambia (Madge, 1990) and Viet Nam (Nguyen Thi Yen *et al.*, 1994).

In the Orissa case, the disadvantage of shortage of labour suffered by the poorer households was often compounded by restrictions on their access to the resource. Use of trees on village common land was monopolised by the rich and powerful, forcing the poor to collect from further afield (Fernandes *et al.*, 1988). Declining access by collectors due to changes in land ownership and control has been reported from many situations.

Many authors have also noted that poor gatherers are often exploited by middlemen who control access to the market, or by those who control access to the resource. This is particularly a problem with extractive commodities where collectors depend on intermediaries both for access to markets and for supplies of goods. In the worst cases, such as the rubber tappers in the Brazilian Amazon, concessionaires traditionally took advantage of the virtual monopsony created by their control of the rubber stands to keep the collectors in a state approaching debt bondage (May, 1992; Richards, 1992). Even in less exploitative situations, collectors have little if any bargaining power in their transactions with merchants and traders, or with private owners and managers or public officials who control access to the resource.

However, the widely voiced criticism of intermediaries in many of these situations needs to be tempered by recognition of the difficulties, costs and risks associated with trade in often seasonal and perishable products, production of which is widely dispersed across rural areas with limited transport infrastructure, with little if any access to storage or credit facilities, and serving poor markets in which large numbers of people are seeking to derive a living from the trade. Such market systems may be inefficient and unstable, with sharply fluctuating prices, but they are not necessarily exploitative — in the sense of intermediaries capturing an exorbitant share of the profit (Padoch, 1988 and 1990)[10/].

Nevertheless, prices to collectors are often a small fraction of the market value. Combined with unstable markets, this means that some forest product activities provide no more than marginal and uncertain returns to the producer. This is also the case with some of the overcrowded one-person, low-skill processing activities discussed earlier. Thus, while these forest based activities provide some means of existence to the poorest, they may not provide any means for future investment (either in forest gathering or agriculture), or for improving their quality of life. The concentration of the very poor in such low return activities evidently limits the extent to which they can benefit from NWFPs.

Participation by Women

The high proportion of women involved in NWFP activities — both as owners and employed — has already been noted. However, where they are concentrated in low return labour intensive cottage industry activities such as mat and basket making, there is a danger that their share will decline. As was noted earlier these very small enterprises have great difficulty expanding, or even surviving, and tend to lose their markets to factory made alternatives.

10/ In India, the trade in non-timber forest products was nationalised, in order to replace market intermediaries with a system designed to increase the share of the product value that accrued to the gatherers and producers. However, in practice it appears the bureaucratic procedures of state marketing agencies have introduced rigidities and distortions into the trading system that have had negative impacts on the intended beneficiaries, and on the level of production (Shiva 1994).

There are also instances of women being displaced in higher value forest products processing activities. As the lac-turnery cottage industry in India, for example, shifted increasingly from hand lathes to machine lathes women found it difficult to get access to the necessary training and have been progressively displaced and marginalized (Campbell, 1991). Where this is the case, particular gender-focused interventions may be called for in order to correct the discrimination.

On the other hand, women have widely been successful in such expanding activities as food preparation and vending, and in the trading of other NWFPs. There therefore does not seem to be a generic impediment to participation by women in NWFP activities[11/]. Barriers to, and opportunities for, their involvement tend to be situation specific.

Access to Raw Materials

Nearly everywhere users of forest products are faced with a decline in the size or quality of the resource from which they obtain their supplies. Timber harvesting in the forest is likely to damage or destroy other components of the forest that provide products for small enterprises. Clearance of land for agriculture and pasture reduces the extent of the resource, distances users from remaining supplies, and is likely to result in more intensive use of what remains. Shortages of NWFPs are a real problem for many.

However, reduction in forest cover and disturbance of the forest structure does not necessarily mean reduced NWFP availability. Bush fallow or farm bush may be as, if not more, productive of foods and other products as the pristine forest; people may adapt by drawing on a wider range of edible plants and animals; or trees valued for food may be protected or planted as the forest is removed. A recent study in Sierra Leone found that the greater part of locally used NWFPs came not from the forest but from fallow and farm bush. The four species used most frequently for construction were all fallow not forest species. Only 14 percent of all hunted or collected foodstuffs derived from forest itself, and 32 percent of the medicinal plants. Moreover, the most used bushmeat species, the rodent "grasscutter", is found only under open cover; it does not occur in the closed forest (Davies and Richards, 1991).

In many situations fallow land, farm bush and even the forest itself is actively managed by local users to conserve or encourage species of value[12/]. The babassu palm in northeast Brazil has long been integrated into local farmers' shifting cultivation system (May *et al.*, 1985), and farmers in the flood plain forests of the Amazon area manage them to favour the economically more valuable species they contain (Anderson and Ioris, 1992). Planted fruit trees appear everywhere at a very early stage in agricultural settlement, and as natural tree stocks diminish the amount and range of planting generally increases (Arnold and Dewees, 1995).

Though the main impetus for this domestication is to meet household needs, it can include species intended for non-farm enterprise activities. Recent work in west Kalimantan has documented a major transformation of forest areas adjacent to communities with improved access to markets, in favour of "orchards" of the wild fruit tree durian (Padoch, 1992; Peluso, 1994). The expansion of household level cultivation of rattan in Kalimantan, first as rattan gardens incorporated into shifting cultivation systems, and then as a smallholder crop, also illustrates the impact that commercialisation

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11/ Analysis of the results of the six-country small enterprise surveys in Africa indicated that female headed forest products enterprises are likely to grow less rapidly than those operated by males. This result is similar to that reported for all small-scale enterprises in previous studies in the region (Downing and Daniels 1992). One explanation for this finding is that females may be more risk-averse than their male counterparts and may choose to diversify rather than grow.

12/ The subject of management of NWFP resources is dealt with in the theme paper entitled "Resource Development for Non-Wood Forest Products".

can have on encouraging production of products that are suitable for cultivation at this scale and level (Godoy and Feaw, 1991; Peluso, 1991).

People also display considerable adaptability in use of available forest products. As supplies of a particular product are depleted, users switch to using or selling another. For example, in Ghana people are continuously experimenting with and adapting their health practices to reflect new needs and changing availability of medicinal products (Falconer, 1994).

Consideration of whether or not reduction in forest resources is affecting people's dependence on products that those forests contain also needs to take account of the dynamics of change in these patterns of use and dependency. The changes that disturb or deplete the forest may themselves open up new livelihood options that reduce users' dependence on or interest in NWFPs. As logging roads were built in Kalimantan, alternative employment opportunities emerged, reducing interest in rattan collection (Peluso, 1988). The same happened in the Amazon, where the road infrastructure also dramatically enhanced the value of agricultural and pasture uses of forest land, undermining many extractive forest product activities — but stimulating those such as babassu oil-seed production that could be operated on an industrial scale.

Nevertheless, there are many situations in which forest reduction has reached the stage where supplies of needed NWFPs have been severely depleted or even lost. This is notably the case where use was narrowly focused on particular products and species — hence the decline in so many extractive trades.

For similar reasons, raw material shortages can be a particular problem for processing enterprises. The results from the surveys of small enterprises referred to earlier nearly always show entrepreneur perceptions of raw material supply problems to be higher in the forest sector than in most other sectors (FAO, 1987; Arnold *et al.*, 1994). For the countries reported on in Table 11 it is apparently a problem that is getting worse; with more entrepreneurs listing it as their main problem now than at start-up.

Table 11: Perceived problems faced by small forest products enterprises[1]

Business problems	At start-up		Currently	
	Grass/cane/ bamboo	Wood-working	Grass/cane/ bamboo	Wood-working
Any problems? (% answering "yes")	54	85	67	85
What was principal problem? (% of those with answers)				
Finance	15	45	5	34
Markets	41	19	33	19
Tools and equipment	0	11	0	10
Inputs	20	21	34	37
Other	24	4	28	0

[1] All country average for six countries in southern and eastern Africa.

Source: Arnold *et al.* 1994

This problem tends to be exacerbated by small enterprises' lack of working capital, which prevents them holding stocks. Nor are they usually able to invest in the resource itself. Their small size and simple technical base similarly often makes it difficult for them to substitute other materials when their traditional inputs become hard to obtain.

Their problems are often worsened by unfavourable forest policies and policy enforcement practices — which can include unfavourable harvesting controls favouring timber production, exclusive allocation of timber to large users, complicated licensing or auctioning procedures, plus demands for heavy deposits or other insurmountable preconditions, high prices due to state monopolies, and monopoly distribution systems. In a survey among furniture makers in northeast Thailand, for example, problems with forestry regulations were cited by nearly half the enterprises as the main negative factor affecting their operations (Boomgard, 1983).

Some of these distortions reflect the pressures on forest services to produce revenue from forest products disposal; this is more easily achieved from a small number of larger enterprises than from many small ones. However, granting licences to harvest NWFPs to urban traders and other outsiders is likely to reduce availability to local people who depend on the forest for some of their immediate needs. Fees and royalties imposed on collection of NWFPs can make their use uneconomic for the poor; much harvesting is consequently carried out illegally, by those seeking to avoid payment.

The mandate of forest services to protect the forest resource can also interfere with NWFP uses. Many users of the forest are more difficult and costly to control and service, raising issues of how to ensure conservation of the resource and environmental stability. Countries often impose restrictions on private sale and/or transport of particular forest products for this reason. This can have the effect of discouraging investment in production of these products on non-forest land, as well as raising costs to those engaged in production and trade (and making them more dependent on intermediaries). Forest services may also be themselves producers and sellers of particular products; often competing with local producers and traders at what are effectively subsidised prices.

These conflicts of interest between the two sides contribute to the poor relations that so commonly characterizes relationships between forest service personnel and forest users. This in turn undermines efforts to involve users in more collaborative forms of sustainable management of the resource.

Tenure and Control

Controls exercised by forest services are paralleled by other changes that restrict or remove users' access and rights to harvest as pressures on a resource increase. The greater part of the raw material supplies that users of NWFPs draw on comes from land that they do not control — privately owned land or land controlled by private concessionaires, state land managed by forest services or other government departments, or common pool land operated under collective control or without any form of control at all ("open access"). They are therefore very vulnerable to changes in land use. Loss of use rights as land owners shifted to other land uses, and withdrew rights of access from the tappers and collectors, has been a major factor in undermining rubber tapping and babassu kernel collection in the Amazon. Lack of security of access to future forest product harvests influences household decisions in favour of the short term results to be obtained from shifting cultivation rather than extractive activities (Pinez-Vasquez *et al.*, 1990).

Commercialization and the Decline in Local Controls

The commercialisation of forest products that were previously collected for own use puts pressure on collective management systems and encourages privatisation of the products in demand. The example from Orissa cited earlier (Fernandes *et al.*, 1988) is but one of many where, even when the resource remains in the public domain, as its value rises access to the harvest is effectively captured for the benefit of just the wealthier and more powerful within the community. Though

villages in Kalimantan still retain rights to rattan and other forest products on adjacent lands, in practice they are now often unable to exercise these rights in the face of gangs of collectors retained to procure supplies for the rattan processing factories, or uncooperative logging companies with rights to harvest timber on the same area (Peluso, 1991). There are also numerous instances where use or harvesting rights to particular products on private land — for example for fuelwood and post-harvest grazing — are withdrawn once those products acquire significant market value, and industrial rights usurp local rights (McElwee, 1994; Jodha, 1990; Falconer, 1994; Beer and McDermott, 1989).

More profound still have been shifts in control that have removed the resource from forest products production. Table 12 shows the reduction in village common land per capita in various areas of India, as a result of land reform (and encroachment) that has transferred land from communal control to private ownership, and thereby from forest product to agricultural use. A very large part of the village lands on which the poor depended for much of their income, and for fuelwood and other subsistence biomass products has in this way been removed from their use (Jodha, 1990).

Table 12: Decline in area of common property resources and increase in population pressure upon them

State	Average area of CPRs per village (ha)	Decline since 1950-52 (%)	Persons per hectare of CPR	
			1951	1981
Andhra Pradesh	827	42	4.8	13.4
Gujarat	589	44	8.2	23.8
Karnataka	1165	40	4.6	11.7
Madhya Pradesh	1435	41	1.4	4.7
Maharashtra	918	31	4.0	8.8
Rajasthan	1849	55	1.3	5.0
Tamil Nadu	412	50	10.1	28.6
Source: Jodha, 1990				

The erosion of traditional NWFP production and management systems has come about as a result of a long period of political, economic and physical changes. State assertion of control first over the forest resource and then over the land has widely reduced access and rights of usage. At best people were left with usufruct rights, application of which was subject to the whim of the State and its officials. In recent times the reduction in availability of common property resources has nearly everywhere been massively accelerated. Privatization and encroachment, as well as government appropriation, have been the main processes taking resources out of common use. Increasing pressures on what is left have frequently led to its progressive degradation.

Concurrently, traditional methods of access control, usufruct allocation, and conflict resolution have widely become ineffective or have disappeared, undermined by political, economic and social changes within the village and nation. Increasing population pressure and in-migration of outsiders, greater commercialization of the products of the resource, and technological changes that encourage alternative uses of the land, have all contributed to increased differentiation within communities that reduces communal cohesion and uniformity of interest. With the progressive transfer of responsibility for resource management decisions to the central state, many common pool resources are no longer managed in any meaningful sense of that term by those who use them. In his study in the dry regions of India, Jodha found that of the communities that in 1950 had exercised controls such as rotational grazing, seasonal restrictions, and use of watchmen, only 10 percent had such controls in 1980, and use of fines, taxes, and fees had ceased altogether. Much usage is now of an unregulated "open access" nature (Messerschmidt, 1993; Shepherd, 1992; Jodha, 1990; Poffenberger, 1990).

Collective, Private or State Control

The shift away from collective local control is now so heavily entrenched in many countries as to make further privatization or appropriation seem either inevitable or desirable, or both. However, recognition of the continuing importance of common pool resources to many rural populations has stimulated re-examination of policies and practices that lead to the erosion and breakdown of local collective systems of resource management. The strong thrust towards bringing use of common resources under private or government control has been widely influenced by the thesis of the "tragedy of the commons", which argues that the increasing pressures on individual users prevent effective cooperation and group control (Hardin, 1968). However, much usage of common property resources is of an "open access" nature, characterised by unrestricted entry and unregulated use rather than by collective management. Verdicts of breakdown of common property resource management have all too often been erroneously passed on situations in which the deterioration actually came about due to unregulated use under an open access regime.

This misunderstanding has been compounded by a tendency to overlook the factors that encourage collective action, and the self regulating capabilities of groups of users, and the reasons why the alternatives of private or state control may themselves not be sustainable or efficient. Because exclusion from a common property resource is difficult, it may not be feasible to privatize it. Privatization, by transferring control of the resource to a limited number of individuals who thereby acquire the social and legal sanction to exclude others, is likely to exacerbate the problems of the excess of population without access to private property (Bromley and Cernea, 1989). Private use can also lead to overuse and degradation. Equally, the State may not be able to control, manage or prevent degradation to a resource it has expropriated (Berkes *et al.*, 1989).

There are, therefore, good reasons for questioning the discrimination against collective management, and in favour of attempts that have been made to reverse this trend. However, interventions to strengthen or establish contemporary systems of collective local management of forest resources have to date had only limited success. When local institutions have broken down under the pressures of change, it is not to be expected that new village institutions capable of controlling resource allocation and use can be created easily. The low returns and high social cost associated with trying to control common property resources may prove unacceptable to users, to the point at which they prefer to leave it to the state to manage them.

Commercialisation puts particular pressures on collective control systems. Though the resource acquires a higher value as market demand emerges, which in principle could increase the incentive to conserve and manage it (Peters *et al.*, 1989), in practice it usually heightens pressures to exploit it now. Given the relatively long production periods of many NWFPs, uncertainties about future prices, and the often uncertain tenure situation of the users, many will understandably opt for the short term returns that can be obtained from increasing current exploitation levels (Pinedo-Vasquez *et al.*, 1990). In such situations, conflicts within the community, and with outsiders, about use of the resource are likely to increase, and become less easily resolved. As increased resource and product values make the transaction cost of privatising worthwhile, this is likely to undermine the incentive to maintain collective control further.

However, successful local control systems do exist or have evolved. In a recent review of information on the subject, McElwee (1994) argues that one of the key factors is being able to control the *intensity* of commercialization, so that it does not overwhelm the resource or the institutions governing the resource:

> Communities who seem best able to adapt to commercialisation are either those with flexibility in determining whether to participate, which allows control over degree of change ... or are those in which change has been less rapid.

Strong social institutions, small homogeneous groups of users, rapid returns to investment in collective management, and well defined rights of use and a legal system able to help a user group enforce its rights, are among characteristics that have been cited as being conducive to effective collective control.

Some of the more successful adaptations are ones that combine features of both collective and individual control. The concept of separate land and tree tenure, whereby ownership of the produce of a tree can be separated from rights of use of the land on which the tree stands, is widespread where land is still communally controlled. Across much of Africa, for instance, this provides farmers with sufficient assurance of security of access to tree products to stimulate tree planting and management on land on which they only have usufruct rights (Fortmann, 1985; Warner, 1993, Shepherd, 1992). Peluso (1994) has described, for an area in west Kalimantan, how systems to control access to tree produce have changed over time in response to political ecology and market forces. Most recently, with a major expansion in the market demand for the fruit durian, and a consequent increase in its production, a system dominated by groups of descendants from the original planters of long-living fruit trees is being replaced by more individual control. This gives greater ease of management, and avoidance of potential disputes about distribution of proceeds, but diminishes the access to tree benefits of those in a family that do not have producing trees of their own. But the two systems co-exist, with choices between the two being determined within each descent group.

However, in most situations the more pronounced trend is towards shifting the focus of production of NWFPs on to individually controlled land. Managed fallow, farm bush, home and forest gardens and compound farms, and other trees incorporated into farm systems are becoming increasingly the main source of many NWFPs. The products most at risk of depletion are then the ones that are not easily domesticated in this way. Many medicinal plants fall into this category.

Regulations and Support Programmes

Small enterprises in general have to operate within a policy environment that is oriented towards large modern sector industry. Thus, small enterprises often face subsidized credit allocation regulations and tax concessions aimed at firms above a particular size. Even where such overt restrictions do not occur, licensing and other burdensome bureaucratic procedures tend to exclude them from access to available incentives or assistance (Liedholm and Mead, 1987). A widespread issue is therefore to achieve a more neutral policy environment, in order to remove inadvertent bias against the small enterprise sector.

In designing programmes to provide support to small forest product enterprise activities, it is important to recognise that there are different potential target groups with different needs and opportunities. Those in the process of starting up face different problems and constraints than those seeking to expand. Those new entrants driven by supply side forces, as people search for activities where they can sustain themselves, face different issues than those who are responding to market opportunities. Among those enterprises that are growing, those seeking to expand from a one-person beginning have different needs for assistance from those that aspire to graduate to larger scales of operation.

The large numbers entering many non-timber tree products activities — and small enterprise activities generally — suggests that there is no shortage of prospective entrepreneurs, and raises questions as to the volume of resources that should be allocated to encouraging yet more new entrants. The high rate of attrition among start-ups suggests that support at this stage should focus on helping potential entrepreneurs identify prospective lines of activity that are compatible with their capabilities and experience. It also raises the possibility that it could be more efficient to concentrate limited resources for support services mainly on helping established businesses.

The concentration of new entrants in many countries in low-return tree product activities that can offer no more than marginal, unsustainable livelihoods, presents particular issues. Support to such activities once higher return or less arduous alternatives emerge could impede the emergence of better

livelihood systems for the participants. That being the case, it may be more fruitful to help people move into other more rewarding fields of endeavour rather than seeking to raise their productivity in their current line or work. Care needs to be taken in such a case to ensure that not only current income levels but also future growth prospects are indeed better in the alternative product lines to which people are being encouraged to move.

With regard to support of established enterprises, a credit programme that provides small amounts of working capital may be of great help to a very small enterprise seeking to grow a little. As discussed earlier, this type of incremental growth is often associated with substantial gains in efficiency. Enterprises seeking to graduate to a larger size, by contrast, would generally need more complex forms of assistance, including help in searching out new markets, in management skills and in production control. It is generally more expensive to offer this type of assistance, but benefit/cost ratios can still be favourable if the result is substantial growth in employment, in efficiency and in incomes earned by the clients.

With such diversity among the enterprises and those engaged in small no-timber forest products activities, support programmes need to be based on a sound understanding of the patterns of growth in particular sub-sectors and situations, and a clear focus on the needs and possibilities of the particular category being targeted. Generalised approaches, intended to assist everyone, are unlikely to be effective.

CONCLUSIONS

NWFPs constitute an important part of the livelihood system of huge numbers of rural, and many urban, households. Consideration of their role should form part of analysis and planning related to nutrition, health, food security, agriculture and rural development as well as forestry.

Given the often rapid and substantial shifts in patterns and levels of dependence on particular products and activities that occur, it is important to be able to identify the direction of change and the factors responsible for change, and to be able to distinguish between those products and activities that are likely to remain viable and grow, and those that will decline or disappear.

In pursuing this aim it is useful to distinguish three different basic situations within which small enterprise activities are prominent:

- in economies where population is growing faster than per capita incomes, growth in non-farm employment reflects its function as a sponge; absorbing people unable to obtain employment, or sufficient employment, in agriculture in labour-intensive low-return, typically household based, activities such as collecting and mat making;

- in situations where per capita incomes are rising, small enterprise growth is likely to be in activities to meet growing and diversifying rural demands, and in higher-return activities such as vending, trading and other service roles; this is likely to be accompanied by a reduction in the share of low return activities;

- overlapping with the other two, forest-products activities often play an important buffer role during the process of growth and change; providing a source of income on which rural people can fall back during periods when crop failure, poor markets or prices, or other setbacks, adversely affect their livelihood system.

These different situations evidently have different potentials, and limitations, and call for different responses. Many of the low-return activities typical of the first situation defined above offer no more than a marginal, fragile livelihood, and seldom provide a base for sustained improvement. They are commonly available to the poor because they are in isolated regions or because their extraction and processing is difficult, unpleasant, or unrewarding. Support to such activities once

higher return or less arduous alternatives emerge could impede the emergence of better livelihood systems for the participants. On the other hand, in the situations where they are found in large numbers they can still be hugely important to those engaged in them.

In examining experience to date, the small enterprise activities that have grown consistently tend to be those that 1) involve products that are staples of domestic demand, such as fuelwood, processed foods and furniture; 2) require certain skills or inputs, or involve flexible production processes that can be upgraded and expanded readily, or that do not suffer diseconomies of small scale of operation; and/or 3) use raw materials that are widely available, or that regenerate readily and quickly, and/or that can be brought under local or household management. However, while this may provide useful pointers to longer term potentials, it is clear that growth of activities that exhibit these characteristics will continue to be accompanied by a huge number of other, often more transitory or less robust, enterprise activities that emerge in response to needs and opportunities in particular situations and at particular stages in the development process.

REFERENCES

Afsah, Shakeh. 1992. *Extractive reserves: economic-environmental issues and marketing strategies for non-timber forest products*. Draft. Washington, DC, ENVAP, The World Bank.

Anderson, A.B. and Ioris, E.M. 1992. The logic of extraction: resource management and income generation by extractive producers in the Amazon. In *Conservation of Neotropical Forests*, Redford, K.H., and Padoch, C. eds. New York, Columbia University Press.

Arnold, J.E.M. 1994. Non-farm employment in small-scale forest-based enterprises: policy and environmental issues. Working Paper No. 11, EPAT/MUCIA Research and Training. Madison, University of Wisconsin.

Arnold, J.E.M., Chipeta, M.E. and Fisseha, Y. 1987. The importance of small forest-based processing enterprises in developing countries. *Unasylva* 39(3 and 4): 8-16.

Arnold, J.E.M., Liedholm, C., Mead, D., and Townson, I.M. 1994. Structure and growth of small enterprises using forest products in southern and eastern Africa. OFI Occasional Papers No 47. Oxford, Oxford Forestry Institute.

Arnold, J.E.M. and Dewees, P.A. eds. 1995. *Tree management in farmer strategies: responses to agricultural intensification*. Oxford, Oxford University Press.

Beer, J. de and Mcdermott, M. 1989. *The economic value of non-timber forest products in Southeast Asia*. Amsterdam, Netherlands Committee for IUCN.

Boomgard, J.J. 1983. The economics of small-scale furniture production and distribution in Thailand. Unpublished PhD dissertation, Department of Agricultural Economics. Lansing, Michigan State University.

Boomgard, J.J., Davies, S.P., Haggblade, S.J. and Mead, D.C. 1991. A sub-sector approach to small enterprise promotion and research. GEMINI Working Paper No. 10. Bethesda, Maryland, USA, Growth and Equity through Microenterprise Investments and Institutions (GEMINI) Project.

Brosius, J.P. 1992. Bornean forest trade in historical and regional perspective: the case of Penan hunter-gatherers of Sarawak. In *Society and non-timber forest products in Asia*, J. Fox, ed. Honolulu, Program on Environment, East-West Centre.

Browder, J.O. 1989. Social and economic constraints on the development of market-oriented extractive systems in Amazon forests. Paper presented at the Symposium on Extractive Economies in Tropical Forests: A Course of Action, National Wildlife Federation, Washington, DC, 30 November-1 December 1989.

Browder, J.O. 1992. The limits of extractivism: tropical forest strategies beyond extractive reserves. *Bioscience* 42(3):174-182.

Campbell, J.Y., ed. 1991. Women's role in dynamic forest-based small-scale enterprises: case studies on uppage and lacquerware from India. Community Forestry Case Study 3. Rome, FAO.

Davies, A.G. and Richards, P. February 1991. Rain forest in Mende life: resources and subsistence strategies in rural communities around the Gola North Forest Reserve (Sierra Leone). A report to ESCOR. London, UK Overseas Development Administration.

Downing, J. and Daniels, L. 1992. The growth and dynamics of women entrepreneurs in Southern Africa. GEMINI Technical Report No. 47. Bethesda, Maryland, USA, Growth and Equity through Microenterprise Investments and Institutions (GEMINI) Project.

Falconer, J. 1990. *The major significance of "minor" forest products: the local use and value of forests in the West African humid forest zone.* Community Forestry Note 6. Rome, FAO.

Falconer, J. March 1991. People's uses and trade in non-timber forest products in southern Ghana: a pilot study. Prepared for the Ghana Forestry Department and ODA Forest Resources Management Project, Draft Working Paper (mimeo).

Falconer, J. 1994. *Non-timber forest products in southern Ghana: main report.* Chatham, Republic of Ghana Forestry Department and Overseas Development Administration, Natural Resources Institute.

Falconer, J. and Arnold, J.E.M. 1989. Household food security and forestry: an analysis of socioeconomic issues. Community Forestry Note 1. Rome, FAO.

Falconer, J. and Arnold, J.E.M. 1988. Forests, trees and household food security. Social Forestry Network Paper 7a. London, Overseas Development Institute.

FAO. 1987. Small-scale forest based processing enterprises. Forestry Paper 79. Rome, FAO.

Fernandes, W. and Menon, G. 1987. *Tribal women and forest economy.* New Delhi, Indian Social Institute.

Fernandes, W., Menon, G., and Viegas, P. 1988. *Forests, environment and tribal economy: deforestation, impoverishment and marginalisation in Orissa.* Indian Social Institute.

Fisseha, Y. 1987. Basic features of rural small-scale forest-based processing enterprises in developing countries. In *Small-scale forest based processing enterprises.* Forestry Paper 79. Rome, FAO.

Fisseha, Y. and Milimo, J. 1986. Rural small-scale forest-based processing enterprises in Zambia: report of a 1985 pilot survey. FO:MISC/86/15. Rome, FAO.

Godoy, R., Brokaw, N.L.V. and Wilkie, D. 1992. *The effects of economic development on the extraction of non-timber tropical forest products: hypotheses, methods, and information requirements.* Draft. Cambridge, Harvard Institute for International Development.

Gunatilake, H.M., Senaratine, D.M.A.H. and Abeygunawardena, P. 1993. Role of non-timber forest products in the economy of peripheral communities of Knuckles National Wilderness area of Sri Lanka. *Economic Botany* 47(3): 275-281.

Hadi, S. 1991. Forest-based handicrafts in Indonesia. In *Case studies in forest-based small-scale enterprises in Asia: rattan, matchmaking and handicrafts*, J.Y Campbell, ed. Community Forestry Case Study 4. Bangkok, FAO.

Haggblade, S. and Liedholm, C. 1991. Agriculture, rural labour markets, and evolution of the rural nonfarm economy. GEMINI Working Paper No. 19. Bethesda, Maryland, USA, Growth and Equity through Microenterprise Investments and Institutions (GEMINI) Project.

Haggblade, S. and Hazell, P. 1989. Agricultural technology and farm-nonfarm linkages. *Agricultural Economics* 3: 345-364.

Hardin, G. 1968. The tragedy of the commons. *Science* 162:1243-248.

Havnevick, K. 1980. Analysis of rural production and incomes, Rufiji District, Tanzania. Institute of Resource Assessment, University of Dar-es-Salaam, IRA Research Paper No. 3, published jointly with CHR Michelsen Institute, Bergen (Norway), DERAP No. 152, 137.

Hecht, S.B. 1992. Valuing land uses in Amazonia: colonist agriculture, cattle, and petty extraction in comparative perspective. In *Conservation of neotropical forests*, Redford, K.H. and Padoch, C. eds. New York, Columbia University Press.

Hecht, S.B., Anderson, A. and May, P. 1988. The subsidy from nature: shifting cultivation, successional palm forests and rural development. *Human Organization* 47(1): 25-35.

Hyman, E.L. 1983. Analysis of the woodfuels market: a survey of fuelwood sellers and charcoal makers in the province of Ilicos Norte. *Biomass* 3:167-197.

Jha, L.K. and Jha, K.N. 1985. Tassar culture and its impact on generation of income and employment. *Myforest* 21(4): 289-294.

Jodha, N.S. 1990. Rural common property resources: contributions and crisis. *Economic and Political Weekly*, Quarterly Review of Agriculture 25 (26).

Kamara, J.N. 1986. Firewood energy in Sierra Leone: production, marketing and household use patterns. Verlag Weltarchiv Studies No. 9. Hamburg.

Kaye, V. 1987. Etude sur les potentialités de l'artisanat d'art en Côte d'Ivoire: plan triennal de développement de l'artisanat d'art. Sous direction de l'artisanat d'art, Direction de promotion de l'artisanat.

Kilby, P. and Liedholm, C. 1986. The role of nonfarm activities in the rural economy. Employment and Enterprise Policy Analysis Discussion Paper No. 7. Cambridge, Harvard Institute for International Development.

Levin, P. 1992. Non-timber forest products: wild edible resources in southern Thailand. In *Society and Non-timber Forest Products in Asia*, J. Fox ed. Honolulu, Program on Environment, East-West Centre.

Liedholm, C. and Mead, D.C. 1987. Small-scale industries in developing countries: empirical evidence and policy implications. MSU International Development Paper No. 9. Lansing, Michigan State University.

Liedholm, C. and Mead, D.C. 1993. The structure and growth of microenterprises in southern and eastern Africa. GEMINI Working Paper No. 36. Bethesda, Maryland, USA, Growth and Equity through Microenterprise Investments and Institutions (GEMINI) Project.

Longhurst, R. 1987. Household food security, tree planting and the poor: the case of Gujarat. IDS/ODI Workshop on Commons, Wastelands, Trees and the Poor: Finding the Right Fit. Brighton, Institute of Development Studies at the University of Sussex.

Madge, C. 1990. Money, medicine and masquerades: women, collecting and rural development in the Gambia. Ph.D. thesis submitted to the School of Geography, Faculty of Arts of the University of Birmingham, Birmingham.

Malhotra, K.C., Deb, D., Dutta, M., Vasulu. T.S., Yadav, G. and Adhikari, M. 1993. The role of non-timber forest products in village economies of South West Bengal. Rural Development Forestry Network Paper 15d. London, Overseas Development Institute.

Marks, S. and Robbins, R. 1984. People in forestry in Zambia. Forestry Department. Rome, FAO. (Mimeo.)

May, P.H. *et al.* 1985. Babassu palm in the agroforestry systems in Brazil's mid-north region. *Agroforestry Systems* 3(39):275-295.

May, P.H. Common property resources in the neotropics: theory, management progress, and an action agenda. In *Conservation of neotropical forests*, Redford, K.H. and Padoch, C. eds. New York, Columbia University Press.

McElwee, P. 1994. Common property and commercialisation: developing appropriate tools for analysis. M.Sc. dissertation. Oxford Forestry Institute, University of Oxford.

Melnyk, M. 1993. The effects of sedenterization on agriculture and forest resources in southern Venezuela. Network Paper 16b, Rural Development Forestry Network. London, ODI.

Messerschmidt, D.A., ed. 1993. Common forest resource management: annotated bibliography of Asia, Africa and Latin America. Community Forestry Note 11. Rome, FAO.

Nguyen Thi Yen, Nguyen Quang Duc, Vu Manh Thien, Dang Duc Phuong and Ogle, B.A. 1994. Dependency on forest and tree products for food security: a pilot study in Yen Huong Commune, Ham Yen District, Tuyen Quang Province, North Viet Nam. Working paper 250. Uppsala, Swedish University of Agricultural Sciences.

Olsson, G. 1991. Forests and forest product use in Vanuatu and Tonga. Working Paper 2 — RAS/86/036. Port Vila, South Pacific Forestry Development Programme, FAO/UNDP.

Padoch, C. 1988. The economic importance and marketing of forest and fallow products in the Iquitos region. In *Swidden-fallow agroforestry in the Peruvian Amazon*, Denevan, W.M. and Padoch, C., eds. Advances in Economic Botany Volume 5. New York, The New York Botanical Garden.

Padoch, C. 1990. *Marketing of non-timber forest products in Western Amazonia: general observations and research priorities*. New York, New York Botanical Garden.

Peluso, N.L. 1986. Rattan industries in East Kalimantan, Indonesia. Paper commissioned by FAO. Draft. (A condensed version of this paper appears in *Case studies in forest-based small-scale enterprises in Asia: rattan, matchmaking and handicrafts*, J.Y. Campbell, ed., Community Forestry Case Study 4, Bangkok, FAO.)

Peluso, N.L. 1989. The role of non-timber forest products in shifting cultivation communities and households: current knowledge and prospects for development. Field Document No. II-2-UTF/INS/065/INS. Jakarta, Directorate General of Forest Utilization, Government of Indonesia and FAO.

Peluso, N.L. 1991. The political ecology of extraction and extractive reserves in East Kalimantan, Indonesia. *Development and Change* 23(4): 49-74.

Peters, C.M., Gentry, A.H., and Mendelsohn, R.O. 1989. Valuation of an Amazonian rainforest. *Nature* 339: 656-657.

Pinedo-Vasquez, M., Zarin, D., and Jipp, P. 1990. Land use in the Amazon. *Nature* 348: 397.

Poffenberger, M. 1990. *Keepers of the forest: land management alternatives in Southeast Asia*. New Haven, CT, USA, Kumarian Press.

Richards, M. 1993. Commercialization of non-timber forest products in Amazonia. NRI Socio-economic Series No. 2. Chatham, Natural Resources Institute.

Schwartzmann, S. and Allegretti, M. 1987. Extractive production in the Amazon and the rubber tappers' movement. New York, Environmental Defence Fund.

Shepherd, G. 1992. Managing Africa's tropical dry forests: a review of indigenous methods. London, ODI Agricultural Occasional Paper 14. Overseas Development Institute.

Shiva, M.P. 1994. Determinants of the key elements of demand and supply of non-timber forest products. Paper prepared for the International Workshop on India's Forest Management and Ecological Revival, New Delhi, 10-12 February 1994.

Siebert, S., and Belsky, J.M. 1985. Forest product trade in a lowland filipino village. *Economic Botany* 39(4):522-533.

Tandon, J.C. 1991. The safety match industry in India. In *Case studies in forest-based small-scale enterprises in Asia: rattan, matchmaking and handicrafts*, J.Y Campbell, ed. Community Forestry Case Study 4. Bangkok, FAO.

Tewari, D.N. 1982. Minor forest products of India. Paper presented at the USAID Conference on Forestry and Development in Asia, Bangalore, India.

Townson, I.M. 1994. *Forest products and household incomes: a review and annotated bibliography*. Review draft. Oxford, Oxford Forestry Institute.

Warner, K. 1993. *Patterns of tree growing by farmers in eastern Africa*. Tropical Forestry Paper 27. Oxford and Nairobi, Oxford Forestry Institute and International Centre for Research in Agroforestry.

Weinstock, J.A. 1983. Rattan: a complement to swidden agriculture. *Economic Botany* 37(1): 56-68.

Wells, J., Fatihah Haddar, Wall, D., and Page, M. 1994. Links between population, settlements and the environment: the provision of organic materials for shelter. Working Paper 1. London, School of Construction Economics and Management, South Bank University.

NON-WOOD FOREST PRODUCTS AND NUTRITION

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INTRODUCTION

Non-wood forest products (NWFPs) have been defined as "all goods of biological origin other than wood in all its forms, as well as services derived from forest or any land under similar use." In many parts of the world, these products still play an important biological and social role in local food systems. They can contribute substantially to nutrition, either as part of the family diet or as a means to achieve household food security. They can also improve health through the prevention and treatment of diseases. Poor households residing in and around forest areas — particularly landless people, women and children — depend to a greater or lesser extent on the exploitation of common property forest resources in their everyday life or in periods of crisis.

Since NWFPs are essentially part of local subsistence economies, they have not received the required attention in development planning and in nutrition improvement programmes of the population group which depends on them. As a result, their potential contribution to human welfare remains unrealised. Although one should not expect forest foods to ensure food self-sufficiency of the local population, they can nevertheless constitute an important element of sustainable diets, i.e. balanced diets based on local foods which can be obtained in a sustainable way. Such resources which are often seen as relics of the past should actually be considered as underexploited opportunities for the future.

This paper will therefore summarize existing information on the contribution of NWFPs to household nutrition, discuss existing constraints to their sustainable use and suggest measures to optimize their contribution[1/].

NWFPs AND HOUSEHOLD NUTRITION: PRESENT SITUATION AND MAJOR TRENDS

NWFPs AS SOURCES OF FOOD

Forest foods combine foods from plant and animal origin. Plant foods are often classified into fruits and seeds, nectars and saps, stems and tubers, leaves and mushrooms. Animal foods can be of invertebrate (insects and insect larvae) or vertebrate (bushmeat or fish) origin. This paper will not attempt an exhaustive inventory of forest foods but will present a few examples to illustrate their role in local food systems.

Forest foods or "bush foods" are often associated with wild or uncultivated plants and animals. The dichotomy between "wild" and "domesticated" is, however, often artificial as the analysis of local farming systems in forested areas worldwide shows a continuum from subsistence foraging to commercial agriculture. There is no clear dividing line between foraging and agriculture.

1/ The present document has been prepared in conjunction with the theme paper entitled "Socio-Economic Benefits and Issues in Non-Wood Forest Products Use". Although it is planned as an independent document, efforts have been made to ensure complementarity of both papers. The reader is referred to the theme paper for further information on issues not directly related to food intake.

Farming the forest

Kayapo Indians in the Amazon basin rely heavily on semi-domesticated NWFPs planted along trails or in forest fields for food, medicine, building materials, dyes, scent, insect repellent, etc. and the exchange of plants as gifts is an essential social mechanism. Village sites are marked by planting trees such as Brazil nut trees (*Bertholletia excelsa*) or babassu (*Orbignya phalerata*) palms. Large trees are felled or natural forest openings are utilized for planting, transplanting and spreading plant species which require little or no human care after planting. They also have been managing "resource islands" or "war gardens" filled with the requisite species for human and animal survival (in particular resistant tubers) to provide refuge in times of war or disasters. It is therefore often difficult to differentiate apparently primary forest from old forest fields.

> ("The importance of semi-domesticated species in post-contact Amazonia: effects of the Kayapo Indians on the dispersal of flora and fauna", Posey, in Tropical forests, people and food, Unesco 1993.)

In Papua New Guinea, management of forest resources has led to a domesticated forest landscape with forest gardening. Home gardens with trees are also important sources of food for many. In Java, agroforestry systems provide more than 40 percent of the total calories consumed by some farming communities (Christanty *et al.*, 1986). In Nigeria, traditional home gardens contain at least 60 species of trees which provide food products (Okafor and Fernandes, 1987).

Nutrients from Forest Foods

Forest foods provide a wide variety of nutrients: carbohydrates, such as starches, fructose and other soluble sugars, protein, fats and micro-nutrients (vitamins and minerals).

Tree legumes and human nutrition

The seeds of the African locust bean (*Parkia spp*), a perennial tree legume, are consumed in Africa, South-East Asia and tropical South America.

In Malaysia and Indonesia, the whole pods, sometimes preserved by pickling in salt, are eaten raw or cooked as a vegetable known as *petai*.

In West Africa, from Gambia to Cameroon, the beans of the Savannah species are widely fermented to the traditional *dawadawa* or *soumbara*, a nutritious protein (40 percent of dry matter) and fat (35 percent) rich food which keeps for over a year without refrigeration and is added to soups and grain porridges, while the vitamin-C rich pericarp called *dozim* is eaten by children raw or as a sweet drink. The beans mature in the dry season in February and March, providing valuable food in the middle of the traditional "hungry season" before the new harvest (Campbell-Platt, 1980). Annual production figures are difficult to obtain since they do not enter regular commercial trade. It has however been estimated that 200,000 tons of beans are gathered each year in Northern Nigeria.

The fruit of the related carob tree is made into flour or beverage in the semi-arid Chaco region in South America. Prepared as *Patay*, it has a high content of absorbable calcium.

The deep roots of *Parkia* trees needed to find underground water provide a reliable annual crop even in the lean, drought years where herbaceous plants and cultivated crops fail to grow.

Table 1: Nutrient composition of the edible portion of some tree/shrub species in compound farms[1/]

Species	Edible part	Calories	% fresh weight (unless otherwise stated)				mg per 100 g fresh weight (unless otherwise stated)				Vitamin A (in international units)	Thiamin (kg gamma)	Riboflavin (kg gamma)
			Water	Protein	Fat	Carbohydrate	Ca	Fe	Nicotianic acid	Ascorbic acid			
Annona muricata	fruit pulp												
Artocarpus communis	fruit pulp	109	70.0	1.5	0.3	25	25	1.0	-	15	35	200	-
Carica papaya	fruit pulp	38	89.0	0.6	-	9	10	0.5	0.1	60	2500	20	20
Cola acuminata	nut	309	12.0	9.0	1.0	66	-	-	0	-	-	-	-
Cola nitida	nut	-	83.0	1.5	0.6	-	3.1	1.4	0.7	9.8	31	11	47
Daniella oliveri	dried leaves		9.4	5.5	-	-	-	-	-	-	-	-	-
Ficus gnaphalocarpa	dried leaves	-	11.6	13.8	-	-	-	-	-	-	-	-	-
Irvingia gabonensis	dried kernel	-	-	-	54.0	-	-	-	-	-	-	-	-
Monodora myristica	residual seed meal	212	1.0	17.6	2.8	29	-	-	-	-	-	-	-
Moringa oleifera	fresh seeds												
Moringa oleifera	fresh leaves												
Pentraclethra sacrophylla	kernel	569	10.0	22.0	45.0	17	90	-	-	-	-	-	-
Prosopis africana	pod pulp	279	9.6	9.2	3.0	53	160	70	-	-	-	-	-
Prosopis africana	dried stems + leaflets	300	7.9	10.2	6.8	50	-	-	-	-	-	-	
Pterocarpus spp	dried leaves	218	10.1	17.1	2.4	32	500	70	-	-	-	-	-
Spondias mombin	fruit pulp	-	72.8	1.3	0.1	-	31.4	2.8	0.9	46.4	71	95	50
Telfaria pedata	kernel	517	6.6	19.6	36.0	28.5	-	-	-	-	-	-	-
Vitex doniana	dried leaves												

[1/] Data extracted from Irvine, 1961.

Different parts of the same species are consumed as food by different population groups. For example, local people consume products of certain palm varieties as cooked fruits, as hearts of palm, as vegetable oil, as palm wine (the sap is rich in protein, vitamins and iron) or in the form of flour for baking. Their high contents in fats and beta-carotene render them particularly important for the nutritional welfare of the population. Another example is the baobab (*Adansonia Digitata*): the leaves, either fresh or dried and ground to a powder, are added to the staple of grain crops. The fruit is also eaten. Processing techniques also vary from one population group to another, determining the nutritional content and quality of the food eaten.

Starch reserves in stems, roots and tubers (cassava, sweet potatoes, yams) usually constitute a major food source in forest areas. Sago starch is widely used in Asian rainforests: palm sago of the *Metroxylon* species constitutes the main energy food for at least 300,000 people in Melanesia and one million people eat it regularly as part of their diet (Ulijaszek, 1983). Forest yams, which constitute the tubers of lianas, are consumed in Africa, Australia and Asia (e.g. the Philippines, Malaysia and Thailand).

Most fruits and berries are rich in carbohydrates (fructose and soluble sugars), and in vitamins (in particular Vitamin C) and minerals (calcium, magnesium, potassium). Some of them can also contain protein, fat or starch (such as bananas and plantains, or palm dates). Juicy fruits are usually poor in proteins and oil but rich in vitamins and minerals.

Nuts are rich in oils and carbohydrates and as such play a key role in people's diets. Chestnuts have been for centuries a staple food of poor rural households in forested areas of Europe. The shea-butter tree (*Butyrospermum paradoxum*) follows the oil palm as the main source of fat in Africa.

Herbaceous plants and young leaves are eaten as vegetables and provide essential vitamins. A study in Swaziland found that wild leaves supplied as much beta-carotene, Vitamin C, calcium and iron as leaves from cultivated plants.

From local leaf to national delicacy

Gnetum africanum is a Central African forest creeper. Its perennial foliage is consumed in large amounts as vegetable. The leaves are gathered and cut into thin slices. These can be eaten raw and green but are generally added to meat and fish dishes at the end of the cooking time. They constitute a significant source of protein, particularly essential amino acids, and mineral elements.

Women play an essential role in the gathering of gnetum and sell it in the markets.

Traditionally, gnetum consumption was limited to localized population groups. With the recent demographic mix, it has spread to the population at large and gnetum has become a socio-cultural symbol. Many restaurants now offer specialities including gnetum in the sub-region and it is even exported to Europe. With an average daily consumption of 2 g per day in Congo, this wild species is now threatened with extinction.

Nectars and pollens contribute to the production of honey and therefore constitute an important albeit indirect element of local food habits. Gums and saps provide proteins and minerals. Gum arabic (from *Acacia senegal*) — usually better known for its industrial uses — is traditionally consumed by Mauritanian nomads either fried as "tomake n'dadzalla" or mixed with a sugary liquid.

Invertebrates include leaf-eating insects, caterpillars, snails and crabs. A total of 1 383 species of edible insects have been identified to date, 63.6 percent of which live in tropical forests. Insects are very efficient into converting plant protein (9-10 percent) into insect protein (44-70 percent). They

are also an important source of fat in areas where local diets are poor in fats. Caterpillars are particularly rich in Vitamin B 12.

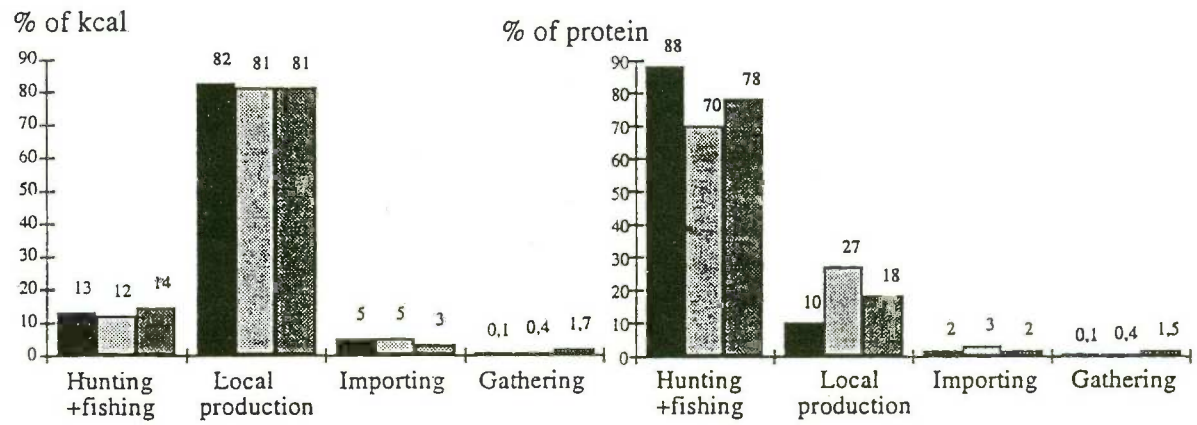
Vertebrates include mammals, bird, freshwater fish. In many parts of the world, hunting still remains an important subsistence activity and bushmeat still provides a critical source of protein for both urban and rural populations. In Amazonia, indigenous groups living near large rivers acquire up to 85 percent of their dietary protein through fishing (Eden, 1990). Snails and rats may be eaten several times a week in some villages.

Forest Foods and Household Diet

Forest foods are particularly important in predominantly subsistence economies in remote areas. They generally play a supplementary role in the diet, and rarely constitute staple foods. They contribute to diet diversity and flavour. They are eaten as snacks or relishes to complement the usually starchy staples. Sauces improve the quantity and quality of food intake. They therefore constitute an essential part of an otherwise bland and nutritionally poor diet.

The contribution of forest foods to the household diet varies from one village to the other according to the environmental, socio-cultural and economic context. In forested areas of Africa and Latin America, game provides most of the meat eaten by rural populations. In savannah areas of Venezuela, some groups obtain almost all their calories from foraging in the savannah and the forest (Hurtado and Hill, 1987). Even those who live primarily in agricultural settlements in Paraguay spend a quarter of their time foraging (Hill et al., 1987). In Bihar, Orissa, Madhya Pradesh and Himchal Pradesh, India, 80 percent of forest dwellers depend on forest for 25-50 percent of annual food requirements (Malhotra et al., 1992).

Figure 1: Contribution to the energy (left) and protein (right) content of the diet of the Yassa, Mvae and Bakola, according to food acquisition method



Source: Koppert *et al.*, "Food consumption in three forest populations of the southern coastal area of Cameroon: Yassa, Mvae, Bakola", in *Tropical forests, people and food*, Unesco 1993.)

Seasonality is an important constraint for foraging and determines, to a great extent, variations in the diet of indigenous people. Seasonality constraints have therefore generally been built into traditional farming systems.

In many agricultural communities, people rely on a main staple crop, the seasonality of which implies periods of food shortage — usually referred to as "lean season" or "hungry season" — which particularly affect the poorest households. In lean periods, when few cultivated varieties of food are available, storage facilities are empty and/or money is in short supply, hunting and gathering helps

alleviate seasonal hunger. This explains why the peak collection of forest fruit does not occur during the main fruiting season, when fruits are most plentiful, but rather when they are most needed, i.e. when cultivated food supplies dwindle and the requirements for agricultural labour are limited. Some forest foods are also consumed in times of scarcity as a substitute for staple foods.

Planning for a balanced diet

In compound farms in the rainforest of southeastern Nigeria (Okafor and Fernandes, 1986), farmers have developed a multi-crop system that provides a diversified and continuous production of food, combining species with different maturity periods such as yams, cassava, cocoyams, bananas, plantain, maize, okra, pumpkin, melon, leafy vegetables and a variety of trees and shrubs, 60 of which provide food products. This ensures a balanced diet but also reduces the need for storage in an area where post-harvest losses are high.

The contribution of forest foods to nutrition also varies both among and within households. Poor and landless people are often more dependent on forest foods than those with moderate incomes: one study reports that poor and landless Thai households depend on forest foods five to six days a week, while moderate income people rely on forest foods, on average, three days a week (Saowakontha et al. 1988).

Table 2: Seasonal variation in food products available in the village of Kibangu, Kwango-Kwilu

Minor dry season (Jan.-Feb.)	Minor rainy season (March-May)	Major dry season (June-Aug.)		Major rainy season (Sept.-Dec.)
Harvest period		Dry period	Transition period	Lean period
Manioc		Manioc	Manioc	Manioc
Maize		Maize	Maize	Mushrooms
Cowpeas		Cowpeas	Dried cowpeas	Wild leaves
Millet		Millet	Millet	Manioc leaves
Bitter cucumber		Bitter cucumber	Bitter cucumber	Fruits
Sweet potatoes		Sweet potatoes	Wild leaves	
Yams		Yams	Yams	
Palm oil		Freshwater fish	Palm oil	
Peanuts		Grasshoppers	Dried peanuts	
Beans		Wild snakes	Fruits	
Leaves of wild plants		Wild leaves	Insects	
Manioc leaves		Rats		
Groundnuts		Game		
Palm nuts		Fruits		
Fruits				
Fresh caterpillars				
Bought products				

Source: Seasonal variation of diet and nutritional status of young children in villages of Kwango-Kwilu, Zaïre — Kukwikila et al., in *Tropical forests, people and food*, Unesco (1993).

Fruits and seeds are consumed as snacks mainly by children and in some cases by women. Ntomba children in Zaïre also collect small fry, caterpillars, grasshoppers, crickets which they share among themselves. Some of these foods are actually considered as child food (Pagezy, 1990). In Haiti, children are reported to miss school in periods of food scarcity in order to complement their diet with

foraging. In the Andes, berries from wild shrubs are eaten by children and constitute a major source of vitamins in their diet.

Forest foods can be life saving in times of famine or natural disasters as roots, stems and honey can provide energy. In areas when rainfall is low and erratic, fruits of trees and shrubs play an important role as emergency food. Generally however the collection, processing and preparation of such foods is time consuming and they are therefore being progressively abandoned with increasing commercialization and degradation of forest resources. People tend to rely more and more on markets and food aid in times of emergency.

Cultural Aspects in the Consumption of Forest Foods

Edible plant or animal species in a given area may or not be eaten, depending on the local culture. The consumption of foods is certainly as much a social issue as a biological one. Food is an essential part of most social interactions and rites. The selection of foods must be understood in the context of the social, political and economic processes that underlie them. Individual decisions regarding food acquisition and consumption are seldom independently made or value-free. They are generally guided by local cultural perceptions, attitudes and beliefs.

Wild foods often have a cultural value and are consumed during special feasts. Their taste is often considered superior by local populations. Some forest sites and/or species may also have a sacred value.

These values vary from one village to another. However, traditions are continuously changing according to new perceived opportunities. This evolution is accelerated by changes in attitude in the younger generations and immigration of people with different values.

Local perceptions of the value of a given food are generally independent from its nutritional content. A typical example is meat. Bushmeat is often called "real meat" and is highly preferred to domesticated animals. The distribution and exchange of game meat play an important role in social relations and indigenous cultures. This often remains the case as societies evolve and modernize. This partly explains the high urban demand for bushmeat, which has become a luxury item.

Changing consumption patterns and cultural value of forest foods

A three-month qualitative study was carried out by FAO (Olsson, 1991) in representative villages in Tonga and Vanuatu islands, South Pacific. In typical Tongan farms, various crops and coconut trees are intercropped with an average of 85 trees of various species providing fruit, raw material for handicrafts (e.g. weaving, preparation of bark cloth, decorative elements) or cooking utensils (from bamboo, branches and half-coconuts). Pigs are left to forage.

Consumption of some traditional foods, such as insects, is declining and elders complain that young people do not like this type of food any more. Foods which once provided security against famine following hurricanes and droughts have now been replaced by more recently introduced cassava and sweet potato and have become obsolete as famine foods. However, these foods retain a high cultural value which cassava and sweet potato have not acquired even though they provide food security. They therefore do not run the risk of being depleted from ritual feasting.

In some cases, cultivated starchy vegetables are considered as real food while a low value is attributed to most gathered plants. Low availability of culturally valued foods often leads to complaints of food scarcity and hunger even if other potential food is plentiful.

Mushrooms are highly valued in many societies, and sometimes considered as "meat". Although they contain protein, carbohydrates, fats, salts, fibres and are rich in Vitamin B, they are usually considered as gourmet foods rather than subsistence foods.

In any society, the use of foods is determined by a series of unwritten rules and codes. Taboos and ritually marked foods may, for example, determine the selection of foods for specific social groups (e.g. women, children, adult males). These are often linked to local health beliefs. Many foods — in particular spices — are considered to have properties that improve health and are therefore used as self-administered medication. For example, in some areas lactating women consume greater quantities of bushfoods to acquire additional vitamins. Actually the dichotomy medicine vs. food used by industrialized societies bears little relevance to most rural communities because many foods are considered to have properties that improve health.

Foods or medicines?: an example from Sri Lanka

Traditionally, villagers inhabiting the edge of the Sinharanja rain forest have used a variety of plant species for both food and medicine.

Seeds of wild cardamom, for example, are harvested by large groups of villagers from August to September. By virtue of their uses as a spice (used to flavour curries and cakes and exported to the Middle East where it is added as a flavouring to coffee) and medicine (given internally for the diseases of the liver and uterus, as a diuretic and to prevent excessive vomiting in children), these seeds contribute to the local village economy.

Woody stems of the liana *Coscinium fenestratum* is one of the commonest indigenous medicinal ingredients found in both rural and urban households, and is usually taken in combination with other medicinal plant products to treat a variety of ailments from fever to tetanus.

A variety of indigenous food preparations (cooked into curries or as steamed salted or sweet dishes) is made with flour made from the fruits of the *Shorea tree*. These are strongly recommended by local physicians for gastritis and other bowel ailments.

Underutilized food plant resources of Sinharaja Rain Forest, Gunatilleke and Gunatilleke, 1991 in *Tropical forests, people and food*, Unesco (1993).

Women play a key role in this field since they usually are the first to diagnose and treat the problems of children. Wild plants constitute the main medicinal source in most traditional societies. They are used in the prevention and treatment of diseases and therefore contribute to the effective biological utilization of food by the individual. Besides this direct contribution, medicinal plants can be bartered or sold and generate income in kind or cash.

NWFPs and Household Food Security

Household food security has been defined as the capacity of the household to cover its food needs at all times. NWFPs traditionally have always played a major role in the household economy of people living in or near forested areas.

Besides their direct contribution to the diet, discussed in the previous section, NWFPs can contribute to household food security in several ways:

- as in-kind contributions to the household economy, either directly by fulfilling other essential needs (e.g. shelter, clothing) or indirectly as input to the food production system;
- as a means to generate income for the household budget or as bartering goods.

NWFPs as In-Kind Contributions to the Household Economy

NWFPs have been traditionally used as construction materials or to make ropes, containers, kitchen utensils or clothing. Many of these in-kind contributions are crucial. Tens of thousands of tons of baobab leaves are harvested per year in West African countries, yet production and consumption remain entirely a local affair and only a small proportion actually enters the commercial circuits. Their role, like that of many NWFPs, is therefore generally underestimated. Development planners and technical staff should however not forget that when NWFPs are not used any more for a given function, they have to be replaced by a substitute that usually must be bought and imported to the area. The contribution of NWFPs directly to fulfil basic needs is therefore particularly important for the poorest households. In many areas they will use, for example, raffia or palm rather than corrugated iron for roofs.

NWFPs also contribute to food production through a variety of mechanisms: they may enrich the nutrient content of the soil, retain moisture, provide shade and windbreaks, control erosion, provide fodder both for domesticated and wild animals (tree fodder is essential in the dry season when the herbaceous groundcover is desiccated), medicine for livestock, stakes for plants. They are used in the preparation of hunting and fishing equipment, in the construction of storage facilities and fences and as plant-based insecticides (e.g. neem tree).

They also indirectly contribute to income generation, since they enter into the making of tools and looms and of crop-marketing equipment (e.g. baskets).

It is often difficult to estimate the value of this in-kind contribution since these items are usually not purchased in these areas, and therefore have no commercial value. However, estimates can be made according to the access to and cost of available alternatives in terms of time, labour and money.

NWFPs, Trade and Income-Generation

NWFPs have traditionally been used in trade, the modalities and importance of which change as the socio-economic environment evolves. Even in isolated areas, barter is increasingly being replaced with monetary exchanges. The sale of NWFPs or employment opportunities resulting from their commercial exploitation for the local, regional or international markets can provide a substantial share of the income of local households at a specific time, therefore contributing to increased welfare and food security.

NWFPs play an important role in local food trade as they enter in the composition of currently consumed foods and beverages. As mentioned earlier, it is difficult to differentiate forest foods and agricultural products, or rather wild and domesticated species. Some NWFPs, such as Brazil nuts, coconuts, essential oils or gum arabic, are well known on the international market. They can provide additional income and jobs to local people and bring in much-needed foreign exchange. Some are of national or regional importance (e.g. yerba mate in Argentina).

Wild foods and medicines find an increasing market with urbanization. Given the rising demand for bushmeat, hunting has become in many cases more lucrative than agriculture. In forested areas of Gabon, the recent economic recession and drop in cocoa prices have prompted the majority of village men to rely on wildlife exploitation as a primary means of generating revenue. As a result, the household consumption of bushmeat and its market value depends on the existing supply. The increased marketing of game and the corresponding diversion of a major traditional food source have often resulted in the decrease in nutritional status of hunting communities.

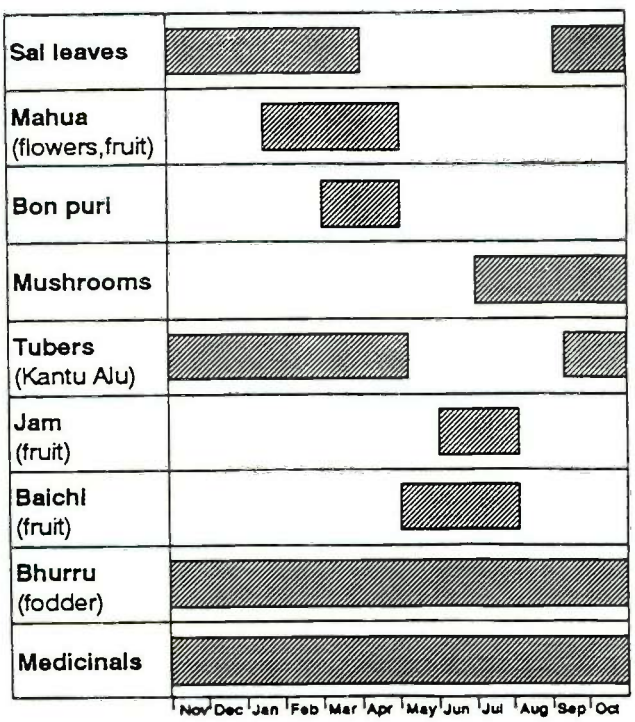
NWFPs in rural economies: forested areas in India

In India, NWFPs are widely produced and used in Madhya Pradesh, Maharastra, Orissa, Bihar, West Bengal, Gujarat, Andhra Pradesh and North Eastern States. Tribal groups have been progressively pushed into marginal areas where agricultural yields are lower and more uncertain and they therefore rely to a high degree on NWFPs which provide employment to 5,7 million persons per year. Almost 50 percent of the state forest revenues and 80 percent of the net export earning from forest produce derive from NWFPs.

In the West Midnapore District of Southwest Bengal, productive species can be classified into 7 categories: raw material for commercial sale or processing, subsistence foods and drinks, animal fodder, fuel, timber and fibres for tools and construction purposes and medicine. A number of species have multiple uses: sal tree leaves are used to make plates for religious ceremonies — which provides an income-generating occupation during agricultural lean periods — fruit are eaten, seeds are sold to produce edible oils, twigs and branches are used for fuel, and stems are used as roofing poles. The fruit of the mahua — *Bassia latifolia* — tree are used for fermenting wine, the flowers for human and livestock consumption and the seeds for oil pressing. Fruit and seeds products are very seasonal with harvesting periods ranging from 2 to 6 weeks.

Many types of individuals depend on forest and tree foods. All family members may be involved in their collection but women are usually responsible for processing. Women traditionally play a major role in the processing and trade of NWFPs in many countries: in southwestern Nigeria, women are involved in cola nut trade, in the processing of parkia beans and palm oil and in the making of soap. Women are more likely to allocate the income generated to family sustenance. However this is changing as NWFPs acquire increasing commercial value.

Figure 2: Collecting periods for non-wood forest products in Southwest Bengal



Source: Malhotra *et al.*, 1992

As we have seen for forest foods, processing and trade of NWFPs are often seasonal: this is due in part to the seasonal availability of raw material (such as fruit or mushrooms) that we have previously mentioned, but can also be due to an acute need for cash and/or the availability of labour during slack agricultural work. NWFPs can provide a cash buffer in times of emergency or hardship. Provided forests are accessible, beneficiaries will often be unemployed adults, landless people, children,and other marginal groups.

The income-generating potential of NWFPs will vary from one village to the next, according to the ease of access to markets, the existence of trade networks, the viability of other income-earning opportunities and the skills required for processing. Increased exploitation may, however, lead to a reduction of income-earning potential.

NWFPs in rural economies (African rain forest)

In a Forest Resource Management Project jointly funded by the Government of Ghana and the Overseas Development Administration, U.K., a study was carried out in eight villages in the Ashanti and Western Regions of Ghana (tropical moist forest) to examine the uses and role of NWFPs in rural economies and the impact of forest degradation. Particular attention was given to the trade of bushmeat, chewsticks, plant medicines, food wrapping leaves and cane products. In the daily urban market in Kumasi — the biggest in Ghana — more than 90 percent of traders are women. Seven hundred people are involved on full-time basis in trading NWFPs, among which:

- 100 leaves traders: *Marantaceae leaves* are traditionally used for wrapping foods (including fish), highly preferred to plastic bags and paper and are widely used by street food vendors. The monthly demand for leaves exceeds US$ 47,000, providing an important contribution to the household economy of both rural people and urban traders. Leaf gathering in early rains in particular helps the poorest households to tide over the hungry season.

- 100 medicine traders: these are mostly women. Some men are specialized in fetishes or specific goods.

- 25 full-time basket traders (sell 1,000-5,000 baskets a month). US$ 6,730 worth of cane are traded per month in Kumasi. 11 enterprises employ 70 people full-time in cane-processing. Children take up weaving during school holidays.

- 50 full-time traders for smoked bush meat, 15 for fresh meat, for an annual value of US$ 209,000 or an approximate amount of 160 tons.

In two of the villages studied, NWFPs constitute the main source of income. In Kwapanin, women gather leaves for food wrapping because the local economy collapsed due to bush fires. In Essamang, women are involved in sponge-making and men are full-time cane basket weavers (100 weavers out of a population of 720).

The high demand for cane has resulted in a dwindling supply of canes and community resentment against outsiders looking for cane.

Income-Generation and Nutrition

Generating income alone does not automatically ensure improved household food security. Increased exploitation of NWFPs can modify the time allocation of different family members and affect some activities previously related to household food production, processing and preparation, or child care. The income generated is not necessarily spent on appropriate food and health care. Studies carried out in hunting communities have shown that the money obtained was spent on a limited range of processed foods such as sugar, cookies, tinned meats and coffee, and on ammunition, alcohol and batteries. The commercialization of forest foods may also be detrimental to the diets of local people, when the over-exploitation of forest foods has led to a decrease or the disappearance of traditional food sources.

Household food security does not automatically translate into improved nutrition. People's knowledge, attitudes and practices will influence food selection (for production and purchasing), preparation and distribution amongst household members. In some cases, when nutrition and health are given low priority, increased income has actually proven detrimental to nutritional well-being.

It is therefore acknowledged that NWFPs have been historically an integral part of rural food systems and local cultures. Dependency on NWFPs has remained highest in poor households and in marginally productive and environmentally fragile areas. Households in or near forested areas combine different uses of local NWFPs (as food sources, in-kind or cash contribution to household food security) in their economy. This combination will vary according to the knowledge about and availability of these products, the opportunities perceived by the household and its present needs, which in turn will be determined according to ecological, cultural and economic factors. The contribution of NWFPs to household nutrition and the underlying mechanisms will therefore change according to evolving lifestyles, increasing monetization of local economies and existing resource constraints (in terms of natural resources and cash).

EXISTING CONSTRAINTS AND CAUSES OF DECLINING USE

The sustainable management and appropriate use of NWFPs face a variety of constraints.

Lack of Information

Information on food-related practices of population groups living in forested areas or in their vicinity, including their food habits and perceptions of foods, is essential for understanding the local food and nutrition situation and its evolution. Available information is uneven, since it has been developed by social-science researchers or biologists (particularly anthropologists or ethnobotanists) concentrating on specific population groups rather than on the local food and nutrition situation. This kind of information is not usually readily available to development planners and policy-makers, who may not even be aware of its existence. Moreover, the professional background of the authors and the requirements for scientific publications can render this information difficult to find, understand and use.

Information on the productivity, nutritional value and use of locally relevant NWFPs is also inadequate. However, checklists of wild plant and animal species eaten by rainforest people are now available for many countries and databases on their nutritional value are being set up. Relevant data could be found in existing food composition tables in similar ecological areas. Development institutions however are usually unaware of their existence. These data should be used critically since the chemical composition of plants varies according to its age and geographical origin (it varies according to climate, altitude or soil).

"Hard data" on the contribution of NWFPs to local diets are often seen as necessary to raise the awareness of policy-makers as to their potential or to warn them against possible negative implications of development programmes on the food and nutrition situation of indigenous groups if

the contribution of NWFPs to local consumption patterns is ignored. In fact little information is available on the impact on diets of the reduced consumption of forest foods. Such data are either missing or inadequate since consumption of forest foods is generally under-reported and nutrition studies generally do not address this topic specifically.

The same is also the case for the economic significance of NWFPs. As a rule, no estimates are made of the cash equivalent of their indirect contribution to household food security of subsistence households.

Most information on local edible plants (harvesting, processing, preparation) is indigenous knowledge. In many parts of the world, this is being lost at an accelerated pace and disappears with changes in lifestyle (decrease in subsistence use of wild species, changing occupational patterns of household members) and disappearance of village elders.

Generally speaking, in the last decades, the prevailing forestry approach, concentrating on a limited number of primary commodities (essentially timber) in the search for accelerated economic development, has led to the loss of information which was widely available in forestry departments in late nineteenth and early twentieth centuries.

Limited Availability, Access and Use

Availability of NWFPs is becoming a major issue in certain areas for a variety of reasons:

- the degradation of natural resources can affect the habitat of given wildlife species;
- over-exploitation of a given commodity can lead to dwindling supply (e.g. cane harvesting in Ghana);
- inappropriate production/harvesting techniques can be responsible for low yields or even plant destruction (e.g. palm wine harvesting);
- paradoxically, efforts to conserve the rainforest through prohibition of forest clearance and shifting cultivation have led in some cases to the gradual disappearance of sustainably-managed fallow species.

Furthermore, household access to forested areas can be limited as a consequence of demographic pressure or of tenure and legislation issues. Present efforts to privatize common property land have therefore given rise to increasing controversy. Changes in forestry management approaches have led to the decline of often sophisticated traditional tree management practices.

Availability and access problems are compounded by inadequate management of natural resources. Exportation of cane, for example, is encouraged, without attention to ensuring sustainable supply. Regeneration of fibre resources does not keep pace with present exploitation.

If the availability of traditionally exploited NWFPs is becoming a problem, a variety of locally available products remain unexploited, some of which could contribute to diet diversification of both local and urban consumers and/or fetch a high market. Around 200 indigenous and exotic fruit species, for example, have been inventoried in Amazonia.

Inadequate Post-Harvest Technology

Technology is also needed to prevent post-harvest losses. This is particularly important for perishable products. Many NWFPs (e.g. juicy fruits) are characterized by seasonal gluts. Fruit rot and prices fall. The lack of appropriate processing, preservation and storage techniques limits their potential contribution to the household diet as some species may not be edible as such and as many

forest foods, being perishable, can only be consumed for a limited period in the year. It also is a major limitation for their marketing and income-generating potential. Organoleptic qualities of popular beverages in rural Argentina, for example, cannot be maintained and these drinks are therefore increasingly being substituted in urban areas.

Household processing of certain forest foods is time-consuming. The absence of alternative processing techniques leads to their progressive substitution by easily prepared foods.

The safety of some forest foods can be a problem. Naturally occurring toxicants are often associated with forest foods and plants. Appropriate processing and preparation techniques are not always known by the local population, resulting either in health problems or limited consumption. A prolonged consumption of food containing natural toxins may bring about chronic toxicity exhibited by reduced growth, digestive disturbance or aggravation of malnutrition. In the absence of acute symptoms, the condition is often undetected. Apart from the obvious health effects, a continuous ingestion of such toxicants can also markedly affect the person's productivity and, as a consequence, further endanger the existence of those populations that subsist on such foodstuffs.

Poisonous Plants: a "rule of thumb"

Although it is impossible to pinpoint all poisonous plants by a simple set of rules, the following generalities are commonly used in survival training:

- most poisonous plants have a bitter taste and/or milky juice;
- most plant poisons occur in seeds or nuts, some in the fruit and roots, few in the leaves;
- wild mushrooms should not be eaten;
- laminated bulbs (for example, lily) are generally poisonous;
- some, but by no means all, poisons are heat-labile and water soluble;
- the "soup" remaining after boiling wild plants should not be consumed;
- children should be taught early enough not to put any wild plant berries, foliage or any other parts, into their mouths.

Inadequate processing, storage and preparation of food can also lead to contamination. For instance, forest foods such as Brazil nuts, pinion nuts and Aleppo pine nuts can be contaminated by aflatoxins when stored in warm and humid conditions.

Poor Marketing

Poor marketing can result in major variations in price (a factor of from 1 to 10 between peak and off-peak months). This is not only due to product availability but also to the fact that many unorganised people enter the market during slack agricultural time.

Inappropriate harvesting and handling practices often result in poor or uneven product quality, which can be a major constraint to successful marketing. For example, products sold as gum arabic — which is widely used by the food industry as a food additive to improve viscosity, body and texture of a large variety of food products — may actually include different varieties of gum, and not only that of *Acacia senegal*, which presumably produce the highest quality gum. The lack of quality standards and related controls also limits the commercial exploitation and the export potential of certain products, such as wild mushrooms, leading to low prices and closure of markets. Traditionally-processed mushrooms lack uniformity, are often not properly cleaned, and the dehydration techniques used give them a smoky taste and a black colour, thus dissuading potential consumers.

Marketing of forest foods to generate cash has, in many instances, proven to be a double-edged sword as people with acute cash needs will tend to divert traditional foods away from the household diet.

Lack of Institutional Support

The limited capability of harvesters and processors is compounded by the lack of institutional support. Development workers, and particularly forestry and agricultural extension workers cannot provide the needed technical and management training and advice (such aspects are usually considered neither in their own training nor included in their plan of work) or the required credit support. Health staff, home economists or primary school teachers usually do not provide any advice related to the processing/conservation, preparation and use of such foods.

Inaccurate Consumer Perceptions

Consumers' perceptions determine, to a great extent, local consumption and the marketing potential of forest foods. People usually have limited knowledge of the nutritional value of forest foods. Consumers, in forest areas as well as outside, are often unaware of the benefits and possible uses/preparation of forest foods. They also have little knowledge, if any, of the quality and safety aspects related to the handling, processing/preservation and storage of forest foods. While some forest foods, such as bushmeat, are usually perceived as high prestige foods, others can be perceived as poor people's foods. Some edible forest foods may also be assumed to be toxic and unfit for human consumption (e.g. mushrooms).

In many countries, extension activities are designed at the national level and may not adequately consider local needs and resources. Nutrition education programmes, for instance, often overlook forest foods and promote the use of foods which may not be locally available. These foods would therefore have to be imported to these areas and purchased by the households concerned. In some cases, this has changed the food perceptions of indigenous people and undermined sound traditional food habits (e.g. promotion of weaning foods based on maize gruel in an African rainforest area).

STRENGTHENING THE CONTRIBUTION OF NWFPs TO NUTRITION

NWFPs continue to make an important contribution to household food security and nutrition in forested areas that have remained at the margin of agricultural and economic development. Their availability, use and importance are closely related to local ecological, economic and socio-cultural conditions. Over the years, this use has been influenced by the overall shift from subsistence economy to market economy. Particular attention needs to be given to ways of making this a successful transition that results in improved welfare for the populations concerned, particularly in household food security and appropriate nutrition.

Gathering Relevant Information

Further information needs to be collected, particularly regarding food-related practices, including food habits and the contribution of forest foods to the local diet. Relevant literature at national and international level should be reviewed, and relevant information clearly summarized for use of development workers at local level. This will require better coordination between the scientific community (including national research centres and universities) and development institutions.

This desk review will need to be complemented with local information-gathering. Qualitative information to identify locally relevant NWFPs and to gain a dynamic understanding of usage patterns (including harvesting systems and task allocation within the household) can be collected through participatory appraisal techniques. Specific attention should be given to food preferences, coping mechanisms during the hungry season, and income-generating opportunities. This should be combined,

as needed, with quantitative data-collection. Data on relevant NWFPs should then be incorporated into national forestry statistics and nutrition-related information.

Indigenous knowledge is likely to be the most important source of information. Women are often more knowledgeable on food plants as they are the main gatherers. Elderly people are generally the best informed regarding traditional practices and recent trends. This information-gathering process could be part of a participatory research approach and incorporated as much as possible in the normal activities of community-level development workers. The use of NWFPs, and in particular the consumption of forest foods, should be monitored.

Improving Availability, Access and Use

The production/exploitation techniques for NWFPs should be improved to ensure sustainability and increased yields.

Enrichment planting of indigenous species of nutritional value (e.g. planting of mango saplings in India) and domestication of wild species can provide a more reliable and sustainable food supply. Wild food species, in particular trees, can thus be introduced into local farming systems. They can be incorporated into home gardens or used as shade trees for tea plantations. The domestication of wild yams in agroforestry systems is seen as an important element of the sustainable development of tropical forest regions. Overall, the relation between wildlife management and welfare of indigenous groups is being given increasing attention.

Some areas that are not appropriate for agricultural production could be converted to alternative food production systems: food extraction from palms could be encouraged in swampy areas, for example.

Selection of food-bearing species should take into account not only nutritional value (e.g. appropriate variety of palm to increase beta-carotene consumption) and productivity but also storage constraints: large seeds that take more than two months to germinate should be encouraged.

Legislation should be modified to facilitate sustainable exploitation of NWFPs by local people, and particularly by the poorest households.

Improving Post-Harvest Technologies

The strengthening or introduction of appropriate storage, preservation and processing techniques can both improve household consumption and generate further income. Particular attention should be given to food quality and safety at the processing and preparation stage. Foodstuffs meant for sale should also be in line with existing marketing standards.

Processing and preservation should be considered at different levels: household, cottage-industry, and food industry. However, first-stage processing should be organised within or in the immediate vicinity of forest areas in order to ensure local employment generation and value addition. Cheap and efficient post-harvest techniques for depulping fruits or seed, quick drying of harvested plant material and prophylactic treatment preventing insects (e.g. biopesticides) and microbiological contamination should be introduced together with standards for dry storage.

An appropriate processing technology can improve the socio-economic status of local people, generate employment and ensure better value for the material collected, thus helping to alleviate poverty. Particular attention should, however, be paid to gender issues when dealing with NWFPs. Some foods may be traditionally reserved for men (e.g. palm wine); women and children will likely receive little benefit from the promotion of such foods. The participation of forest users, and in particular women, in the decision-making process of village-level activities is essential.

The development of appropriate technology to process raw products into ready-to-consume food for urban consumers should also be encouraged since this is an essential condition to their effective promotion.

Norms for collection, processing and export of high-value forest foods need to be developed. The application of these norms should be included in more general training on food quality control at different levels.

Processing research should be commodity-oriented and concentrate on NWFPs which can contribute to improve the diet in a sustainable way, or which have a marketing potential at local, national or international levels.

Rationalizing Marketing Systems

Existing marketing systems should be rationalized, and procurement strategies developed. Collectors often receive minimal compensation while consumers have to pay inflated prices. This can be due to the lack of competition between middlemen but it can also be linked to the high risk assumed in buying, transporting and selling in difficult logistic conditions products which are often perishable and of varying quality.

The various intermediaries in the marketing chain should be informed of relevant characteristics of the products which they are trading in order to ensure better service to customers and sellers while maintaining or improving their own benefits.

As previously suggested, efforts should concentrate on products with significant potential for income and employment generation. Efforts should also be made from the start to maximize the participation, organisation and competence of low-income households, and particularly of women: in most cases, when traditional activities have gained economic recognition, they have been taken over by better-off social groups.

Providing Institutional Support

Given the multiplicity of constraints in a given area, the promotion of NWFPs requires an integrated approach which is location-specific and multidisciplinary. Local policy-makers and development staff have an essential role to play in the elaboration, coordination and implementation of such an approach. A communication strategy to raise awareness of decision-makers and relevant development staff at different levels should therefore be considered in countries in which subsistence economy in forested areas is still important.

All the issues mentioned above will require support at all stages of the food chain, and primarily at the local level. Training and extension advice should be provided to potential farmers/harvesters and processors. Credit should also be made available for economic activities based on NWFPs.

Consumer Information and Nutrition Education

An appropriate communication strategy should reinforce sound food-related practices and suggest means to diversify the household diet on the basis of locally available foods and also to ensure food safety. Particular attention should be given to existing forest foods. When NWFPs are used by the household as a means for income generation, a nutrition education and communication strategy for nutrition should be associated to enable households to make informed choices.

Promotion campaigns to encourage the consumption of specific foods would be particularly relevant in an urban or international context. Forest foods could, for example, be introduced in

popular canteens or incorporated into street foods in order to provide useful nutrients, preserve traditional food habits and revitalize the social and cultural role of forest foods.

Towards an Integrated Strategy

None of these solutions are, by themselves, likely to ensure the optimal use of local NWFPs. Depending on the situation, horizontal and/or vertical integration may be needed.

On the one hand, participatory micro-projects should integrate management of natural resources, promotion of appropriate harvesting, processing, storage and preparation of NWFPs and community organisation, giving specific attention to at-risk groups. Such an approach could be used to address local nutrition problems through promotion of relevant forest foods (Table 3).

On the other hand, a commodity-based approach will be needed to promote effective commercialization of and relevant consumer information on products likely to bring employment and/or income generation. The different stages of the production chain from research to utilization will need to be addressed.

Table 3: Some common nutrition problems and the potential role of forest food

Nutrient-related problems	Forest food with potential for combatting deficiencies
Protein-Energy malnutrition: due to inadequate food consumption causing reduced growth, susceptibility to infection, changes in skin hair and mental facility.	Energy rich food which is available during seasonal or emergency food shortages, especially, nuts, seeds, oil-rich fruit and tubers; e.g. the seeds of *Geoffroea decorticans, Ricinodendron rautanenil,* and *Parkia* sp.; oil of *Elaeus guineensis*, babassu, palmyra and coconut palms; protein-rich leaves such as baobab (*Adansonia digitata*) as well as wild animals (e.g. snails) including insects and larvae.
Vitamin A deficiency: in extreme cases causes blindness and death; responsible for blindness of 250,000 children/year.	Forest leaves and fruit are often good source of Vitamin A; e.g. leaves of *Pterocarpus* sp., *Moringa oleifera, Adansonia digitata*, the gum of *Sterculia* sp. palm oil of *Elaeus guineensis*, bee larvae and other animal food; in addition fats and oils are needed for the synthesis of Vitamin A.
Iron deficiency: in severe cases causes anaemia, weakness and susceptibility to disease, especially in women and children.	Wild animals including insects such as tree ants, mushrooms (often consumed as meat substitutes), as well as forest leaves such as *Leptadenia hastata, Adansonia digitata.*
Niacin deficiency: common in areas with a maize staple diet; can cause dementia, diarrhoea, and dermatitis.	Forest fruit and leaves rich in niacin such as *Adansonia digitata*, fruit of *Boscia senegalensis* and *Momordica balsamina,* seeds of *Parkia* sp., *Irvingia gabonensis* and *Acacia albida.*
Riboflavin deficiency: common throughout southeast Asia; among those with rice diets causes skin problems.	Forest leaves are especially high in riboflavin, notably *Anacardium* sp., *Sesbania grandiflora,* and *Cassia obtusifolia,* as well as wild animals, especially insects.
Vitamin C deficiency: common to those consuming monotonous diets; increases susceptibility to disease, weakness.	Forest fruit and leaves often supply the bulk of Vitamin C consumed, especially good sources include fruit of *Ziziphus mauritiana, Adansonia digitata* and *Sclerocarya caffra;* leaves such as *Cassia obtusifolia,* and the gum of *Sterculia* sp., are also good sources of this vitamin.

For example, efforts to stabilize the supply and improve the quality of gum arabic to comply with the specifications of the Joint FAO/WHO Expert Committee on Food Additives (JECFA) are presently under way in several African countries. These will include documenting in-depth botanical sources, characteristics and properties of gum arabic produced and traded by these countries, assessing the production systems and reviewing existing quality control systems in each country in order to identify the needed interventions. It is expected that this valuable export product will thereby provide increased employment and income for thousands of people in the countries concerned.

CONCLUSION

For thousands of years, ecosystems and indigenous populations have evolved in symbiosis. Human societies have gradually moved, at their respective paces, from a dependence on wild foods and particularly upon forest foods to a dependence on domesticated plants and animals on the one hand, and from a subsistence economy to a market economy on the other. In the process, timber and other products of "commercial significance" (i.e. which are the object of international trade) have received increasing importance and indigenous knowledge on the sustainable management of forest resources has been progressively lost. NWFPs have not received the required attention in development planning and forest foods are overlooked in most nutrition programmes.

Forest foods can constitute an important element of sustainable diets. They can broaden the food base and diversify the diet thus preventing nutrient deficiencies and ensuring dietary balance. They come from locally available natural resources, which are part of and/or compatible with the local ecosystem. NWFPs also contribute to household food security and health. Some of them play or could play an important role in local, regional and/or international trade.

These opportunities remain too often unexploited. This is a matter of particular concern in forested areas where the sustainable management of natural resources is a priority and where indigenous groups face severe food and nutrition constraints. In such areas, the promotion of NWFPs could be an important element of sustainable development strategies.

An integrated approach developed on the basis of local needs and resources should be adopted to promote the appropriate management and use of NWFPs. Relevant scientific research by anthropologists or botanists should be reviewed and complemented by community-level research which will seek to retrieve relevant indigenous knowledge and to gain a good understanding of the contributions made by NWFPs to the household economy. Local population groups should be involved from the start in planning and implementing community level activities which will contribute to their household food security and socio-economic development. Particular attention should be given to vulnerable households and to the role of women in the design and implementation of these activities.

The development of technological research and quality standards and the design of communication strategies for better consumer information will be particularly important for the successful marketing of forest foods which have an economic potential.

Foresters have a major role to play in the promotion of NWFPs and this role should not be limited to the design and promotion of sustainable exploitation techniques. It is increasingly recognized that forests should be seen as dynamic systems and that the needs of indigenous people, and particularly household food security and appropriate nutrition, should be taken into account when discussing productivity and environment.

The promotion of NWFPs should not be seen, however, as the sole responsibility of forest departments. All development workers from government or non-governmental institutions operating in or near forested areas — particularly agriculture extension workers and health staff — should be made aware of the present and potential contribution of NWFPs and should be involved in a concerted effort to promote household food security and appropriate nutrition of the local population on the basis of existing resources.

REFERENCES

Anonymous. 1989. Actas del Simposio sobre Comercio Exterior de Hongos Comestibles, Temuco, 23 de Junio 1989. Pontificia Universidad Católica de Chile y Corporación Nacional Forestal, IX Región de la Araucania.

Anonymous. 1989. Actas de las V Jornadas Técnicas sobre Uso Multiple del Bosque y Sistemas Agroforestales, 4-7/10 1989. Misiones, Argentina, Instituto Subtropical de Ciencias Forestales.

Anonymous. 1992. *Forest resources of the temperate zone: main findings of the UN-ECE/FAO 1990 forest resource assessment*, Vol. 2. Benefits and Functions of the Forest. United Nations.

Campbell, B.M. 1986. The importance of wild fruits for peasant households in Zimbabwe. *Food and Nutrition* 12(1):38-44.

Campbell-Platt, G. 1980. African locust bean (*Parkia species*) and its West African fermented food product, dawadawa. *Ecology of Food and Nutrition* 9(2):130-132.

Christanty, L., Abdoellah, O.S., Marten, G.G. and Iskandar, J. 1986. Traditional agroforestry in West Java: the pekarangan (homegarden) and kebun-talun (annual-perennial rotation) cropping systems. In *Traditional agriculture in Southeast Asia: a human ecology perspective*, p.132-158. Denver, Westview Press.

Eden , M.J. 1990. *Ecology and land management in Amazonia*. London, Belhaven Press.

Falconer, J. 1992. Non-timber forest products in southern Ghana: a summary report. ODA Forestry Series No. 2. London, ODA.

Falconer, J. 1990. "Hungry season" food from the forests. *Unasylva* 41(160):14-19.

Falconer, J. and Arnold, J.E.M. 1988. Forest, trees and household food security. Social Forestry Network Paper 7a. London, Overseas Development Institute.

FAO. 1989. *Arid zone forestry: a guide for field technicians*. FAO Conservation Guide 20. Rome, FAO.

Hassan, N., Huda, N. and Ahmad, K. 1985. Seasonal patterns of food intake in rural Bangladesh: its impact on nutritional status. *Ecology of Food and Nutrition* 17(2):175-186.

Hill, K., Hawkes, K., Hurtado, M. and Kaplan, H. 1994. Seasonal variance in the diet of Ache hunter-gatherers in eastern Paraguay. *Human Ecology* 12(2):101-135.

Hladik, C.M., Haldik, A., Linares, O.F., Pagezy, H., Semple, A. and Hadley, M. 1993. *Tropical forests, people and food: biocultural interactions and applications to development*. Man and the Biosphere Series, Vol. 13. Paris, Unesco.

Malhotra, K.C., Poffenberger, M., Bhattacharya, A. and Dev, D. 1992. Rapid appraisal methodology trials in Southwest Bengal: assessing natural forest regeneration patterns and non-wood forest product harvesting practices. *Forest, Trees and People Newsletter* 15/16:18-25.

Ogle, B.M. and Grivetti, L.E. 1985. Legacy of the chameleon: edible wild plants in the Kingdom of Swaziland: a cultural, ecological, nutritional study. *Ecology of Food and Nutrition* 16,(3): 193-208, and 17(1):1-64.

Okafor, J.C. and Fernandes, E.C.M. 1986. Compound farms of southeastern Nigeria: a predominant agroforestry homegarden system with crops and small livestock. *Agroforestry Systems* 5(2):153-168.

Olsson, G. 1991. Forests and forest products use in Vanuatu and Tonga. RAS/86/036 Working Paper 2. Rome, FAO.

Poulsen, G. 1982. The non-wood products of African forests. *Unasylva* 34(137):15-21.

Saowakontha, S. *et al.* 1988. Roles of food gathered from forest in self-reliance and nutritional status of villagers in northeast Thailand: the case of Ban Nong Khong. Khon Kaen, Thailand, Khon Kaen University.

Tewari, D.N. 1994. *Tropical forest produce*. New Delhi, International Book Distributors.

Thompson, B. 1984. Introducing nutrition considerations into forestry projects: experience from northern Thailand. FAO/EWC Workshop on the Socio-Economic Aspects of Community/Social Forestry in the Asia-Pacific Region, held in Bangkok, Thailand.

Ulijaszek, S.J. 1983. Palm sago (*Metroxylon* species) as a subsistence crop. *J. Plant Foods* 5(3): 115-134.

Wickens, G.E. 1991. Management issues for development of non-timber forest products. *Unasylva* 42(165):3-8.

MAKING NON-WOOD FOREST PRODUCTS PROGRAMMES SUCCEED: LESSONS FROM SMALL-SCALE FOREST-BASED ENTERPRISES

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BACKGROUND

Over a decade ago, FAO launched the Forestry for Local Community Development programme to focus attention on the need for forestry to play a more effective role in rural development. The programme continues, now under the name Forests, Trees and People, to pursue this objective. In the context of this work, creating off-farm employment and income opportunities in rural areas through small-scale forest-based enterprises (FB-SSEs) was targeted early for study, with focus on developing countries. FAO's two main reports on this (Fisseha, 1985; FAO, 1987) stand as basic references that can serve as foundations for further work.[2/]

This early work revealed that small-scale enterprises are a major source of rural livelihoods in developing countries. Much of this employment and income may be of a semi-subsistence nature and poorly remunerative, but some enterprises are profitable and graduate into significant size. Even the semi-subsistence ones are important in that they reduce open unemployment and, even more important, are accessible to disadvantaged societal strata such as rural women and the landless, which other livelihood options elude. Work on non-wood forest products (NWFPs) development is one avenue for securing these benefits of small enterprises.

In this paper, an attempt is made to draw lessons from the work on FB-SSE for application to improving the chances of having successful NWFP activities. The paper adopts a common sense rather than analytical style and, although it makes no claim to newness of ideas, is an attempt to conveniently group in one place selected key factors influencing growth prospects. It needs to be said that a consensus has yet to emerge on the full range of key factors which can aid FB-SSE growth. The work on NWFPs will need to contribute to research in this direction.

BASIC INFORMATION

NWFP ENTERPRISES DOMINATE THE SMALL-SCALE FOREST ENTERPRISE FIELD

An early compilation of data already revealed dominance by NWFPs among forest-based enterprises: Fisseha (1987) estimated that manufacture of baskets, mats and hats accounted for between 27.3 percent of all manufacturing FB-SSEs (in Sierra Leone) and 70.4 percent (in Egypt), with high ratios also reported for Jamaica (63.5 percent) and Zambia (60.3 percent). If bamboo and cane

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2/ Since then, some excellent updates of the literature have been undertaken, including those by Arnold *et al.* (1994), Arnold (1994b), and an extensive bibliographical survey by Townson (1994).

processing are also added (separate figures were not available), these ratios would be higher still. In Niger, Fisseha (1990) reported five times as many NWFP-based as wood-based SSEs, with the ratio of employment being 3:1 in favour of NWFPs.

A more recent set of studies (Arnold *et al.*, 1994) in six eastern and southern African countries[3/] gave the following distribution of forest-based SSEs: 42 percent based on grasses, cane and bamboos (i.e. NWFPs); 27 percent on woodworking; 20 percent on trading and transport of various forest products; and 11 percent others, such as charcoal production and sawmilling.

ATTRIBUTES OF FB-SSEs

The main characteristics of FB-SSEs are detailed in FAO (1985, 1987) and Arnold *et al.* (1994), with a convenient summary in Campbell (1991). In short, FB-SSEs are largely rural and dispersed in location, and are dominated by NWFP-based activities as well as by gathering and trading.

FB-SSEs are usually small (generally averaging between 1.8 and 3.8 workers, including the owner) with over 60 percent of them usually being one-person operations, i.e the owner is often also the only worker[4/]. Among them, NWFP-based enterprises are particularly small and, as they tend to have the lowest entry barriers to new entrepreneurs, are generally the most numerous, like those based on trading. The work mentioned earlier showed that, apart from a few cases such as export-oriented processing of rattan, the greater part of NWFPs tend to be collected, traded or processed by small enterprises, even if in aggregate total production and associated employment may be huge. In other words, NWFPs are generally produced by the masses, rather than being mass-produced.

In many countries, enterprises based on NWFPs, such as grasses, leaves, canes and bamboos, are the smallest in size but are far more numerous than those based on wood; if food-type NWFPs such as fruit, honey, mushrooms or wildlife meat are added, the dominance by NWFPs within the FB-SSE category becomes even more marked.

The very small size means they lack resources to operate independently. Consequently, FB-SSEs are often *closely associated with and even located in households*. It goes without saying that being at the lower size scale, NWFP-based SSEs (like trading enterprises) dominate the household-based category, while the larger ones (many of them wood-based) are more likely to move into workshops.

Smallness is also associated with other features which may influence growth potential. Key among these is that FB-SSEs (again, especially NWFP-based ones) have low levels of technology, with little or no powered equipment being used. They have limited financial capacity and cannot afford to own raw material sources but, instead, tend to rely on common property sources. The owners, although often possessing some technical skills, rarely have managerial training, so that FB-SSEs are often managed on the basis of intuition rather than expertise.

The above paints a rather dismal picture: small, numerous, dispersed, financially weak, technologically primitive, managerially poorly served — what chances do FB-SSEs have to succeed? Some of the relevant factors are reviewed in the following section, although with no attempt at exhaustive coverage.

3/ Botswana, Kenya, Lesotho, Malawi, Swaziland and Zimbabwe. The surveys were based on ISIC product classification codes within which wood products are better represented than those based on NWFPs.

4/ Enterprises of below five workers are often labelled as "micro" enterprises or "cottage" enterprises. Many tend to operate informally and their character is as diverse as the individual owners.

FACTORS FAVOURING SUCCESS

Do they Succeed at All?

In spite of the characteristics just mentioned, SSEs in aggregate do grow. Small enterprises show remarkable resilience in that new ones come up even faster than others close so that there is often a net increase in employment and production. There is a permanent ferment of new enterprise births and deaths so that most jobs created are not from growth of existing operations but, rather from new, transient units.

In the case of eastern and southern African FB-SSEs, Arnold *et al.* (1994) reported this high turnover to be particularly true for enterprises based on grass, canes and bamboo, or on trading, for which 80 percent and 78 percent of jobs, respectively, came from new units. Such a state of instability can neither be considered a sign of dynamism nor of inherent sub-sector health or attractiveness. It cannot permit accumulation of either capital or skills nor can it facilitate retention of other developmental gains, even though there may be overall net increase in low-grade employment.

For the NWFP enterprises, the units almost never grew bigger. By contrast, for woodworking (with larger enterprises), 55 percent of employment growth came from enterprise expansion. Indeed, Arnold (1994b) reports that employment in the woodworking enterprises was growing ten times faster than for grass, cane and bamboo activities, with over half the growth being due to expansion rather than new start ups.

According to the International Labour Organization (ILO), little is known about mortality rates of rural enterprises and about conditions for their success and expansion or failure (in Chuta, 1987); many SSEs are thought to die within such a short time of start-up that they are not captured by statistics. Estimates suggest that 50 percent of new SSEs die within three years (Arnold *et al.*, 1994) and 80 percent within five (FAO, 1987). Daniels and Fisseha (1992) reported for Botswana that for all SSEs, 16 percent died within a year of creation and 54 percent by the fifth year; by the fifteenth year, about 88 percent had closed.

Combining net new-enterprise formation with gains from expansion, national annual growth in employment was estimated at 7.8 percent in Botswana and in rural areas 6.7 percent; growth by urban woodworking was 81.2 percent, while in rural areas it was zero (Daniels and Fisseha, 1992). In Zimbabwe, the 1988-93 average growth for all SSEs in numbers of enterprises was 19 percent annually; rates were 20 percent for grasses, cane, bamboo products and 8.3 percent for wood processing (Arnold *et al.*, 1994); mortality for all SSEs was estimated at 10 percent annually.

A few SSEs, particularly the larger ones, expand production and may graduate into the workshop-based size. Some even exhibit considerable longevity. In Jamaica, a 1992 study was able to trace processing enterprises surveyed 12 years earlier (Fisseha, 1994) and found 57 percent still in operation, with an average age of 20.3 years. However, craft works (mostly based on grasses/straws) showed the lowest longevity (only 44.4 percent surviving) with woodworks next lowest at 50 percent.

What can Make them Succeed or Grow?

A number of factors affect the prospects of success, some internal to the product, others from the policy, institutional and commercial environment and yet others from level of support.

Selecting the Right Product — Is there Demand?

Central to success is selecting the right product. Does it have a market or can one be created? Issues related to demand and markets are treated in detail in the paper by Lintu. Aspects particularly relevant to small-scale enterprises follow.

Without adequate and profitable markets, there is no basis for enterprise. As stated by FAO (1987), "Only when market prospects are found satisfactory or capable of improvement would further assessment of the other criteria [of potential for continued growth] be useful". For this reason, it is important in pursuing NWFPs development, as for FB-SSEs in general, to first narrow down the products and activity types of interest to those already with a market or good prospects of having one. Products with limited current market and poor future prospects should be discarded before scarce resources are spent on their promotion. Products retained as having a future can then, for purposes of designing support programmes, be grouped into three categories:

Category 1: **those which have large current markets** (i.e. are consumed by a large segment of the population) even if the market may not have a long-term future[5/]. Such products may permit good returns and viability for the time they are still in demand. Often, these products are subsequently easily displaced by mass-produced natural or artificial substitutes.

Category 2: **products which may have a relatively small market now but have future relevance as the economy develops.** Into this second category could fall certain non-utility basketware enterprises, which may, if tourism flourishes for example, gain a large future market. Essences or extracts for use in perfumes or modern medicines may also come under this category.

Category 3: products of a traditional character, which will remain marketable on a niche basis for ceremonial or other strong cultural reasons or to meet new demand (such as by tourists). Examples could be traditionally dyed forest fibre cloth or kola nuts.

Category 1 probably covers the largest number of NWFPs development opportunities. In broad terms, utility non-wood products of the "basket, mat, woven hat" type, which serve a very important purpose for poor people and farming communities, belong here. Some of them can be speedily abandoned as incomes rise or alternative income opportunities emerge. Certain traditional medicines could similarly fall under this category.

Arnold (1994a) has observed that "some of the most important saleable products face uncertain markets because of growing competition from industrial or synthetic alternatives or domesticated sources of materials." Some products of "extractivism" may eventually fall prey to this phenomenon and so could some traditional medicinal NWFPs. Rubber or palm oil went through the transition, having developed such large markets that artisanal supplies no longer sufficed.

Great success in SSE production attracts domestication of produce or industrial entrants into processing to supply the larger market so displacing artisanal producers[6/]. Rattan is a candidate for rapid domestication and much of its processing is already on a scale beyond SSE level. Townson (1994) mentions eight studies which refer to falling demand due to substitution by synthetics; three referring to natural substitutes and a few others indicating loss of popularity with buyers.

Often, displacement is due to greater convenience, more assured availability, consistency in quality and lower prices for industrial goods against which equivalent utility FB-SSE products can

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5/ The suggestion has sometimes been made that some products produced by FB-SSEs, may, in economic terms, be "inferior goods", demand for which will fall as incomes rise. This aspect should be ascertained before deciding on what NWFP to support. Arnold (1994b) identifies products such as mats and baskets, often made in one-person enterprises, as being "low-return" items quickly abandoned when wages rise or alternative opportunities emerge.

6/ Production by the masses with small quantities by every household can, in total, yield as much as industry but cannot cope effectively with concentrated demand. Any NWFP which shows likelihood of becoming a mass-consumption commodity for concentrated markets (e.g. urban) may not for long remain in the SSE domain.

compete only behind barriers created by poor transport/communications infrastructure, other locational advantages or deliberate policy preference for SSE products.

The competitiveness of FB-SSE products may also suffer when the depletion of their raw materials leads either to higher costs or poorer quality.

Is the Macro-Economic and Administrative Environment Favourable?

NWFP-based SSEs can be expected to respond to macro-economic or administrative influences, although at such a low scale do FB-SSEs operate that only limited attention has been given to their responsiveness to broader economic policy influences on them. To the extent that they may be in particularly remote locations and partly cushioned by subsistence household economies, many NWFP enterprises may not be abruptly affected by a policy change.

For larger SSEs, the influence of macroeconomic and administrative interventions may be clearer. For example, Fisseha (1992) revealed the possible strong importance of one macroeconomic factor for enterprise survival: 24 percent of the enterprises closed in 1991 alone and another 29 percent in 1992, in coincidence with major Jamaican currency devaluation. Contraction of markets was identified by entrepreneurs as one of the top three reasons for closure and may itself have originated from the devaluation.

It is unclear why devaluation, which makes imports more costly, did not have the reverse effect of favouring local SSE products. There is no information on the impacts of other policy changes associated with structural adjustment. Empirical research is needed to ascertain if they initially create need for informal SSE employment as the formal sector sheds jobs.

Administrative influences have been considered largely in the negative sense of perceived or suspected official bias against small enterprises. Thus it is claimed that there is a policy bias in favour of large industry, for example reflected in exchange rates that favour the use by large-scale industries of imported energy, equipment and skills, enabling them undercut SSEs. Wages and industrial labour safety regulations are made for the larger enterprises and are onerous for small ones. Infrastructure is designed to serve large industry and conditions for access to it (e.g getting connected to utilities grids) has been made difficult and costly. And barriers restrict FB-SSE access to finance, if only through high transaction costs relative to the volume of funding SSEs need.

These and other cries of "foul" are covered in detail elsewhere, including FAO (1987), which carries a general review of various aspects as applied to FB-SSEs, and Arnold (1994a), Arnold *et al.* (1994) analyzing particular aspects or geographical regions in greater detail.

In certain countries, positive discrimination is practised in favour of all SSEs or specific SSE types. India is an example of where certain sectors or commodities are reserved only for SSEs. In that country, certain supplies to government are to be sourced only from SSEs. Examples from the forest-products sector include: cane baskets; bamboo tool handles; brooms; natural oils of cashew shells, sandal wood, pine, and eucalyptus; turpentine; and wooden furniture and fixtures (Parameshwaran, 1987). Behind such barriers, FB-SSEs can grow and even prosper. However, in this day of free market economics, it is hard to see how this approach can be readily promoted.

What of Forest Raw Materials?

With time or increased demand, the survival or growth prospects of FB-SSEs may be threatened by depletion of, or reduced access to, forest resources; FB-SSEs are generally too small to own their resource. It goes without saying that deforestation would lead to raw material problems for FB-SSEs. Under conditions of shortage, smaller enterprises would tend to be threatened first unless favoured through raw material reservation schemes of the kind operating in India (Parameshwaran,

1987) or through forest concession practices, which enable small enterprises to benefit alongside large industries.

The greater part of FB-SSE raw materials come from private, common property or open access forests not controlled by the enterprise and therefore often insecure. In many cases, enterprises appear to be started with the expectation of using materials for which usufruct rights are granted only for subsistence use and for which commercial harvesting would therefore either require illegal use or securing a licence. Other aspects of access rights are more fully treated in Arnold (1994a). Townson (1994) refers to six studies which address the question of access restrictions due to tenure.

Many other studies refer to destructive harvesting by FB-SSEs of their raw material base. This phenomenon may have several origins: lack of commitment due to non-ownership of the resource; excessive numbers of informal enterprises competing for the resource, with each maximising harvest before it runs out; or inadequate provision in forestry development programmes (including government ones) for the particular raw materials needed by FB-SSEs. The latter is particularly the case for NWFPs, which rarely feature adequately in forest development or management plans. Accordingly FAO (1987) recommended that forests "need to be managed to realise more of the potential of the non-wood components of the forest."

Before embarking on an NWFPs programme, it must be ascertained where the raw materials and ancillary inputs will come from, at what cost, whether they are accessible, for how long, and who will ensure their sustainability.

The Entrepreneur is the Key

A study in Botswana showed approximately three-quarters of all SSEs to be household-based, with nearly two-thirds of the labour coming from family members, including the proprietor (Daniels and Fisseha, 1992). The particular dependence of SSEs on the owner is confirmed in the recent six-country Africa studies (Arnold *et al.*, 1994) showing 67 percent of enterprises to be one-person operations. Results from Niger suggest that the dependence of entrepreneurs on their own and on family labour tends to increase as enterprise location became more rural (Fisseha, 1990).

The proprietor is the sole worker in two-thirds or more of cases, has little capital or technology, and no particular managerial training. The proprietor is thus the main "asset" of the enterprise whose productivity and efficiency is not enhanced by labour-saving technology or specialised skills and adequate funding, and whose weaknesses are worsened by lack of supportive aids. The smaller the SSE, the more critical the attributes of the entrepreneur become for success; the characteristics of the owner are often probably the "make or break" ingredient related to success of NWFP enterprises. In Jamaica, a study tracing SSEs after 12 years from the first survey (Fisseha, 1994) found that death or emigration of the entrepreneur was the second most common reason associated with closure of enterprises.

The growth potential of many otherwise sound enterprises can easily suffer from reliance on management by an owner who has only technical skills, no management exposure, depends on intuition and acts without benefit of information which management in large industry would have. Such is the degree to which the entrepreneur is stretched that, in particularly small units, even the capacity to receive assistance may be negligible. Joshi (1987), referring to the situation of micro-enterprises in India, felt that "poor people operate below what might be called an entrepreneurial threshold" and called for assistance to start by helping them to first reach that threshold. He therefore proposed a "foster-entrepreneur" scheme.

The likelihood is that the determinant factor for enterprise success or survival is human capabilities; a poor entrepreneur can fail even if supported by adequate technology and with access to a limitless market. According to Fisseha (1987), the calibre of small-scale manufacturing enterprise managerial quality is central both to the viability of an enterprise and to the success of external

intervention efforts. As FAO stated in 1987 "Managerial weaknesses ... serve to worsen all the other problems since ... entrepreneurs often lack capacity to analyze situations and chart ways to minimise adverse impacts of problems." Furthermore, it appears that for small enterprises in developing countries, the optimum technical level of operation may be far higher than the available managerial talent can cope with (Chuta, 1987), i.e. they cannot cope with technically sophisticated enterprises.

Other Factors

SSE entrepreneurs often perceive shortage of finance and poor access to technology as key bottlenecks to enterprise success. Consequently, they call for more or better credit, largely for capital investment. The truth of the matter may well be that at the extremely small-scale level where many NWFP-based SSEs operate, the capacity to absorb either finance or technology is limited unless preparatory capacity upgrading is undertaken.[7/] For enterprises at the lower end which have almost no capital investment, working capital can be critical and, for the household-type of forest-based enterprise, "it may represent the entire investment" (Brunton, 1987) and may in any case be just as important, if not more so, than investment capital (Fisseha, 1987).

With regard to technology, the almost exclusive reliance on human labour makes the smallest FB-SSEs unable to adapt quickly to changing tastes, designs or to upgrade production either in quantity (when market expands) or quality. Under manual production, attempts to cope with volume tend to destroy quality and brings SSEs into disrepute, accelerating loss of customers to manufactured substitutes.

Last but nevertheless quite important is the question of organisation. The profile of FB-SSEs given earlier indicated smallness, spatial dispersal and capacity weakness, all on a scale where individual support would be far from cost-effective to provide. Even with innovative approaches to providing assistance, success would require grouping of enterprises. NWFP enterprises being particularly small, the issue of organisation would be even more central for them and should feature in planning when first contemplating programmes.

CONCLUSIONS

Capacity to develop or succeed is a multi-faceted phenomenon. An enterprise can gain capacity to develop from: continuing relevance of its products to the market (i.e. strong demand); an enabling macro-economic and administrative environment; a favourable location; access to reliable and adequate technology, and to inputs (including raw materials, utilities, support services and finance); and human abilities.

NWFPs programmes need to resist the temptation to select products for focus largely or only on the basis of their having a market or adequate raw materials. Selection should involve also simultaneous consideration of the availability of suitable entrepreneurial resources. The question is, how does one find adequate entrepreneurs among those who have capacities only for enterprises of 1-3 workers? Yet if this is not done, there may not even be the capacity to benefit from supportive interventions.

Secondly, NWFPs programmes should be promoted where the beneficiaries have demonstrated ability to organise and cooperate or where there reasonable grounds to expect them to be able to. The other key factors influencing success would also be assessed.

Social objectives apart, one approach might be to focus on NWFPs that are of interest to larger-scale entrepreneurs, i.e. those able to operate enterprises of a workshop scale. They will be

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7/ It should nevertheless be recognised that what little finance or minimal tools/equipment they are able to handle may be vital for survival.

fewer and easier to reach; they will more easily qualify for formal sector services such as bank finance; they will probably have a higher absorption capacity for productivity-enhancing technology; and they may well be more adaptable as the economy develops. However, social objectives often have to be a primary consideration in selecting target activities. This will often mean including or even focusing instead on "micro" household-based enterprises as they have far higher total employment generation potential. In order to partly meet both the need for success and social objectives, approaches may include:

- adopting a two-track approach by selecting both micro and larger enterprises for attention;
- organising the micro enterprises for servicing in groups, whether in terms of technical assistance or delivery of financial support;
- making entrepreneurial selection and capacity-building a central rather than peripheral concern of any intervention;
- in any case, selecting not just the product but the people to be involved[8/] because the latter will largely determine prospects for success. The choice of product, technology and approach to support interventions would all need tailoring to suit the people and organisations selected rather than being ready packages.[9/]

In promoting NWFPs development, it is necessary to look not at the product or commodity in isolation, but at a wide range of factors which would enable that product to be exploited, managed for sustainability, and marketed for profit. Most important, however, is to identify those entrepreneurs with the ability to manage the activities or quickly learn how to do so.

REFERENCES

Arnold, J.E.M. 1994a. Non-farm employment in small-scale forest-based enterprises: policy and environmental issues. EPAT/MUCIA Working Paper No. 11. Madison, University of Wisconsin.

Arnold, J.E.M. 1994b. Socio-economic benefits and issues in non-wood forest products use. Paper for the Expert Consultation on Non-wood Forest Products, Yogyakarta, Indonesia, 17-27 January 1995.

Arnold, J.E.M., Liedholm, C., Mead, D., and Townson, I.M. 1994. Structure and growth of small enterprises in the forest sector in southern and eastern Africa. Oxford Forestry Institute Occasional Paper No. 47. Oxford, OFI.

Brunton, P. Desmond. 1987. Financing small-scale rural manufacturing enterprises. In *Small-scale forest-based processing enterprises*. FAO Forestry Paper No. 79. Rome, FAO.

Campbell, J.Y., ed. 1991. *Case studies of forest-based small-scale enterprises in Asia: rattan, matchmaking and handicrafts*. Community Forestry Case Study No. 4. Bangkok, FAO-RAPA.

Chuta, E. 1987. Growth and dynamism among rural small-scale enterprises: information gaps. In *Small-scale forest-based processing enterprises*. FAO Forestry Paper No. 79. Rome, FAO.

8/ Arnold, (1994a) has suggested that FB-SSEs are most likely to succeed where the product : is a staple with assured large domestic demand; requires certain skills or inputs and processes capable of ready upgrading; and uses readily available raw materials or which can be easily grown and placed under entrepreneur household management.

9/ It is, after all, the human capacity that will permit correct identification of opportunities, innovation, and organisation of for production and its adaptation to markets; external assistance cannot substitute effectively for the owner in any of these.

Daniels, L. and Fisseha, Y. 1992. Micro and small-scale enterprises in Botswana: results of a nationwide survey. GEMINI Technical Report No. 46.

FAO. 1987. *Small-scale forest-based processing enterprises*. FAO Forestry Paper No. 79. Rome, FAO.

Fisseha, Y. 1985. *The contribution of small-scale forest-based processing enterprises to rural non-farm employment and income in selected developing countries*. FAO Forestry Department Document No. FO:MISC/85/4. Rome, FAO.

Fisseha, Y. 1987. Basic features of rural small-scale forest-based processing enterprises in developing countries. In *Small-scale forest-based processing enterprises*. FAO Forestry Paper No. 79. Rome, FAO.

Fisseha, Y. 1990. Small-scale enterprises in Niger: Survey results from Dosso and Maradi Departments. Lansing, Michigan State University.

Fisseha, Y. 1994. Dynamic study of Jamaican micro and small-scale enterprises. GEMINI Technical Report No. 70. Lansing, Michigan State University.

Joshi, D. 1987. Shortages of forest raw materials and the development of small-scale enterprises in India. In *Small-scale forest-based processing enterprises*. FAO Forestry Paper No. 79. Rome, FAO.

Parameshwaran, K.P. 1987. Institutional support for small-scale rural processing enterprises: the case of India. In *Small-scale forest-based processing enterprises*. FAO Forestry Paper No. 79. Rome, FAO.

Townson, I.M. 1994. Forest products and household incomes: a review and annotated bibliography. Review draft. Oxford, OFI.

NON-WOOD FOREST PRODUCTS AND INTEGRATED MOUNTAIN DEVELOPMENT: OBSERVATIONS FROM NEPAL

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INTRODUCTION

Mountain areas lie in the margins of mainstream development, globally in general and more particularly in the developing world. Consequently they have remained as net exporters of natural resources. With some exceptions, mountain areas have scarcely been the primary focus of resource development. Over-exploitation and depletion of resources, loss of biodiversity and indigenous knowledge have been rife. The net beneficiaries have often been non-mountain areas and populations. The paradox of mountain development has been that while a number of indigenous resources with potential comparative advantages continue to remain neglected, the path to sustainable development continues to be searched along conventional lines. In contrast to this is where the link between non-wood forest products (NWFPs) and integrated mountain development emerges so strongly.

The purpose of this short paper is to elucidate this linkage in the contemporary Hindu Kush-Himalaya (HKH) context. First, the nature of mountain environments and the implications of contemporary changes, both external and internal, are highlighted. The imperatives of integrated mountain development are then traced to indicate how NWFPs can be an element in the overall strategy of sustainable mountain development. Finally, two case observations from Nepal elucidate the contemporary context and derive some conclusions.

THE MOUNTAIN CONTEXT

Mountain areas entail living in the third (the vertical) dimension, where altitude and relief impose limits to human habitation and micro-environmental variations resulting from a number of factors such as slope, aspect, soil type and depth, thermal regime and precipitation restrict the choices of productive activities (Troll, 1972; Groetzbach, 1988; Whiteman, 1988). Altitude and relief together restrict the availability of cultivable land. Yields of traditional crops tend to be lower than plains areas for lack of inputs and appropriate technology packages. Altitude and relief also act as barriers to the development of transportation and can be overcome only at great economic investment and sometimes considerable environmental costs. Mountain areas are dynamic areas in terms of the operative tectonic, geomorphic and slope-induced physical processes. This inherent dynamism makes mountain areas extremely fragile. Resources tend to be rapidly degraded with high-intensity use and such degradation can be, and often is, highly irreversible. Mountain areas therefore tend to be scale-sensitive with relatively lower carrying capacities. Diversity of micro-environments and consequent high degree of variation in physical, biological attributes of natural resources also contribute to make mountain areas home to a number of endemic floral and faunal species and provide considerable scope for mostly modest-scale, area-specific comparative advantages. Some of these niches have traditionally been exploited by trading communities in the mountains. Human adaptation to the physical and resource systems of the mountains has manifested itself in a variety of ways, ranging from ethno-engineering to collection of medicinal herbs. Over the centuries, mountain people have recognized the contextual value of resources and developed systems to enhance the production and productivity of resources and use them for their own purpose or for exchange.

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These objective conditions of the mountains or "mountain specificities" (Jodh, 1990 and 1991) historically provided, and in a sense determined, both the relative opportunities as well as almost absolute constraints to mountain development. In a context where the demand on the resource system was not particularly severe, traditional forms of adaptation worked pretty much to achieve some kind of a low level, steady-state environment and economy. Inaccessibility was addressed through the development of a self-provisioning, non-market dependent system. Barter-based exchange provided the requisite means of survival to high mountain communities based on pastoralism and some agriculture. Local resource centred production based on diverse production bases, the backbone of the subsistence economies of the mountains, was a response to the risk associated with a dominant mono-culture. The pace of changes, both external and internal to the mountains, in the last few decades has been so rapid as to make these traditional forms of adaptation either irrelevant or inadequate.

These changes have been marked by a rapid growth in population, a rapid rise in the expectations of mountain population (due to a large extent to the rise in literacy), relatively rapid growth in transportation and tremendous strides in the development of communication. These changes have created conditions where the demand for mountain resources has multiplied many times, both within and outside the mountain habitats. In the HKH, for example, population growth in most areas/regions in recent decades has remained in excess of 2 percent. The degradation and depletion of most common property natural resources has been phenomenal (Chalise *et al.*, 1993), due both to the conversion of forest land into other uses and to the heavy demand for fuelwood, fodder and a number of other forest products. While the pressure of population on cultivated land has been consistently on the rise, alternative employment opportunities remain stagnant or grow at a sluggish rate relative to the rise in labour force (Sharma, 1993). In many areas, migration of mostly the young and the innovative from the mountains has been phenomenal.

Population growth, degradation or depletion of common property resources, gradual incorporation of the mountain economies to the global/regional economic systems, the demise of traditional institutions, overall lack of mountain-sensitive government policies — all together have contributed to exacerbate the problems of development in the mountains. The problems are manifested in very widespread poverty, environmental degradation and lack of alternative employment opportunities amidst continuing high rates of population growth.

IMPERATIVES OF INTEGRATED MOUNTAIN DEVELOPMENT

The challenge of mountain development in the contemporary context is basically one of alleviating poverty, enhancing alternative employment opportunities, conserving the mountain environment and habitat and ensuring a measure of distributive justice by addressing the concerns of the women and the marginalised and disadvantaged groups. It need hardly be emphasized that the comparative advantages afforded by the mountain environment have to be the basis for addressing these development challenges. While the productivity of the elements of traditional agriculture has to be enhanced, a more fundamental search has to be in areas that do not compete with agriculture, that address issues of the maintenance of biodiversity and environmental regeneration, that contribute to employment and income generation, that provide mountain areas with some measure of control in bargaining for the value of their resources and that help in the development of participatory institutions that can assure the distribution of benefits to those sections of society that are in the most need.

The crux of integrated mountain development lies in initiating a process that recognizes and reinforces the positive linkages among the various imperatives noted above. This means looking at the mountain environments as systems with inter-linked physical, economic, cultural, and institutional dimensions. Integrated development in this context would be the process of searching for complementarities within and among these dimensions: complementarities in terms of physical processes such as land use and watershed management in response to variable slopes, pedological as well as hydro-meteorological conditions and farming systems. Complementarities need also to be strengthened in terms of the economic systems of production and exchange that contribute to highland-lowland interaction because the problem of economic and environmental development in mountain

areas in the contemporary world cannot be addressed by maintaining mountain areas as isolated, closed entities. The social and cultural dimensions of the mountains are more complex and have imbedded in them a whole system of values and folk knowledge regarding the mountain habitats and resources. Integrated mountain development would also mean the integration of modern scientific understanding to the symbolism expressed by the extant social and cultural systems and the indigenous knowledge systems so that contemporary problems and issues are better and holistically addressed. Then there is the institutional dimension with respect to common property resource use and management, and participation in the development process because decentralized, participatory approaches have perhaps an even greater relevance in mountain areas than elsewhere.

NWFPs in the mountain context are one category of resources that link all of the dimensions of integrated mountain development noted above. They provide a mostly non-competitive and often complimentary land use *vis-à-vis* agriculture in the mountains, where one of the main problems is paucity of cultivable land. NWFPs show the potential to integrate economic and environmental development, which is one of the main contemporary challenges in mountain development. As sources of alternative employment and income generation, NWFPs can also support and sustain economic development of poor mountain areas. Indeed, traditionally NWFPs have also been the last resort for the distress economy of the poor. Sustainable reliance on NWFPs also creates the need to maintain and conserve biomass and biodiversity. NWFPs provide a potential basis for highland-lowland interaction and exchange. With greater processing and value-added opportunities NWFPs can provide the mountain communities with better terms of trade and bargaining power. A great deal of folk knowledge has been generated around the variety of NWFPs on which mountain communities have depended for their own consumption or exchange for centuries. These indigenous knowledge systems, together with modern scientific knowledge, can be used to enhance the utility as well as conservation of the NWFP resources. NWFPs in much of the mountains have been, and continue to be harvested from common property resources. NWFPs therefore provide scope for the promotion of participatory approaches in natural resources management and can also be a vehicle in addressing the economic concerns of the poor and disadvantaged groups.

Fortunately, mountain areas of the HKH are home to a number of high value NWFPs, among which medicinal herbs and plants are an important category. Systematic information on many high value NWFPs remains lacking. The attempt here will be to describe the present status and use of some of these resources. Although the examples provided below do not strictly fall in the category of NWFPs, these nonetheless provide an idea of the role that high value NWFPs could play in the generation of income and employment and in the alleviation of poverty, and therefore development, of mountain areas.

HIGH-VALUE MEDICINAL PLANTS: CASES FROM NEPAL

Jaributi refers to a group of NWFPs that are collected from the wild from the mountains of Nepal and traded in India as raw materials for industries related to pharmaceuticals, food and beverage or perfumes. It is an ancient trade that thrived on the traditional Ayurvedic system of medicine. The trade volume is enormous but for the most part remains invisible. Much of the collection takes place from common property or government land. Although regulations stipulate the need for receiving a permit prior to collection and export out of the district and a payment of royalty on the amount collected, the royalty rates are neither based on an understanding of the resource situation nor the market value. Critical information related to the resource situation, income, employment beneficiaries, as well as trade and marketing aspects are lacking.

Available information from various sources (MPFS, 1988; Aryal, 1993; Edwards, 1993; DeCoursey, 1994; Karnali Institute, 1994; Malla, 1994) indicates that the trade comprises of a northward flow of money and market information through discreet channels, and a southward flow of raw materials. Collecting households are normally poor households and the earnings from *Jaributi* trade supplement the family income at the most critical period. Although the harvesting period of different plant species may differ, much of the harvesting takes place between August/September

through December, which is the non-agricultural season in the Nepalese mountains. Often the quantities and prices are predetermined for the collector households who receive money in the form of advances. At the village level, harvesting and collection activities are mostly coordinated by the village trader who provides the advances, stores the produce and supplies it to the next link in the marketing chain: the road-head or district headquarters trader. While some of the produce may have official sanction for collection and, export, bulk of it takes place under cover. Once the *Jaributi* reach the Tarai towns in the lowlands of southern Nepal, the trade is almost completely taken over by a small group of powerful, large-scale wholesalers with links across the border in India and access to up-to-date market information. The wholesalers have a virtual monopoly on the *Jaributi* trade and control the prices paid to the small traders and collectors.

Nepal has some processing facilities, both in the government and the private sector, but these facilities are quite insignificant relative to the volumes traded in India. The bulk of the "value added" occurs in the major Indian cities.

Two case studies elucidate the problems and prospects of *Jaributi* as vehicles of development in the Nepalese mountains.

COLLECTION AND TRADE OF JATAMASHI (*NARDOSTACHYS GRANDIFLORA*) IN THE CHAUDABISA VALLEY, JUMLA[2/]

Jumla is a remote district in northwestern Nepal. The Chaudabisa valley lies in the eastern part of Jumla. Covering about four Village Development Committees, it contains 17 major villages and a population of about 15,000. Only about 10 percent of the total land area is arable with maize, buckwheat, wheat and potato as the major crops. Yields are low. Cropping intensity is also low. Livestock play an important role in the economy and an average household may have as many as five large animals and about 15 ruminants. About 41 percent of the total land area is forested and another 26 percent consists of high-altitude meadows.

Household size in the Chaudabisa area is about 8, compared to 5.6 for Nepal as a whole. Only about 60 percent of the households are self-sufficient in food year-round. Migration, therefore, is quite common. Collection and trade of *jatamashi* has remained an important source of supplementary income to almost 80 percent of the households in the Chaudabisa area. It has been an established part of the economy for the last 10-15 years.

Jatamashi is a source of essential oil and naturally occurs in favourable locations at altitudes ranging from 3,000 to 4,500 m in Jumla and surrounding districts. There are 14 types of NWFPs exported from Jumla, according to government records. *Jatamashi*, although not strictly a forest product, is the dominant export. Most of the harvesting takes place between mid-September to mid-December. Although there is no official sanction, there are traditional harvesting territories of collectors from particular areas. Excessive pressure can at times result in conflict over harvesting territories. There is a STOL airfield in Khalanga, the headquarters of Jumla district. Large quantities of *jatamashi* is collected from Jumla and surrounding districts are airlifted to Nepalgunj, a major trade centre near the border with India. Permits are required for the collection of *jatamashi* and a fixed royalty needs to be paid to the government before it can be exported out of the district. However, the discrepancy between collection for which royalty was paid and the quantity of *jatamashi* airlifted out of Jumla shows that almost half of the trade goes unrecorded in government accounts. In fiscal year 1992/93, the government records show a collection of 78,046 kg, while in the same period a total of 151,245 kg of *Jatamashi* was airlifted out of Jumla. Also, the records of *Jatamashi* airlifted from Jumla show that between 1988/89 and 1992/93 the total amount exported went up from 25,000 kg to 151,245 kg, a sixfold increase in five years.

2/ Based on the Karnali Institute Report (1994) A Feasibility Study on Establishing a Processing Plant for Medicinal Herbs at Chaudabisa, Jumla.

Jatamashi collection by Chaudabisa households amounted to 69,500 kg, or nearly 46 percent of the total exports from Jumla in 1992/93. The household collection ranged from 24 kg to 600 kg per household. *Jatamashi* collection was taken as an important activity by about 545 households. Assuming that 25 days were involved in the harvesting and collection of *Jatamashi* and that about 1.5 persons were involved per household, the total employment generated by the activity comes to about 20,600 person days per year including porterage. Average collection in the 545 households is over 100 kg per year. In 1992/93, this meant a net revenue of US$ 20 per household. Households in Chaudabisa reported earnings between US$ 20 to US$ 60 per year from the sale of *Jatamashi*.

Chart 1 shows costs incurred, gross and net revenue generated, and the profits per kg of *Jatamashi* received by collecting households of Chaudabisa and traders at different points in the chain from the source to the market. The farmer who collects *Jatamashi* and sells to the Jumla trader in the headquarters gains at the most US$ 0.20 per kg, and may be lower if the farmer sells the produce to the village trader. Government regulation in Nepal restricts the export of unprocessed *Jatamashi* and there is a processing plant at Krishnanagar in the Nepal-India border. However, because of the differences in price it becomes expedient to the Nepalgunj trader to siphon the bulk of the *Jatamashi* to India.

The market price for *Jatamashi* per kg in 1993 was US$ 1.36 at the Krishnanagar Processing plant, US$ 1.70/kg at Nepalgunj and US$ 2.24/kg across the border in India. By selling in Nepal, the Nepalgunj trader makes a profit per kg of US$ 0.23, while if sold in India the Nepalgunj trader stands to gain US$ 0.54 per kg over and above the profit in Nepal. The profit for the collector is reduced by 20 to 30 percent if the produce is contracted through advance payment or loan by the village trader.

What the chart basically illustrates is that the Chaudabisa collector gains the least in terms profits per kg and the profit to the traders increases progressively as the produce travels from the source to the market in India. *Jatamashi* rhizome of Chaudabisa area has oil content of between 2 and 3 percent and the price of *Jatamashi* oil in the market in 1993 was US$ 180 per kg.

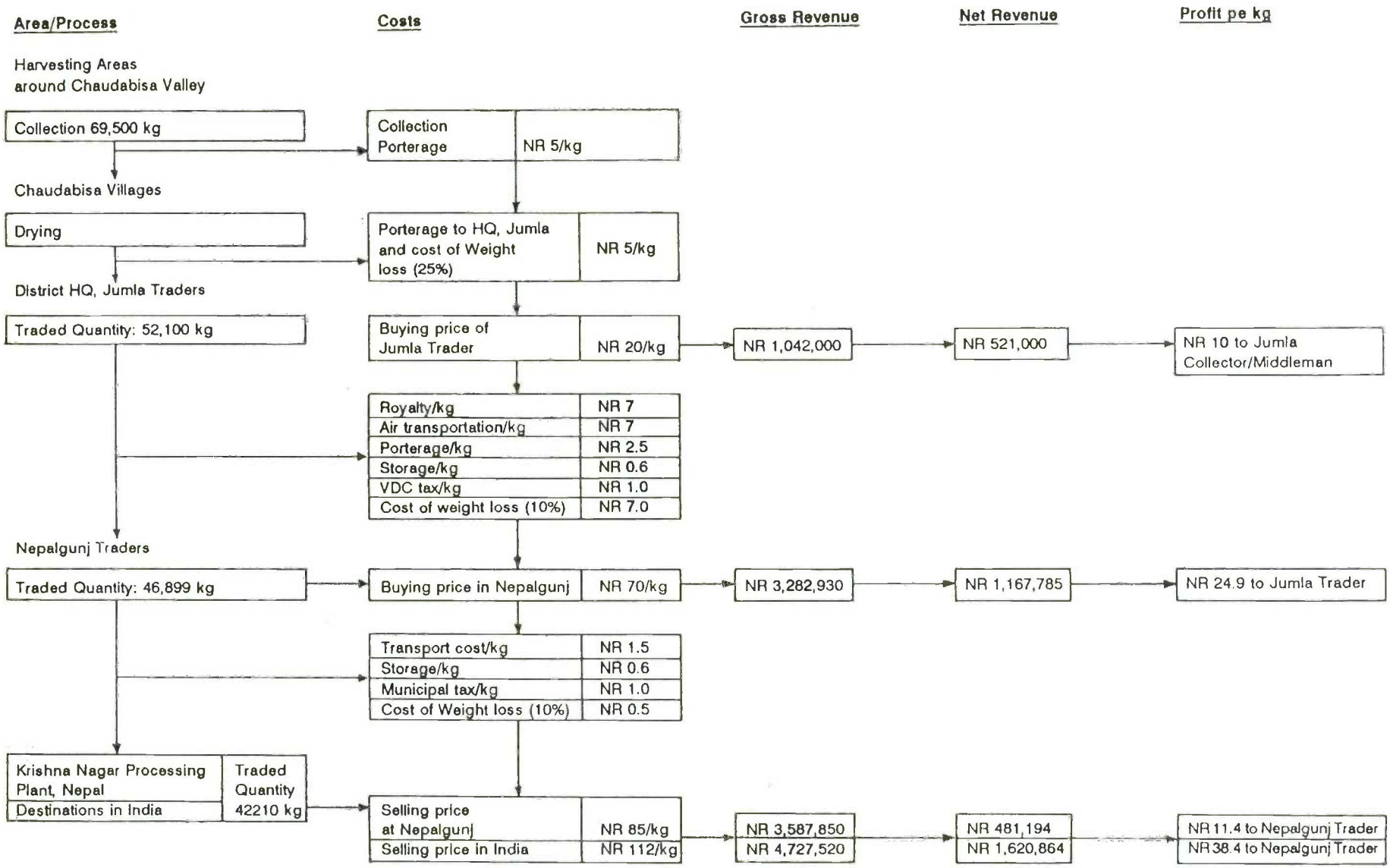
While *Jatamashi* is a resource of major comparative advantage and could be an important source for its development, the linkages currently are not all positive and in favour of the environment and economy of the Chaudabisa area. What remains unknown, however, is the resource situation, since data at that level does not exist. Also, the methods and timing of harvesting are not monitored and it could well be that the resources are currently over-exploited. Most of the *Jatamashi* is collected/harvested from the wild from government land on what is apparently a first-come, first-serve basis. There is no management structure tied to the harvesting of resources at the present.

COLLECTION AND TRADE OF CHIRAITA (*SWERTIA CHIRATA*) IN THE KOSHI HILLS, EAST NEPAL[3/]

The eastern hills of Nepal are the major source of *Chiraita*, a plant with fever reducing properties traditionally used in Ayurvedic medicine. The demand for *Chiraita* has remained high in recent years due to its alleged use in Indian alcoholic beverages. It is a biennial herb occurring at altitudes of 1,200-3,000 m, mostly on open ground. The trade volume of *Chiraita* from the Koshi hills is considerable. In 1991/92, about 140 mt of *Chiraita* is reported to have passed through Hile and Basantpur road heads in the Koshi hills. *Chiraita* is harvested mostly from government managed forests and are subjected to royalty payment. Royalty rates are not related to the abundance or market value and are not related to sustainable harvesting rates because the resource situation for the most part remains unknown.

3/ Based on Edwards (1993). The Marketing of Non-Timber Forest Products from the Himalaya: The Trade between East Nepal and India.

Chart 1: Jatamashi: From Source (Chaudabisa) to Market



Source: Karnali Institute (1994)

Chiraita is harvested in August-September. The collectors normally are linked in ritual (mit) relationships with the trader. Most often the village trader advances some amount to the collectors during festival time and settles the accounts at some later date when the *Chiraita* collection is delivered. The collectors, however, have a choice of selling the produce to the village trader or trader at the roadhead. For example, the local collectors in the Sherpa village of Gongtala have a choice of selling to the village trader (in which case the price may be US$ 0.96 per kg) or sell it to the road head trader at Hile (at a price of US$ 1.60 per kg, nearly 66 percent higher than at Gongtala) four days walk away.

The higher price the collectors may receive at Hile involve high labour or porterage costs, and no availability of credit, whereas selling to local traders will involve no porterage cost and credit would be available from the village trader. The timing of the sale is also extremely important in the case of *Chiraita*. For example, a speculative collector could wait till February and sell at a price of US$ 2.25 per kg. However, this would involve high labour costs, high risk and the need for storage.

In 1992/93, the *Chiraita* trade of 140 tons passing through Hile and Basantpur resulted in a turnover of US$ 280,000 (at a typical price of US$ 2/kg). The *Chiraita* producing catchment area has a population of 85,000 households. According to KMTNC (1991), *Chiraita* harvest accounts for US$ 3.30 per household or about 5 percent of the gross household income. Other studies reveal that the income distribution is not equitable.

On the basis of the Gongtala study, Edwards (1993) estimated that the total beneficiaries from the *Chiraita* trade in the Koshi hills may number about 6,900 households, or a population of little over 41,000 at a household size of 6. Table 1 shows the number of households of various categories of beneficiaries and the income distribution.

Table 1: Households and income distribution from Chiraita trade in the Koshi Hills, East Nepal

Beneficiaries	Number of house-holds	Gross Income (NR '000)[4/]	Percent of Total Gross Income	Gross Income per Household (NR)
Collector households	5,300	6,360	45	1,200
Porter households	1,000	1,200	9	1,200
Village trader households	100	3,000	21	30,000
Independent collector households	500	3,500	25	7,000
Total	6,900	14,060	100	

Source: Edwards (1993)

In terms of per household benefits, the village trader appears as the largest beneficiary. However, trading is a full time activity for much of the year. Also the independent collectors would receive a higher proportion of the income if they marketed the produce directly at roadhead.

CONCLUDING REMARKS

These two cases are not isolated examples. Exploratory studies show that in the eastern parts of the Annapurna region in central Nepal, 14 major *Jaributi* (mostly from forests) are regularly traded in sizeable quantities (DeCoursey, 1994). A total of 32 *Jaributi* are traded from the Sindhupalchok district adjoining Kathmandu (DeCoursey, 1993). In the Langtang National Park alone, 172 useful plant species have been recorded, of which 91 are used for medicinal purposes (Yonzon, 1993). The

[4/] Exchange rate is NR 50 to one US Dollar.

list in each case would be longer if all NWFPs were taken into account. However, the information base on high-value NWFPs is extremely poor, partly because much of the trade remains illegal. The situation must be similar in other countries/areas of the Hindu Kush-Himalaya region. What emerges from a cursory survey of extant information is that the total income turnover from medicinal plants alone is quite considerable and can be an important element in the strategy of mountain development in the HKH. There appear to be, however, a number of issues that need priority attention if NWFPs in general and medicinal plants in particular are to play a meaningful role in mountain development. Some of these issues are noted below.

Ecological database: Existing information is extremely scant regarding the status of the resource base, the probable impact of harvesting/collection practices, and area-specific sustainable harvesting. This database is extremely important for charting a strategy for the development of NWFPs and needs to be created through an appropriate research framework (Edwards *et al.*, 1993) on a priority basis.

Management of common property resources: Most NWFPs in general, and medicinal plants in particular, are harvested from common property resources in situations where access appears to be neither restricted nor regulated. Sustainable harvesting and management of these resources would not be possible without promoting participatory institutions that could oversee, monitor and enforce regulations and sustainably manage and benefit from these resources. Examples of such traditional institutions or others institutional innovations need therefore to be explored. Also, relevant community forestry and agroforestry experience need to be brought to bear on this issue. In many countries of the HKH there are regulations that prevent the legal harvesting of even minor forest products. These concerns also need to be addressed.

Marketing institutions: The village traders and the middlemen appear to be performing a useful role in the marketing of medicinal plants. However, the scope for cooperative arrangements to share the costs and benefits of direct marketing, to develop a system of regular and up to date market information, to ease access to credit and technology, and to promote specific *Jaributi* with comparative advantage in specific areas/regions, appears to be considerable. Such marketing cooperatives could also engage in basic processing and quality control of medicinal plants and other NWFPs. Low-volume, high-value products such as Morchella mushrooms or *Jatamashi* oil are reported to offer good scope for cooperative arrangements. An extremely important concern in this respect is the organisation and empowerment of local communities.

Increasing value added in collection/harvesting areas: The collection and transportation of medicinal plants alone is not going to yield many returns unless attempts are directed to increase value added through proper cleaning, sorting, packaging and through simple processes of distillation or extraction at the village level.

Mechanisms for ensuring better distribution of benefits to particularly disadvantaged households need also to be assessed. This would in particular require looking at processes that contribute to protect the access rights of the poor to these resources. Part of royalties derived from medicinal plants from specific areas could be used for local community development and conservation work, something that is being tried from the returns from tourism in protected or conservation areas in Nepal at the present. The royalty system also needs to be rationalized and tied to the resource situation.

Gender issues: While women are involved in the collection and basic processing of medicinal plants, much of it remains a male-dominated activity. However, there are some areas where the women's role could be more enhanced. This reportedly includes harvesting of particular species such as *Nagbeli* (*Lycopodium clavatum*) and cultivation of *Jatamashi*. The potential of specific NWFPs in contributing to women's income within households need to be particularly assessed.

Promotion of cultivation on private land: There are a number of NWFPs that show potentials for cultivation in private land. These need to be identified, their market potential assessed and promoted at the farmer's level. Cultivation can be encouraged and indeed may be essential for unmanaged and threatened high-altitude herbal species. Many scientists in Nepal believe that cultivation of medicinal and aromatic plants in particular is necessary to assure sustainable harvests. Aspects of extension as well as research and demonstration to promote commercial cultivation of potential medicinal plants therefore requires priority attention.

REFERENCES

Aryal, M. 1993. Diverted wealth: the trade in Himalayan herbs. In *Himal* Jan/Feb 1993.

Chalise, S.R. *et al.* 1993. Natural resources management in a mountain environment. In *Mountain environment and development: constraints and opportunities*. Kathmandu, ICIMOD.

DeCoursey, M.A. 1993. Report on the status of selected non-timber forest products in Sindhupalchok and Kabhre Palanchok Districts. Report submitted to Nepal Australia Forestry Project (unpublished).

DeCoursey, M.A. 1994. Healing forest and ailing economies: non-timber forest products in Nepal. *TRI News* Fall 1994:46-49.

Edwards, D.M. 1993. The marketing of non-timber forest products from the Himalayas: the trade between East Nepal and India. Rural Development Forestry Network Paper 15b. London, Overseas Development Institute.

Edwards, D.M. 1993. National framework for research into Jaributi. In *Focus on Jaributi*. FRSC Occasional Paper 2 (93). Kathmandu, FRSC, Ministry of Forests and Soil Conservation.

Forest Research and Survey Centre. 1993. *Focus on Jaributi*. FRSC Occasional Paper 2 (93). Kathmandu, FRSC, Ministry of Forests and Soil Conservation.

Groetzbach, E.F. 1988. High mountains as human habitats. In Allan, N.J.R., *et al.*, eds., *Human impact on mountains*. New Jersey, Rowman and Littlefield.

HMGN/ADB/FINNIDA, MPFS. 1988. Master plan for the forestry sector: forest based industries development plan. Part 2, Medicinal and aromatic plants and minor forest products development. Kathmandu, HMG/MOFSC.

Jodha, N.S. 1990. A framework for integrated mountain development. MFS Discussion Paper No. 1. Kathmandu, ICIMOD.

Jodha, N.S. 1991. Mountain perspective and sustainability: a framework for development strategies. In Jodha, N.S., *et al.*, eds., *Sustainable mountain agriculture perspective and issues*. Vol. 1,41-82. New Delhi, Oxford IBH.

Karnali Institute. 1994. A feasibility study on establishing a processing plant for medicinal herbs at Chaudabisa, Jumla. A report submitted to USAID. Kathmandu, USAID.

KMTNC. 1991. Environmental management and sustainable development in the Arun Basin, Vol. 5: *Sustainability and economic growth*. Kathmandu, King Mahendra Trust for Nature Conservation.

Malla, S.B. 1994. Medicinal herbs in the Bagmati Zone. ADPI Discussion Paper Series No. 8. Kathmandu, ICIMOD.

Sharma, P. 1993. Population and employment challenges in the mountains. In *Mountain environment and development: constraints and opportunities*. Kathmandu, ICIMOD.

Troll, C. 1972. *Geo-ecology of the high mountain regions of Eurasia*. Wiesbaden, Franz Steiner.

Whiteman, P.T.S. 1988. Mountain agronomy in Ethiopia, Nepal and Pakistan. In Allan, N.J.R., *et. al.* eds., *Human impact on mountains*. New Jersey, Rowman and Littlefield.

Yonzon, P. 1993. *Jaributi* exploitation from Langtang National Park. In *Focus on Jaributi*. FRSC Occasional Paper 2 (93). Kathmandu, FRSC, Ministry of Forests and Soil Conservation.

PROCESSING, REFINEMENT AND VALUE ADDITION OF NON-WOOD FOREST PRODUCTS

T. De Silva and C.K. Atal[1/]

INTRODUCTION

Non-wood forest products (NWFPs) have long been used for subsistence by communities living near forests. Indiscriminate felling of forests for timber has caused loss of biodiversity and many serious environmental problems, including damage to ecosystems, weather changes and soil erosion. The other valuable forest resources have been neglected.

Many people living in and near forests are unaware of the potential of that resource for income generation because they lack access to information on processing possibilities. Sustainable exploitation of these resources could improve their livelihood through supplemental income and employment. Tropical rain forests are particularly abundant with plants yielding essential oils, gums, medicines, tannins, and colorants.

More recently, NWFPs have received international attention as a result of:

- the growth of green consumerism in developed countries;
- more open international markets;
- increasing awareness of biodiversity conservation and sustainable and protective use of forest resources;
- realization, based on a growing number of reports, of the potential of multi-use forest management to generate rural income, and that in many cases NWFP yield more income over time than timber species from the same resource;
- growing recognition of the need to involve people living near forests for sustainable management of forest resources.

The United Nations Conference on Environment and Development (UNCED) in 1992 brought these factors into bold focus and from that emerged an agenda for implementation. The Agenda 21, Chapter 11 — Combatting deforestation, includes the promotion and development of NWFPs through value addition, domestic processing, and promotion of small-scale forest-based enterprises for rural income and employment. Many countries are now preparing plans for implementing Agenda 21, and NWFP programmes can be incorporated. Government commitment, the absence of which had previously posed a major constraint to NWFP development, appears serious.

Only a few developing countries have had the resources to carry out large-scale, commercial processing of NWFPs. Historically, most NWFPs have been exported to industrialized countries where they are processed as final products. However, with inexpensive equipment and small-scale operations, local processing of selected NWFPs can be environmentally and economically viable.

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This paper will focus on the processing potential of commercially important NWFPs, particularly for the following products:

- Essential oils and oleoresins;
- Medicinal products;
- Vegetable oils (small-scale production);
- Tannins;
- Dyes/colorants;
- Sweetening agents;
- Gums;
- Balsams;
- Waxes;
- Fibre boards.

Most of these can be produced on a large-scale, but only a few lend themselves to local, small-scale processing due to requirements for capital investment, trained personnel and infrastructure.

IMPEDIMENTS TO DEVELOPMENT OF NWFP INDUSTRIES

Research on NWFPs has generally not considered commercial products, but focused instead on new drugs, which require large sums of money, long periods of research, and sophisticated facilities. A major constraint has been the lack of information on the social and economic benefits to be derived from appropriate industrial utilization of NWFPs.

Another major constraint in the industrial development of NWFPs has been the lack of financial support and incentives to the entrepreneurs as a result of the low priority that governments and banks have placed on these forest industries.

Besides these institutional obstacles, industries involved in processing NWFPs face uncertain supply due to natural disasters, and wide fluctuations in market demand.

Yet in many cases these obstacles have been successfully overcome and industries based on essential oils, tannins and medicinal plants have thrived. In some countries like China and India, these industries are competitive with those of industrialized countries.

Other problems associated with industries based on NWFPs in developing countries are:

- Poor harvesting (indiscriminate) and post-harvest treatment practices;
- Lack of research on development of high yielding varieties, domestication etc.;
- Inefficient processing techniques leading to low yields and poor quality products;
- Poor quality control procedures;
- Lack of R&D on product and process development;
- Difficulties in marketing;
- Lack of local market for primary processed products;
- Lack of downstream processing facilities;
- Lack of trained personnel and equipment;
- Lack of facilities to fabricate equipment locally;
- Lack of access to latest technological and market information.

Small-scale processing by rural communities generally requires both access to centralized downstream factories and a regular market for the primary products. The link between secondary processing and consumer industries should also be strengthened in order to develop a healthy local chain of operations from farmer to consumer as a viable alternative to export.

REQUIREMENTS FOR NWFP INDUSTRIES

The main requirements for establishing a NWFP-processing industry are:

- financial resources;
- available raw materials;
- a ready market for the finished products.

Steps in the process include:

- Selection of NWFPs for processing based on facilities available and marketability;
- Fabrication or procurement of equipment, provision of required services (water, energy, chemicals etc.);
- Adaptation or development of agronomical practices, harvesting and post-harvest treatment;
- Training in processing methods and quality control;
- Actual processing, often with assistance either from experts, NGOs or international agencies;
- Packaging and storage of finished products;
- Marketing outlets (local or export). In some cases the primary processed product could be used as a raw material for downstream processing of fragrances, isolates, and flavours.

The viability of rural processing can also depend on local availability of water, energy, transport facilities, and skilled personnel.

Where running water is scarce, condensers used for producing essential oil could be air cooled.

Where electricity is not available, the only cheap source of energy may be fuelwood, in which case fuelwood should be promoted side by side with the steps toward rural production. In some instances the residue has been successfully used for compost-making where organic cultivation could be encouraged.

Because seasonal availability of raw materials often limits production, any programme for rural NWFP-based industries should carefully plan its product mix. The equipment should be versatile in use.

Initial processing activities can benefit from support by international organisations, and should proceed with market promotion and contacts. UNIDO's programme can support such development, provided other support also exists. Once established, local operations may then require only marginal assistance in terms of market information and new technologies.

PRODUCTS FOR EXPORT

For products intended for export, scale of production often poses the main problem. Export orders are usually large and required on a time schedule. The needed large-scale processing and storage facilities require large capital investments. In such cases central processing will be the choice. Energy requirements and pollution risk can be reduced by centralized processing.

The problem of scale can be overcome by organising rural producers into cooperatives, so that small-scale processing can be practicable, provided the availability of facilities such as fuel oils or

generators. For essential oils, mobile distillation units provide another way for a processing venture to cover wide areas where raw materials are available.

Manual equipment can be preferable for rural production of medicines in simple dosage forms. Small generators can supply all the electricity needs, or use of biogas can be promoted.

Products for export have to satisfy stringent criteria of quality. To reduce the risk of marketability, it can be advisable to select a product that is presently imported, to ensure a local market as well.

Figure 1 shows a scheme for establishing processing industries based on NWFPs. Proper coordination of the multidisciplinary activities is vital for the success of industries venturing into this field.

STAGES OF PROCESSING

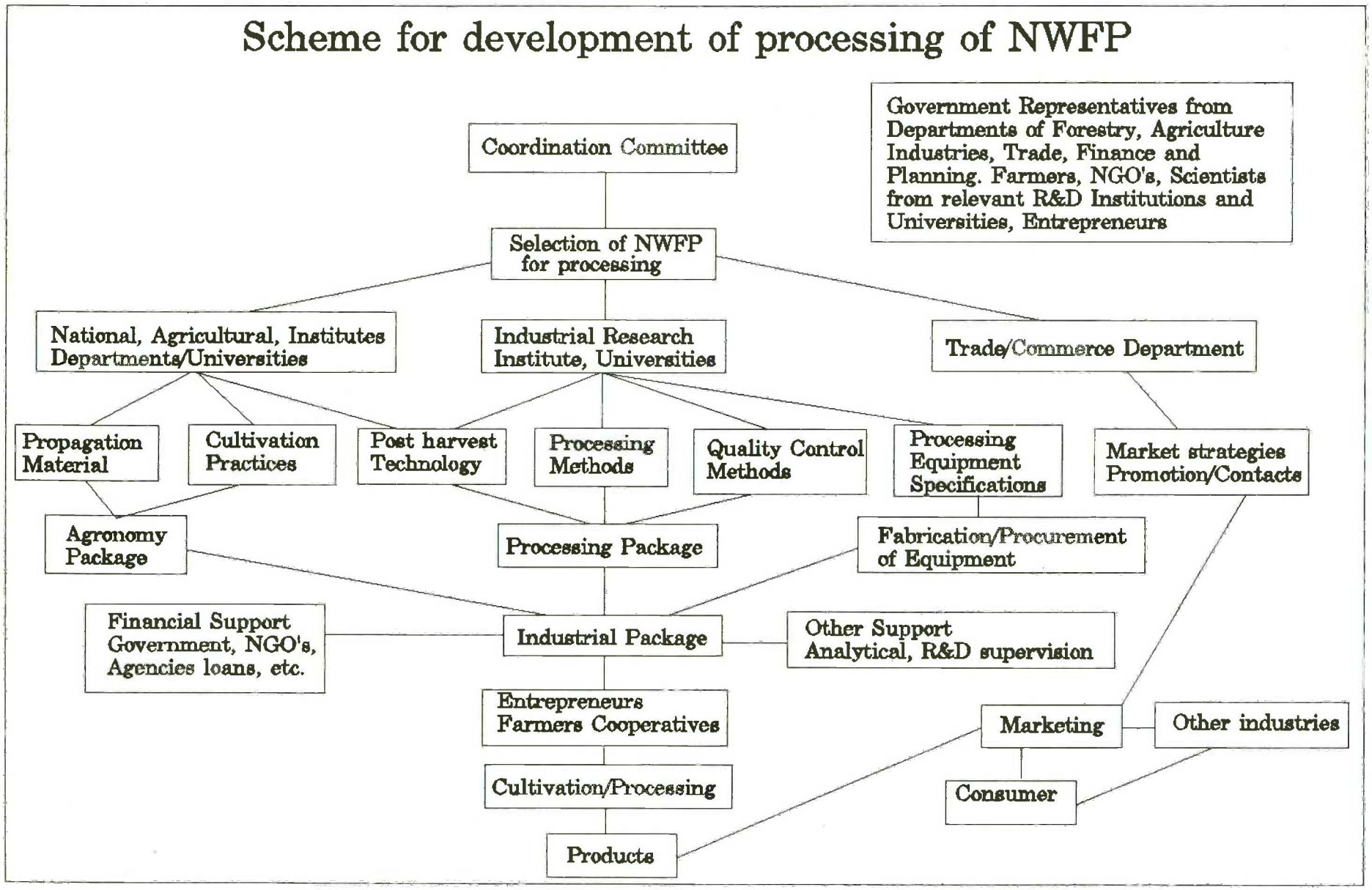
The following example of medicinal plants shows how progressively more sophisticated processing methods can be introduced in stages.

Stage I	1)	Harvesting of authentic material
	2)	Good post-harvest treatment
Stage II	3)	Stage I followed by comminution of raw materials
	4)	Packaging of powders as uniform doses
	5)	Formulation of pills from powder
	6)	Production of medicinal wines under controlled conditions which will need a sugar source
Stage III	7)	1, 2 and 3 followed by aqueous extraction
	8)	Preparation of standardised extracts (liquid and solid)
	9)	Formulation into dosage forms, capsules, sachets.
Stage IV	10)	Stage III followed by conversion into other dosage forms such as tablets, syrups, ointments
Stage V	11)	1, 2 and 3 followed by preparation of extracts with other solvents
	12)	Fractionation of extracts
	13)	Activity screening of extracts
	14)	Formulation into dosage forms
Stage VI	15)	Isolation of pure phytopharmaceuticals from 8, 11 or 12
	16)	Conversion into semi-synthetic drugs
	17)	Formulation of 15 and 16 into dosage forms including injections
Stage VII		New drug development

The first stage can take place in remote villages, with products transported to nearby towns for further processing. This requires no energy sources, sophisticated packaging material, or background technical education. Rural producers will need training only in harvesting methods, post-harvest treatments, and simple packaging.

The other stages will depend on the pace of local development. In most rural areas, Stage II is desirable. When all the needed facilities are available, this can to be upgraded to Stage III.

Figure 1


Scheme for development of processing of NWFP
Government Representatives from Departments of Forestry, Agriculture Industries, Trade, Finance and Planning. Farmers, NGO's, Scientists from relevant R&D Institutions and Universities, Entrepreneurs
Coordination Committee
Selection of NWFP for processing
National, Agricultural, Institutes Departments/Universities
Industrial Research Institute, Universities
Trade/Commerce Department
Propagation Material
Cultivation Practices
Post harvest Technology
Processing Methods
Quality Control Methods
Processing Equipment Specifications
Market strategies Promotion/Contacts
Agronomy Package
Processing Package
Fabrication/Procurement of Equipment
Financial Support Government, NGO's, Agencies loans, etc.
Industrial Package
Other Support Analytical, R&D supervision
Entrepreneurs Farmers Cooperatives
Marketing
Other industries
Cultivation/Processing
Consumer
Products

Stage VI is possible in developing countries that can afford to invest large sums of money or establish joint ventures with companies from industrialized countries. Apart from a few like India and China, most developing countries, have neither facilities nor money for the initiation of Stage VII.

Increasing sophistication in processing can follow the same pattern for production of essential oils, again depending on the facilities available. Primary processing in that case will require an energy source and a supply of water. Mobile distillation units can be introduced if roads exist for easy access.

HARVESTING AND POST-HARVEST TREATMENT

Indiscriminate harvesting of NWFPs can be minimized by creating a regular but limited demand with processing units that support a supply from sustainable harvesting. Assessments of the impact of harvesting NWFPs on biodiversity should proceed before launching into ventures that require a regular supply of NWFP materials.

Domestication of species offers another tool for ensuring steady and environmentally sustainable supply.

Raw materials which are to be kept after harvesting have to be dried and stored properly to prevent any deterioration and infestation. Therefore, harvesting and post-harvest treatments have to be linked with the processing schedule and can vary from crop to crop.

For example, the yields of essential oils obtained from aromatic plants will depend on the harvesting stage and post-harvest treatment. Following factors which can differ from raw materials to raw materials can influence the yield.

- Stage of harvesting (maturation, flowering stage);
- Time of harvesting (early morning, evening etc.);
- Rate of drying (avoid decomposition);
- Temperature of drying (avoid decomposition);
- Moisture content after drying (avoid molds growth);
- Storage conditions (prevent hydrolysis, oxidation, infestation);
- Storage time before processing (loss of oil).

The optimum conditions have thus to be determined for each plant material. For further consideration of this topic, see the satellite paper by Clay in this volume.

RAW MATERIAL SUPPLY

Any R&D programme on such products should plan the supply situation before launching consumer products with a high demand. Nursery approach on raw materials should be initiated in order to safeguard the natural flora.

The case of taxol extraction from the bark of the Pacific Yew illustrates this. In 1961, the National Cancer Institute (NCI) started a massive anticancer screening programme which identified taxol from the Pacific yew tree (*Taxus brevifoia*) as the most promising candidate for cancer treatment. By 1991, NCI had invested US$ 27 million in taxol research. Although the prospective dose of taxol was only 2 g/patient/year, obtaining just 25 kg taxol (enough for 12,500 patients) would require felling of 38,000 trees. It became apparent that the long-term demand for taxol would outstrip all available supply of bark. This led NCI to collaborate with another firm to develop genetic selection and clonal propagation techniques for extracting taxol. The resulting research led Weyerhauser, the commercial forestry firm, to cultivate 15 million yew plants, and to assure adequate clinical supply of taxol for years to come.

SELECTION OF MULTI-USE SPECIES

Afforestation programmes associated with local processing (e.g. through agroforestry) should consider species with multiple uses. This ensures a product mix, and can also provide farmers with various primary products for subsistence or sale.

Neem (*Azadirachta indica*) provides an example of such a species. Abundant in Asia, neem provides a range of products, including an insecticide that is highly competitive in price and quality with petroleum-based synthetic insecticides.

Soap production from neem oil is the most feasible industrial option. Neem seed cake left after extraction of the oil represents 80 percent by weight of the whole seed. Parts of neem tree are also used in the preparation of traditional medicines.

ORGANIC PRODUCTS

There is a growing demand in industrialized countries for natural products in place of synthetic compounds, not only as food and medicine but for other consumer products as well. Use of essential oils in aromatherapy is increasing, creating a demand for exotic oils. The oils produced from organically grown plants without the use of synthetics such as fertilizers, pesticides or other chemicals, trade at premium prices sometimes three to five times the price of conventional oils.

Production of so called "organic products" requires labour for weeding and the use of organic fertilizers. Hence developing countries which have cheap labour and unpolluted land can opt for organic cultivation. As the present demand is relatively low, small-scale production would be best. Rural based industries with simple steam distillation, using non-contaminating stills, would yield the organic oils. A buyer could monitor the whole cycle from planting to the finished product. There is a system whereby buyers grant certification for production of organic products after inspection.

With the trend for green products increasing, it is expected that some industrialized countries will insist on eco-labelling of products as a condition of import. This could mean that any NWFP has to have a certificate ensuring that no ecological damage has been caused by its production.

PROCESSING FACTORS IN VALUE ADDITION

Secondary processing activities for local "value addition" require considerable research and development. Local research capabilities may have to be strengthened for work on NWFPs, and incentives, often merely through greater awareness of potential impact for the country, to scientists to pursue such research.

In some cases, the obstacle is lack of conversion of applied research results to industry. In this case, facilities to develop process parameters and products at a pilot scale can help.

UNIDO has helped to bridge this gap by introducing a polyvalent pilot plant for processing medicinal and aromatic plants and spices. This plant has enabled researchers to produce final products for market-testing. This has strengthened university-industry links, and encouraged universities by demonstrating the potential of industrialization of their R&D work. Particularly for medicinal products that require years of clinical testing before marketing, institutions that want to initiate downstream processing of NWFPs should possess facilities for pilot scale production.

POLYVALENT PILOT PLANT

As mentioned above, the gap the laboratory to industry can be bridged by pilot-scale processing, which allows chemical engineers to translate bench-scale findings to industrial-scale outputs.

UNIDO's polyvalent pilot plant design (Figure 2) includes all engineering drawings, specifications, and bills of quantities, so that it can be fabricated in all countries with facilities for stainless-steel welding. The plant allows for simplicity of design, installation, operation, maintenance, and repair. Its features include:

- Modular construction, to permit increases in capacity and function by adding modules. One can add more unit operations or more sophisticated capabilities later.
- Independent operation of plant components.
- Capacity for aqueous or solvent extraction, continuous extraction, preparation of solid extracts, oleoresins, distillation of essential oils and if needed, fractionation of essential oils and production of absolutes and concretes, and even processing of other economic plant-derived products.
- Adaptability for developing indigenous technologies locally.
- Opportunity for training local personnel in the processing of medicinal plants, aromatic plants and spices. Other areas of training include plant operation, process control, quality assurance, trouble-shooting, maintenance, repair and management.
- Easy replacement of standardized and optimized process control and measuring units, pumps and other ancillaries.
- Simple and accessible plumbing and electrical wiring.

This plant has been introduced successfully in many situations.

QUALITY CRITERIA

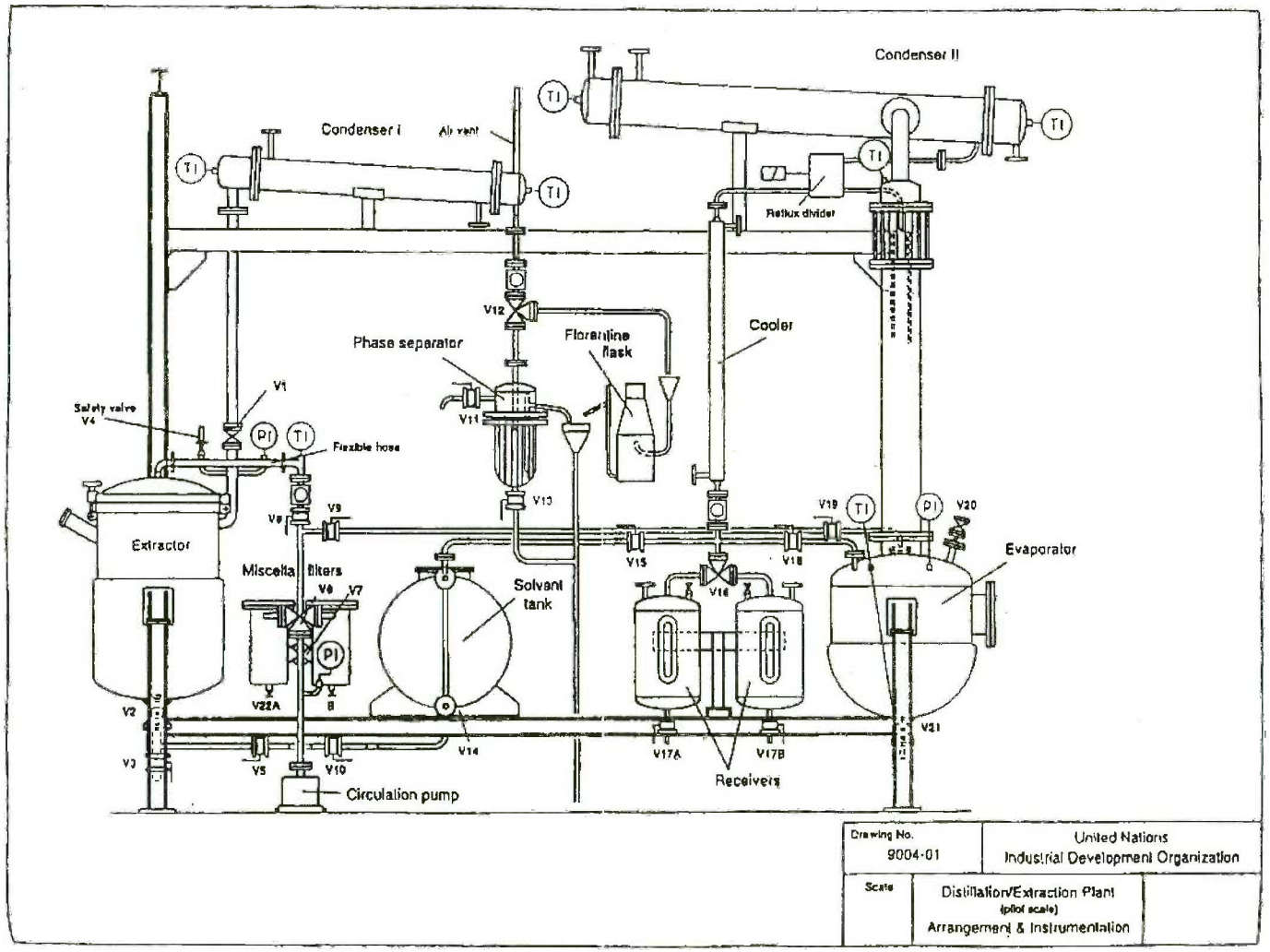
Processed products must comply with national and international specifications. There are International Standard Specifications for most processed NWFPs. In addition to these, importing countries and buyers may have their own requirements. Processing methods must account for these requirements. In most case, quality has to start with the use of good quality raw materials and post-harvest treatment that avoids contamination.

Quality requirements for medicinal plants are still more stringent in terms of toxic materials and active principles. Compound medicines demands much research in order to develop specifications by which a standardized uniform product is obtained.

Export products also involve legal requirements governing registration and packaging.

Stringent requirements are being introduced presently to safeguard the environment, to reduce pollution caused by use of synthetic chemicals and reduce health risks due to side effects of using synthetic materials. Increasingly, the machinery and processes used in industries require validation to comply with International Standards Organizations (ISO) norms, particularly ISO 9000 series. The products have to conform to ISO specifications and other pharmacopoeial or buyer specifications. Furthermore eco-audit procedures will be required for safeguarding environmental damage. Organic production will reduce the risks of contamination of products and the environment with synthetic chemicals.

Figure 2


Condenser II
Condenser I
Air vent
Reflux divider
Cooler
Phase separator
Florentine flask
Safety valve V4
Flexible hose
Extractor
Miscella filters
Solvant tank
Evaporator
Circulation pump
Receivers
Drawing No. 9004-01
United Nations Industrial Development Organization
Scale
Distillation/Extraction Plant (pilot scale) Arrangement & Instrumentation

Benefits are reported by leading companies who have got ISO 9000 certification. One chemical plant reports a US$ 2.4 million/year savings merely by reducing the production of non-conforming material, eliminating unnecessary tasks etc. A new specification ISO 14000 series is expected to add an environmental dimension to the quality standard. This will be equivalent to the European eco-audit and management scheme (EMAS) currently in effect in Europe. These requirements have to be taken into account when planning industrial production of NWFPs in developing countries as ISO regulations will have an impact on marketing of the products.

The awareness of quality criteria is increasing in the developing countries and new regulations governing safety of products, quality specifications and good manufacturing procedures are being enacted.

RANGE OF PROCESSED NWFPs AND THE RELATED TECHNIQUES

The following is a discussion of industrially processed NWFPs.

ESSENTIAL OILS

Figure 3 shows products that could be derived from aromatic plants and the related production processes. The cost of production varies depending on the raw materials, facilities for processing, and labour and energy costs. Their production on a large industrial scale requires significant variations in the technologies used. In case of rural small-scale processing these technologies have to be adapted to suit the existing situation at field level.

The international market for essential oils is dominated by a few countries. Some of these countries import oils from developing countries and export them after refinement or blending.The market is quite competitive and protected. Hence the developing countries have to develop strong market strategies for promotion of their products.

Steam distillation is the widely used technique in the extraction of essential oils. In this process, steam is passed through the plant material whereby the constituents that are volatile in steams are carried along with the steam. Steam can be generated in a separate boiler or at the bottom of the still by direct heating. The advantage is that the volatile components can be distilled at temperatures lower than the boiling points of their individual constituents, and that on condensing, the oils, being immiscible in water, forms a layer thereby easing separation. Though the process sounds simple in theory, the actual commercial process for greatest efficiency and quality varies widely, depending on the characteristics of the raw material and the final product.

Production of some expensive essential oils from flowers such as jasmine and rose takes place through a process called enfleurage. This is a technique by which the raw material is kept in contact with fat in order to get the fat saturated with the essential oil. The adsorbed oil is then extracted from the fat using ethanol. The ethanol is finally distilled off to yield the oil. This will contain all compounds that are adsorbed into the fat.

Some parts of plants that contain very minute amounts of essential oils such as flowers are extracted using low boiling solvents such as hexane, pentane or petroleum ether. These extracts will contain all material soluble in the solvent including the essential oil compounds. The process of separation of the essential oil needs an additional step of removal of the solvent in a separate evaporator (Figure 4). This is an expensive step due to the cost of solvents and the cost of production will depend on the efficiency of the recovery of the solvent for re-use. Hence this process has to be done at a central facility using good manufacturing practices. The scale of production will determine the economy of the process.

Figure 3

Processes Used and Products from Aromatic Plants

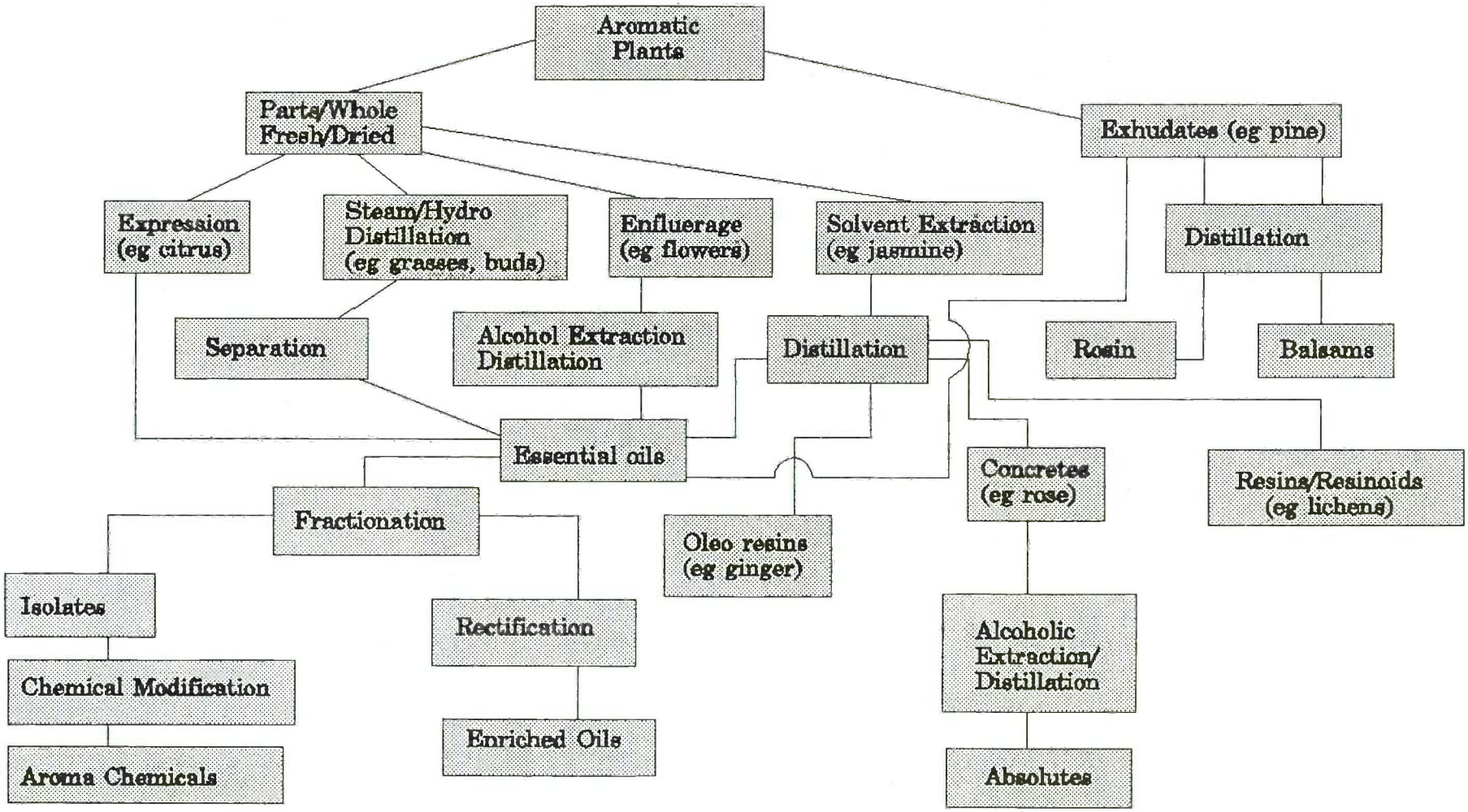
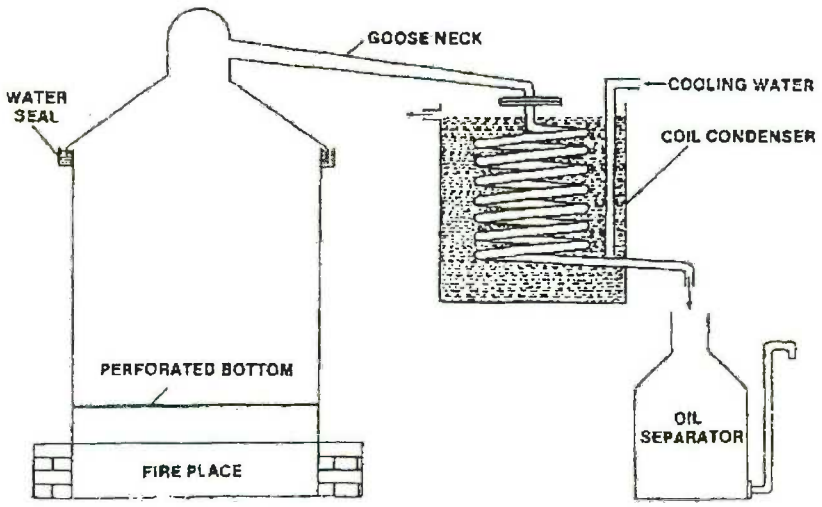


Figure 4: Field distillation still



ABSOLUTES

Certain finished perfumery products like colognes use the alcohol soluble fraction of concretes called *absolutes*. The concretes are mixed with alcohol and stirred vigorously to get all alcohol soluble compounds into solution. On cooling the mixture, alcohol insoluble compounds separate out at the bottom. The alcohol extract is filtered and the alcohol is evaporated in an evaporator to yield the absolute. In this case too a primary evaporator and a secondary evaporator are used.

OLEORESINS

The extraction of spices such as ginger, pepper, chili, cardamon using solvents and the removal of these solvents as in the case of concretes yields oleoresins, which contain not only the essential oil compounds but other flavour principles of the spice such as pungency, waxes and other solvent soluble extractives. Oleoresins therefore are more representative of the spice than the essential oil obtained from it. The extraction process could be a continuous soxhlet extraction process or solvent percolation through a series of extractors.

DOWNSTREAM PROCESSING OF ESSENTIAL OILS

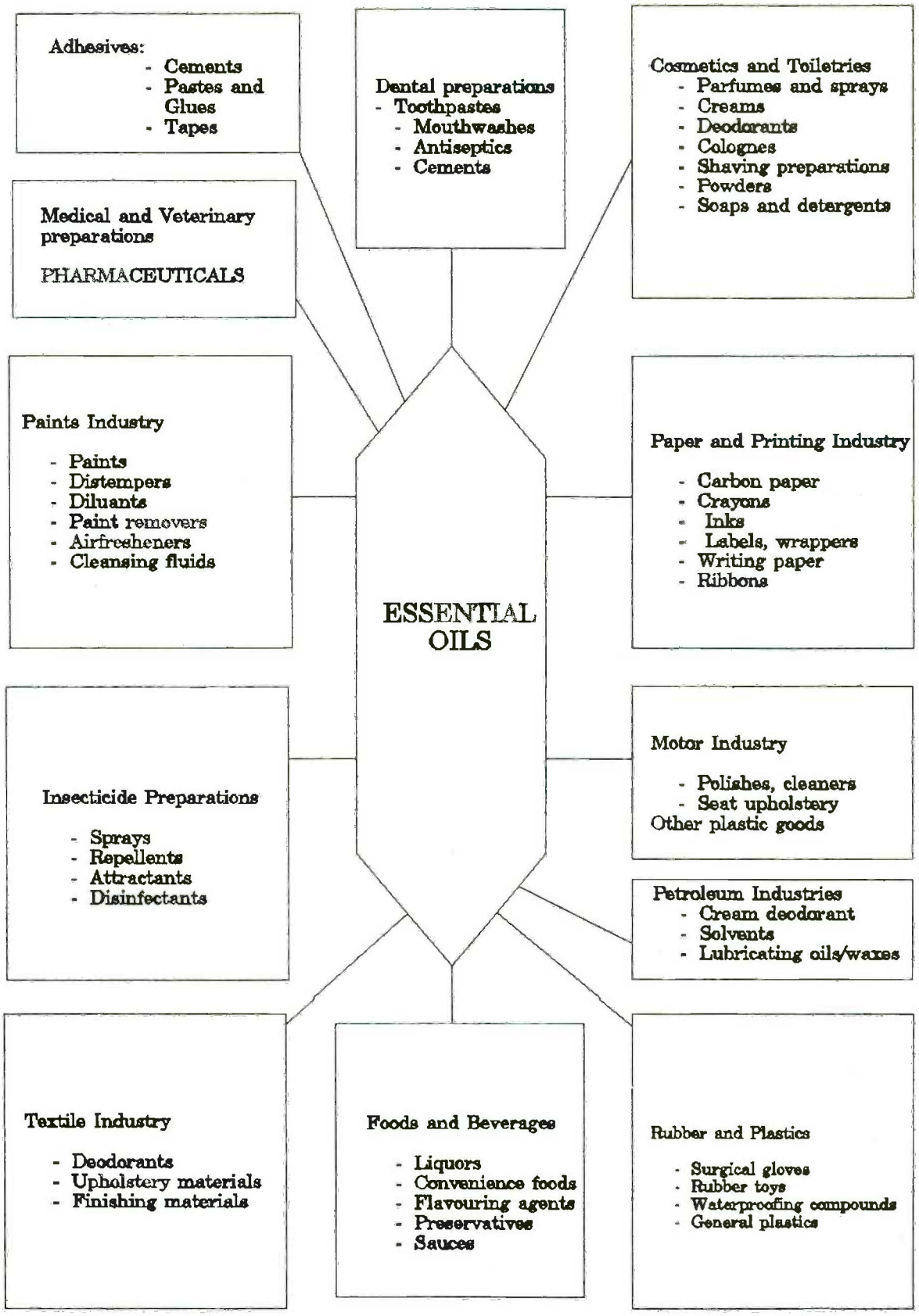
Essential oils could be further processed or rectified to add value. The main industrial uses of essential oils are indicated in Figure 5. Rectification of essential oils is sometimes needed depending on their end uses. The process of rectification may consist of one or more of the following:

- removal of moisture, colour and sediments;
- removal of compounds in order to improve the odour characteristics, stability and sustainability;
- isolation of compounds that are highly valued;
- enrich the oils by removing or adding other fractions.

This is done by a process of fractionation which could be carried out in some developed rural areas having small-scale processing with back up from national research institutions who would carry out the analysis and develop the fractionation parameters. This needs more training and equipment and many not be possible in certain rural communities or with forest dwellers. It would be better to carry out the fractionation of oils at a central facility which can afford to invest the funds and personnel required for this activity. As a result of fractionation pure isolates of added value such as citronellal and citral could be produced.

Figure 5

Some Industrial Uses of Essential Oils



These isolates could further be processed using chemical methods to produce high value aroma chemicals which have an export market. These aroma chemicals can be used in blending of perfumes and flavours for local industries.

Medicinal Plants Products

About 80 percent of the world population still depend on medicinal plants for their health care. Medicines prepared using traditional methods are still used by the practising healers in the developing countries. Hence there is a demand for these traditional medicines which are prepared using wildly growing plant species. Around 20 percent of the drugs in modern pharmacopoeias are also plant derived, either as pure phytopharmaceuticals extracted from plants or as synthetic derivatives of them. Although the raw materials for the production of phytopharmaceuticals have been produced by crop-wise cultivation of selected varieties of plants, most of those used for traditional medicines have been collected from the forests. In fact this had in certain instances lead to threats of extinction of some valuable species. Hence it is imperative that domestication and cultivation of medicinal plants have to be initiated. In order to encourage cultivation, guarantee of purchase of these plants has to be given. This could only be achieved by introducing small-scale processing units for the production of traditional medicines. These NWFPs in some cases could be sustainably harvested from forests for small-scale processing whilst systematic cultivation has to be introduced to meet the demands for medicines at the national level.

Figure 6 shows the industrial products that can be obtained from medicinal plants.

The medicines for internal use prepared in the traditional manner involve simple methods such as hot or cold water extraction, expression of juice after crushing, powdering of dried material, formulation of powder into pastes via such a vehicle as water, oil or honey, and even fermentation after adding a sugar source.

Downstream Processing of Medicinal Plants

Preparation of standard extracts and conversion of them into dosage forms are activities that can be done as a rural based small industry to meet the demands of the local population. This is necessary in areas where traditional medicines are the main form of treatment.

The value of medicinal plants as a source of foreign exchange for developing countries depends on the use of those plants as raw materials in the pharmaceutical industry. These raw materials are used to:

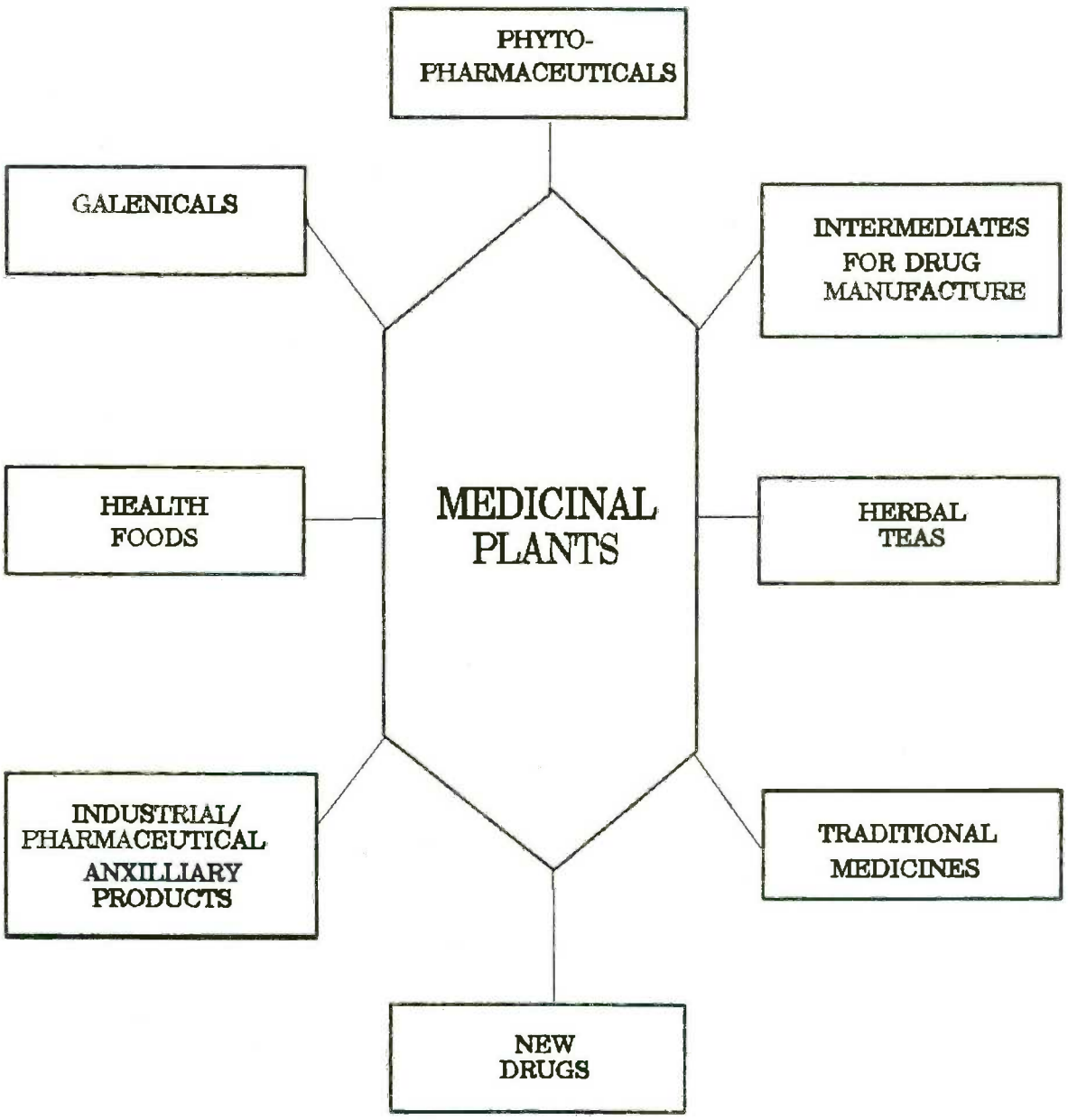
- Isolate pure active compounds (phytopharmaceuticals) for formulation into drugs;
- Isolate intermediates for the production of semi-synthetic drugs;
- Prepare standardised galenicals (extracts, powders, tinctures).

If one is to produce known pure phytopharmaceuticals used in modern medicine such as quinine, reserpine more processing stages and more sophisticated machinery are required. Furthermore safety and pollution aspects have to be considered. As these compounds occur in small quantities in the plant source, large amounts of raw materials have to be processed in order to benefit by economy of scale of production. Hence large-scale central processing is the only solution but costs have to be minimized to be competitive in the market.

Most of these processes and formulations are patent protected. Even transferring technology through contractual agreements and payment will not be of much help unless there is a large local demand for these drugs. Often the drugs so produced are more expensive than world market prices owing to the limitations of the economy of scale of production. Hence any country venturing into such activity should be able to use most of the production within the country.

Figure 6

Industrial Uses of Medicinal Plants



If the isolation of the pure compound is patent protected or involves complex and sophisticated procedures and equipment, some value of raw materials can be retained by producing concentrates of the plant in the countries of origin. But this will need prior agreements with the buyers as some pharmaceutical firms do not favour the purchase of extracts.

Certain plants are rich sources of intermediates used in the production of drugs. The primary processing of parts of plants containing the intermediates could be carried out in the country of origin thus retaining some value of the resource material. For example diosgenin (from *Dioscoria* sp.) and hecogenin (from sisal) used in the production of steroids can be commercially produced in the countries of origin where there are steady supplies of sufficient raw materials.

The processed product (galenicals) from the plant could be a standardised fluid/solid extract or a powder or a tincture. These have to be formulated for incorporation into modern dosage forms. New formulations require some development work, particularly on account of the nature of the processed products. Plant extracts are difficult to granulate; they are sensitive to moisture and prone to microbial contamination. Hence the types of excipients to be used and the processing parameters have to be determined. The downstream processing activities leading to different medicinal plant based products are indicated in Figure 7.

The potential of the know how available with traditional healers and the rural people with regard to the use of plants as curatives, has not yet been fully tapped. Many plants from traditional uses have been useful in the development of new modern drugs. Many have been models for subsequent new drug development. The R&D with respect to new drug development is very expensive and requires long periods of work. For developing countries, this activity seems to be a virtual impossibility due to financial constraints. Hence it is proposed that joint research programmes be organised with industrialized country scientists or firms with safeguards to guarantee sharing of profits in the event of a successful outcome of a new drug. Already such activities are taking place as in the case of Costa Rica. But it has to be emphasized that more safeguards and intellectual property issues have to be worked out for successful partnerships in this regard.

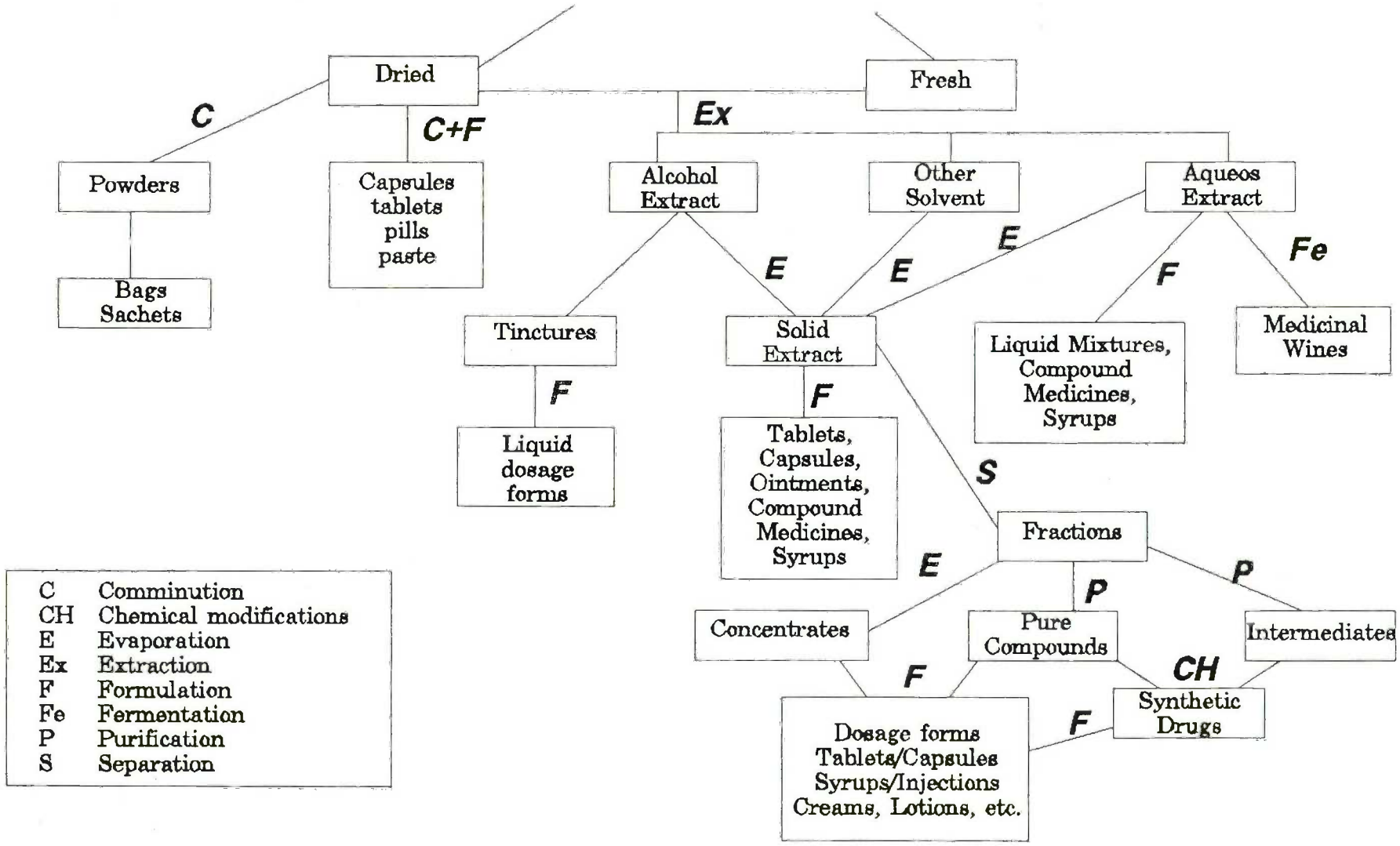
Several joint venture models are now in operations. The innovative agreement entered into between the National Biodiversity Institute (INBio) in Costa Rica and the pharmaceutical company, Merck, can be cited as a case study. INBio is a non-profit Costa Rican institution dedicated to the conservation of the rich biodiversity by facilitating non-destructive and economic uses by national and international enterprises.

INBio signed a two-year agreement with Merck to analyze and prospect a limited number of Costa Rican plants, insects and micro organisms for biologically active compounds. The agreement was aimed at enabling Costa Rica to obtain the funds and expenses needed to effectively protect her biodiversity. A payment of US$ 1 million was payable by Merck to INBio at the beginning of the project, 10 percent of which was earmarked for the Costa Rica's conservation programme.

Remaining funds were to be used to partially cover the cost of the biodiversity inventory that INBio is conducting as well as the costs of collecting, analyzing and preparing samples of extracts to be sent to Merck. INBio is to receive royalties in a fair share of profits from the commercialization of any product or information derived from the samples sent to Merck. In the pharmaceutical industry this can take up to 15 years and involves high intrinsic risks. Hence any pay offs from this agreement has to await the introduction of a new drug into the market. By integrating and building its human and material resources in collaboration with a highly capable and successful company, INBio hopes to find new products as well as sustainable uses for its forests and biodiversity.

Figure 7

Medicinal Plants Parts/Whole



Another area for R&D work which would result in success could be to work on biopesticides as there is a strong move to reduce the use of synthetic products. Already new plants have emerged as promising candidates apart from the already widely used pyrethrins. Neem tree extracts are now being studied and some new bioactive products have been isolated. This is a good NWFP for expansion as the world market for pesticides is very large. More plants have to be subjected to R&D, some leads could be obtained from traditional uses.

VEGETABLE OILS

Many forest trees possess fatty oil containing seeds which could be processed to give vegetable oils. Edible oils are used as cooking oils and in the food industry. Bulk of the oil is used in soap-making on both small and large scale. Some are used as components of other industrial products after secondary processing. Many of the oils are industrially produced on a commercial scale. But the process of production of fixed oils is simple and can be carried out at rural level. The equipment required is simple and can be fabricated in the country.

The primary processing of seeds to yield the oil is dry expression avoiding contamination and taking care not to subject to temperatures leading to decomposition. Sometimes boiling the crushed raw material in water will yield the solid fat on cooling. Training in harvesting the fruits at the optimum maturity and processing can be easily imparted. In fact the processing has been practised as a cottage industry in many countries for subsistence uses.

Secondary Processing of Vegetable Oils

Apart from cooking oil and domestic lighting, vegetable oils have also been used as a fuel in small diesel engines, enabling a certain degree of mechanization in rural areas.

Although the oils are primarily exported, they can be further processed to yield much more valuable products for a number of industries. For example, lauric oils yield C_{12}-C_{15} fatty alcohol derivatives, which are components of detergents. These alcohol derivatives, originally made exclusively from lauric oils, now come from petroleum synthetics. The growing demand for natural products could boost the demand for fatty alcohol derivatives from lauric oils. This will be a growing market to be exploited by the palm oil producing countries by downstream processing of their oils to produce these fatty alcohol derivatives. This multi-billion dollar lauric oil market is supplied by palm kernels mainly from coconuts (*Cocos nucifera* L. - 2,573,000 t of oil/yr) and the African oil palm (*Elaeis guineensis* Jacq. - 997,000 t/yr). Small amounts are also obtained from wild groves of the babassu palm (*Orbignya* sp.) in Brazil (150,000 t/yr) and a few other Central and South American palms such as *Acrocomia aculeata*, *Scheelea martina*, *Syagnu* species and *Astrocaryum* species.

TANNINS

Tannins are a group of non-crystallisable compounds widely distributed in plants, but usually localized in specific parts such as beans, nuts, fruits, barks, and stems. In addition to combining with animal skins to form a strong and flexible leather, tannins also react with salts of iron to form dark-blue or greenish-black compounds, the basis of common inks. Tanning materials are often utilized in oil drilling to reduce the viscosity of the drill without reducing the specific gravity and in the production of pharmaceuticals. The main industrial uses of tannins are leather, dyes, inks, antioxidants, lubricants, and drugs.

Tannins are extracted from many plant sources. The processing of the plant parts to obtain tannin extracts and tannin powder, though simple, needs carefully controlled conditions.

Dyes and Colorants

Colouring for food, textiles, paper and paints were originally obtained from plant and mineral resources. With the advent of synthetic dyes and pigments, the demand for natural dyes decreased so much so use of natural dyes was almost restricted to some food uses. Due to the toxic nature of synthetic dyes and pigments, particularly if used in quantities in excess of permissible limits, and the emerging demand for naturals, there is a resurgence of interest for natural dyes and pigments. Many of the forest resources are rich in dyes and pigments and hence could be sustainably harvested for commercial use. Industrial processing of the raw materials collected could be carried out at rural level if supplies of raw material are not very large.

Sweetening Agents

Many countries have sources of plant based sweeteners other than industrially produced sugar. These can be good substitutes in rural areas as people do not always have access to refined sugar. Some of the resources for getting the sweeteners are the sap of palm flowers, parts of plants such as leaves of stevia, arils of *Thaumatococcus daniellii* and bark sap of the maple tree. The final products are syrups, powders and solids. In addition bees honey obtained as a NWFP is used as a sweetening agent. The primary processing of these raw materials is simple and can be carried out at rural level. The training required can be imparted and the equipment needed fabricated locally. In many instances, fermentation has to be prevented and any toxic substances have to be removed as in the case of stevia where heavy metals is a problem. Processing as a small-scale industry can be cost effective and the product has a local market as well as a secondary use in confectioneries. The remaining liquor (molasses) could be fermented to yield alcoholic beverages and vinegar.

Gums

Gums are natural hydrocolloids mostly produced by plants as a protective after injury. They have diverse applications in pharmaceutical, cosmetic, food and textile industries. Though many synthetic products have replaced the uses of natural gums, their use continues for specific purposes. The move for green products is sure to give a boost to the production of natural gums.

As a food additive, a wide range of toxicological evaluation is needed to satisfy the international regulatory committees concerned with the safety of food and with specifications of their identity and purity. Gums of the identity and quality permitted for use in foodstuffs command high prices, but there is a large supply of gums from many other botanical sources which subsequently only command low prices for use in technological (i.e. non-food) applications. It is important for exporters and merchants in gum-producing countries, to monitor the decisions of the international regulatory committees as these greatly influence international gum trading.

Gums and resins are used in industries for paper, textiles, adhesive, pharmaceutical, food, and perfumery, as well as in paints, coatings, printing, detergents, and cosmetics. In addition gums from other plants are locally used and new uses for these gums are being investigated.

Balsams

Balsams are resinous mixtures containing large amounts of benzoic acid and cinnamic acids or esters of these acids. They are used in medicine other consumer industries. These are mainly pathogenic products obtained as exudates from trees.

Waxes

Natural waxes are NWFPs of commercial value used as components of industrial products like candles, varnishes, pharmaceuticals and cosmetics. Some of them are collected, melted and formed into cakes or pieces. Some waxes such as candellila can be obtained by solvent extraction. These too

can be processed at rural level for income generation. Even with severe competition from synthetic waxes, some specific properties of natural waxes have kept them in demand. The processing and refining of the wax oils are simple but important in order to produce good quality grades.

FIBRE BOARDS

Some parts of plants or residues after extraction of the main product could be used to produce other products such as fibre board boxes and hand made paper. Pine needles are one such source of lignocellulose which could be converted to fibre board for use as packing material.

It is estimated that on an average, the availability of needles of *Pinus roxburghii* per ha is between 2.5-3 t/ha. Even a portion of the needles (15-20 percent) if collected from easily approachable forests, will be sufficient to meet the requirement of number of small mills. It will help in preventing the forest fires without disturbing the ecology. The areas under *Pinus roxburghii* in the sub-Himalayan region is 1 million hectares. The needles could be collected (April-June) with rakes and baled at the site with mobile baling presses for transportation. The process for the production of fibre boards from pine needle used in the sub Himalayan region in India is simple and can be adapted by other countries.

The process does not require any binder. The process consists in giving a softening treatment in a rotary digester followed by defibration to get a suitable pulp, in a Hollander type beater. The pulp is blended with pulp made from waste paper, then converted into a sheet in a sheet-former of a single cylinder machine. The wet sheets (2 or 3) from cylinder machine are laminated and hot pressed to get a thicknesses of 3.2 mm. The boards are given a coating to make them water resistant. The yield of the fibre board is 55-60 percent based on the moisture free weight of the needles. The board is converted into packing boxes using wooden battens which are stapled with a machine specially designed for the purpose. A few perforations or slots are given to the board for fruit breathing. Fibre angles could also be used in place of wooden battens for converting the board into a box.

The main effluents of the plant are dissolved matter and small quantities of suspended lignocellulosic fines. These pass through the washing screen. The effluent from the mildly cooked pine needles contain the dissolved matter consisting of mainly colouring matter, resinous substances and some quantity of lignin. About 7-8 cubic meters of liquor will be obtained from each ton of digested needles. The pH of the liquor is around 6 and could be disposed in a close dry channel if available. If not available, some detention tanks may have to be provided, along with an arrangement to remove the suspended particles. The tanks could be emptied during rainy season when the liquor gets diluted with rain water.

This simple and appropriate technology may prove useful particularly in rural and hilly areas as well as in certain developing countries where pine needles and surplus agriculture residues are available.

MARKET STRATEGIES

Marketing problems often beset the industrial development of NWFPs in developing countries as it is a function of two groups, the rich buyers and the helpless producers. The prices are dictated by the buyers who control the market. Poor producers have been let down so many times that some have given up processing NWFPs in favour of other livelihoods. As a result, there could be the eventual disappearance of certain products from the markets. A case in point is the producers of Ylang Ylang oil in the Indian Ocean Region countries who are abandoning this product in favour of other crops because of the unreliability and the low prices of the market. Therefore the investment on and promotion of industrial processing of NWFPs has to carefully consider marketability and the use of these as products for import substitution. Alternatively, local utilization of NWFPs for downstream processing and development of new products could be encouraged.

Some regular suppliers of NWFPs to the world market are reducing their supply as a result of increased local utilization. These niches in markets should be identified and included in planning of products for industrial production. All attempts should be made to minimize production costs and improve the quality of the products in order to be in a better position to compete in the world markets. Trade promotional activities should be seriously undertaken by the Governments in order to advertise their specific products and to negotiate marketing agreements.

Although the green movement in industrialized countries is creating increased demand for natural NWFPs, "green" products still must comply standard specifications and legal requirements of the countries. Furthermore, price of production still has to be minimized in order to be competitive in the world market. The protective nature of the markets and price fluctuations both dictate the need for considered market strategies. It could be more advantageous to decide on the scale of production based on local and national demands and the possibilities for secondary processing or use in the manufacture of other consumer products such as soaps, cosmetics and pharmaceuticals.

RESEARCH AND DEVELOPMENT

Much research and development work is required to tap the full potential of NWFPs. Industries of essential oils, dyes, medicinal plant products established to date have been a result of R&D on naturally occurring plant species. Research has studied only a fraction of the flora. Research needs range from development of superior propagation materials, agrotechnology, to new products and marketing of finished products. Moreover once research leads are found, it also takes time and more development work before being accepted for use as drugs or as additives in other consumer products.

Because industrial research in developed countries focuses on synthetic substitutes as soon as a new useful natural product is discovered, it is vital for developing countries to safeguard the property rights of the original resource with international conventions, while at the same time developing higher-yielding and disease-resistant varieties through genetic improvement.

THREAT FROM SYNTHETIC SUBSTITUTES

Cheaper synthetic substitutes have always threatened markets for NWFPs. However, the long-term effects of synthetic drugs and the development of resistance by pathogenic parasites to synthetic drugs have weighted the scales on the side of natural NWFPs. More and more R&D is done through joint collaboration to study the medicinal and other uses of plants products. The resurgence of interest on naturals has resulted in more funds being allocated to this type of R&D required to reduce costs of production.

Any threat from synthetic products should be taken as a challenge for vigorous R&D work to improve the economic competitiveness of the product. In the essential oil industry, the survival of many essential oils and flavour industries is largely due to intensive research on breeding new and better oil yielding varieties, improvements on agrotechnology and post-harvest technology, by-product utilization, value added product development, new formulations resulting in improving their competitiveness vis a vis synthetic substitutes.

Pine oleoresin and its two main products, the rosin and turpentine oil, afford another excellent example of an industry that survived and co-exists with its petrochemical-based synthetic competitors, synthetic resins for surface coating industry and mineral turpentine as a solvent and thinner in paint industry. Through sustained research on chemical modification of natural resin and development of natural resin based derivatives like hydrogenated resins, disproportionated resins, alkyd resins and melamised resins, the natural resin retained a place of its own in the surface coating industry. Similarly, research and development on natural turpentine, elevated it from the position of a cheap solvent and thinner to a valuable chemical feedstock for the manufacture of perfumery chemicals and a wide range of pesticides.

FUTURE PROSPECTS FOR PROCESSING OF NWFPs

New drugs represent a potentially valuable source of NWFP income. New product development is focused on the substitutes for synthetics that are going out of favour and new curatives for chronic diseases such as arthritis, rheumatism, asthma, allergies.

As mentioned above, agreements between the country of origin of plant resources and the R&D institutions in developed countries should guarantee that a portion of profits from newly developed drugs revert to the source country. A more important role has to be played by the scientists in developing countries in participating in joint research programmes leading to the discovery of new drugs. Though this appears to be a long shot financial benefits accruing from such work could be substantial.

New markets should be identified for expanded production, for example in the area of green products. Production of stable, low volume, high value products which can be stored for long periods pending market fluctuations will be advantageous.

Regulations governing the registration and import of processed NWFPs to Europe and USA are being reviewed and a somewhat relaxed set of regulations is expected. This could open up markets for useful and safe NWFPs from developing countries. The proposed European monographs on herbal medicines and raw materials now being developed by the European Scientific Cooperative for Phytotherapy (ESCOP) would make it easier for developing countries to process the NWFPs to comply with these specifications.

Another area that is opening up is that of "Alternative Medicine". Many societies have been formed to promote this sector and simplified registration procedures are expected. Oral and external use medicines can be sold without claims or indications. This level of registration will need proof of only their safety and quality control of production and not evidence of efficacy. This opening can be exploited by the already established herbal medicines used in systems like Ayurveda and Chinese medicines.

An increase in the number of herbal products in pharmacies of developed countries is a testimony to a growing demand for these products. Studies have shown that the cost factor has little or no effect on the sales and that the trend for herbal medicines in Europe is increasing. As a result opportunities for collaboration with developed countries are increasing and joint venture projects for R&D are expected to increase.

It has to be emphasized that the future of these products will also depend on advertising and packaging, in addition to conformation to specifications. In consumer-oriented societies, attractive and safe packaging is as important as the quality of the product.

RECOMMENDATIONS

The recognition and the will of governments to implement multiple use forestry programmes are essential for the development of sustainable utilization of NWFPs. The forest management policies and plans should consider timber and NWFPs as complementary in the use of forests for economic gain, while conserving the forests and their biodiversity.

Decisions on the scale of exploitation of NWFPs from wild sources have to be based on accurate inventories of plant resources, and the feasibility of sustainable harvesting. Planting programmes should consider medicinal and aromatic plants as a priority for industry development, as niche markets for these products already exist.

Information on the Resource Base

A thorough understanding of the resource base is absolutely necessary before a country can plan development of industries based on NWFPs. Hence it is necessary to:

- identify all the important NWFP resources which are used or required by local communities or needed by trade and industry within the country or for export. This exercise should be conducted with participation of local user collectors and representatives of trade and industry.

- compile all information on NWFPs according to their use and prioritise items which provide substantial social benefits and/or large volume internal or export trade as raw material for industry, including information on use and value of exported species.

Policy Issues

In addition to other policies that demonstrate a commitment to NWFP resources as a means of employment generation, governments should enact the following processing-related policies:

- Facilitate free market economic policies by removing bureaucratic controls and other restrictions.

- Reform regulatory and legislative controls on processed NWFPs such as medicinal products manufactured according to indigenous pharmacopoeias in a manner conducive to the development of industry.

- Include essential oil and other NWFP production into afforestation and reforestation projects and other agroforestry programmes.

Research and Development

The necessary inputs in terms of infrastructure and facilities should be provided to encourage R&D necessary for the development of the industrial processing of NWFPs. The following activities should receive the urgent attention of governments and other donor agencies:

- R&D on process and product development. Appropriate technology adaptable at forest or rural locations.

- Development of downstream processing to produce value added products.

- Strengthening of R&D institutes including provision of pilot plant processing facilities for testing viability and for training personnel.

- Setting up facilities for design and fabrication of process equipment for appropriate technology as well as pilot plants for scale up operations.

- Develop indigenous scientific and technological capabilities in industrial utilization of NWFPs by training overseas.

Marketing

As mentioned earlier, marketability will be a crucial factor in determining the failure or success of industries. For local markets, user industries should be promoted so that locally produced NWFPs can be used to save foreign exchange needed for importation of such additives. Further processing to yield value added products will be limited by the local demand situation unless they

could be produced at prices to be competitive in the world market. Even if the cost of production is low and quality of the products are good, it will be difficult to enter the protected world market.

In terms of improving market outlets, the following activities are recommended:

- conduct feasibility studies for new ventures in terms of investments, marketability, sustainability, and economic viability, and potential for joint ventures.
- increase entrepreneurs' awareness about the potential of NWFP industrial processing through workshops, symposia and exhibitions.
- promote trade through visits to brokers/buyers and participation in trade fairs, etc.

Financial and Infrastructural Support

Establishment of small-scale industries based on NWFPs in rural areas needs financial resources and other infrastructural support. Plans for such projects should include funding from governments and other aid organisations and international development agencies. Funds earmarked for such development projects should be disbursed under proper supervision to make sure that maximum benefits are obtained. The involvement of farmers, government officials, NGOs and other agencies on a day to day basis will ensure the proper implementation of such projects.

Private entrepreneurs can be attracted to invest in rural industries by improving the accessibility to the sites of NWFPs, and by providing easy access to credit and tax incentives. Extra funds should be allocated for appropriate institutional development and R&D needs of agroforestry and appropriate process technology to assist speedier realization of potential benefits achievable by the NWFP utilization. The papers by Sène, Arnold, and Pswarayi-Riddihough and Jones discuss in more detail the financial resources and other infrastructural support needed for NWFP ventures.

It is hoped that governments will give serious consideration to the above and provide legislative, financial, administrative and other support to enhance transfer of technology, human resource development, and establishment of industries based on NWFPs.

Governments should join forces with international organisations and donor agencies to provide technical assistance and support for the management, conservation and development of forests.

REFERENCES

Anand, Nitya. 1993. Factors having a bearing on the industrial utilization of medicinal plants for the production of plant based medicines. Report. Geneva, UNIDO.

Anon. 1954. *Natural plant hydrocolloids*. Advances in Chemistry Series 11, American Chem. Soc.

Anon. 1986. Status report on prominent tree-borne oilseeds. Jammu, India, Regional Research Lab.

Anon. 1993. Proceedings of the workshop on non-timber forest resources. *Economic Botany* 47:215-290.

Atal, C.K. and Kapoor, B.M. 1982. *Cultivation and utilization of medicinal plants*, Part I. Jammu, India, Regional Research Laboratory.

Atal, C.K. and Kapoor, B.M. 1982. *Cultivation and utilization of aromatic plants*, Part II. Jammu, India, Regional Research Laboratory.

Balick, M.J. 1979. Amazonian oil palms of promise: a survey. *Economic Botany* 33:142-128.

Bennet, S.R. *et al.* 1991. *Food from forests.* Dehra Dun, India, Indian Council of Forestry Research and Education.

Bielenber, C. 1993. Feasibility of jatropha oil as a substitute for diesel fuel in Male. Washington, DC, Appropriate Technology International.

Bringi, V.N.V. 1988. Progress in chemistry and technology of non-traditional oil seeds. *J. Oil Technologists Assoc. of India* (April-June):41.

Chaudhry, D.C. 1993. Agarwood from *Aquilaria malaccenis. Minor forest products news* 3(4). Dehra Dun, India.

Chawla, J.S. 1987. Utilization of forest and agro-industrial residues. *Holzforschung and Holzverwerchung* 39:121-125.

De Silva, K.T.D. 1982. Development of drugs from plants. *Proc. Sri Lanka Ass. Advmt. Sci.* 38:55-71.

De Silva, K.T.D. 1993. UNIDO development programmes on industrial utilization of medicinal and aromatic plants. *Acta Horticulturae* 333:47-54.

Duke, J.A. 1981. *Handbook of the legumes of world economic importance.* New York, Plenum Press.

Dwivedi, A.P. 1993. *Forests: the non-wood resources.* Dehra Dun, India, International Book Distributors.

EEC. *Market for herbal medicines 1990.* UK, McAlpine, Thorpe and Warrier, Ltd.

FAO. 1989. *Small-scale harvesting operations of wood and non-wood forest products involving rural people.* FAO Forestry Paper 87. Rome, FAO.

FAO. 1994. *Non-wood News* 1.

George, Watt. 1966. *The commercial products of India.* New Delhi, Today and Tomorrow Printers (Reprint).

Godin, V.J. and Spensley, P.C. 1971. *Oils and oils seeds.* Tropical Products Institute, U.K.

Grainge, M. and Ahmed, S. 1986. Potential of neem tree for pest control and rural development. *Economic Botany* 40: 2201-2209.

Gupta, T. and Guleria, A. 1982. (Reprint 1992) *Non-wood forest products in India.* New Delhi, Oxford and IBH Publishing Co. Pvt. Ltd.

Hill, Albert F. 1951. *Economic botany.* New York, McGraw Hill Book Co., Ltd.

Humphrey, F.R. 1964. Occurrence and industrial production of rutin in S.E. Australia. *Economic Botany* 18(3):1964.

International Atomic Energy Agency. 1982. *Improvement of oil seed and industrial crops by induced mutations.* Vienna, IAEA.

ICFRE. *Chir pine: a monograph.* Dehra Dun, India, Indian Council for Forestry Research and Education.

Ikram, Hussain. 1978. *Compendium of medicinal plants.* Karachi, Pakistan Council of Scientific and Industrial Research.

Imle, E.P. 1978. Hevea rubber, past and future. *Economic botany* Vol. 42. New York, New York Botanical Garden.

Jain, P.P. *et al.* 1988. Chemical studies on oilseeds of forest origin, *The Indian Forester* 114.

Kerr, K. 1991. Economic potential of handicraft enterprises in rural development: focus on Indonesia. *Unasylva* 165, Vol. 42.

Knowles, P.F. 1967. Processing seeds for oils in towns and villages of Turkey, India and Egypt. Paper presented at 7th annual meeting of Soc. for Economic Botany, April 1966.

Lawrence, Ray V. 1972. Rosin and its derivatives. Sympine Symposium. New Delhi, India.

Laxmikantan, V. 1982. Chemistry and industry of tree borne oilseeds in service to citizens. *Proc. National Seminar on Chemistry, Industry and Citizen*. Dehra Dun, India, ICFRE.

McLaughlin, S.P. 1983. Biocrude production in arid lands. *Economic Botany* 37:150-158.

Mantell, C.L. 1949. The water soluble gums: their botany, sources and utilization. *Economic Botany* 3.

Martin, G. 1921. *Perfumes, essential oils and fruit essences*. Ludgate Hill UK, Technical Press, Ltd.

Martin Leake, H. 1975. A historical memoir of indigo industry in Bihar. *Economic Botany* 29:36.

May, P.H. 1991. Building institutions and markets for NWFPs from Brazilian Amazon. *Unasylva* 165, Vol. 42, pp.9.

Mugedo, J.Z. and Waterman, P.G. 1992. Sources of tannins. *Economic Botany* 46:55-63.

National Academy of Science. 1975. *Herbal pharmacology in Peoples Republic of China*. Washington, DC, NAS.

Negi, J.S., Prabhakar, D.B., and Chawla, J.S. 1984. Whole tree utilization: pine twigs for fibre boards. *Holzforschung and Holz verwerschung* 36:77-80.

Okafor, J.C. 1991. Improving edible species of forest products *Unasylva* 165, Vol. 42, pp. 17.

Ollson, G. 1991. Socio-economic importance of NTFP. *Unasylva* 165, Vol. 42, pp. 24

Princes, L.H. 1983. A new oilseed crop. *Economic Botany* 37:478-492.

Rembert, D.J. 1979. The indigo of commerce in colonial North America. *Economic Botany* 33:128.

Sharma, O.P. 1984. *Chemistry and technology of catechu and kutch*. Dehra Dun, India, International Book Distributor.

Shiva, M.P. *et al.* 1988. Role of eucalyptus in agroforestry and essential oil production potential. *Indian Forester* 114 (11).

Singh, B. 1988. Effect of removal of pine needles from the forest floor. *Indian Forester* 114: 761-769.

Soni, P.L. 1991. Carbohydrates. Dehra Dun, Surya Publications.

Sukh, Dev. 1978. Rural development: outline of an approach. *J. Sci. and Industrial Research* 37:391.

Tangley, Laura. 1993. *Marketing biodiversity products: the Tagua Initiative*. Washington, DC, Conservation International.

Tcheknavorian, Asenbauer and Wijesekera, R.O.B. 1982. Medicinal and aromatic plants for industrial development. UNIDO report, IO.505 3, June 1982. Geneva, UNIDO.

Tewari, D.N. 1994. *Tropical forest produce*. Dehra Dun, International Book Distributors.

Tewari, D.N. 1993. Non-timber forest produce in poverty alleviation. *The Indian Forester* 199:959-964.

Trease, G.E., and Evans, W.C. 1983. *Pharmacognosy*. U.K., Bailliere Tandall.

UNIDO. 1981. Report of the Workshop on Essential Oil Industry, Lucknow, India.

UNIDO. 1991a. Report of Second UNIDO Workshop on Essential Oil Industry, Manila, Philippines.

UNIDO. 1991b. Design options for a polyvalent pilot plant for the distillation and extraction of medicinal and aromatic plants

UNIDO. 1994. Development programmes on the industrial utilisation of medicinal and aromatic plants. Report. Geneva, UNIDO.

Wickens, G.E. 1991. Management issues for development of non-timber forest products. *Unasylva* 165, Vol. 42, pp.3.

Wijesekera, R.O.B. 1992. *Practical manual on the essential oils industry*. Geneva, UNIDO.

TRADE AND MARKETING OF NON-WOOD FOREST PRODUCTS

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INTRODUCTION

With recognition of rapidly dwindling forest resources (especially in tropical regions) and concern over sustainable development emerging as an UNCED follow-up, sustainable forestry has come to the forefront of the debate on environmental forestry development.

Sustainable forestry consists of conservation, sustainable forest management and sustainable utilization of forest resources. Compared to the conservation and resource management, sustainable utilization appears to be frequently overlooked in the forestry sector, although it is the element which is creating value for the resource and thus making resource conservation and management feasible and attractive. It is an important means not only in creating value but also in distributing it among those involved in forestry operations. The value from the forest resource is derived through harvesting, processing and marketing of products based on wood, non-wood materials and services provided by the forests.

In aiming at sustainable forest utilization, contributions of a multitude of forest products and services have to be simultaneously recognized. The range of non-wood forest products (NWFPs) is currently receiving increasing attention. It is important to recognize that not all NWFPs, despite their name, originate from pure forests. They can also be produced on farm and grazing lands.

In sustainable forest utilization, marketing provides a means for maximizing the values and distributing them among the participants in forestry activities. It is closely linked to processing which converts the resource into marketable products. In this paper marketing is discussed with specific reference to NWFPs, without forgetting the other elements which are equally vital for sustainable utilization.

After defining the term "marketing", this paper will place the marketing of NWFPs into perspective by highlighting some examples of the importance of selected products, markets and the related trade flows. This paper does not try to quantify these markets nor indicate the predominant trade flows in general. Discussion of the marketing environment and trade policies is beyond the scope of this paper.

The paper will then review the basic components of NWFPs, their producers, markets and competitors from the marketing point of view. It will describe some of the typical features of NWFP marketing practices.

The next three sections will discuss the importance of marketing information, needs for marketing capabilities and institutional and infrastructural support to marketing.

Conclusions drawn from major issues emerging from the discussion will then form the basis for making recommendations for strengthening and developing NWFP marketing to better contribute to sustainable utilization of forest resources.

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MARKETING DEFINED FOR THIS PAPER

In the socio-economic context of forestry, marketing is one of the means, in combination with processing and resource management, to cater for the needs of people involved. Marketing provides a set of tools with which people can create more efficiently economic value for the resource and products made of it. Proper marketing also assists in a more equal distribution of the economic value created among the participants. Marketing is therefore vital not only to medium and large-scale industrial enterprises but also in helping small farming and forestry communities move from a subsistence economy to one in which they can start and sustain profitable enterprises on their own.

For clarity this paper will use the following definition of marketing:

> *Marketing is basically a technology which is at the disposal of producers to identify market opportunities in the form of market needs and wants, analyze competition, develop appropriate approaches to reach the markets and to make profit. It uses a mixture of basic factors comprising product, channels of distribution, promotion and price by which it satisfies the needs and wants of the customers in the markets. Marketing operates in an environment which is created by economic, social, cultural, technological, political, regulatory, legal, institutional and infrastructural factors, all of which are beyond the control of the individual operators doing marketing.*

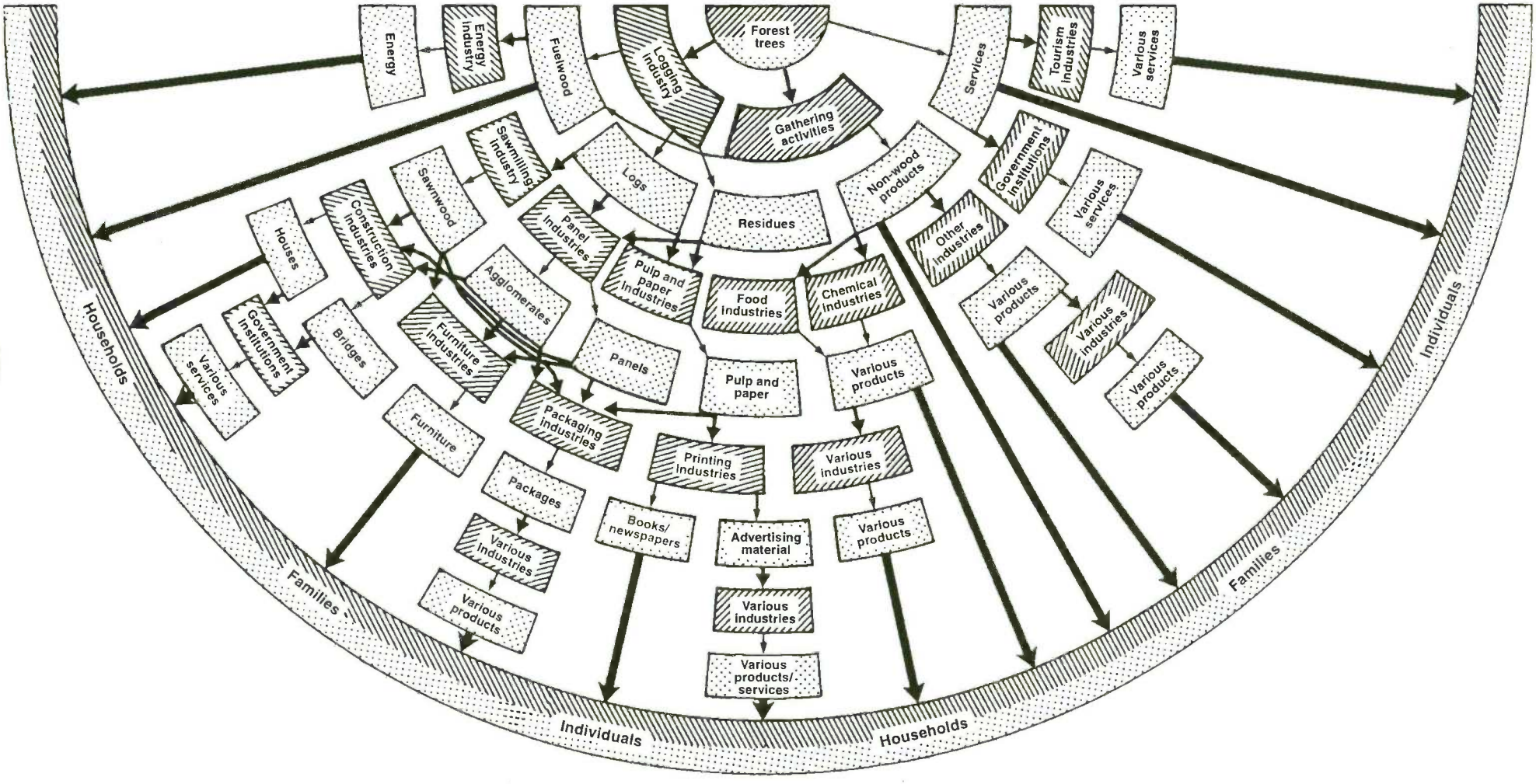
Discussing marketing in the context of NWFPs means discussing marketing in all its possible variations. NWFPs comprise such a varied group of products that meet the needs and wants of all kinds of end-users. Some of the products find markets with final consumers without any major processing (e.g. fruits, berries, mushrooms, etc.), others have markets with industrial customers which use them as raw materials in making either other industrial products (e.g. converting essential oils or gums to fragrances and flavours) or consumer products (e.g. rattan furniture). This paper tries to limit the discussion mainly to the marketing of consumer products from the forest to the final consumers and to that of raw materials to the processing industries. However, in view of the increasing interest in value-added products the marketing of further processed goods either to final consumers or to further processing industries cannot be entirely ignored.

In discussing NWFP marketing one has to be careful in defining the context in which the discussion takes place. Does it concern marketing of products gathered from the forest to the first processing stage, or marketing of primary processed products to the secondary processing stage, or marketing of secondary processed products to further processing stages or final consumers? These are basic questions which have to be asked in order to identify the kind of marketing approach. Figure 1 tries to illustrate the basic cycles of "processing-product-marketing" chain which follow each other in taking the forest products from forest to final consumer. The discussion in this paper will concentrate on the first two levels of the "processing-product-marketing" cycles, i.e. from forest to primary processing/consumers and from primary processing to secondary processing/consumers.

NON-WOOD FOREST PRODUCTS TRADE

Information on NWFP resources, harvests, processing and trade is scarce and dispersed. For some internationally traded products the information is more readily available than for others of more local importance. Some specific case studies provide information on trade for some products. Furthermore many NWFPs can be and are produced as purely agricultural activities and statistics make no distinction between agriculture-based and forest-based products. Information on some of the further processed products of NWFP origin are combined with that of synthetic products. Data and information are not collected regularly but often through specific surveys only. It is therefore not possible to estimate the volume and value of the whole NWFP sector in terms of trade. The

Figure 1: Cycles of processing - product - marketing



Source: Lintu, L. 1986. Marketing in the forestry sector. Unasylva 153, Vol. 38. FAO. Rome.

importance of this trade can only be illustrated by citing examples of products for which some systematically collected information is available. Some information collected by FAO for exports of gum arabic from Sudan and rattan from Indonesia, Malaysia and the Philippines is shown in Tables 1 and 2 to illustrate the importance of the trade of these products to the countries concerned.

Table 1: Volume and value of exports of gum arabic from Sudan, 1980 to 1990

Year	Volume (1,000 mt)	Value (million US$)
1980	26.2	36.7
1981	33.4	43.5
1982	29.9	42.7
1983	27.3	38.0
1984	38.4	51.0
1985	27.4	28.9
1986	19.1	56.7
1987	18.6	60.0
1988	18.6	62.5
1989	18.1	49.4
1990	25.0	53.0

Source: FAO, 1993

Table 2: Value of exports of rattan from Indonesia, Malaysia and the Philippines, 1981 to 1990

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	(million US$)									
Malaysia	3	3	3	3	4	5	20	31	32	26
Philippines	45	42	56	60	58	62	94	136	137	121
Indonesia	73	83	86	93	97	104	151	56	117	-

Source: FAO, 1993

It is generally maintained that NWFPs are important locally, nationally and internationally. Many of the products contribute significantly to the creation of economic benefits and cash income at the community level (e.g. forest foods marketed at village markets). Some of the products contribute to the national economy (e.g. tendu leaves for bidi production in India) while many enter international trade and are vital elements in many industries worldwide (e.g. essential oils sold to the fragrance and flavour industries).

A great number of products is marketed simultaneously in all three main market levels. Very seldom does any one NWFP alone reach outstanding economic significance in trade. In most instances their significance stems from the cumulative contribution of several diverse products in the trade of a nation. For instance in India, at a national level, over 50 percent of forest revenues and 70 percent of export income comes from NWFPs. They provide 50 percent of income for 20-30 percent of rural people (Sekhar *et al.*, 1993). The number of these products is huge. Tewari (1994), for example, lists 282 edible fruits, 104 edible stems-tubers, 199 edible leaves, 112 edible seeds, 46 edible flowers and 74 underground roots, rhizomes and tubers. The theme paper on socio-economic benefits of NWFPs by J.E.M. Arnold highlights their importance to local communities and societies as a whole.

The Brazilian Amazon region provides an example of the importance of NWFPs in regional trade. The total value of these recorded products obtained by gathering and traded in the Brazilian

Amazon amounted to US$ 110 million in 1987. The trade was composed of a number of different products. By order of importance they were: acai (US$ 42 million), babassu (US$ 22 million), rubber (US$ 20.7 million), palm-hearts (US$ 11.8 million), Brazil nuts (US$ 9 million), and sorva (US$ 1.2 million). They are followed by several other products with values less than US$ 1 million each, comprising: gums and waxes (balata, licuri); fibres (buriti, piacava, tucum); oils (andiroba, virola, licuri); and medicinal plants (jaborandi, ipecauanha, timbo) (Vantomme, 1990).

Although NWFP activities with clearly identifiable markets provide value to the resource and thus contribute to the resource conservation and settling of farming populations, there are counter-arguments that the activities are not sustainable. For example, Vantomme (1990) maintains that for the Brazilian Amazon region, extractivism in its actual terms and products is slowly but definitely becoming an obsolete economic activity.

There also appears to be a switch from a purely subsistence use of NWFPs to commercial export-based activities, with significant consequences to marketing practices and related institutional support structures.

One of the main determinants for trade in NWFPs is naturally their sustainable and, especially in case of industrial raw materials, their continuous availability. The competing uses of forests which change the land use, in particular and large-scale timber production, are real and potential threats to NWFP availability. Forest ownership and user rights are also determinant factors in evaluating long-term availability of NWFPs for the market. Similarly, the appropriate assessment of relative economic potential of alternative resource use options is vital in evaluating the supply potential of products from a specified forest area. The volume of trade also varies depending on market prospects. With high prices, supply often increases to levels which threaten the sustainability of resource, and eventually floods the markets with resulting collapse of prices.

Availability also has to be stable, regular and predictable. Many of the customers are industrial operations which expect to operate their plants without interruption, or at least be able to predict possible shutdowns (e.g. with seasonally available raw materials). However, the conditions under which most NWFPs are harvested in natural forests make regularity of supply very difficult to achieve. Weather conditions and other nature-related factors make availability irregular. Furthermore, gathering of these products is in most instances a side activity for farmers whose main income comes from agriculture. Any conflict of NWFP gathering with farmers' agricultural activities can thus reduce their interest in NWFP activities and thus weaken the supply chain. The regularity of supply of some food items may also indirectly be disturbed by calamities on the farming side when people have to rely more on the forest resource for their own consumption, resulting in decreased supply for the market.

Local Trade

Local trade, although relatively small in quantities and values in case of individual products and producers, is often of vital importance to local communities by allowing increased efficiency in resource utilization, opening up outlets for producers/gatherers with excess production and thus providing cash income to them and others involved in selling and distributing the products. The aggregate of a large number of NWFPs and their individual producers makes local and national trade in many instances more important than the international trade.

In order to assess the volume and reliability of potential supply, an analysis of what determines the marketable surplus is important. It is needed for the business sector to estimate the supply volume for trading and processing. Policy-makers need to know how much income can be derived from these products in order to identify appropriate development strategies to target small farmers and other gatherers.

With the increase in economic well-being and shift to monetary economies, factory-made products increasingly erode the local markets for NWFPs in their traditional uses. Under these

circumstances, the contribution of the trade of these products to local economies starts depending on national and international markets. This will, of course, in most instances change the product range demanded and the marketing approaches applied. The barter and customary sharing of products which still exists at the local-level trade will gradually be replaced by money-based exchange systems.

In India, for example, local-level trade is important particularly to forest dwellers, including tribals, some of whom still depend entirely on the forests. About 60 percent of production of NWFPs in India is consumed by about 50 million tribal people. NWFPs are estimated to constitute about 10 to 40 percent of tribal household earnings. Collection of a single NWFP from existing resources is, however, not able to provide enough income to sustain people. Hence different NWFPs in different seasons are collected and marketed to ensure sustained income (Sekhar, *et al.* 1993).

According to a study from the Philippines, no less than 46 percent of the total multipurpose tree products production, which includes many NWFPs, went for home consumption while 10 percent was given away to neighbours and relatives. Only the remaining 44 percent was sold. This implies that small farmers catered more to family consumption on a subsistence level than to markets (Raintree and Francisco, 1994). A significant part of local trade in NWFPs takes place through bartering.

Trading activities are often conducted seasonally, when demand for agricultural (or other) labour is low. Especially the rural poor rely on income from NWFPs in these periods when returns from other sources decrease.

The process of exchange takes place in village markets between the gatherers/producers and final consumers. Most of the products traded are consumer goods, i.e. they are not processed further by any industrial activity. NWFPs traded locally include fodder, food items, plant- and animal-based medicines, construction materials and furniture. Quantification of the local trade is extremely difficult due to its sporadic nature and because only a part of it is monetary-based. Some efforts on a case-by-case basis have been made to measure local trade using sample surveys. Some local markets can, however, be described as industrial markets. For instance, strong demand for fruits in local markets is often propelled by fruit processors, such as syrup and concentrate manufacturers, ice-cream makers, fruit juice makers, and jams and preserve manufacturers (Raintree and Francisco, 1994).

National Trade

There are national markets that support trade of NWFPs in specific countries. Products entering national trade include fruits, nuts, spices, raw materials for flavours and fragrances, medicinal plants, furniture, and many other products. For instance, customary food habits provide national markets for spices and flavours which cannot be sold elsewhere. Herbal medicines is another category of products which are tied to local traditions and therefore to specific national markets. The increasing number and income level of city dwellers especially make these markets expand and require particular marketing approaches, as people who have moved to cities often maintain their cultural habits. Significant opportunities could be identified through appropriate market and marketing studies in these markets.

Tendu leaves for bidi production in India provide an example of national trade in NWFPs. Of the various tobacco products consumed in the world, bidi is a product of typically Indian origin. It is the Indian cigarette in which tobacco is wrapped in tendu leaf instead of paper. India's share of the total world production of tendu leaves is estimated at 85 percent. Most of the annual production of over 350,000 tonnes of tendu leaves are processed into bidi cigarettes in India. The average revenue earned by different states in India from the production of tendu leaves amounts to about Rs. 600 million (approximately US$ 30 million). The activities related to tendu leave collection, drying, packing and transportation are estimated to be equal to full employment of 107,000 (Dwivedi, 1993).

National trade of many NWFPs exists, of course, parallel to international trade of the same products. For example, some 6,000 tonnes of tendu leaves are exported with a total value of Rs. 83 million (approximately US$ 4 million) (Dwivedi, 1993).

The internal trade in medicinal plant material is, in many countries, often considerably more important than international trade. In the United States, for example, imports represent only a small percentage of the value of internal trade in medicinal plants.

INTERNATIONAL TRADE

International trade of NWFPs is composed of imports and exports of many products at different stages of processing. Some of these are unprocessed goods from the forest while others have undergone processing to lesser or larger degree. Many of the products are often traded in rather small quantities compared to other commodities. For example, the quantity of cinnamon bark oil amounts to some 2.8 tonnes/year in the world trade; cinnamon leaf oil 120-150 tonnes/year and rosewood oil 100 tonnes/year. On the other hand there are NWFPs which are produced and traded in considerably larger quantities like Brazil nuts (14,000 tons/year), orange oil, gum turpentine, rosin, rattan and gum arabic.

Essential oils (comprising a number of individual products), which are traditionally used as basic raw materials in fragrances and flavouring, provide an example of international trade in NWFPs. In 1990, the value of total world imports of essential oils amounted to over US$ 1 billion. Principal import markets are the European Union, the United States and Japan, which together account for over 70 percent of the total trade. ASEAN, Hong Kong, Republic of Korea and India, with their share of some 12 percent of the world imports, indicate the importance of the Asian region in this trade. Consumer demand for natural flavourings and fragrances continues to grow despite the increasing market share of synthetic substitutes (ITC, 1993).

Brazil nuts provide another example of international trade in NWFPs. Almost all Brazil nuts are destined for international markets. About US$ 50 million annually, or less than 2 percent of the US$ 2 billion international edible nut market, is made up of Brazil nuts. Brazil represents 80 percent of the production while the rest is covered by Bolivia and Peru. Main markets for Brazil nuts are the United States, Canada, United Kingdom, Germany and Australia (LaFleur, 1992).

International trade means knowing the markets outside the country of production. Very often the trade is controlled by local and foreign brokers, agents, traders and other middlemen. They all have vested interest in the business. Therefore relying solely on the information provided by them does not guarantee that the gatherers and producers get all the information that they need. Products which enter the international trade are often raw materials for further processing in countries of destination. There are also a number of value-added goods based on NWFPs which are internationally traded. The market size, growth and its specific requirements are determined by factors far away from the supplying countries. The reliable availability of marketing information is a key factor for successful marketing in export markets.

PRODUCTS, PRODUCERS, MARKETS AND COMPETITORS

It is not an exaggeration to say that NWFPs represent one of the most challenging product groups from the marketing point of view because of their number, versatility, end-use variation, dissimilarities of the producer base and resource richness. NWFPs are extremely numerous and versatile. They comprise unprocessed raw materials and consumer products as well as further processed consumer or industrial goods. Many of the products are seasonal and with fairly small overall markets, which means that individual producers can only seldom rely and specialize on one product only to make living on it. The resource base also varies greatly, some of it being natural and even wilderness while other resources are plantation-based.

Producers of these products are individual gatherers, including subsistence farmers and rural poor, or large-scale industrial plantations supplying either primary consumer goods or raw materials for further processing industries. They also include simple cottage-level processors, small-scale industries and huge multinational industries which deal with processed NWFP-based goods.

Markets range from simple local village level consumer markets to most sophisticated industrial niche markets in numerous end-use sectors both in developed and developing countries.

Competitors to NWFP marketers come from the sector itself or from other sectors with natural or synthetic products.

Furthermore, NWFP markets have been and continue to be in the middle of a drastic evolution. Traditional markets for many products have been lost to competing synthetic materials while new markets are emerging, especially with the growing interest in natural products. All this would require from the producers full understanding of the changes and ability to quickly identify threats and opportunities in the markets and swiftly adjust to them not only in marketing but also in resource management and processing in a harmonious manner. A further complication arises from the fact that many of these products serve several different local, national and international markets simultaneously, each requiring different marketing approaches.

The most serious problem arises, however, from the fact that many of the gatherers, primary processors and lowest level middlemen, who need all these capabilities are the least well-equipped for the task due to their low level of basic education and limited access to capital. This makes their position much weaker than that of the suppliers of competing substitute materials. It also weakens the position of these gatherers, primary processors and low middlemen compared to more knowledgeable and skilful members of the marketing and processing chain further up.

What does the gatherer/producer need to know in terms of marketing? The basic questions when starting any NWFP-based marketing activity are:

What are the potentially marketable **products** available?

What and where are the **markets** for those products?

Who are the **competitors** in supplying the markets?

What are the specific **strengths of the producer/gatherer** in supplying the markets in relation to the competitors?

What are the **means to get to the markets** in competition with other suppliers?

Some additional issues related to the first four questions will be dealt with below, while those relating to the last question will be covered in the following chapter on marketing practices.

PRODUCTS

NWFPs and their characteristics are a compromise between the available resource and market requirements. Processing and marketing are the tools with which the raw materials are converted to appropriate products to meet market requirements. Processing provides the physical characteristics of the goods while marketing adds to it all the necessary services and other immaterial features to make it a complete product for satisfying the values sought in the market.

From the consumer's point of view, the products represent various values. For example, they can be the delicious taste for fruits, purity for gums, specific aromatic characteristics for essential oils, etc. The value characteristics can also be associated with resource conditions which determine the

continuity, regularity and reliability of supply. They can also be economic values related to low cost in further processing, including low purchase price, low cost of delivery to the processing mill, low risk of spoilage in handling and storage, etc. The values can also be environmental, making the market prefer products which in their harvesting do not damage the resource base, or for which the processing does not pollute the environment, or which can be recycled, etc. These examples illustrate the point that, from the consumer's point of view, the product is something more than just the physical product. This also means that there are a number of physical products which can serve the same function. The product supplier has to be able to identify value characteristics with which the product can be made more desirable than competing products.

Being nature-based, NWFPs can never be totally uniform in their characteristics, nor can their supply be regular and fully reliable. Natural forest-based, "non-domesticated" products and wilderness-based products in particular are less uniform in their characteristics than plantation-based products. There is, therefore, a tendency to move towards more uniform plantation-based production whenever potential markets become large and attractive enough and the production is found to be feasible in plantations.

Some of the products originate from "wilderness", i.e. they are not domesticated. The products are collected depending on their seasonal availability or other nature-determined conditions which can affect both the quantity and quality of the products available. It also means that their availability can vary considerably from year to year and from location to location. From the marketing point of view this is, of course, a major disadvantage because many customers prefer sustained and secure supply of even-quality products. This is particularly important for products which are used as raw materials in further processing industries. Products originating from domesticated resources (i.e. systematically managed forests or plantations) provide more supply security to the customers and are therefore preferred by them.

Some problems of variation in products and their quality can be overcome by application of product and quality standards and related grading. Standards and grading rules are available for many NWFPs both at the raw material and at various processing levels. For example, the grading of gum arabic is based on physical parameters — colour, shape, size and purity — which makes the grading rather simple so that it can be done by the producers themselves. The standards and grading rules are, however, often very dispersed and vary from market to market and producer to producer. A serious effort would be needed to identify all the relevant standards, grading rules and related testing methods and initiate work on their harmonization to the maximum extent possible.

Another means for solving some problems related to the variation of product specifications and quality is appropriate packaging and storage. For instance, Iqbal (1993) found that if steps could be taken to deliver morels in a cleaner state to exporters, the product could be sold at higher prices and the collectors' profit margin would also increase. Processes like cleaning, grading and packaging are much cheaper in developing than in developed countries due to lower labour costs.

The type of the product is one of the factors which determines the marketing approaches to be used. Some NWFPs are ready for final consumption immediately after harvesting, while others need to be processed before becoming useful and acceptable to consumers, as discussed above. Some of the NWFPs have to go through several stages of processing before becoming a final consumer product (e.g. essential oils after having been extracted from wood are first converted to fragrances and then into perfumes). Many of these products are specialities serving very specific end-use niches in the market (e.g. chicle) while others represent commodity-type products (e.g. rattan stalks) and are used more widely.

Many products consumed as food items, medicines or health and beauty care products are subject to restrictions and regulations on their use, as they can potentially affect human health.

Another particular feature related to the NWFPs is their great number which has also been mentioned earlier in this paper. The draft classification presented in the theme paper by Chandrasekharan identifies a great number of product categories, each having numerous different products included in both at the resource level as well as the primary processing level. Medicinal plants imported to Europe via Hamburg alone number between 500 and 600, based on an examination of UK and German trade catalogues, particularly that currently published by the largest German importer, Heinrich Ambrosius. Many of these plants are imported in relatively small amounts, however (Lewington, 1993).

Even a single species can be a source of various products which find markets in numerous end-uses.

As mentioned earlier, the diversity of NWFPs and their markets means that practically all possible approaches of marketing are needed. Some of the products need to be marketed with consumer marketing methods while some others require industrial marketing approaches. For some products commodity marketing arrangements are adequate while for many speciality products niche marketing is the most appropriate method.

PRODUCERS

Producers will be described here only as part of marketing process. See the paper by Arnold for discussion of the socio-economic aspects of producers' involvement in processing and marketing.

Producers of NWFPs include the gatherers who collect the products from the forests. They also comprise those primary-level processors who buy the basic raw materials from the gatherers and convert them into primary products. Producers are also the ones who convert the semi-processed primary products to value-added, semi-finished products or to final consumer products at the successive stages of processing and marketing.

Individual producers/gatherers are numerous and small and thus have little power in the market place. Clay and Clement (1993) noted that, in the case of Brazil nut operations in the Amazon region, the gatherers cannot provide quantities of product that even a small manufacturer would need. The Xapuri Brazil-nut shelling factory, for example, produces 70 metric tons of Brazil nuts per year, but M&M Mars uses 70 metric tons of peanuts per 8-hour shift in Snickers candy bars. Individually, local Brazil-nut shelling cooperatives could never convince large companies like M&M Mars to use their nuts. By working together, producer groups can control larger market shares, exerting considerable influence over entire markets (Clay and Clement, 1993).

Although NWFPs have features which are attractive from the gathering and processing point of view, they may not necessarily be strengths in marketing the products, but rather the contrary. For instance, the following have been listed as advantages of NWFPs gathering and processing activities:

- small in size and often household-based,
- often involve diversity of a product,
- frequently seasonal in nature,
- labour intensive and use simple technologies,
- provide direct benefits to the local economy,
- accessible to low income and socially disadvantaged groups and are most often managed by women (Sekhar *et al.*, 1993).

Many of these advantages on the gathering and processing side are disadvantages from the marketing point of view. Being small and household-based operations, they do not possess the necessary strength in negotiating with customers and middlemen in the markets. The diversity of product means the need to master different marketing approaches as products serve different needs and wants in the market. Their seasonal nature affects the continuity and regularity of supply and may

make customers favour competing synthetic materials with more predictable availability. Simple technologies might in some cases also mean lack of flexibility in production and low quality. The gathering and processing activities provide direct benefits to local economies only if the products can be successfully marketed and the marketing is controlled by the producers to make sure that the benefits flow to the local community. Low income and socially disadvantaged groups often lack the necessary basic knowledge and resources for efficient marketing.

The gatherers of NWFPs are in most instances part-time operators whose main activity is farming. They do not necessarily have any long-term commitment to the activity should the main activity in farming require more time and other inputs.

The resource base for gathering activities is usually not owned by the gatherers, who only have formal or informal user rights. Resource management is therefore not the responsibility of the gatherers and their interest in its long-term sustainability is not always there. For example, the over-collection of many medicinal plants from the wild often stems from local poverty which is itself a result of the particular socio-economic situation in which many rural inhabitants find themselves (Lewington, 1993). Furthermore, alternative resource-use patterns with detrimental effects on gathering activities can be introduced without gatherers being involved.

The poor gatherers also lack adequate awareness and benefits obtainable from different species and different forestry programmes like social forestry and agroforestry (Sekhar *et al.*, 1993).

In order to be successful, an NWFP operation has to be operated as a "business unit" which comprises and controls all its basic functions, including raw material procurement, processing, marketing, financing and human resource development. Running such a system requires business management capabilities, which poor gatherers are unlikely to possess or acquire on their own. There would seem to be a major role for the extension systems.

MARKETS

From the marketing point of view, markets are comprised of their geographic location, end-uses, and customer needs and wants in the end-uses and the buyers there.

Geographically, markets for most of the internationally traded NWFPs are in industrialized countries in Europe, Japan, Oceania and North America. There are also large domestic markets in the producing countries themselves, both in the developing and industrialized regions. Information on the geographic markets is mostly in the form of trade statistics which are, however, incomplete and only seldom allow worldwide assessment of the size and importance of markets.

In terms of end-use, the markets for non-wood raw materials and primary processed products are extremely varied, even for the same products. The end-uses for primary processed products are extremely numerous. The main end-use sectors served by non-wood forest raw materials and primary processed products include: cattle and other animal raising, food industry, pharmaceutical industry, fragrance and flavour industries, dye and colorant industries, insecticide industries, industrial chemical industries, furniture industries, building and construction industries, religious ceremonies, etc. Market information is very seldom available by end-uses.

The following few examples further illustrate the variety of end-uses for some NWFPs.

- Eucalyptus oils are classified in the trade into three broad types, according to their composition and main end-use: medicinal, perfumery and industrial. Medicinal oil is sold as such or in formulation with other oils. Perfumery oil is usually employed in lower-cost perfumes and disinfectants, while industrial oil is used as a source of citronella for the chemical industry.

- Sandalwood oil is widely employed in fragrance industry to provide for higher-priced perfumes.

- Pine resin is the raw material for gum turpentine and gum rosin. Traditionally, turpentine has been employed as a solvent or cleaning agent for paints and varnishes. There are also specialized uses for it in the pharmaceutical industry. Nowadays turpentine is used as a source of chemical isolates which are then converted to a wide range of products. The biggest single turpentine derivative, synthetic pine oil, is employed for fragrance and flavour use. There are also many non-aromatic applications such as polyterpene resins.

- Olibanum, myrrh and opopanax, the hardened, resinous exudates obtained from trees of certain *Boswellia* and *Commiphora* species, are used in unprocessed form for both fragrance and flavour purposes. The major fragrance use is for burning as incense in religious ceremonies. In some markets, olibanum is highly valued for chewing. In China these products are used in the preparation of traditional medicines.

- The most common end-use for nutmeg and mace is as spices in the food-processing industry. They are, however, also used as sources of essential oils, oleo-resins and nutmeg butter for perfumery and pharmaceutical industries. A possible future use for nutmeg is as a natural control for insects that infest stored cereal grains.

- Basketwork finds markets in end-uses like fruit and fish packaging, giftware and gift packaging, house furnishing with items like magazine racks, umbrella stands and lampshades, household items such as bread baskets, flower holders, and waste paper baskets.

- The principal end-use of rattan is furniture manufacturing but it also used for making light partitions in house construction.

- Medicinal plants are used directly and in pharmaceuticals, as building blocks or starting material for production of semi-synthetic drugs, as blue-prints for the manufacture of synthetic drugs of a similar structure and as tools to help understand physiological and pharmacological mechanisms, especially in drug development and testing. They are also used in a great variety of other end-uses. Plant extracts and medicinal herbs and spices are used in food, flavour, fragrance and cosmetic industries.

As regards detailed customer needs and wants in each of the end-uses, the markets are even further fragmented. Information is hardly ever readily available but has to be obtained through specialized marketing studies.

Some of the products are sold as bulk commodities like fodder in domestic markets and nuts, gum arabic and resins in export markets. Some other products are marketed to specific end-use segments or niches as specialities.

From the gatherers' point of view, the markets are the middlemen and the government-operated buying organisations which buy the products. The markets for gatherers are also the village or town markets where they sell or barter their products directly to the consumers.

Often the number of middlemen available to buy the products is limited and tied to a larger buying organisation. For example, in the case of Brazil nuts the gatherers sell the in-shell nuts to middlemen who trade mainly in merchandise or forward goods in exchange for a guarantee of future delivery of products. The buyers and their agents are normally forwarders of funds and merchandise to the middlemen but will also buy from independent middlemen. The gatherers only control the gathering of the nuts and their sale to middlemen.

COMPETITORS

With the development of synthetic products, many of the traditional NWFPs have lost their markets. This often distorts discussion, as many nostalgic generalizations are still made. Synthetic materials are a reality and a constant threat to NWFPs.

Another competitor to certain NWFP activities comes from the sector itself: the tendency for marketable NWFPs to be cultivated, as mentioned earlier. A typical example of this is natural rubber. Wilderness-based rubber was overtaken by plantation-grown rubber, which is itself threatened in certain end-uses by synthetic rubber. Rubber itself came under heavy attack by plastics when they were introduced; overall rubber demand was significantly affected.

On the other hand, a NWFP can also pose a threat to a plantation-grown product, for example the threat posed by sheanut butter to cocoa butter. Sheanut butter is a very good substitute for cocoa butter, as their physical and chemical properties are very similar. Sheanut's most important use is in foods. Especially in the United States, Europe and Asia, sheanut butter is almost entirely used in manufacturing food items like chocolate, candies, margarine and bakery products, with only 3 to 5 percent of imports used in the cosmetics and pharmaceutical industries (Dwivedi, 1993).

Markets, once lost, are difficult to regain fully. This is illustrated by the case of gum arabic. Gum arabic sales had increased throughout the 1960s, reaching a peak around 1970 at approximately 70,000 tonnes. But the severe Sahelian droughts of 1973-74 led to a world shortage and high prices. This resulted in an impetus for some major users to shift to the newly developed modified starches. Consequently, annual sales of gum arabic never exceeded 40,000 tonnes again. A further disruption in supplies forced many more companies to shift irreversibly to reformulations of their products based on synthetic products. Sales could not exceed 20,000 to 24,000 tonnes per year, even after adequate gum arabic stocks became available in 1986. Nonetheless, despite steadily decreasing demand over the past 15-20 years, gum arabic still remains a major natural exudate of commerce (Anderson, 1989).

Government policies can also change the conditions for competition between various products. For instance, the policies regarding medicinal advertising often encourage the use of imported medicines as illustrated by an example from Nepal. Nepalese traditional medicine is very rich and still largely used in the rural areas. Most of the rural population cannot afford the costly "modern" medicines. Although health work should focus on the 85 percent of the population that uses traditional medicine, measures focus on helping the 15 percent that use "modern" medicines. International commercial pressure from Western and Indian pharmaceutical industries is slowly changing the medicine consumption habits of the Nepalese by using high-cost advertising campaigns with which no traditional medicine maker can compete (Dwivedi, 1993).

Sometimes NWFPs are hedged against competition by their specific features or their low cost relative to synthetic substitutes. For example, consumer demand for natural flavourings and fragrances continues to grow despite the increasing market share of synthetic substitutes which have lower production costs, stable pricing and regular supply. This is due in part to the fact that not all essential oils can be satisfactorily replaced by synthetic substitutes such as clove oil. Some essential oils, such as orange oil, are available at such low prices that the investment in research would not be worthwhile to develop substituting synthetic materials.

There is also a growing tendency on the part of consumer to prefer the use of "natural" ingredients in the composition of a product. For example, there is a general market trend away from petrochemically derived substances back towards natural products. Natural materials can, however, only regain ground if they are competitively priced and meet other requirements of the customer. If the natural product is only slightly more expensive, then there is still a reasonable incentive for the buyer to choose "natural", as the public acceptance and environmental implications of the natural additive should broaden the appeal of the finished product. This trend is especially pronounced within the food industry.

MARKETING PRACTICES

Descriptions of a marketing practices are too often limited to portraying it as a physical activity of haulage, sorting, grading, packaging, storage, display, etc. In spite of the fact that ultimately the buyer is directed by the values which are provided through the physical activities, value-based descriptions of marketing practices are really rare.

The marketing of NWFPs used as raw materials in industries normally takes place in two main stages:

- the marketing of raw material, i.e. from the gathering stage until it reaches the industrial user as a raw product; and

- the marketing of the semi-finished or finished industrial or finished consumer product either to other processing industries or to final consumers.

The first stage is mainly carried out in the producing, developing countries with less-developed marketing organisations, while the latter is carried out in the consuming, industrialized countries with modern marketing organisations.

The most simple marketing practices for NWFPs can be found on the local and national markets. An example of local level practices is provided by the leafmeal fodder marketing in the Philippines. Leaves used for animal feed in the Philippines mainly come from leucaena (*Leucaena leucocephala*)and are processed by leaf millers. The pre-sale activities include sun-drying, bagging the leaves in straw sacks and hauling them manually or by animal-drawn sleds to the roadside where middlemen come. The marketing of leafmeal from the farmer leaf-gatherers to the users passes through two stages. Although farmer gatherers could sell directly to the leaf millers, there are local traders who assemble the farmers' produce. From the leaf-millers, middlemen act as dealers of milled leaves to the end-user. These middlemen are recognized by the farmer/leaf gatherers and leaf millers as an important part of the marketing channel, since they bear all the risks and costs related to the marketing of whole, powdered or pelletized leaves (Raintree and Francisco, 1994).

Another example of local-level marketing practices is fruit marketing, also in the Philippines. There it is based on contract marketing. The process starts when the trees start to flower. The seller and buyer jointly estimate the price on a tree-by-tree basis, based on the foreseeable volume of harvest. The buyer pays half of the assessed value in advance; the rest is paid at harvest. The contract buyer bears all the cost of pre-marketing services and sometimes also transportation costs and handling in delivering the products to wholesalers and/or retailers (Raintree and Francisco, 1994).

At the raw material level, gatherers may sell their product to middlemen and/or to a government buying or export agency. The practices for selling gum arabic in Sudan illustrate this approach. Distribution channels for gum arabic in Sudan can be described as simple and governed by the social and economic forces operating in the Sudanese economy. Like all other Sudanese products, they consist of three sub-systems, ranging from a subsistence producing end to semi-modern exchange sub-system, and at the receiving end to a modern export-oriented system.

Typically, gum arabic involves a large number of producers scattered in remote areas, whereas consumers are large, varied and scattered in the developed countries in the Western world. The product is gathered from remote areas in small quantities into concentration points. Storage is an important step. Most of the product has to be stored along the delivery line because of long transport distances. The concentration of supplies is by the piece, while selling to the consumers is in bulk. The gatherers' role in the marketing system is instinctive and traditional.

Theoretically every gatherer should sell the gum in the auction markets organised by the government, where the product is sold to specialized merchants who transport the gum to their storing

shed for cleaning, grading and packaging. All clean and graded gum is then sold to the gum exporting company. However, in practice the gatherers are often prevented from selling their produce at the auctions by lack of cash, transport, water and labour. Their actual marketing difficulties start even before the gum arabic is produced. As it often happens, the gatherer needs cash before the product can be harvested. For this he has to arrange an advance sale of the expected produce with the village merchant in order to get his/her essential supplies or with the water transport operator to get the water. Both the price of the essential supplies and that of the expected produce are fixed by the village merchant and the transport fee by the truck operator. Under the circumstances, the gatherer has no alternative but to accept. It has been estimated that about 30 percent of the producers do not sell their product in the auction markets due to the above reasons. The gatherers sell their gum unsorted, although the grading is quite simple, based on physical parameters of colour, shape, size and purity (El Hag Makki Awouda, 1990).

Marketing practices in selling Brazil nuts are quite similar in that the gatherers are dependent on the supplies made available by the buyer-dependent middlemen and they are not involved in the simple value-adding processes of grading and shelling the nuts.

Marketing of essential oils to flavour and fragrance industries provides another example of marketing practices at the next level of processing and marketing chain, i.e. from the primary processing to the secondary processing. According to an ITC Market Profile (ITC, 1993), the fragrance and flavours industry is dominated by a few multinationals which produce and trade fragrance and flavour chemicals and compounds worldwide; an estimated 60 to 80 percent of essential oil imports are carried out by the industry. Until the mid-1980s, the industry was relatively fragmented with a large number of medium-sized and small companies which blended their own perfume and flavour compounds from natural and synthetic raw materials or purchased ready-made formulations from larger compounding houses. By the end of the 1980s, there was a shift towards a larger concentration of the market in the hands of a few multinational companies with worldwide manufacturing facilities.

An indicative breakdown of the relative market shares of the major fragrance and flavour producing companies in the world, which together cover 70 percent, or over US$ 5 billion, of the world market in terms of value, according to industry sources, is given in Table 3.

Table 3: Breakdown of relative market shares of major fragrance and flavour producing companies

Company	Market share (percent)
IFF	12
Givaudan-Roure (Hoffman-La Roche)	11.5
Quest/Unilever	10
Takasago	7
H&R (Bayer)	6
Firmenich	5
PFW (Hercules)	5
BBA (Union Camp)	4
Dragoco	3
Florasynth	3
Hagasegawa	3

Source: ITC, 1993.

At the level of producer/distiller of essential oils, the process of marketing starts with the development and appropriate product testing. For example, essential oil used as a flavouring or fragrance agent is evaluated by taste or smell, respectively. The oil undergoes laboratory testing based on representative samples to qualify it chemically and set acceptable limits for the major components

and for physical characteristics such as colour, specific gravity, etc. The conditions of sale often also require compliance with legislated technical specifications. Furthermore, in many countries individual ingredients must be formally approved by government institutions before they can be offered for sale. The process of product development and testing can take several years and is expensive. For the oils which are well established in the market, the standard specifications have been set and are published by ISO and national standard organisations. Buyers assess new essential oil sources on the basis of samples which have to be representative of the actual batch to be delivered. Another basis on which buyers assess the supplier is the regularity of supply. The main threat is posed by synthetic substitutes which do not suffer from supply shortages. The quality, the service, and the technical support are the main means to guarantee the long-term success as a reliable supplier (Boland *et al.*, 1991).

The basic structures for essential oil marketing from farmer/distiller to flavour and fragrance industries vary. The traditional marketing channel used to be through brokers. The brokers have gradually started taking possession of products and thus are becoming dealers who hold stocks and sell the product at marked-up prices. There is, however, also a growing tendency to bypass dealers and brokers in favour of establishing direct contacts between distillers and larger flavour and fragrance industries.

Many NWFPs are gathered from natural forests with the aim of sustaining the social and economic development of local populations and thus contribute to the sustainability of forest resources, especially in tropical countries. All these issues have been and still are in the centre of environmental discussion all over world which draws attention of not only decision-makers but also the "man in the street". The concern over forest resources and introduction of NWFPs as environmentally-friendly alternatives to timber in converting the forest resource to economic benefits has given unprecedented amounts of free publicity to nature-based products. Some commercial NWFP initiatives have been able to take advantage of this free image advertising. The "green marketing" schemes make up one form of these initiatives. They increasingly apply sophisticated marketing and promotional tools and techniques and often use mass media coverage, advertising and packaging to get their message across and increase sales. A number of funding agencies and environmentally oriented grant, loan and investment funds have also been set up over the last few years with the mandate and commitment to support relevant research and commercial development. Much "green marketing" is based on linking the identification and promotion of new products with the market opportunities rising from consumer consciousness of environmental values. "Green marketing" emphasizes ecological origin of products, sustainable use of resources and the involvement of local population in the activities in its promotional campaigns. It has developed and introduced product names in which words like "green", "ecology", "rainforest" and "community" are used. Such product names associate the product to nature and local communities in the minds of the consumers. "Green marketing" aims to satisfy the needs and wants of customers for ecological and social values together with the product.

As illustrated by the examples above, marketing of NWFPs does not just happen on its own. A considerable amount of time and money must be invested to make it happen in a way that will return the most revenues to forest residents and the countries in which they live. Much of the current activities around these products are, however, still heavily production-oriented. It is clear that production orientation is needed to improve the quality and quantity of supply and to reduce the costs, while a marketing orientation is mainly aimed at increasing demand and value and to allow more products to enter the market.

The production-oriented approach uses product development, efficiency in raw material, labour and capital inputs and technology as main means to achieve better performance in producing increasing volumes of higher-quality products at lower costs.

In a marketing-oriented approach or practice, the use of the basic elements of marketing, (i.e. product with its various features like quality, distribution channels, promotion and price, as an appropriate mix), becomes a dominant feature.

Marketing-oriented approach has to identify and solve problems related to individual marketing factors. Table 4 lists some marketing problems in the uplands in the Philippines.

Table 4: Marketing problems and issues in the uplands in the Philippines

Product	Price	Promotion	Distribution Channels	People and Producers	Others
Finding the right product	Unstable prices due to volume fluctuations	Lack of post-harvest facilities	Existing cultural barriers that result to difficulties	Land tenure issue especially among tribal communities	Land tenure issue especially among tribal communities
Quality handling technology	Lack of inadequate entrepreneurial skills in pricing	Lack of capital to engage in promotion activities	Insufficient or lack of transportation facilities	Illiteracy of same upland farmers	Conflicting government policies
Volume of product is seasonal thus supply may be insufficient at certain times of the year	Monopoly of traders dictating market prices	Lack of NGO capability to act as marketing arm		Lack of organisation among farmers	Government regulations on raw materials and semi-finished products
Lack of product development initiatives Lack of product alternatives Lack of capital	Insufficient knowledge on market information such as market prices and industry profile				Lack of farm-to-market-roads Existing peace and order situation Access to market information Lack of entrepreneurial skills Lack of capital

Source: Raintree and Francisco, 1994 (Original source: Philippine Uplands Resources Centre, UNAC 1991, 1st NGO Consultative Workshop on Upland Development Issues Proceedings.)

MARKETING INFORMATION

Marketing is a largely information-based, or "soft", technology. It is operated on the basis of information about markets, means of accessing the markets, competition and business environment. Efficient marketing relies on a well-functioning marketing information service that provides necessary quantitative and qualitative information regularly, reliably, timely and at a lowest possible cost.

Information is needed on the markets (demand, end-uses, supply), marketing factors (products, distribution channels, promotion and prices), competition, marketing environment (comprising social, economic, political, technological, regulatory, legal, cultural, infrastructural, etc. environments), and institutions related to marketing.

Especially in the case of NWFPs, systematically collected, analyzed and disseminated information is seldom available except for a few selected products and markets.

Much of the information on these products is collected from the resource side or at the level of processing. This is, of course, appropriate when satisfying the needs for information for marketing

from the resource to the primary processing. Increased attention would seem to be needed to collect information from the markets and end-uses to which the primary processing industry is selling its products. Similarly, collection of information on marketing factors would need to be improved.

For an efficient collection of data and information, a well-defined classification of products is the foundation. Equally important is to identify and classify the end-uses in different markets to which the individual products can be sold.

As illustrated earlier, the demand for many NWFPs is derived, i.e. the final consumption takes place after a great number of successive loops in the production-product-marketing chain. Better understanding of the actual needs and wants of the customers in the market requires learning about the specific values that customers associate with the products offered. The marketing information system would therefore have to allow for providing relevant information.

Lewington (1993) provides an example of the frustrations that a market analyst faces in studying the markets for medicinal plants. She notes that perhaps the primary and most logical avenue to pursue in search of detailed import information, customs and excise records, proves to be of little help. In practice, one finds that the categories under which most medicinal plants are listed are so broad as to make the information almost useless. Only those plants entering a country in very large quantities are listed individually, but complicating the matter to a much greater extent is the fact that both those plants listed individually (and which do not have some medicinal use) and those grouped together, may also be used for several other purposes — perhaps as foods or flavourings, or for cosmetics — which are not distinguished. In the absence of detailed official statistics, interviews with traders would seem to be the best avenue to pursue. However, here one finds that the complexity of the trading network and the levels of secrecy (or confidentiality) are such that very little can be ascertained. According to Lewington, an examination of trade catalogues provides the only relatively detailed information as to the number and names of plants entering Europe (specifically Germany and the United Kingdom), although it has not been possible to get information relating to the serious matter of origin, wild or cultivated.

According to Carandang (Raintree and Francisco, 1994) who analyzed the market for small-scale multipurpose tree products in the Philippines, most of the producers (56 percent) depend on buyers (mostly wholesalers) as their source of price information. Only 10 percent of them have actual access to the prevailing market prices, while very few (1 percent) depend on their own discretion to assess the fair market price for their products. This, of course, leaves the producers largely at the mercy of middlemen as to the availability and accuracy of information on which they base their marketing decisions.

Some efforts have been made to set up marketing information systems to cater specifically to the needs of local operators. These are usually set up to provide price information on agricultural products, but some also cover selected NWFPs.

For example, the Tribal Cooperative Marketing Development of India Limited (TRIFED) operates a marketing information system which mainly serves the agricultural sector but also covers some NWFPs. The system collects price information from the domestic and export markets and disseminates it to the member cooperatives in a mimeographed publication fortnightly. The information does not, however, reach the local people.

The Agricultural Market Information Service in Indonesia is a large and expensive national marketing information system in which price collectors gather information at selected markets. The system uses computers and other high technology in processing and radio for national dissemination of information. At the local level, however, the system distributes information by using blackboards.

A further example comes from Ghana, where a Marketing Information System has been set up and operated by government agencies to provide agricultural market information. Twice a month,

the system collects wholesale and retail prices for some 30 commodities. The primary target group for the information, which is composed of wholesale and consumer price indexes, is government agencies.

With the assistance of FAO, a market information system specifically designed for forestry communities was set up in early 1990s in the Philippines. The system continues to be in operation, run by volunteers, mainly women, from the local community supported by the government forestry agency. From the local nearby markets, the system collects prices of products grown by the farmers involved and reports them on blackboards set up in suitable positions in the community. A detailed description of the system is presented in a satellite paper.

Identification of appropriate sources of marketing information can often pose difficulties. Preparation of appropriately annotated listings of relevant databases is one way to solve the problem. For example, FAO is in the process of testing a Compendium of Computer-Based Databases of Relevance to Forest Products Marketing, which also covers NWFPs and should thus help to increase knowledge of possible information sources. More work in this area would merit consideration.

Market information, once available through marketing intelligence systems, can also be disseminated through mass media. For example, in India the major means for disseminating marketing information to remote farmers include: All India Radio (95 percent coverage of the country's area), the National Television (90 percent) and the business sections of newspapers. In order to be able to tap this vast and powerful network some basic factors need to be recognized (Dwivedi, 1993):

- **Choice of products**: Considering the limitations of space in newspapers and of time in the electronic media, it would not be possible to take up all the NWFPs of interest in the country;

- **Standardization of product**: Price and other marketing information can only be reported for products which are defined clearly enough;

- **Important markets**: Most regional newspapers make a distinction between the readership they serve and that served by national papers. They concentrate on providing information on markets within the region.

- **Supply of information:** Newspapers commonly appoint one or two traders in the important markets who send in prevailing prices of different commodities. Television picks the information from some newspapers and sometimes from wire services. The State Marketing Boards also supply market information which is disseminated through mass media.

- **Number of people involved**: Newspapers are interested to know the economic importance of the activity and the number of people involved in it at various levels to judge its relevance to their involvement.

One specific and important means to collect market and marketing information is through market and marketing research. Especially detailed information of end-uses of individual NWFPs and means of accessing the markets have to be obtained through specific marketing studies. Marketing studies are needed to analyze the flow of raw materials from the gatherers of NWFPs to the primary processing industries. They are also needed to study the market opportunities and means of accessing the markets for products from the primary processing industries. The latter markets are often abroad. Information from the studies can be used both for planning and operation of marketing activities, including also components of marketing, such as product development, pricing, promotional policies and marketing and delivery channel development.

Domestic market and marketing studies are carried out by local research institutes and universities. For example, in the Philippines the few existing marketing studies on multipurpose tree species have mostly been conducted in research and academic institutions in different regions,

particularly state universities and colleges. Studies covering a certain area or commodity are not yet consolidated. They cannot therefore provide a general picture of the marketing system and practices of products in the country.

At the local level, limited marketing studies could be carried out with the assistance of extension workers. There is, however, a need for appropriate guidelines on how to carry out such studies as many extension workers do not have any experience with them.

Many studies related to marketing of primary processed NWFPs have to be conducted in export markets. For these, specialized market research consultants have to be used. In view of the high costs of carrying out market and marketing studies in the export markets, ways and means to conduct them jointly through farmers cooperatives, industry associations or some other institutional set up are worth exploring. In some instances, international organisations can assist in this.

In developing information systems especially for small-scale enterprises and community forestry systems, two critical questions should be asked: How sophisticated do the information systems have to be? and Can the truly small enterprises afford them?

As illustrated above, the information systems in their initial stages can be fairly simple and low-cost operations and still serve a useful purpose. However, with experience in using information, the needs for further sophistication will increase and the costs of the information will undoubtedly go up. One way to keep the cost of information at an affordable level is to cooperate in its collection. Knowing that all enterprises will need the same basic information should make cooperation in information collection feasible as soon as users realize the real value of information. Therefore, as important as an appropriate information system is the need to realize the value of information and to be able to use it properly. This also means that the improvement of marketing information systems has to be closely tied to the development of capabilities in marketing and using marketing information. The increased efficiency in operating businesses leading to better results will make it possible even for small-scale enterprises to help upgrade marketing information services.

MARKETING CAPABILITIES

Marketing capabilities include the basic knowledge of marketing, skills to apply that knowledge in practice, and appropriate attitudes to recognize and appreciate the value of marketing as one of the basic functions in an NWFP business.

The marketing capabilities are needed at all levels, starting from gatherers and farmers of non-wood raw materials through operators of primary processing industries to further processing industries. The members of the marketing and distribution channels specifically involved in marketing need the capabilities for their every-day operations. The government officials at the policy-making level, as well as in regulatory activities, need to have a basic understanding and appreciation of marketing. People in various governmental and private organisations who are involved in promoting trade in NWFPs also need to have basic capabilities in marketing.

According to Pabuayon (Raintree and Francisco, 1994), human resource development at all levels cuts across all people-oriented programmes and sectoral groups involved in extension. In government, the target groups are: policy/decision-makers and administrators for re-orientation seminars on extension concerning current development thrusts and objectives; and trainers (core training staff) and extension workers. Both of these groups must be adequately equipped in terms of principles and techniques/skills in farm management and marketing. As also illustrated above, the needs for capabilities vary depending on the target group.

Poor recognition of the role of marketing is clear in most NWFP activities. Planners and operators in this sector are more involved with issues of resource, processing and community

development than with those related to identification of potential markets and developing appropriate marketing approaches to take full advantage of them.

Pabuayon (Raintree and Francisco, 1994) notes that until recently, marketing extension services were rarely considered in the agricultural development programmes of Malaysia and Indonesia. In Thailand, marketing extension was referred to as "the neglected services". In the Philippines also, past efforts did not fully recognize the importance of providing farmers with marketing services in view of the largely sectoral orientation (i.e. production) of agricultural development planning. Thus, the marketing aspects of the farming business for the most part received little attention and the farmer likewise assumed an attitude of passing on to middlemen and trading sectors all post-production activities. This limited opportunities for increasing income.

To better guarantee a success, all economic activities related to NWFPs should start from the markets and their needs and wants. Many activities concentrate on producing something and only then start finding markets for products which may not have been adequately developed to meet the needs and wants of markets. Much of this is due to poor recognition of marketing as one of the basic functions of forest-based community-level businesses. This is partly due to the fact that markets are far away and that all commercial activities are done by middlemen from outside the forestry sector. LeCup (Raintree and Francisco, 1994) notes that the villagers in a project area in Nepal had no marketing knowledge because they were far from roads and from the trading places for medicinal plants. They did not know the use nor the quality required of those plants.

Another reason for a heavy resource and production orientation could be the low level of recognition of marketing in the basic training of forestry specialists in many instances. Marketing is either not present in the curriculum of forestry training institutions, or only marginally. Extension workers and NGO staff are faced with similar shortcomings.

Pabuayon (Raintree and Francisco, 1994) notes that in the Philippines agricultural and forestry development planning, the traditional concern of an extension service is providing farmers assistance to enhance technology adoption. Thus, human resource development for extension workers has generally focused on technical skills in agriculture and agroforestry. In addition to being production oriented, the extension service has been commodity-specific, resulting in the proliferation of many government agencies, each providing its own extension service.

The lower-level middlemen who have acquired their marketing capabilities through practice are often claimed to take advantage of farmers' and gatherers' ignorance of marketing. Farmers and gatherers are, indeed, in a weak position when they do not understand the commercial mechanisms that determine product characteristics, service requirements and prices. Their additional weakness derives from the lack of organisation. Individual gatherers are in a much weaker position in negotiating with middlemen than a cooperative. On the other hand, the lower level middlemen, with their largely experience-based knowledge and skills, are in a relatively weak position when dealing with industry-level buyers who have formal education in marketing and skills sharpened through experience. The intuitive skills of lower-level middlemen could be developed into full capabilities through appropriate training which provides them with the necessary knowledge base.

Government officials involved in the development of NWFP activities responsible for formulating and introducing policies and implementation measures in the sector could benefit from a sufficient recognition of marketing and an understanding of its basic elements. For instance, surveys of training needs in marketing of forest products in Indonesia (Ollikainen, 1991) and in the Philippines (Lintu, 1991) identified several ministries and their departments as well as various governmental and non-governmental agencies involved in marketing of forest products, including NWFPs, as potential target groups for marketing training.

According to the training needs surveys carried out under FAO's Forest Products Marketing Programme, there are only limited training opportunities specifically designed for forest products

marketing offered in the forestry faculties of universities. Industry marketing specialists who have a basic training in marketing received it in colleges of business administration, without any specific training in forest products or the forestry sector. Some national training organisations (e.g. in the Philippines, the Institute of Small-Scale Industries, and the Philippine Trade Training Centre; in Indonesia, the Indonesian Export Training Centre) offer some training events of relevance to marketing of processed NWFPs.

Some initiatives by NGOs are contributing to training in forest products marketing. The recent Workshop on Marketing of Multipurpose Tree Products in Asia, organised by the Forestry/Fuelwood Research and Development (F/FRED) Project together with other NGOs and donor agencies and held in the Philippines, tackled issues directly relevant to the marketing of NWFPs.

Case studies, NWFP monographs and market profiles produced by FAO and ITC, among others, provide relevant training material for seminars and workshops on NWFP marketing. Additional training material is being produced by FAO in the form of manuals and guidelines specifically targeted to community-level forestry operators.

INSTITUTIONAL AND INFRASTRUCTURAL SUPPORT TO MARKETING

Institutional support to marketing is provided basically on two levels. At the highest level it comes in the form of government policy measures and regulations governing their implementation. In the case of NWFP marketing, the implementation of trade policies and forest policies in particular has the greatest impact. At the operational level, institutional support consists of the various cooperative arrangements among producers, standardization organisations, product and quality monitoring and control institutions, research institutes, extension and other human resource development services, banking and credit services, marketing information services, transport and communication networks, etc. Most institutional support is provided by the governmental or other public organisations and is therefore to a large extent beyond the control of individual operators in a single sector. There are, however, forms of institutional support for which operators in the sector can organise themselves, such as getting organised as groups, initiating training and forming joint marketing information systems.

NWFP activities usually fall under several ministries, such as national planning, agriculture and forestry, trade and industries, health and education. Coordination of work at the national level is a precondition for successful development of NWFP activities, including their marketing. However, adequate recognition of these products and their importance by the various policy making bodies is the primary condition for initiating such cooperation.

Many NWFPs are export commodities and therefore governed by foreign trade policy, which is a combination of:

- foreign exchange policies which determine, among others, exchange rates and payment regulations;
- import policies which deal with, among other things, tariff and non-tariff barriers;
- export policies which concern regulations and procedures, incentive schemes, export promotion policies and practices and export credit and insurance; and
- international relations through which trade negotiations are conducted, countertrade and similar arrangements made and international transport and warehousing regulations formulated.

At the national level, trade is further influenced by monetary, fiscal, production and price control and investment policies.

Many institutions are responsible for various foreign trade activities. Table 5 lists institutions which were identified in an ITC study as concerned with foreign trade (ITC, 1986).

Forest services and customs offices have a particular role in NWFP activities. Their limited capability for dealing with such a varied product category often poses problems, as illustrated by an example from Nepal in which the government charged different royalties for different medicinal herbs collected from the forests and where there were differences in export regulations depending on the products. Some herbs were banned for export altogether. Identification of products based on samples involved problems of incorrect names, which required significant amounts of knowledge and institutional support from research institutions for the officials to correctly identify the products traded (Malla *et al.*, 1993).

As NWFPs are only one of many product categories over which forest and trade policies have an influence, in most instances no specific attention can be paid to them unless they turn out to be particularly important in that country. In India, the Ministry of Environment and Forests has initiated the concept of Tree Growers' Cooperatives in collaboration with National Dairy Development Board. The cooperative undertakes marketing of the produce of the farmers by entering the market for certain non-wood and other forest products to purchase the commodities at the current market price and selling them at the market price. The entry of the cooperative as a large buyer pushes up the market prices and thus helps the farmers to get better return for their efforts (Raintree and Francisco, 1994).

The national forest services are also involved in inventorying NWFP resources, regulating their harvesting and collecting royalties from the gatherers.

Universities, other training institutions and extension services provide institutional support through training of personnel for the marketing function. Government agencies and private industry organisations collect, analyze and disseminate information to support marketing efforts. These commendable national efforts should be brought together at the regional and international levels to make the information more readily available to other interested users.

Industries, private-sector research institutes and individual scientists have data and information which is useful for NWFP marketing. For example, health and safety information needed by manufacturers probably already exists but is not readily available. Similarly, industries know the standard chemical properties of each product they are dealing with. Identification of such sources of information and establishment of appropriate alliances to get an access to the information are therefore important.

At the operational level of marketing, banking and credit systems provide financing to support production and trade of NWFPs. Transportation and communication authorities provide services vital to efficient marketing. They all are important to a successful operation of the NWFP sector, especially if the sector and its importance are sufficiently known to them.

Cooperatives are vital in organising gatherers and small-processing industries and developing marketing structures jointly. In the agricultural sector there are already well-functioning cooperatives which may be interested in expanding their activities to cover NWFPs. In India, for example, there are many success stories of marketing agricultural produce through the cooperative sector.

Due to the great variety of NWFPs, some of which even compete with each other, sector-wide cooperation appears difficult to achieve. Due to the lack of common representation, for instance in the form of producers' associations which could serve as sector spokespeople, specific public support in many instances is not apparent.

In some sectors of NWFP trade there are national trade associations and even regional federations. For example, the European Scientific Cooperative for Phytotherapy (ESCOP) has been set up under the auspices of the European Union to advance the status of herbal medicine in Europe

and assist with regulatory status. One of ESCOP's main goals is the publication of 200 plant species monographs that will detail the pharmacology and preparation of medicinal plants in a proposed standard format for application to the European Union for marketing authorization.

In the fragrance industry, the International Fragrance Association (IFRA) has been set up primarily to monitor the toxicological and other hazardous aspects of the various raw materials used in the perfumery trade. The Research Institute of Fragrance Materials (RIFM) assumes a similar role in the United States.

Table 5: Institutions concerned with foreign trade and their functions *

		CM	PO	FTC	CB	MF	MT	MFA	TPO	SI	BS	TS
Functions related to foreign trade												
Policy recommendations:	on exports		(x)	x	(x)	x	x	x	(x)	x		x
	on imports		(x)	x	(x)	x	x	x	(x)	x		x
Policy-making:	on exports	x	x	(x)	x	x	x	x	x			
	on imports	x	x	(x)	x	x	x	x	x			
Policy implementation:												
Control functions:	on exports				x	x	(x)		x	(x)		
	on imports				x	x	(x)		x	(x)		
Export promotion:												
Domestic promotion activities					x	x	x		(x)	x	x	
Advisory services to exporters							x		(x)	(x)	x	x
Commercial representation abroad								x	(x)			
Trade fairs and missions							x	x	(x)	x		
Incentives:	establishment	x	x	(x)	x	x	x		x			
	granting			(x)	(x)			x				
Export credit				x				x		(x)		
Export credit insurance				x	x	x		x	(x)			
New export development		x	x	x				(x)		(x)	x	
Training								x	(x)		x	
Functions related to investment												
Policy recommendations		(x)	x	x	(x)	x		(x)			x	
Policy formulation		(x)	x	x	x	x						
Control functions		(x)		x	x	x		x	(x)			
Studies and profiles		(x)				x		(x)	(x)		x	
Promotion		x				x		(x)	(x)			

CM Council of ministers and/or monetary council;
PO Planning organisation: board or ministry;
FTC Foreign trade council or equivalent;
CB Central bank;
MF Ministry of finance;
MT Ministry of trade, commerce or development (divisions other than TPO);
MFA Ministry of foreign affairs;
TPO Trade promotion organisation;
SI Specialized institution, such as foreign trade institute, export credit insurance company, packaging institute, standards institute, etc.;
BS Banking financial system;
TS Trade sector
* x's in brackets indicate the institutions which seem best suited to perform the task concerned.

Source: ITC, 1986.

Significant support to the NWFP sector is coming from large and small NGOs. Their main concern is the resource conservation, environment and survival and well-being of local communities through NWFP activities, among others. Some of these NGOs have marketing well recognized in their programmes.

There are international and national organisations active especially in the areas of product classification, standardization and quality control. For example, the International Standardization Organization (ISO) and many national standardization organisations have established standard specifications and testing conditions for various NWFPs.

The World Health Organization (WHO) has been charged to develop international standards and specifications of identity, purity and strength for the most widely used medicinal plants and their galenical preparations. WHO has also produced *Guidelines for the assessment of herbal medicines*.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) provides an international instrument for listing species of plants and animals whose numbers are considered to be endangered to the extent that commercial trade must either be monitored and controlled or prohibited. Only very few medicinal plants are included in CITES lists.

The International Union of Nature Conservation (IUCN) and World Wide Fund for Nature (WWF) are working in the area of resource conservation and sustainable utilization.

FAO, UNIDO and ITC have NWFPs as part of their programmes which deal with their resource, processing and marketing aspects. FAO also provides specifications for food, flavouring and colouring agents and other food additives, through its various statutory bodies, international conferences, Codex Alimentarius and related guidelines and manuals which are disseminated as FAO Food and Nutrition Papers.

The work of various public and private organisations and institutions undoubtedly contributes to the common goal of increasing the awareness of the opportunities offered by NWFPs in sustainable utilization of forest resources and improving the related policy environment, information base, and technologies for resource management, processing and marketing. Many of the activities are still, however, overlapping and parallel. Appropriate mechanisms to increase cooperation and coordination would be helpful in increasing efficiency in the subject matter area.

CONCLUSIONS

The major issues which emerge from the discussion in this paper lead to the following conclusions related to the further development of NWFP marketing:

- There is a need for increased recognition of marketing as an important means of contributing to sustainable utilization of forest resources. The recognition is necessary on all levels from the policy-making government level down to the lowest operational level. Adequate recognition would help secure the necessary political and donor support for strengthened development of NWFP marketing, and through it the sustainable utilization of forest resources.

- There is a need, especially among gatherers and low-level middlemen, for knowing better the market opportunities for NWFPs. There is also a need to improve the knowledge of the resource potential for these products.

- Threats posed by competing materials, especially synthetic substitutes, to these products need to be known better to assess real marketing opportunities.

- There is a need to recognize and use appropriate means of taking full advantage of market opportunities. Price is too often used as the main, if not the only, means in marketing, even though many NWFPs are specialities for which product characteristics, distribution channels and service factors play more important marketing roles than price.

- Marketing information is very poorly available for most of these products. Information from local and national markets is the least developed sector. Similarly, information is not available by end-use sectors. Systematically collected statistics are missing partly due to the lack of appropriate product classification.

- Poor availability of marketing information is closely related to the lack of marketing capabilities. Information is not gathered or made available because the capabilities to use it are missing. The low level of marketing capabilities also means low recognition of the whole marketing function in NWFP operations.

- Infrastructures and institutions require strengthening to better support marketing activities by gatherers and their organisations. Cooperation and exchange of information among existing institutions at national and international level is needed. Local research organisations need to develop standards, grading rules and testing methods and provide related services to back up marketing.

- Development and harmonization of resource, industry, trade and other relevant policies are necessary to make the business environment more conducive to efficient marketing of NWFPs.

RECOMMENDATIONS

From these conclusions come the following recommendations for action to make the marketing of NWFPs more efficient:

- Improve supply-side information through appropriate, systematic forest resource surveys and continued inventories of useful NWFPs (identify and develop related study methodologies).

- Develop harmonized NWFP classification and definitions and initiate systematic worldwide collection of statistics on NWFP raw material resources, harvesting, processing, trade and end-uses.

- Conduct appropriate demand outlook studies for identifying market opportunities for useful products (identify and develop related study methodologies).

- Conduct complete marketing studies for main kinds of products in the main end-use sectors in principal countries (identify and develop related study methodologies).

- Disseminate information emerging from well-planned and conducted resource, industry, market and marketing studies (develop appropriate networks).

- Increase awareness of the importance of marketing in NWFP activities.

- Strengthen and set up marketing information systems to provide necessary and relevant information on markets and suppliers (identify and develop related methodologies).

- Provide comprehensive training to gatherers, producers, traders and related extension workers in NWFP marketing.

- Fully institutionalize information collection, analysis and dissemination, training, and other support activities at the national level.

- Make available appropriate communication, transport, research and other facilities.

- Make policy-makers realize the value of efficient marketing to sustainable utilization of forest resources.

- Donors should lose their fears of sustainable utilization and fully recognize its contribution to sustainable forestry and the importance of marketing as part of sustainable utilization.

- Ideally, at the local and national levels, identify and concentrate on marketing of products which seasonally complement each other and form a full product range as well as fit in the overall marketing approach (i.e. a product for each season with similar marketing characteristics to allow the use of an unchanged marketing approach all year round).

- In view of the substantial input requirements and long lead time resulting in high commercial risks, work for public support for introducing new NWFPs in markets.

REFERENCES

Anderson, D.M.W., 1989. NFT Gums: ancient and modern commercial products. *NFT Highlights*. NFTA 89-01. Waimanalo, Hawaii, Nitrogen Fixing Tree Association.

Basha, C.S. and Bhat, K.M., eds. 1992. *Rattan management and utilization*, proc. of the rattan (cane) seminar, held 29-31 January 1992, Trichur.

Boland, D.J., Brophy, J.J. and House, A.P.N. 1991. *Eucalyptus leaf oils: use, chemistry, distillation and marketing*. ACIAR/CSIRO. Melbourne and Sidney, Inkata Press.

Clay, J.W. and Clement, C.R. 1993. *Selected species and strategies to enhance income generation from Amazonian forests*. FO: Misc/93/6. Working Paper. Rome, FAO.

Coppen, J.J.W. 1994. Flavours and fragrances of plant origin: a review of the production, markets and developmental potential of selected essential oils and resins and their plant sources. Study undertaken for FAO by Natural Resources Institute. Rome, FAO.

Dwivedi, A.P. 1993. *Forests: the non-wood resources*. Dehra Dun, International Book Distributors.

Edwards, D.M. 1993. *The marketing of non-timber forest products from the Himalayas: The trade between East Nepal and India*. Rural Development Forestry Network. ODI. Network Paper 15b. London, ODI.

El Hag Makki Awouda. 1990. *Grading and marketing of gum arabic*. UNO/SUD/007/NSO.

Falconer, J. 1992. Non-timber forest products in Southern Ghana: a summary report. ODA Forestry Series no. 2. Chatham, Natural Resources Institute.

FAO. 1993. *Forestry statistics today and tomorrow*. Rome, FAO.

FAO. 1994. *Nutmeg and derivatives*. FO:Misc/94/7. Working Paper. Rome, FAO.

Fuller, D. 1991. Medicine from the wild. Washington DC, TRAFFIC USA.

Husain, F. 1992. Spices: trends on the world market. International Trade FORUM. October-December 1992. Geneva.

Iqbal, M. 1993. *International trade in non-wood forest products: an overview*. FO:Misc/93/11. Working Paper. Rome, FAO.

ITC. 1986. *Monograph on the role and organization of trade promotion*. Geneva, ITC.

ITC. 1988. Rattan furniture: market brief (Fed. Rep. of Germany, France, Belgium-Luxembourg, United Kingdom, Japan, Switzerland). Geneva, ITC.

ITC. 1989. Rattan cane: market brief (Italy). Geneva, ITC.

ITC. 1990. Cardamom: market brief (Jordan, Kuwait, Sweden, Saudi Arabia, United Arab Emirates). Geneva, ITC.

ITC. 1991 a. Handicrafts and cottage industries. A guide to export marketing for developing countries. Geneva, ITC.

ITC. 1991 b. Market research file on Selected Tropical Fruits (Germany, France, United Kingdom, Netherlands). INT/60/01. Geneva, ITC.

ITC. 1991 c. Basketwork: market brief (Italy, Spain). Geneva, ITC.

ITC. 1993. Essential oils: market profile. Geneva, ITC.

LaFleur, J. 1992. Marketing of Brazil Nuts: a case study from Brazil prepared for the Forest Products Division. Rome, FAO.

Lewington, A. 1993. Medicinal plants and plant extracts: A review of their importation into Europe. Species in Danger series. Washington DC, TRAFFIC Network.

Lintu, L. 1986. Marketing in the forestry sector. *Unasylva* 153, Vol. 38.

Lintu, L. 1991. A survey of training needs in marketing of forest products in the Philippines. Rome, FAO.

Malla, S.B., Shakya, P.R., Rajbhandari, K.R., Bhattarai, N.K. and Subedi, M.N. 1993. Minor forest products of Nepal: general status and trade. Report submitted to Forestry Sector Institutional Strengthening Programme. Component No. 2. Kathmandu.

Ollikainen, T. 1991. *Training needs in marketing of forest products in Indonesia*. UTF/INS/069/INS. Field Document No. 1. Jakarta, Ministry of Forestry, Government of Indonesia and FAO.

Patterson, G.W. 1990. Kenya Bixa industry: a production, processing and marketing resource/constraints analysis. Rome, IFAD.

Raintree, J.B. and Francisco, H.A., eds. 1994. *Marketing of multipurpose tree products in Asia*. Proc. of an international workshop held in Baguio City, Philippines, 6-9 December, 1993. Bangkok, Winrock International.

Sekhar, C., Vinaya, R.S. and Surendan, C. (authors). Shiva, M.P. and Mathur, R.B. (eds.). 1993. Price regime analysis, marketing and trade of minor forest products. A case study. Dehra Dun: Centre of Minor Forest Products.

Tewari, D.N. 1994. *Tropical forest produce*. Dehra Dun, International Book Distributors.

Vantomme, P. 1990. Forest extractivism in the Amazon: is it a sustainable and economically viable activity? First International Symposium on Environmental Studies on Tropical Rain Forests. Manaus.

MARKETS AND THE PUBLIC/PRIVATE SECTOR INTERFACE: THEIR IMPORTANCE IN THE SUCCESSFUL DEVELOPMENT OF NON-WOOD FOREST PRODUCTS

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INTRODUCTION

This paper was conceived as a result of discussions and lessons learnt at previous regional FAO Expert Consultations on Non-Wood Forest Products and other international conferences. Such meetings often concentrate on technical and perceived developmental issues, without giving due attention to the commercial dimension. In part, this is due to the fact that knowledge of the markets for many non-wood forest products (NWFPs) is partial and limited. A successful outcome to any developmental project, however, is dependent upon there being a demand for the product and uptake by the private sector at the producer, trader and consumer levels.

It is imperative that a market-led approach be applied in the selection of R&D projects. Resources available for R&D in most countries are limited and we should seek to ensure that these are allocated to those projects which hold real promise of commercial success. We must avoid the understandable pressures within many institutions to formulate projects on a supply-driven basis (i.e. in-house technical capability) and guard against the belief that there will be an automatic and significant market for something which is technically of a high quality. Neither an old product in a new form, nor a completely new product because it is natural and derived from the forest, are guarantees of marketability. We should be asking ourselves the question "What realistically can be sold?" rather than "What can we produce?" or "What do we produce at present?"

Failure to apply market criteria at the conception stage of a new project can result, at the very least, in rejection of the project proposal by funding bodies or, more seriously, in the dissipation of many years of scientific effort — frequently of a very high calibre — on R&D which ultimately fails to be taken up commercially.

Technologists, therefore, with the assistance of their marketing colleagues, must incorporate economic and market considerations into their work. This can, and indeed should, be achieved by developing a good interface with the private sector, from which it is possible to gain a better appreciation of opportunities and constraints.

This paper seeks to illustrate with some examples the benefits of close liaison between public sector institutions and the private sector. It also highlights particular considerations for new NWFPs and the separate issues of "marketing" and "commercialisation". Finally, suggestions are made on means by which R&D bodies can improve their knowledge of markets.

NOVEL NWFPs

The subject of novel NWFPs is addressed first because there is currently a propensity in R&D institutions worldwide to focus on them. This arises, in part, from the intellectual and scientific appeal of developing a new product and also from the "green/rainforest/natural product" movement, which has such a high profile in developed (and developing) countries. However, it must be recognised by decision-makers at the policy and funding levels, and by researchers, that the risks involved in

developing new products are high and the scale of market demand — and consequently, the benefits to forest dwellers — for the majority of new products is likely to be small. In the few cases where the market is large, it is probable either that the natural forest will be unable to support expanded harvesting or collection, or that it can be more cheaply produced by some other means. Since the research investment may be of a similar order of magnitude whether the project eventually has a small or major impact, it is clearly beneficial to apply weighting and prioritisation criteria when screening project ideas at the outset.

A good example of a critical, market-led approach, and one which has gained active private-sector support, is provided by a recent project in the Brazilian Amazon funded by the U.K. Overseas Development Authority (ODA). This project was concerned with the evaluation of native, aromatic plants as candidates for new cash crops for use in sustainable agroforestry systems by farmers on the forest verge. The project formulation stage benefited from the availability of a substantial analytical database on the aromatic flora of the Amazon. The data were assessed on the basis of the prospective marketability of the plants' essential oils and the likely ease of domestication and successful cultivation.

The oils from some of the plants were of possible interest to perfumers in the world fragrance industry. However, these were rejected in the initial selection phase on the basis of high investment risk: fragrance houses are unwilling to develop new products for which continuity of supply and consistent quality and competitive pricing cannot be guaranteed, while farmers themselves are reluctant to invest on a substantial scale unless they are assured a market. Instead, it was decided to focus attention on a shrub, *Piper hispidinervium*, which was, perhaps, less challenging from a chemical point of view, but which displayed very good product marketability prospects. *P. hispidinervium* is a "weed" indigenous to the southern Amazonia region. Its attraction lies in the fact that the leaf contains a very high content of the chemical safrole, which is the starting material for the production of the fragrance material heliotropin and the "soft" or "green" insecticide ingredient, piperonyl butoxide (PBO). Demand for natural safrole (about 2,000 tonnes annually) is currently met by the destructive harvesting of wild forest trees in southern Brazil (*Ocotea pretiosa*) and in China and Viet Nam (*Cinnamomum camphora* varieties).

P. hispidinervium scored highly on several selection criteria:

- there was a very substantial market potential and no major threat from synthetic competition;
- the weed-like traits augered well for domestication;
- the essential oil distilled from the plant would be sold as an industrial chemical (but one with a relatively high unit value) and market acceptability, effectively, would be based on its safrole content rather than a complex set of fragrance criteria; and
- product quality would be determined in large part by the germplasm grown and less on the skill of the farmer/distiller.

At an early stage of the project, discussions with the major world processors and end-users of safrole were held and their interest confirmed. As a result, they were able to offer continuing advice and some financial support.

After three years of cultivation and pilot-scale distillation trials, including appraisal of oil samples by buyers, the results have proved extremely encouraging: cultivation and plant management has been simple; harvesting (and hence first cash flow) is possible after six months, and can be repeated at four- to six-month intervals (tentatively for three years, but possibly for much longer); and preliminary data suggest that returns from cultivation and distillation should be attractive to the farmer. Moreover, some 10,000 ha would need to be cultivated to replace the existing non-sustainable supply base of the oil. An adaptive-phase project is now being formulated which will involve

commercial-scale proving trials with farmers, and for which the world's major buyers of safrole have pledged further support.

Within the same project, trials have also been conducted on Brazilian rosewood (*Aniba rosaeodora*) which provides a highly valued perfumery oil of commerce (currently priced at about US$ 23/kg). This was selected for research on the basis of: existing, if comparatively small, demand (about 150 tonnes annually); the need to address the problem of long-term sustainability of supply in an industry which, again, is based on destructive felling of wild forest trees; and its possible utility as a minor cash crop tree within an agroforestry package. The trials suggest that cultivation for timber feedstock to produce the traditional oil which is distilled from the trunk wood might be possible on a short-rotation basis and that a new product, a leaf oil, could be produced by a sustainable coppicing system. The project has benefited considerably from interaction with the private sector: first from the traditional distillation industry in Brazil, which would welcome a sustainable source of rosewood oil, and second, from the international traders and fragrance houses who are undertaking objective appraisals of the potential of the new leaf oil. This particular project is highlighted since, although it meets several important criteria, the small market size for the products does not offer a sufficiently high return on investment in R&D to make it attractive on its own. A decision on further investment will be dependent, therefore, on confirmed promise of sales of the new leaf oil and on spreading the R&D costs by making it part of a larger project.

Similar types of products (i.e. those which have a significant established market demand but a threatened supply-base) may well merit examination elsewhere and might be expected to find support from the private sector.

IMPROVEMENT OF EXISTING NWFP INDUSTRIES

While "novel" NWFPs have their particular attraction for the researcher, we should not allow this to lead to neglect of established NWFP industries, many of which have a need for improvement and offer the opportunity for scientific research of a high order. This is illustrated by two examples from the plantation sector.

Eucalypts have been widely planted for pulp, timber and fuelwood purposes. They are also an important source of essential oil, particularly the medicinal type. However, most of the research aimed at improving productivity and product quality of eucalypts has been devoted to timber and pulpwood applications. Comparatively little effort has been given to essential oil production and to multipurpose use. At the Natural Resources Institute (NRI), work on species and provenance selection and on field management systems for oil-bearing species has been carried out for a number of years in collaboration with private-sector companies in Africa. This has been mutually beneficial and, indeed, could not have been performed by any other means. Close contact with the private sector ensures that the research does not go off at academic tangents but follows lines which have a demonstrably practical objective and will result in economic returns. It is important also to note that collaboration with the private sector is not necessarily a constraint to dissemination of the results of the research. NRI's experience is that publication is generally agreed by the private sector collaborators so that the results remain in the public domain for others elsewhere in the world to benefit.

Similar research has been undertaken by NRI on pines, which are tapped and utilised as a source of turpentine and rosin.

ADDED-VALUE PROCESSING OF NWFPs

Upgrading the value of materials by further processing prior to sale is a natural interest of all those involved in NWFPs R&D. However, a word of caution and suggestions on the approach to this subject are needed here on the basis of NRI's experience. For a variety of reasons it is neither easy

nor necessarily economically justified to attempt to penetrate the added-value market. Some of these reasons are not always apparent at the concept stage.

A study on gum arabic was recently undertaken by NRI on behalf of a Kenyan NGO. It was aimed at assessing the potential for producing value-added derivatives for direct sale to the printing and pharmaceutical industries in the UK. Direct interviews with importers, processors and end-users revealed that major technical and practical constraints existed for the production at origin of spray-dried or formulated products. However, the simple process of *kibbling* (that is, reducing the larger lumps of gum to a smaller and more uniform size) prior to export was identified as something which could offer the value-added advantages that were sought. This example demonstrates the benefits of carrying out a market study, albeit a rather small one, and identifying the appropriate developmental option before embarking on an investment which, at first glance, might appear to offer the greatest return.

A rather more surprising conclusion was reached by an NRI study in 1989 for Perum Perhutani, the Indonesian State Forest Corporation. Indonesia was then making a growing impact on the international market as a supplier of turpentine but was importing substantial quantities of the derivative, pine oil. Logic appeared to point to curtailment of the volume of raw turpentine exports and domestic processing to pine oil for import substitution and, possibly, for export. However, the market study indicated that at that time there would be no substantial economic advantage in taking this course, primarily from the level of competition for pine derivatives on the international market. The study recommended that the market situation be reviewed after a suitable interval and that any feasibility study involve examination of a broader range of turpentine derivatives. (No such investment had been made as of August 1994.)

THE LAG-TIME IN IMPLEMENTATION OF RESEARCH RESULTS

Even with soundly selected and executed developmental work, there can often be a considerable lag-time between dissemination of the results and their eventual uptake by the commercial sector. This fact must be appreciated, firstly by the researcher — who understandably is impatient for his findings to be utilised — and equally importantly by the funding agencies. In the experience of NRI, the lag-time can be long and eventual uptake can occur in areas which had not originally been foreseen.

Pine tapping, once again, provides an example. During the 1970s and 1980s, it was recognised that major changes were occurring in the global supply and demand for turpentine and rosin and that opportunities were emerging for the development of new industries in non-traditional areas. The results of a market study and a techno-economic profile outlining methodologies and financial aspects of turpentine and rosin production were published by NRI in 1984 for the benefit of prospective new producers. No immediate, visible outcome occurred in what had been perceived as the obvious candidate countries. Some years later, however, it was learnt that an industry had been set up by an entrepreneur in Kenya using the NRI publications as a source of much-needed information. The same entrepreneur has recently expanded into Uganda. This demonstrates the slow and often unexpected manner in which disseminated information bears fruit.

MARKETING AND COMMERCIALISATION OF NWFPs

The importance of market knowledge has been stressed in the preceding discussion. Other key aspects of ensuring a successful development are product marketing and commercialisation. These are two distinct issues which are frequently confused. The first involves identification and promotion within specific markets and the second is concerned with establishing an effective mechanism for commercial uptake.

A good example of the sort of problem which can be encountered is provided by a current project in Bolivia. This involves diversification by farmers out of coca cultivation in the remote areas

of Bolivia into new cash crops in sustainable agroforestry systems. One of the developments involves essential oil production by farmer cooperatives. The choice of essential oils is highly appropriate in terms of their high unit-value characteristics. However, the original concept was very much technology-driven and the marketing/commercialisation aspects were neglected. This has now been rectified by technical assistance by the UN Industrial Development Organisation (UNIDO), to which NRI has contributed as consultants. Examination of the international and regional markets has provided a better focus on the most promising crops and target markets. The latter proved to be regional, with Brazil being prominent. Of equal importance, the regional market study brought buyers into direct contact with the cooperatives and it was possible to establish commercialisation (trading) mechanisms with several interested companies.

Success in a commercial venture is dependent upon many factors but the means by which the product is traded from producer to buyer must be recognised from the outset as being of critical importance. Products do not sell themselves, but require sustained efforts and contacts.

MEANS OF IMPROVING MARKET AWARENESS

Many NWFPs are relatively minor and specialist items in terms of world trade. Consequently, reliable information on trade and markets is often not readily available to researchers in producer countries. Nonetheless, it must be accepted that research on markets is a very important element of project identification and formulation. Ideally, a team of technologists and economists should be involved at the outset in the new project process.

With some commodities, UN bodies or specialist research organisations in the developed countries undertake and publish market studies. By the time such documents are accessed by researchers in producer countries, they may be out of date; supply and demand are dynamic and not static. Nevertheless, this type of publication can provide a better understanding of the market, constraints and risks and, most importantly, the identification of prospective buyers. The published proceedings of specialist conferences provide equally valuable sources of information.

Up-to-date awareness of market opportunities or constraints requires a more intensive effort. Valuable guidance, if not the definitive picture, can often by provided by individuals within UN and specialist overseas institutions, so networking is a good idea. Developing and extending contacts within the domestic private sector can also be worthwhile; many traders are highly experienced and knowledgeable and, in addition to providing guidance on the international market, they can often identify unrecognised domestic market opportunities.

At some juncture, it will be necessary to contact prospective overseas buyers. In the first instance, dealers are an important source of information; end users still rely heavily on these intermediaries. Several traders should be consulted to avoid biased views or ones unduly influenced by short-term market trends. In communications, concise background information on the project should be provided and, if available, a representative sample of the product. This makes a favourable impression on the recipient.

Finally, the role of FAO should be acknowledged in the areas of both compilation of statistics and information dissemination. The series of meetings on NWFPs, of which this consultation is the culmination, have served to highlight the importance of NWFPs in the social and economic life of people all over the world and the need to conserve the forest resource. The forest is there to be used, but wisely and sustainably. The meetings have provided a valuable forum for discussion and it is to be hoped that the information, advice, cautionary tales and salutary lessons offered by speakers at the present one contribute to this better use.

SOME MARKETING PROBLEMS FACED BY AGROFORESTRY FARMERS IN ASIA

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INTRODUCTION

To raise the economic status of the rural poor, efficient market development should be made an essential component of social community forestry. Past experience has shown that market demands provide significant incentives for farmers to grow trees. Besides being profitable, planting of trees will also encourage economic usage of land unsuitable for agriculture. The response from farmers to market demand will be influenced by how returns compare with other income-generating activities, farmers' productive capacity and available primary inputs. Access to credit facilities and markets will influence the type of species adopted by farmers. Farm forestry will also provide employment for other sectors of the community (FAO, 1985).

Pabuayon (1990) notes that an efficient marketing system is one that moves goods from producers to consumers at the lowest cost consistent with provision of services that consumers desire and are willing and able to afford. If transportation infrastructure is poor, proximity of the farmer to the market becomes very important. Storage, grading systems, processing facilities, market information and market facilities where buyers and sellers can interact and transact business in a relatively competitive manner must be considered. Buyers must not be allowed to exercise exploitative control on prices at the expense of producers. Although farmers are able to participate in marketing of their produce, they rarely receive a fair price for it. Incentives for increased production are minimal and incomes remain small (Edwards, 1988).

Market development requires incentive structures, such as land tenure security, technical assistance, credit support as well as viable marketing schemes. Another important variable in the farmers' decision-making process about the type of product to grow will be price, therefore favourable price structures will be important. This will in turn require an efficient input market, i.e. low-cost inputs of fertilizer, seeds and seedlings.

IMPORTANT COMMODITIES PRODUCED IN ASIA

Types of wood and non-wood commodities of importance in Asia differ between and within countries, but a report in *Foreign Agriculture* (1992) lists rubber, palm oil, coconut and its derivative products, tropical fruits and spices as highest in value in terms of international export in the Asian region. Products which are not important in terms of export but important at local and regional levels include indigenous fruits and firewood.

MARKETING STRUCTURES AND THEIR LIMITATIONS

There are three main types of marketing channels in Asia. Farmers market individually, with the assistance of middlemen or through cooperatives.

MARKETING INDIVIDUALLY

A farmer marketing individually represents a small competitor individually controlling meagre resources. This limits farmers' bargaining power in the market, which is further weakened by a poor

financial position and inability to keep up with rapid changes in market conditions. The small size of surplus marketed by farmers makes it difficult for them to sell to companies interested in bulk purchases. Farmers are generally unaware of markets for their produce, and in some instances even when they are aware, they do not know how to market their products. This ignorance is perpetuated by a lack of information on markets and prices. Farmers sell to whoever wants the produce at prices usually set by the buyer. Each farmer makes non-systematic independent decisions which are not planned. They thus lose out to unscrupulous traders.

Marketing through a Middleman

Middlemen have maintained a stronghold on the market scene because they are able to provide farmers with resources essential to their work: **quick credit, non-bureaucratic and quick payment for goods and good organisation**. They remain essential for commodities that require time, storage, space and energy inputs, for example for products that must be dried, stored, transported, processed and packaged before distribution. In many cases these commodities are sold and bought several times, adding value at each step, before reaching the consumer. The technology and finance to perform these functions are usually beyond the reach of low-income farmers and are left to middlemen who have the resources.

A combination of the farmers' lack of knowledge of actual market prices and poor marketing supports the middlemen. They are often money lenders, local merchants of food and beverages and other household requirements. Once the farmer is indebted, he or she is obliged to sell and buy continuously with the same individual, even when prices are unfavourable. Poor communication and transportation facilities, highly segregated markets, and unequal bargaining power between buyers and sellers make the field more profitable for middlemen (Pabuayon, 1990). Farmers sell through middlemen for want of a better marketing system, and because middlemen give cash advances without bureaucratic intervention in periods when the farm is not producing money (Punzalan, 1981).

Marketing through a Cooperative

Cooperatives are in operation in many countries in the region but very few have been successful. A study carried out to test the possibilities of small-farmer group marketing found four major deficiencies in cooperatives on the continent (Anonymous, 1983):

- lack of strong leadership to direct the cooperative;
- lack of group homogeneity to ensure a common view on problems and rapid identification of correction measures;
- lack of planning on long-term goals of the cooperative; and
- lack of government support needed at the initial stages of a cooperative.

In Taiwan, Hsu (1983) found that some farmers were not loyal to their cooperatives and sold high-quality goods to other buyers when prices were better, and poor-quality goods to the cooperative, often demanding the same prices, rendering the cooperative poor competitors.

Many cooperatives have failed to meet the goals for which they were created: self-reliant farmers, clear advantages of large-scale transport, shipping and marketing to attract the interest of farmers, concerted efforts to expand business areas, volume marketing either through specialization or diversification, provision of a central authority to bargain with exporters, importers and processing industries. In many cases, also, they have failed to take into account differences in members' cast, sex or religion. They have also tended to be too small and poorly funded, and as a result have not been efficient in marketing or competing with well organised middlemen and dealers who have been performing these services for long periods. The poor funding typical of cooperatives in the region has rendered them inefficient in management functions. They usually lack any business plan. Further, poor funding has limited the potential for cooperatives to make full analyses of the markets. Legislation

which would assist cooperatives become viable, such as tax exemption and concessional loans, has generally been lacking.

COMMON FARMER PROBLEMS

Some of the problems encountered by farmers, between production and marketing of products, are discussed briefly below.

PRODUCTION

Low production is a major limitation for some of the commodities considered. In many cases this results from the small acreage of land owned or leased by farmers. Also, the quality of planting stock used by farmers is generally poor, resulting in poor-quality products that cannot compete on the market. This acts as a disincentive to increasing production. Further, technologies used by most farmers are not conducive to large-scale production, they do not use fertilizer or other methods of soil enrichment, and generally trees are tended only when all other agricultural work is at a minimum.

HANDLING AND STORAGE

Handling and storage facilities are below standard, with worst consequences for perishable products that bruise and spoil easily. This results in losses estimated between 25 to 50 percent. There is a general lack of strict standards to guide grading and packaging for most commodities and buyers often re-grade/sort and package before reselling to companies. Failure by farmers to respond to standard guidelines is due to the complexity of the guidelines. Local standards are needed that are easy for the farmer to understand while at the same time relating to internationally accepted standard. Availability of storage facilities among the poor is inadequate or non-existent.

PROCESSING

Farmers seldom process their products before marketing them, which could earn them added income, increase product value (especially in the case of fruits and edible oils) and allow adjustments to seasonal excess of supplies. Processing techniques are not easily available to farmers and in some cases farmers feel that even if they process their products they would still only earn a small income, but this has not been proven.

TRANSPORTATION AND INFRASTRUCTURE

In urban areas, infrastructure and transportation are usually well developed, but not in remote areas where poor infrastructure and high costs of transportation are barriers for potential market entrants, leading to a less competitive market environment. In some countries like Nepal, produce intended for the market never makes it there because both infrastructure and transportation are poor. This problem is acute on larger islands, for example in the Philippines, where farmers are scattered over wide areas and transport costs are high. Some bulky commodities, such as fuelwood, a low-value product, are expensive to transport and therefore less lucrative. Poor transportation decreases quantities available for the market and acts as a disincentive to increased production. Most farmers do not own vehicles so overhead costs of transportation of certain commodities may be even higher than expected returns. Poor economic conditions in these countries hamper the possibilities to upgrade the infrastructure in the immediate future.

CREDIT FACILITIES

An analysis of farm and village forest-use practices in South and Southeast Asia noted that very few villagers report using credit from government sources, such as banks (Mehl 1991). For credit facilities, farmers tend to rely on family members, traders and middlemen. Few farmers borrow from formal financial institutions because they lack collateral. Also, methods used for credit checking make

most farmers ineligible. However, even where farmers would have been eligible to borrow, long delays between application and receipt of loan have generally deterred them. Repayment methods seldom suit farmers who prefer to repay with produce at time of harvest rather than cash. Monthly instalments for the repayments of debts are inappropriate, as farmers receive only one or two lump-sum "paychecks" a year.

Generally, governments in developing countries have intervened heavily in rural financial markets, with the aim of supplying affordable credit to small farmers and rural business people to spur investment. Weak legal systems and ineffective enforcement arrangements contribute to commercial banks' reluctance to lend to rural people. Farmers' lack of collateral, mainly resulting from lack of secure land tenure, has not encouraged banks (Yaron, 1992).

Lack of commercial bank lending options has led to flourishing informal credit markets, which are characterized by low transaction costs for the borrower and rapid disbursement of funds and in many cases high interest rates and/or low product prices. Close familiarity with the borrower's creditworthiness and efficient loan collection mechanisms have established the informal credit market as the exclusive, and in some cases the preferred, source of credit in rural areas, in spite of the high interest rate charges, limited loan portfolio and operation in limited areas (Yaron, 1992).

Yaron (1992) also reports that for the most part, past performance of the state and donor-supported agricultural credit operations has been poor, with most programmes reaching only a minority of the farming population. Those institutions that they have managed to reach have generally failed to develop into self-sustaining credit facilities. Another problem with these loans has been that benefits tend to be concentrated in wealthier farmers. A recent study carried out in China and Thailand showed that for both borrowing and non-borrowing farmers, only a small minority had an unsatisfied demand for formal credit, as they have access to the more flexible services of the informal moneylenders.

Policy

Governments need to assist small farmers to market their produce both locally and internationally. Whatever policies are implemented should reflect this. There is a need to review existing policies and ensure that they offer sufficient incentives and stability to encourage growth of efficient marketing enterprises. These include: food pricing, import policies and market intervention conducive to a full utilization of existing human and capital resources.

Marketing Information

One of the most common problems faced by small farmers in Asia and other developing regions is the lack of market information on prices and factors influencing market prices. Market information systems must be made available and efficient. Governments should fund and develop ways in which market information can be disseminated. Small-scale farmers are often short or resources, so information must be disseminated at little or no cost to them.

CONCLUDING REMARKS

This brief résumé from Asia highlights some of the problems farmers face as they compete in the market to increase their economic status. There is a trend for both international donor or lending agencies and local governments to promote small-business operators in forest-based production. However, there is a need for governments to examine market structures and attempt to ensure all components, from producers to consumers, receive a fair share of product value.

REFERENCES

Anonymous. 1983. Introduction, in *Small farmer group marketing in Asia*. Bangkok, U.N. Economic and Social Commission for Asia and the Pacific.

Edwards, C.1988. Developing and using agricultural data to describe the current situation and analyze the outlook. In *Collection and analysis of market information for farm production in Asia*.

FAO. 1986. *Tree growing by rural people*. FAO Forestry Paper. Rome, FAO.

U.S. Department of Agriculture. 1992. *Foreign agriculture 1992*. Washington, DC, USDA Foreign Agricultural Service, Information Division.

Hsu Wen-Fu. 1983. *The marketing of farm products by farmers' organizations in Taiwan. In Producer-oriented marketing: strategies and programmes*. Taiwan, Food and Fertilizer Technology Centre for the Asian and Pacific Region.

Mehl, C.B. 1991. Trees and farms in Asia: an analysis of farm and village forest-use practices in South and Southeast Asia. Bangkok, Winrock International Forestry/Fuelwood Research and Development (F/FRED) Project.

Pabuayon, I.M. 1990. Marketing tree products from small farms: case studies from the Philippines and implications for research. In Haugen, C., Medema, L. and Lantican, C.B., eds., *Multipurpose tree species research for small farms*, proc. international conference held November 20-23, 1989 in Jakarta, Indonesia. Bangkok, Winrock International and IDRC.

Punzalan, D.C. 1981. Cooperative marketing in the Philippines. In *Food marketing in Asia: systems, cooperatives and policies*. Taiwan, Food and Fertilizer Technology Centre.

Yaron, Y. 1992. Rural finance in developing countries. Policy research working papers: agricultural policies. WPS 875. Washington, DC, The World Bank.

AN OVERVIEW OF HARVESTING, FOREST PROCESSING AND TRANSPORT OF NON-WOOD FOREST PRODUCTS

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INTRODUCTION

During the past decade, the idea of conserving natural resources by using them more appropriately has become both necessary and fashionable. This idea is not new, of course, since many people living in or near remote or fragile ecosystems have a long history of exploiting their resource base without destroying it. Increasingly, population pressure, shrinking resource bases, increased market demand, or newly found "needs" have driven many community-based groups to exploit their resources at non-sustainable levels.

People everywhere have increasing desires to consume. Wants have become needs as potential producers/consumers are drawn deeper into market economies. In order to consume more, however, local people must have goods to trade or sell. Often the production of marketable goods tests the limits, or even goes well beyond them, of traditional resource management systems, which have never had to provide for so many people or produce such surpluses for external markets. To increase, or more often even to maintain, their standard of living, many groups are degrading or even destroying the resource base that future generations will require for survival.

The questions then, are: Which income-generation, value-added strategies allow local groups to exploit their resources without destroying them? And, How can local groups think through these issues in ways that will help them design and implement successful development strategies, while conserving the resource base for future generations? This paper reviews how local people can reduce resource use and/or increase income. Strategies include to:

- improve the harvesting techniques of existing products;
- reduce post-harvest losses;
- store/warehouse or hold product off the market until the price increases;
- undertake value-added processing and marketing of the products;
- identify and use appropriate production and processing technology; and,
- improve transportation systems.

Community-level, income-generating activities are not theoretical. They are not about paper profits — calculations about the theoretical value of one strategy over another — but, rather, real incomes in real peoples' bank accounts. Likewise, what is at stake is also very real — the conservation of the natural resource base and ecosystem function that future generations of humans and every other species will require for survival.

ISSUES AND PROBLEMS

To date, considerable attention has been focused on the natural resource base of communities. What are the economically valuable species? Can their density be increased? How much of a product can be harvested without destroying the species or the ecosystem? There are, however, a number of strategies that communities can pursue that will decrease their use of resources and increase their

income. The most well known of these is adding value to what they are already selling so that they can generate higher revenues without increasing the off-take of natural resources.

Value-added activities, however, go well beyond village-level processing and manufacture. Each time a product is harvested, stored, bought and sold, transported, processed or altered in some way, "value" can be added. Most communities who collect or produce products that leave their areas currently receive only 2 to 15 percent of the New York City CIF or "landed" price of the commodities that they sell. With population pressures, if producers continue to receive such a small portion of their products' value, they will inevitably be forced to degrade their resource base as they try to maintain their standard of living (not to mention improve it). Furthermore, many of the value-added strategies discussed in this paper apply equally well to communities that use their resources primarily to meet their subsistence needs and only sell surplus on the market.

To begin with, each community should evaluate the current production and trade structure for each product that is being considered for a significant role in their conservation and development strategy. Communities need to determine where value is being added for each product, where risks exist, and where they can gain or loose the most in the short, medium, and long term. Eliminating intermediaries by transporting products longer distances is one strategy. Negotiating directly with buyers or adding value through local or regional processing are others. In some instances, the best strategy is to develop independent product branding or labelling to capture additional value. The best strategies may involve two or more different activities. However, it should be noted that adding value locally, in a traditional sense through processing or manufacture of products locally, does not always make sense. (For a more detailed analysis of these issues, see Jason Clay, *Generating income and conserving resources: lessons from the field*, 1994, Washington DC: World Wildlife Fund.)

Research should be undertaken on each product that is seriously being considered as a part of a community's overall income generation strategy (e.g. once a community has identified two to four possible products). This research should focus initially on identifying, within the current production, trading/marketing and manufacturing systems, the point(s) where value can be captured by producers. Areas of potential intervention or exchange include:

- harvest losses and harvest efficiency;
- financial returns per unit of labour invested in harvesting and/or processing;
- post-harvest losses;
- transportation costs;
- credit tied to purchase (as in a company store system where producers are advanced goods at 1 to 100 times their value and then required to sell their products to the merchant at less than their actual value);
- processing to increase purity and value, reduce volume, or increase shelf life;
- appropriate technology to reduce the costs or increase the efficiency of harvest, transport, storage and or processing; and,
- the impact of monopolies (e.g. transport, credit, markets) on key points in the market chain.

Each non-wood forest product (NWFP) has a different production and marketing system. Essences, oils, flours, nuts, fruits, honey, resins and meats are all different. Each product has its own set of producers, processors, traders/marketers and end users.

Gathering basic information about the journey to market for each product is essential in order to determine which products offer a community the most opportunity for increasing income while conserving their resource base. In addition to the comparative analysis between products that such research affords, it also helps communities decide where they might intercede profitably in the system so that more value can be added or captured by the producer. With this information, a community can make informed decision about when it is advantageous to process their products, when it is not worth the risk or capital investment, or when they do not have the financial or management skills required

for the job. Likewise, they can calculate when it makes sense to hire a truck to transport their product to a better market (it rarely makes sense to buy one!).

It is also important for communities to remember that it is possible (and often profitable) for groups to generate income from activities that they do not control directly. Through negotiations with traders or manufacturers, local groups can generate income on the resale of their products throughout the trading system. Many producer groups now receive a 5 percent "environmental premium," royalties, licensing fees or shares of profits from manufacturers on the sale of their product in New York or London. A 5 percent premium can equal 30 percent or more of the price that a local community originally received for the sale of its product.

This, then, offers a general context to the issue of value-added activities associated with harvest, processing, and transport of NWFPs. Other papers presented at this consultation cover these issues in more depth. The remainder of this paper will focus on the more specific issues indicated in the title. It should be noted, however, that communities should not separate many of the issues covered by the different papers. For example, harvesting should not be separated from inventories of natural resources. Likewise, markets, marketing and value-added processing should be linked to natural resource inventories and management schemes.

Improve the Harvesting Techniques for Existing Products

Most producers would benefit from the adoption of improved harvesting techniques. The implementation of improved harvesting techniques usually requires some training of harvesters, as well as new equipment and/or management strategies. In many instances, baseline data on economically valuable species is needed to measure the extent to which continued or increased harvesting may pose problems for such species.

Many times as people move from subsistence use of their resource base to more market-, surplus-oriented uses, they cannot continue to use their traditional harvesting techniques without degrading the resource base. Through research, it is possible to evaluate which new harvesting techniques make sense in terms of the time they require, their economic costs/returns, or their environmental impact. Research may also be necessary to provide the information that will convince harvesters to trade old practices for more efficient ones. A good review of how to determine the biological impact of harvesting products from different wild species (e.g. leaves, seeds, bark, root, sap) can be found in Charles Peters' 1994 manual entitled *Sustainable harvest of non-timber plant resources in tropical moist forest: an ecological primer* (Washington, DC: Biodiversity Support Programme).

It is quite possible that by merely improving the harvest of products, local producers can realize a 10 percent or greater increase in marketable products, and hence in income, from each product. Gains can be made both by reducing harvest and post-harvest losses (i.e. making more of what is harvested marketable) and by maintaining or increasing natural stands of the species rather than reducing them. If harvesters unnecessarily reduce the number of individuals from which they can harvest, they will spend more time finding others in coming years. In some cases, they will deplete the species on their land and will either have to move to find more, do without, or begin to sell new products.

Guaranteed land and resource rights (or usufruct rights) are key to the development and implementation of sustainable harvesting techniques for every product. Without clear resource rights, harvesters have no incentive to develop long-term harvesting strategies either for single species or more complex agroforestry systems. Resource rights also allow harvesters to make financial investments in the equipment they need to harvest products sustainably or add value to their products through processing.

For many products, the issue of sustainable production has as much to do with harvesting as any other single factor, particularly for wild-harvested, NWFPs. Furthermore, proper harvesting increases income not only in the medium and long term but in the short term as well. The following examples illustrate this point.

- Pau rosa (*Aniba roseadora*), an essential oil of which harvest has almost eliminated the species from the Amazon, can be harvested sustainably if only the leaves and twigs are harvested during certain seasons rather than chopping down the entire tree. Research to date indicates that the highest concentrations of essential oils are actually found in the leaves. Communities need to study their own harvesting practices to determine whether they are environmentally and, consequently, economically viable.

- Balsam of copaiba (*Copaifera multijuga*), the liquid resin from a South American tree, can be harvested from the same tree for decades if the extractor uses a brace and bit to drill a hole into the trunk to extract the resin and then plugs it with a stick rather than opening a hole with an ax, which never closes.

- The production of cinnamon in Indonesia could be undertaken repeatedly on the same piece of land. Today, however, producers move into new areas (even national parks) destroying not only native stands of cinnamon (and the genetic varieties that they represent) but also entire forest ecosystems as well.

- The production of asai (*Euterpe oleracea*) for either fruit or heart of palm can be increased through careful management, monitoring and appropriate harvesting to levels that are significantly more productive than exploiting natural stands through traditional methods.

- Gaharu (*Aquilaria malaccensis* and related spp.) produces a highly valued essence in Southeast Asia. Unfortunately, not all trees produce the essence. The essence results from a chemical change within trees that have a fungal infection. Local residents claim to know how to determine whether standing trees are infected or not. New residents, by contrast, cut all the gaharu trees, but only harvest the infected ones. Non-resident harvesters cannot tell which trees are infected until they cut the tree. Consequently, they are responsible for the destruction of sizeable areas of forest habitat. All harvesters would be better off if those new to the area were instructed in the indigenous management of the species or if techniques could be developed to take core samples from the trees in question to determine if they are infected. If not infected, they could be left, or, better still, deliberately infected so that they can be harvested in the future.

Reduce Post-Harvest Losses

Many harvesters invest little time or money in reducing post-harvest losses. Yet many economically feasible techniques exist which would provide a handsome return to producers. The Brazil nut illustrates this point. The current harvest and handling techniques of harvesters result in the wastage of up to 10 percent of all nuts they harvest. Little is known, for example, about how to harvest or store Brazil nuts in the forest during the rainy season before they are transported to market. Should the nuts be picked up as soon as they fall off the trees, or is it better to leave them in the *ouriço* (the true Brazil nut fruit, a hard woody sphere that holds the seeds) on the forest floor until they can be sold? What are the best storage facilities? Should they be elevated off the ground? Should warehouses be thatched-roofed or slat-sided? Should cracks be left in their sides or the floor so that air can circulate? How deep should the stored nuts be stacked? How often should they be rotated? Under ideal conditions, how long can the nuts be stored unshelled before they go bad? How can collectors determine which of their nuts are bad? If harvesters increase the quality of their nuts, will they receive a better price?

It is not only harvesters that should reduce post-harvest losses, but traders also. Once Brazil nuts are sold to traders, for example, they are shipped by open barge to Manaus or Belém (1,600 to 4,800 km) where they are shelled and packaged for export. On these journeys of up to one month, 25 to 35 percent of the nuts rot. Covering the barges or processing the nuts closer to the forests could reduce the post-harvest losses, generate more employment, and make financial sense.

Harvesting is often an arduous task. Transportation to market is difficult and often must wait until a change of season. Rodents, insects, and rot can reduce harvests by 25 percent or more even of durable items. All of these factors make the reduction of post-harvest losses an essential task as well as a potentially profitable one for every producer. In short, once so much effort (and in some cases money) has been invested in harvesting a product, it makes sense to ensure that as much of it as possible can be used or sold at the highest price. Individual harvesters or communities can reduce their post-harvest losses by 10 percent or more depending on the commodity. The ways to reduce post-harvest loss should be examined for each commodity a harvester or community trades or wants to trade. Any gains made in this activity are literally money in the bank.

Warehousing and Holding Products Off the Market

Once harvesters have invested the time and expense of harvesting a product, they should try to obtain the highest price that they can for it. Most products, particularly wild harvested ones, often have well defined and relatively short harvest seasons. As production peaks, prices decline (often plummet). Lucrative markets for many products, however, could easily be sustained throughout the year if produce were available.

Due to the local glut of product on the market, producers receive very low prices for their product during periods of peak production. Holding a product (i.e. storing it, or processing it and storing it) is often a way to add value. To the extent that the product can be sold out of its normal season (i.e. during the "off" season when it is not common or not regularly available at all), it will not only command a higher price, it will also help to buoy a product's price during the period of peak production. This approach works quite well for regional or national markets. For example, it allows producers to process and freeze seasonal fruit pulps which could have tremendous year-round markets. IPHAE, a Brazilian NGO fruit processor that works with local producers, has found that it can process locally valued fruit pulps and freeze them in 250-g bags for sale in local markets. They receive more than two times the peak season price for frozen pulp, which more than covers the additional costs for freezing and handling.

Warehousing is essential for many international markets. Many manufacturers will not invest the time or money in new products if they are not assured that they will have a continuous supply throughout the year. Even if the supply is limited, most Northern manufacturers want product to be available throughout the year.

Value-Added Processing and Sales of NWFPs

One of the main reasons that primary product producers can be kept impoverished is because they do not benefit from the value that their products generate as those products move through the economic system to the ultimate consumer. This situation is created by lack of both information and competition in the marketplace. In order to increase local revenues, competition must be increased. Some ways to accomplish this are to:

- understand your costs, then invest in production systems that realistically reduce overall costs or increase the overall return to producers, making production and processing more efficient and more competitive;

- seek alternative traders and/or try to circumvent traditional trading or shipping monopolies;

- use product differentiation to create alternative markets and/or buyers (e.g. talk about a product's social or environmental impact or move out of the food industry into the personal care products industry); and

- use the media or sympathetic non-governmental organisations to help market product(s).

Some of the specific questions that communities should think about before embarking on value-added processing of their products are outlined in the text box.

One of the curious effects of monopoly capitalism as it is practised in many areas of the world is that it discourages either sustainable harvesting practices or economically viable production systems. The extraction of NWFPs is seen as the mining of resources which have no intrinsic value. With a few exceptions, these resources' values reflect only the labour and capital costs required to get them to market. In rare cases (e.g. gold or diamonds) market scarcity gives independent value to that of the investment of labour and capital. Two other factors that push the intrinsic value of resources toward zero are (1) that each product nearly always has producers from many parts of the world and (2) products usually have substitutes (e.g. one oil can be substituted for another, one nut for another). Prices tend to determined by the lowest-priced substitute.

To add value or not to add value — that is the question

Whether or not it makes sense to add value locally is a complex issue. Decisions about if or when it might be appropriate to add value locally or how much value should be added vary widely from group to group, commodity to commodity, and region to region. The types of questions that should be considered when making such decisions include the following:

- What is the volume of the commodity in question?
- Where is value currently being added?
- What are the easiest/quickest ways to add the most value with the least risk?
- Which forms of processing open the product to a wider market?
- Which forms restrict its markets?
- Which forms of adding value expose the producers to risks? (This is a fundamental trade-off which must be fully recognized from the outset in all such activities.)
- Which risks should be avoided?
- What is the seasonality of production?
- Can the investments (processing plants, driers, warehouses) for adding value to one crop be used to add value to other products during the off season?
- Is capital readily available? Does the group have access to it? At what costs? Does a group have collateral?
- Is there sufficient labour? Do labourers have any interest in, or skills at, performing the necessary tasks?
- Would local people know how to manage a plant, either in technical or financial terms? Would there be resistance, a priori, to the idea of importing outside management?

Value-added processing should not be done in a vacuum. The best strategies should allow producers or communities to potentially gain as much value as possible with the least risk. By definition, such programmes should be done, therefore, only after a thorough assessment of a community's natural, human and financial resources.

Another way a community can add value to its products is through marketing strategies. In some instances, this will be best accomplished by reducing the risk of not being able to sell one's product by diversifying the number and type of end users for each product they sell. There are several ways to do this. First, products can be sold on local, regional, national, or international markets, or a combination of all of them. In addition, producers can sell to end users who have different uses/markets for the product themselves. For example, Brazil nuts (*Bertholletia excelsa*) can be used as nuts (shelled or unshelled), or in ice cream, baked goods, cereal, candy, oil, flour, salad dressings, cooking sauces, soaps, shampoos and so forth. Likewise products such as fruits can be sold fresh, processed as juice, concentrate, or extract (for juices, yogurt, jams, jellies, ice cream or even personal care products), or dried (for use in snacks, fruit leathers, cereals, etc.).

Market strategies can also be used by communities to differentiate their products in order to command higher prices. Products can be labelled to differentiate them in the marketplace, e.g. organic, wild, green, natural, or socially responsible. Of course, claims will have to be backed up with written information (preferably, though not necessarily, certified by a third party). If consumers are asked to pay more for differentiated products, they will want a transparent system that allows them to see that they are getting what they pay for (i.e. some form of certification). Inevitably, this will increase the costs of the producer community. In addition, if a community differentiates its product, what happens if it cannot meet the demand of manufacturers? This may, in fact, make it harder to get buyers. These issues need careful consideration, and communities need fall-back positions (e.g. identify other possible producers if demand exceeds their supply).

Communities can also reduce the risks associated with selling their product by selling it in different markets, e.g. local, regional, national, and/or international markets. Diversifying markets can also increase demand and consequently, a commodity's price. For example, creating new markets increases overall demand and pushes prices up. Creating new markets is an essential aspect of any strategy where producers want unit prices for their product to stay the same or increase. This type of market differentiation has costs, however.

In 1989, Brazil nut collectors were paid only 2 to 3 percent of the New York value of their nuts. (Some were not paid cash at all, but instead were kept in a constant state of indebtedness — a company store system — by local traders.) A quick study of Brazil nut marketing showed that transporting the nuts to the regional market centre would double their value. Shelling the nuts for export would allow collectors to earn ten times the in-forest value, because it adds value while reducing transport costs (shelled nuts are only one-third the weight and volume of unshelled nuts). In some instances, shelling nuts locally makes it possible to sell Brazil nuts which, in the shell, are not worth the transport costs. (In 1994, only an estimated 5-10 percent of all Brazil nuts were harvested and sold; centralized shelling and transportation costs make it not profitable to harvest the remainder.) Turning nuts into oil would double or even triple the shelled nut values. These are the types of strategies that could be developed for each commodity.

In general, priority, value-added processing activities should be undertaken to reduce post-harvest losses, reduce the weight and volume of raw products, increase their standardization, and guarantee consistent quality and acceptability in multiple markets. In this regard, decentralized processing allows communities to reduce post-harvest losses *and* sell their products competitively in distant markets by reducing transportation and handling costs. In the case of Brazil nuts, the reduction in costs is about 70 percent.

Another important rule-of-thumb is that local value-added activities should increase rather than decrease the ability of a community's products to enter multiple markets. For example, it may be

easier to sell semi-processed goods to a wider range of manufacturers than it is to sell finished products to retail outlets or directly to consumers. Although adding value locally is important, with the exception of handicrafts or the sale of flowers or houseplants, attempts to produce end-user commodities are probably not a good idea. At the very least, the production of finished products should be started slowly. For example, a community rarely has on hand all the different ingredients that would be required to make a finished product. Processing and manufacturing also require reliable sources of energy.

Finally, finished products are often larger and less efficiently transported than either raw materials or semi-processed goods. Thus, end products would require shipping not just the product, but the air and packaging (packaging would probably be shipped into and out of the area), great distances at energy and environmental costs that do not justify the economic (or political) impetus for local manufacture. Such environmental factors might undermine the ability of producers to market their products as "green" or environmentally friendly.

Communities should not attempt to produce finished products if they have little idea about what consumers outside of their areas want. This is particularly true if the distance between the producer and the consumer as well as the difference between their cultures and lifestyles is great. A Brazilian soap company that works with babassu and donates money on the sale of each bar illustrates this point. They have found that their soap, which is produced in Brazil, is too scented for the American market but not perfumed enough for the Italian or French markets.

Efforts to add value locally should not be based on subsidies. While it may be acceptable to subsidize processing in the short term, in the long term, business plans should have to show that the subsidies would be eliminated or else such programmes could not be options for wider replication in the real world.

Programmes to add value should also be ecologically sound. For example, what is gained through sawing tropical timber or processing rattan locally, as in Indonesia, if it is done so inefficiently that more trees or vines must be harvested to achieve the same overall production (or even less net profit) when all subsidies are taken into account? Why not leave the processing to the most efficient commercial processors? Or, if the volume justifies it, why not invest in more efficient local processing plants or establish a joint venture with a more efficient processor? It rarely makes financial or environmental sense to produce finished products in isolated communities. Fortunately, there are usually better ways (many outlined in this paper) to add or capture value locally.

Identify and Use Appropriate Production and Processing Technology

Question technology. Adopting appropriate technology is another way producers can save their time or improve the quality of or add value to their products. On the other hand, technology is also an area where producers can waste a tremendous amount of time and money and become terribly frustrated with development programmes in general. Broken and rusting equipment throughout the world is not only a testimony to failed development strategies but to dashed dreams and increasing cynicism on the part of local communities.

Rapid advances in technological innovations, however, specifically relating to local production and processing activities, can be a real asset to local producers. In addition, researchers can develop applications of existing technology that are particularly suited to solving local problems of scale and expense. When setting up a Brazil nut shelling plant, a community was faced with the expense of a US$ 25,000 vacuum-packing machine. This was a lot of money (equal to all the other expenses of establishing the factory combined) for a project that was not yet proven to be viable. Instead of buying the machine, factory management decided to use small oxygen-absorbing packets designed by Mitsubishi for shipping electronic equipment. These packets (at US$ 0.25 each) were far cheaper to use for absorbing oxygen in the plastic bags of nuts. Two years later the large vacuum packing machine was purchased when production increased significantly and justified it.

Much technology is user friendly and extremely reliable. Sometimes it is designed to address precisely the bottleneck that a community has identified. Sometimes it is for a different product entirely but is readily applicable to a wide variety of other activities. If technological bottlenecks are identified within the overall strategy of a community, every effort should be made to contact other individuals or groups outside the area that might have faced similar problems or know of solutions to them. In short, all technology should be carefully evaluated to determine if it is indeed appropriate, reliable and user friendly, or if, as can be the case, it is more trouble and expense than it is worth.

Improve Transportation Systems

Most communities do not own or have access to efficient, reliable and cost-effective systems of transport. This is true not only of getting into forest areas, harvesting products and transporting them out of the forest, but getting the product to markets (or better markets), to their own warehousing or processing facilities, or getting processed or semi-processed goods to the next stage on the marketing ladder.

One of the main problems with transportation is scale. It is often the case that non-wood products are cumbersome for individual harvesters to carry, yet they are so seasonal that their transport does not justify the purchase of any kind of animal or vehicle solely for that purpose. It is also the case that the weather or seasonal variations can often make it difficult if not impossible to arrange for the right transportation ahead of time in an efficient and cost-effective way. In other instances, the produce of one harvester does not allow that individual to purchase (or even rent efficiently) appropriate transport.

Given these constraints, what should harvesters or communities do? First of all, there is strength in numbers. What does not make sense for one harvester (e.g. hiring a boat or truck to pick up their produce at the edge of the forest or haul it to a regional market centre to avoid one layer of middlemen) may well make sense for a group of producers.

Second, if an animal or a machine is used for transport only a few months of the year, it might make sense to rent them rather than buying them, which ties up scarce resources in assets that are only productive for such a short period of the time. Communities, acting on behalf of several producers, should be able to negotiate better transportation contracts than any single individual. Also, if a community is transporting products together, it might think about selling them together. Many buyers will pay a higher unit price for a larger volume than they will for the same amount of product if it is divided up into a 100 different lots. It saves the buyer time and money to make one purchase, so the seller should be able to get some of that savings as a service to the buyer.

Individual producers or producer groups have little power in the marketplace. They cannot provide the quantities of product that even a small manufacturer would need. The Xapuri Brazil nut-shelling cooperative in western Brazil, for example, produced 70 metric tons (mt) of Brazil nuts per year during its first two years, but M&M Mars uses 70 mt of peanuts per eight-hour shift when manufacturing Snickers candy bars. Individually, local Brazil nut shelling cooperatives could never convince large companies like Mars to use their nuts. By working together, producer groups can supply some of the largest manufacturers, control larger market shares, and exert considerable influence over entire markets.

In general, even trading higher volumes through local organisations, rather than one-on-one through intermediaries, will give individual producers access to higher prices and lower costs. For example, it takes the same administrative time and expense to sell one container (14 mt) of Brazil nuts as it does 100 kg. Furthermore, the transportation costs are much less per unit (e.g. kg, litre). The standard shipping costs of one container from Brazil to the United States are about US$ 2,500, or US$ 0.17/kg. A small shipment of 100 kg would have to be sent air freight at about US$ 2.25/kg.

Furthermore, the same skills and institutional structures that allow groups to sell larger quantities of product in the market enable them to purchase manufactured items in bulk, and thus save money. If one of the main reasons that local groups need money is to purchase consumer goods, then community organisations that are being established to harvest, purchase, process and sell local products should also be used to bring in the consumer goods that community members want to purchase. A revolving fund to purchase raw products from community members can just as easily be used to purchase consumer goods in bulk and resell them to residents at half the price merchants charge. The same skills are needed to run both systems. Plus, whatever system of transport is being used to haul produce out of the area can be used to bring manufactured goods back into it. Back-hauling (i.e. making use of transport that often returns empty from a one-way job) is considerably cheaper than one-way hauling. For example, hauling goods by truck into Amazonian cities costs US$ 0.10-0.12/kg, whereas hauling product out of the area (on trucks that would otherwise return empty) costs just US$ 0.6/kg.

HARMONISING THE UTILISATION OF TIMBER AND NWFPs FROM THE SAME FORESTS

In very few communities, use of forests for subsistence or for cash income is limited to non-wood forests products. In fact, timber and other construction materials are often the most important (commercially, at least) uses of forests by local communities. The question then quickly becomes, how can communities maximize the use of forests for both wood and non-wood products with the least impact on the different economic species, as well as on the ecosystem as a whole?

Again, the most important way to harmonise the two sometimes conflicting uses is through establishment of good baseline data regarding a community's natural resource base. From this information, it will be possible to see what the potential is for complimentary strategies for harvesting wood and non-wood products is as well as where there might or will be conflict between uses. In some instances a species-specific strategy for wood might negate a strategy for non-wood products. For example, a timber tree might also produce a marketable fruit or nut. In other instances, the harvest of a timber tree might have an adverse impact on other species that provide non-wood products. With good baseline data, a community should be able to come up with a strategy that allows for the harvest of all the species that interest them. In rare cases, however, informed choices will have to be made between species. In these instances, a community will have to determine which use is strategically more important to pursue.

EXTENSION AND TRAINING NEEDS

The extension and training needs of each harvester and each community will vary considerably. A one-size-fits-all extension system will probably not work very well for NWFPs. The biggest hurdle may be to get the harvester or community to realize the areas where they need help. The next hurdle is to make sure they know where to find it and seek out assistance. If harvesters or communities do not see the reason to seek assistance, even the best-designed and -run assistance programmes will have little impact.

Still, there are a few general areas where most harvesters and communities could benefit from appropriate technical assistance. In no particular order of importance, they are:

Systematic reporting and information. Lack of information keeps many forest residents in subservient positions to traders. A more level information playing field (or more transparency in the marketing chain) would improve the lot of forest residents considerably. Activities that fall under this general heading could include:

- create and distribute monthly price information from key points in the marketing chain up to and including the FOB price of the commodity leaving the country (e.g. crop forecasting, producer prices, FOB prices for different qualities/classification of product);

- compile and distribute a complete listing of all producers, buyers, sellers, importers, exporters, brokers and agencies, freight forwarders and others included in the commercial chain; and

- use radio, television, the press and any other form of locally important communication to make information available to forest residents.

Commodity-specific programmes. In many areas, one or two products dominate the income-generating activities of most residents. Extension programmes might focus primarily or exclusively on the production of those products. These programmes should focus specifically on:

- increasing forest-dwellers' income;
- decreasing the impact of harvesting on the natural resource base;
- decreasing post-harvest losses;
- increasing the season of the commodity in question;
- lowering processing and transportation costs; and, in general,
- providing more economic autonomy and independence to forest dwellers.

Financial planning and accounting. Most forest-based groups have rudimentary financial skills, at best. It is their overall lack of financial skills that not only allows them to be taken advantage of but also threatens/undermines any of their income-generation initiatives. Technical assistance programmes that build financial capacity for accounting, planning and managing individual or group enterprises is essential for improving the lot of all harvesters and processors of NWFPs.

Training in undertaking resource inventories. Few communities have the kind of detailed resource inventories that are essential for developing sound, long-term natural resource management plans. Technical assistance should focus on having biologists and resource economists work with communities to undertake baseline inventories of the natural resources and develop long-term resource monitoring programmes. From this information, in conjunction with local priorities, groups would be able to develop long-term strategies for using NWFPs.

POLICY CHANGES THAT WOULD SUPPORT APPROPRIATE UTILISATION

Again, many policy changes that would best promote the long-term, sustainable use of NWFPs would be commodity specific. However, in this arena too, there are some obvious areas where policy changes could benefit (or at least be neutral toward) the harvest and sale of NWFPs.

Taxation. Taxation policies should be used to encourage the rational use of forest resources and generate income and employment in forest areas. One way to do this is to tax unprocessed raw materials. This both encourages local processing and provides funds for investment in it.

Land and resource rights. Secure land and resource rights for producers. Producers need long-term resource security if they are to be expected to invest in improved and more sustainable harvesting programmes, management plans, enrichment programmes, or improved warehousing, transport or processing systems.

Credit. Financial institutions need to rethink their lending policies and criteria. In particular, they need to reevaluate their loan-guarantee criteria. New criteria could take into account, such as:

- use of history of an individual or group's production levels in relation to production forecasts;
- allowing harvesters or their organisations to be legitimate debt holders even if they only have use rights to an area;
- allowing physical stock of product to serve as loan guarantees for working capital; and,
- using forest inventories of economically valuable species as collateral for loans.

ADMINISTRATIVE AND ORGANISATIONAL ARRANGEMENTS

A few administrative or organisational arrangements that would support the sustainable use of NWFPs include:

Rural extension. Create a system of rural extension and technical assistance supported by research in natural resource management, reduction of post-harvest losses, value-added processing, and product development which address the current and future needs of those harvesting NWFPs.

Take non-wood products seriously. Local, national and international markets for NWFPs comprise many billions of dollars per year. Even so, they are not taken seriously by most government officials. We need to change official (and often unofficial) regulations and attitudes concerning community-based commercial and processing activities in general, and harvesting NWFPs in particular. Local groups rarely have access to the investment or working capital from government programmes that they need to invest in the changes that would allow them to increase the returns from their use of natural resources as well as their labour.

Enforce rights that exist. Often constitutions or government policies provide considerable protection to forest-based groups on paper, but these rights are not enforced. These groups face systematic discrimination. At other times, forest-based groups do not have ready access to political power and are therefore neglected relative to other groups.

Do not have long-term subsidies for non-wood programmes. Eventually, all non-wood product programmes and strategies must stand on their own, i.e. be self-sufficient. If communities become dependent on subsidized programmes (whether financed by governments, multilateral agencies, foundations or NGOs), they will never be able to exist on their own and compete in the marketplace.

EXAMPLES OF SUCCESSFUL OPERATIONS

This paper has mentioned a number of specific examples of successful harvesting and value-added processing programmes. More details can be provided on request. There are, however, very few detailed studies of such programmes. Usually, the literature is filled with mention of specific facts about one or another aspect of a programme, but not an analysis of the entire strategy, its history and its successes and failures. Often in this work, success or failure is relative. Some parts of every programme are more successful than others, but lessons can usually be drawn from both.

One current business plan for the sustainable harvest, processing and sale of heart of palm involves a management system that is actually more productive than the traditional harvest patterns in the area. Consequently, though it has increased costs (e.g. hiring a botanist to oversee harvesting and monitoring of the long-term biological impacts), the system actually generates considerable profits, even when the product is sold at the normal market price. However, because there is a management plan in place, the product can be certified and sold for 10 percent more than the normal international market price.

While there are few case studies, there are a number of examples:

- IPHAE in Porto Velho, Brazil has developed a mechanical fruit processor (sold for US$ 1,000) that allows local communities to process multiple varieties of fruits and freeze them for later sale.

- In Honduras, women's cooperatives that have little access to capital and electricity have developed in expensive, low-technology cashew fruit-drying systems that allow them to make money throughout the year by selling a previously unmarketable waste product.

- In 1990, babassu collectors in the state of Maranhao, Brazil wanted to figure out ways to get more money for their work. About 400,000 people in this area of Brazil derive up to 50 percent of their income from collecting, breaking and extracting the babassu oil seed. The work is very hard and people make little money.

  After studying the situation, it was decided that breaking the nut takes the most time and produces the least income. A mechanical breaker could free peoples' time to collect more babassu (only 5 percent of the seeds are now collected). Consequently, individuals could make more money by collecting the seeds *and* the price could go down, making the oil more competitive, and in effect guaranteeing markets. The breaking machine costs US$ 30,000, so a number of communities would have to go together to buy one. Few have credit. For this reason, the scheme has not advanced to date. The price of the oil has remained high and therefore uncompetitive and babassu oil factories have shut down, putting 100,000 people out of work.

- In the Philippines, a community that produces bananas has begun to work with a local banana-chip exporter to undertake part of the processing (the first fry) locally of their organic bananas. They are able to capture some added value, reduce losses of transporting fruit and differentiate their product in the market.

- In Northwest Zambia, beekeepers are processing organic honey and beeswax for sale on local and international markets. In the United States, their product is being sold as "Killer Bee Honey" to give it added market appeal.

SOCIAL AND ECONOMIC BENEFITS OF NWFP HARVESTING, PROCESSING AND TRANSPORT FOR LOCAL PEOPLE

There is tremendous potential for local residents to benefit from the harvest, processing and sale of NWFPs. Undertaken carefully, such programmes not only generate increased income, they can also safeguard a community's natural resource base for future generations. At the very least, communities will be better able to understand trade-offs that different strategies offer both at this time and in the future.

This paper has mentioned a number of economic benefits (mostly in the form of increasing income or reducing production costs) that might be achieved by pursuing various suggested activities. The potential impact of each activity is commodity and community specific. The differences a community can achieve through any of these activities might vary considerably from the parameters stated here. Furthermore, no community could undertake all of these activities simultaneously. Some of them are, in fact, mutually exclusive. Others require so many human or financial resources as to virtually preclude other strategies. In short, communities or individual harvesters need to examine each of the suggested activities described above and outlined below carefully. In general, the higher the potential financial return, the greater the risk, although even that does not always hold. Each community should carefully examine its options before embarking on any of them.

The economic benefits from the activities outlined above can be summarized as follows:

Activity	**Economic Impact**
• improve harvesting techniques	increase income 10 percent or more
• increase harvest efficiency in the forest	increase income 5-10 percent or more
• reduce post-harvest losses through improved:	
forest storage and/or transport	reduce losses by 5 percent
install or improve local warehouses	reduce losses of 25 percent of product
transport to distant processing plants	reduce losses of up to 35 percent of product

• improve transport through:	
volume shipping	reduce costs by as much as 10 percent
backhauling	reduce costs by up to 50 percent
process to reduce water and waste matter	reduce costs by up to 70 percent
• hold product and sell in off season	increase gross up to 200 percent
• add value locally through processing	increase gross up to 1,000 percent
• have access to better pricing information	increase income by 10 percent
• improve credit terms	reduce credit costs up to 50 percent
• capture green premiums in Northern markets	increase income 10 percent or more
• have income sharing agreements with manufacturers	increase income 10 percent or more
• purchase consumer goods in bulk	reduce costs up to 50 percent
• transport consumer goods in bulk	reduce costs up to 10 percent or more

In addition to the economic impacts, the social impacts of non-wood product strategies also deserve special attention, precisely because they are so unpredictable. Increased income at the level of the community, for example, does not necessarily translate to increased social equity. Local sub-groups that have not received benefits from economic changes in the past are not likely to do so through any of the activities described in this paper, unless special care is taken to monitor the ongoing impact of the above described activities and adapt them accordingly. Special groups to be considered are: women, the elderly, the illiterate, those without resource rights, those that are less acculturated (e.g. do not speak the national language).

One way to redress some of the social problems that already exist in a community or that might be created or exacerbated through the activities outlined above is to set aside part of the increased returns from the above activities for funds to be used to address social inequities or chronic social problems. For example, some funds from premiums or income-sharing contracts could be retained by the community (rather than divided up and passed back to individual producers) to be used to fund credit programmes or other social services targeted at specific groups. These community funds might also be used more generally to improve such things as health care, communications, schools, or water systems.

While increased income can generally be assumed to have positive social impacts, it is certainly not a given. In fact, the social impact of increased income is one of the least studied aspects of development programmes in general.

Finally, if social inequities already exist at the community level, it might be safe to assume that there are local reasons for it as well as local vested interests to maintain those inequities. At the very least there will probably be considerable inertia to change them. Unless outside funders insist that social equity is an overall goal of harvesting, local processing, and transport of non-wood products, it is doubtful that these activities will change existing inequities. If anything, they might increase or exacerbate them.

CONCLUSIONS AND RECOMMENDATIONS

Communities must make a commitment to the overall success of any NWFP project if it is to succeed. In most cases this means changing the way they think about and use resources. They will also have to invest considerable time and money to identify, much less pursue, new strategies. They will have to put up local resources as collateral, provide local materials to the project thereby reducing the overall cost, provide cash and labour.

Income-generation projects that are funded entirely with grants from outsiders all too often create dependency relationships between grantor and grantee. The point here is for outside entities to lend a hand, not give a handout. When a local group run into problems, one wants it to solve them, not write a proposal for assistance.

While grant money might be useful to undertake some of the preliminary studies and background research, communities should realize from the outset that they are investing in their own future and that it costs money to make money. That is the way a business operates, and the way their businesses will have to operate, too, if they are to succeed. Thus projects should be evaluated in terms of whether they are good financial risks or not.

At the same time, communities need to form strategic alliances with other producers, businesses, government agencies, and non-profit organisations to get access to the human and financial resources that they need but do not have within their own communities. Neither communities nor well-meaning outsiders can solve all the problems associated with the successful and sustainable harvest, transport, processing, and sale of NWFPs. Through desire and effective partnerships, however, communities can determine priorities and design and implements strategies that will generate substantial social and economic benefits for their members.

RESOURCE DEVELOPMENT FOR NON-WOOD FOREST PRODUCTS

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INTRODUCTION

The economic and social importance of non-wood forest products (NWFPs) for tropical countries is well-known (Chandrasekharan and Frisk, 1994; de Beer and McDermott, 1989; FAO, 1983a, 1988, 1990, 1991b, 1993c, 1994a; Gupta and Guleria, 1982; Myers, 1988). Myers (1988) calculated that a tropical forest tract of 500 square km could, with effective management, "produce a self-renewing crop of wildlife with a potential value slightly more than US$ 200 per ha," compared to revenue of just over US$ 150/ha from commercial logging in the same area. Peters *et al.* (1989), in an effort to illustrate the values of NWFPs, presented data on inventory, production and current market value for all commercial tree species occurring in one ha of Amazonian forest, including wood and NWFP resources. They arrive at a combined net present value (NPV) of US$ 6,820 for a fruit and latex production and selective cutting project, with logging contributing just 7 percent of the total. This compares favourably with an estimated NPV of US$ 3,183 obtained from a 1.0-ha plantation of *Gmelina arborea* for pulpwood in Brazilian Amazonia and an NPV of US$ 2,960 for fully stocked cattle pastures in Brazil. In India, the collection and processing of the leaves of the tendu tree (*Diospyros melanoxylon*), used to wrap small cheroots known as "bidi", produces an estimated US$ 200 million (FAO, 1994c) and provides part-time employment for up to half a million women. Indonesia earned US$ 200 million in foreign exchange from NWFPs in 1982 (Gillis, 1986).

In the Amazonia of Peru and Brazil, more than 1.8 million people derive a significant portion of their income from extractive forests, mainly of Brazil nut (*Bertholletia excelsa*) and rubber trees (*Hevea brasiliensis*). Near Xapuri, Brazil this earns an average annual income of US$ 960 per family.

An estimated 80 percent of the plant species providing NWFPs are found only in the biological richness and ecological complexity of primary forests. Some of them can only thrive within natural habitat and do not lend themselves to domestication. On the other hand, even species that can be grown in plantations depend heavily on regular infusions of germplasm from wild gene reservoirs (e.g. cacao, *Theobroma cacao*). Other than wood trees, forest species also represent a wild gene-pool, which are a safety net for narrowly based industrial agriculture.

NWFPs are being depleted at an unprecedent rate due to increasing human population pressure and demand. Each year, an estimated 15.4 million ha of tropical forests and woodlands are destroyed or seriously degraded, principally through agricultural expansion, uncontrolled livestock grazing, logging, and fuelwood collection (WRI/IIED 1988, FAO 1993a).

Therefore it has never been more urgent to realise the full potential of NWFP resources for sustainable development, both in terms of meeting immediate and future needs of increasing populations, and of the continuity of the natural resource base itself. However, the long-term survival of NWFP resources depends on the development of successful strategies to meet the economic needs of people while maintaining biological diversity. The appropriate management and conservation of NWFP resources, either in natural forest or in plantations is, therefore, of fundamental importance as part of these strategies. This paper discuss and analyses some relevant aspects of development of NWFP resources, with emphasis on: (1) types and characteristics of NWFP resources; (2) aspects related to the management of NWFPs; (3) factors influencing sustainability of resources; (4) nature

and severity of different constraints affecting resource sustainability and development; and (5) management guidelines.

TYPES AND CHARACTERISTICS OF NWFP RESOURCES

NWFPs are derived from a variety of sources: plants (trees, shrubs, herbs, grasses, palms), animals (insects, birds, reptiles, large animals), and a range of others. From plants alone, many different parts (e.g. roots, stems, barks, leaves, flowers, seeds, fruits) often provide different products simultaneously and/or at different times. Furthermore, NWFPs exhibit considerable variation in their use, with some consumed immediately on harvest (e.g. fruits, fodder, wild meat), others after primary processing (e.g. edible nuts, bamboo and rattans products), and still others proceeding through a series of downstream processing to meet market specifications (e.g. phyto-chemicals, food additives and flavourings).

An exhaustive list could number thousands and range from exudates (gums, resins and oleo-resins) to palms (rattan); from edible nuts, fruits and vegetables to mushrooms and spices; from meat and by-products from game animals including mammals, fowl, reptiles and fish to the animals themselves for the pet and zoo; from fodder to biochemically-active plants for diverse pharmaceutical and medicinal uses.

Also, differences in habitat lead to regional and even local variation in NWFP resources. The NWFP resources important for a locality would generally fall within a manageable number. In spite of this, however, the range of activities related to their production, management and conservation, processing and marketing is highly complex, requiring adequate technology, support infrastructure, research facilities and skilled manpower.

Resource Knowledge: Distribution, Nature of Occurrence and Products

Many descriptive accounts of NWFP resources have been published — for Asia (e.g. Aksornkoae *et al.* 1992; FAO, 1994a; Gupta and Guleria, 1982; Mann and Saxena, 1980; Nair, 1990; Revilla *et al.*, 1990), Africa (Chandrasekharan, 1993; Cunninghan and Mbenkum, 1993; Campbell and Brigham, 1993; Murindagomo, 1992; Poulsen, 1981), Latin America and the Caribbean (Chandrasekharan and Frisk, 1994; Clay and Clement, 1993; Gentry, 1988; Petersen and Balslev, 1990; O'Hara, 1994), and global use (FAO, 1983b, 1988, 1993a, 1993b, 1994b; ITTO, 1993; Menon, 1989; Saenger *et al.*, 1983). Readers are referred to these publications for detailed information on NWFP resources. See the theme paper by Chandrasekharan for a discussion of classification of NWFPs.

Domestication of NWFP Resources: Advantages and Disadvantages

Many of the plants providing NWFPs are found only among the biological richness and ecological complexity of primary forests. Some of them can only thrive within their natural habitat and do not lend themselves to domestication of any sort. However, many NWFP species can be domesticated.

Domestication of plants yielding NWFPs, involving their genetic improvement and cultivation under intensive practises, is often considered a means of ensuring economic success of growing ventures. Experience has shown that once a NWFP achieves commercial importance, its supply from wild sources tends to be replaced by cultivated sources in order to bring production, quality and supply of raw material and cost under control. In fact, being nature-based, NWFPs can never be totally uniform in their characteristics, nor can their supply be as regular and reliable as plantation-based products. There is therefore a tendency to move towards plantation-based production of NWFPs whenever potential markets become large and attractive enough and plantation production is found to be feasible.

In respect to wild plants providing NWFPs, production in most cases is seasonal; other nature-determined conditions can affect both the quantity and quality of the products. It also means that the production can vary considerably from year to year and from location to location. Consequently the availability of products can vary. From the marketing point of view, this is one of the major disadvantages because many customers tend to prefer sustained and secure supplies of even-quality products.

Intensive cultivation of NWFP resources take place under monoculture, mixed cropping, and agroforestry systems or under special conditions. Certain NWFP plants (such as *Elettaria cardamomum* — cardamum, in Guatemala, Honduras and Costa Rica), can be grown under the shade of natural or man-made forests. Many kinds of mushrooms that are important in trade can only grow in very particular habitats under a narrow range of ecological conditions and micro-climates. Examples are the "black mushrooms" or morels (*Morchellus* spp.), which are widely gathered in wooded areas of north-central Pakistan and traded internationally in large quantities. Other kinds of mushrooms can be cultivated or semi-cultivated in compost derived from their natural habitat. In Bhutan, for example, four kinds of oyster mushrooms (*Ostreu* species) are grown in year-round rotation on forest logs injected with fungal spores or in compost mixtures made from forest litter.

Domesticated NWFP species in agroforestry systems provide continuous tree cover and offer a number of advantages:

- provide a sure way of relieving pressure on natural forest stocks;
- can provide income and employment in rural areas, thereby improving rural welfare and discouraging urban migration;
- in monoculture, can grow faster than the interest rate, thus making plantations an attractive investment;
- may bring advantages of genetic conservation and ecological stability, as well as cultural familiarity and value;
- can be enhanced through improved agro-technology and thus support resource sustainability by facilitating conservation of the genetic resources in the natural forests.

Many wild plants yielding NWFPs have been domesticated and consequently their products have been largely replaced by production from cultivated sources. A few examples are: *Hevea brasiliensis* (rubber), *Elaeis guineensis* (oil palm), *Orbignya phalerata* (babassu palm oil), *Bertholletia excelsa* (Brazil nut), *Anacardium occidentale* (cashew), *Theobroma cocoa* (cocoa), *Pimenta* spp. (pepper), *Bixa orellana* (annatto tree), *Cocos nucifera* (coconut palm), *Areca catechu* (arecanut palm), and *Bactris gasipaes* (pejibaye palm). Annatto trees, native to the tropical forests of South America, have been introduced in Asia and Africa. Important natural resources of rubber and Brazil nut trees occur in the tropical rain forest of the Amazonia region of Brazil and Peru. Rubber and Brazil nuts are still produced in the extractive economy in the Amazonia of South America.

In parts of the Philippines, where natural rattan palm supply has been exhausted, nurseries are now being established to provide stock to plant out in the forest. In this case, the growth and "monetization" of the market for the natural product appears to be in the process of converting it from a wild product into a crop. Much the same process may have led to the development of other NWFPs into staple crops in the past. Bamboos are now routinely plantation-grown but, while they can be grown in the forest without the additional expense of owning or renting the land they grown on, like rattan, they are likely to remain a predominantly wild or semi-cultivated crop for many years to come.

The susceptibility of NWFP plantations, mainly in monoculture, to pests and diseases caused by insects and fungi, is one of the disadvantages of domestication. In fact, once a plant species is

planted outside its natural habitat (the case of most domesticated species providing NWFPs), its susceptibility to pests and diseases increases, in some cases drastically. This can result in the need for extensive use of pesticides which may cause environmental problems. For example, plantations of *Elaeis guineensis* in South America would become heavily infested because many native palms harbour pest populations (Pedersen and Balslev, 1990).

Also, monocultures of domesticated species that replace natural forests result in loss of biological diversity, and intense cultivation of a single plant species rapidly depletes soil nutrient reserves.

Domesticated species that can be grown in plantations, or as pure or mixed crops, are heavily dependent on regular infusion of germplasm from wild gene reservoirs (e.g. cacao and pimenta). Consequently, only the continued existence of species variability in the wild will afford plant breeders a chance for creating, for example, new disease-resistant and high-yielding varieties.

Integrated Land Use Incorporating NWFPs in Environmentally Sound Practices

Appropriately selected NWFP components in an integrated land use can contribute to both the productivity and sustainability of farming systems on marginal land in several ways: by enhancing the production of organic matter; by maintaining soil fertility; by reducing erosion; by conserving water and by creating a more favourable microclimate for associated crops and livestock. These service roles are in addition to direct production roles. Thus they can help supply food, fodder, fuelwood, building material and other raw materials for rural industries and provide new habitat for wildlife. In traditional, integrated land-use practices, NWFP trees and shrubs are also important in maximizing and diversifying the productivity of even highly fertile lands. In this respect, agroforestry systems are very important and are most commonly found in areas with a long history of population pressure, indicating their general efficiency as environmentally sound land-use systems. Whether on marginal or highly productive lands, diversified agroforestry systems may be the most appropriate land use where land tenure constraints, lack of marketing infrastructure or an unfavourable political economy make it imperative for small landholders to reduce risks and satisfy most of their basic needs directly from the land resources under their control (Lundgren and Raintree, 1983).

Plant species providing NWFPs have been used as components of integrated land-use practices with excellent results. For example, the association of naturally occurring *Faidherbia albida* (formerly *Acacia albida*) with dryland grain crops in the Sahel zone and some parts of East Africa where yields of crops grown in proximity to trees can be double those of crops grown in the open (Mann and Saxena, 1980). Some interesting aspects are: nitrogen fixation, microclimatic benefits and the peculiar "reserve phenology" of the trees (which leafs out in the dry season and drops its leaves at the beginning of the rainy season, thus nicely accommodating the requirements of crop cultivation). The pods of *F. albida* trees produced in the dry season are excellent fodder for livestock that gather under the shade of the trees. Similar results are reported for *Prosopsis cineraria*/cereal associations in eastern Rajasthan, India. *P. cineraria* trees are lopped annually for the highly valued fodder.

Soil salinization and related phenomena are the most serious problems threatening land productivity in arid and semi-arid regions. Of considerable relevance, however, to the forest-food interaction are those cases in non-irrigated lands where removal of NWFP-producing trees has created saline streams and soils both on and off site.

In Sudan, gum arabic (*Acacia senegal*) areas are mostly sandy, unstable and highly vulnerable to erosion. *A. senegal* trees help to increase agricultural production either by protecting soil and crops or by improving and adding to soil fertility. The pattern of land use within villages is one of current cultivation and fallow on which there may be *A. senegal* plantations. The system is basically a variation of shifting cultivation and traditionally consists of about four years of cropping followed by a period of 10 to 14 years of fallow under regenerated *A. senegal*. The fallow period rests the soil and

the regenerated trees protect it from wind erosion. The trees also naturally improve soil because they fix nitrogen and add phosphorus, ammonium nitrates and organic matter. The system is rather stable in areas of low population densities.

Multipurpose NWFP trees, particularly nitrogen-fixing and pod-producing species so well adapted to dryland conditions, can be grown at interstitial locations on the farm or in association with crops without replacing them. A prominent NWFP species in the semi-arid Northeastern Brazil used for integrated land use is *Prosopsis julifora*. It resists drought without losing any of its leaves during the long dry season; has high nutritional value, specially its leaves, pods and fruits, which are good animal fodder and source of foods; and is effective against erosion and desertification, and in dune stabilization, reclamation of salinized soils and as support for apiculture (FAO, 1988 and author's personal observation).

Trees providing NWFPs are important land-use components and have been extensively planted by small landholders as an outgrowth of shifting cultivation in many parts of the world. Notable are the oil palm, cacao, coffee and cola plantations of West Africa (Getahun *et al.*, 1982) and the coconut, rubber, oil palm, cacao and coffee plantations of smallholders in Southeast Asia (Dove, 1983). Similar land uses incorporating NWFP species have been used in Latin America and they have provided a sound economic and environmental combination. In Asia and the Pacific, coconut palm is an important land-use component for smallholders and plantations alike.

Integrated land use incorporating NWFP species is also important as a means of providing new habitat for wildlife. For example, the presence of several rows of trees in an otherwise "open" landscape of grasslands or annual or perennial crops provides often one or more of the essential habitat requirements of one or more wildlife species. The windbreak itself may provide a source of food, particularly fruits, seeds or insects for birds and small mammals. In Zimbabwe, wildlife is an important component of land use. About 2.7 million ha of commercial farmland (around 22 percent of the country) is devoted to wildlife production, sometimes in conjunction with livestock (Campbell and Brigham, 1993).

ASPECTS OF MANAGEMENT OF NWFP RESOURCES

The facet that tropical forests are ecologically complex and biologically diverse ecosystems, has two implications: (1) they should be put under multiple-use management to benefit from their great variety of products and services; (2) they should be managed with sustainability as an explicit and prominent objective, owing to the complex interdependencies among species and their vulnerability to irreversible degradation. Managing tropical forests only for wood to the exclusion of NWFPs will fail to maximize the social value of the scarce resource and to ensure its sustainability over time.

Although the great potential for managing NWFP resources on a sustained-yield basis has been frequently emphasized (e.g. Schimidt, 1987; Fearnside, 1989; Allegretti, 1990; Peters, 1990; ITTO 1991; FAO, 1989b, 1989c, and 1993a), rarely has this objective actually been achieved. This situation is primarily due to the lack of concerted effort to manage NWFP resources, to conduct suitable inventory of the resources to be managed, to ensure their regeneration in the forest, or even to broadly define a sustainable level of harvest. Regardless of existing markets or land-tenure systems, maintaining a continual supply of harvestable resources from a tropical forest requires management. This section discusses some important aspects related to the management of NWFP resources.

Resource Inventory and Assessment

One of the major problem widely recognised by forest researchers in implementing sustainable management of NWFP resources is the lack of quantitative information related to the resource.

An FAO forest resources assessment of 1990 noted the depressing state of forest inventory in the tropics. Three of the 90 countries included in the study have never carried out a forest inventory;

39 countries had carried out one assessment prior to 1980; 27 countries had carried out one assessment between 1981 and 1990; and only 21 had carried out more than one assessment (thus allowing for minimum levels of "monitoring", even as regards the status of commercial wood supplies). Twenty-five of the countries had some kind of (mainly quantitative) inventory/assessment information on conservation areas and management of forest resources (FAO, 1993a). The situation is still worse for inventory/assessment of NWFP resources: no country had carried out a complete assessment on the status of NWFP resources.

Inventory of NWFP resources involves extensive fieldwork and the counting and measuring of plants. The objective of these activities is to answer several basic questions about the nature and extent of the forest resource base. For example, what economic plant species are found within the management area? What products do they produce? How abundant are they, and do they appear to be maintaining themselves in the forest? Which of these resources are restricted to a particular forest type, and which are more evenly distributed throughout the site? What plant resources have the highest potential for sustained-yield management? Addressing these questions requires data from a quantitative forest inventory. Inventory/assessment data represents the core of all management operations.

Researchers have developed a wide variety of inventory techniques (for details about forestry inventory techniques and procedures, see Adlard, 1990; FAO, 1981; and Avery, 1983). The selection of an appropriate sampling scheme for forestry inventory ultimately depends on the capabilities and experience of local field workers, the conditions in the forest, and the personal preferences of the resource manager. Wood (1989) reports that out of 36 tropical countries surveyed, fixed-area plots are more frequently used (44 percent) than transects (34 percent). Systematic sampling is the preferred design in Africa and Southeast Asia, while random sampling is more strongly favoured in Latin America. Systemic transects would seem to be the preferred inventory method for NWFP resources. This method presents relatively low probability for errors in locating of the sample unit, and also provides good opportunity to map and refine the initial forest typology. Transect widths of either 10 or 20 m are recommendable in most situations, the smaller 10 m transects being most appropriate in more homogeneous forests.

Two important aspects that have to be considered when designing an inventory for NWFP resources are: (1) the lower diameter limit of measurement of the trees and plants providing NWFPs and (2) the overall sampling intensity. A lower diameter limit of 20 to 40 to 60 cm diameter at breast height (DBH) have been used in different inventories. The problem, however, is that many forest species (e.g. medicinal plants, fruit trees) are mid-canopy or understorey species that may never attain a diameter of magnitude and consequently would be completely missed by such an inventory. A smaller minimum diameter limit is therefore necessary for NWFP resources.

The overall sampling intensity required in a forest inventory is governed by the variability of the forest, allowable inventory costs, and the desired standard of precision (Avery, 1983). For all of this, appropriate inventory techniques have to be adjusted to the specific characteristics of the NWFP resources to be managed.

In an inventory, field procedures and measurements are important. The field procedures for each plot or transect are essentially the same. Each sample tree should have its taxonomic identity and local name determined, its ethnobotanical or use information and size recorded. Detailed botanical surveys of NWFP resources (e.g. medicinal plants) based on the analysis of voucher specimens have shown that a single vernacular name may frequently refer to several different taxa (Gentry, 1988). Ethnobotanical or use information about NWFP resources should be as detailed and specific as possible, and should not be restricted to the primary or current commercial use of the resource. For example, for those species providing specific and/or multiple products, NWFP information should consider all parts of the resource (e.g. bark and leaves may be used medicinally, seeds may contain a valuable oil, stem may produce gum and the fruits may be used as food). This provides an estimate of the overall resource "richness" of the forest and will later serve as baseline criteria for selecting

the specific resources to be managed. It also provides information on the different possible harvest techniques.

Unlike commercial forestry inventories, in which the volume of wood and number of logs are critical variables, the measurement of tree height is not essential in an inventory for most NWFP resources. However, this procedure is justified for some selected vegetative tissues of extreme commercial value (e.g. rattan and nipa palms). Also, additional measurements may be necessary depending on the nature of the NWFP resource being sampled (e.g. bark thickness measurement of *Litsea* spp., and increment measurement of cores to check for the presence of gharu wood in *Aquilaria* trees).

As mentioned before, information is very scarce on inventory of NWFP resources. Bamboo is probably an exception. A suitable inventory methodology for bamboo and rattan palm resources has been developed in the Philippines by the International Development Research Centre. Inventory for the enumeration of rattan palm resources is also being developed by the Kerala Forest Research Institute in India (Menon, 1989).

An inventory model, field sampling procedure, and data forms are reported for sagu (*Metroxylon* spp.) and nipa palm (*Nypa fruticana*) in Indonesia (Reville *et al.*, 1990). Those authors suggest that sagu be enumerated within the same 10-m radius plot used to sample rattan (with 3-m and longer stem) and bamboo. For nipa, 2-m radius plot is adequate to sample the seedlings (not more than 1.5 m tall), while a 5-m radius plot would be needed for larger nipa plants. Additional information in the 10-m radius plot should be recorded, such as varieties of sagu species (three species of sagu have been observed in India), clump number and diameter, total number of stems including the young and overmature, maturity classes (one of five maturity classes shall be identified for each sagu plant), girth measurement, stem height or bole length, damage on a sagu tree and sagu yield (in kg of partially dried extract).

Inventories for a number of NWFP resources have been carried out in small areas and/or in experimental plots, e.g. assai palm (*Euterpe* spp.), which occurs in the Amazonia region of South America. An inventory of *E. oleracea* in the Amazon river estuary has shown that on average, the plant population is between 230 and 600 clumps/ha, considering only clumps with stems higher than 2 m. Total population ranges from 2.5 to 7.5 plants/ha, most of them (50 percent) in the first seedlings stage (one to two leaves and about 20 to 25 cm tall). Population density of *E. precatoria* varies from 50 to 250 plants/ha in the forest ecosystems of Peruvian Amazonia (Kahn, 1988). Higher population densities were found in Manaquiri, Amazonas, Brazil. Inventory data showed population densities varying from 5,740 to 13,396 plants/ha.

Resource Management and Conservation

The term *conservation area* has been defined as "an area of land managed through legal or customary regimes so as to protect and maintain biological diversity and natural and associated cultural resources". (This definition was agreed at the Fourth World Congress on National Parks and Protected Areas, Caracas, 10-12 February 1992.)

The FAO forest assessment of 1993 reports that an estimated area of 212.9 million ha in forestry and 371.7 million ha in wildlife are under management for conservation in Asia and the Pacific, Africa and Latin America and the Caribbean regions. However, none of the areas under management for conservation have been established primarily for the maintenance and sustainability of NWFP resources. Also, it is often impossible to know whether or not a conservation area network is representative, particulary in terms of biological diversity. A special survey conducted by WCMC shows that out of 8,715 conservation areas, only 5 percent are known to have been inventoried for one or more taxonomic groups (FAO, 1993a). Conservation areas covered 1.5 percent of the total land area (0.3 percent in Africa, 3.0 percent in Asia/Pacific and 1.3 percent in Latin America and the Caribbean). Protection forests (mainly set aside for watershed protection), covered 3 percent of the

land area in the tropical countries. Tropical forests reportedly under forest management regimes covered less than 5 percent in 1980 (FAO, 1982). Although a corresponding figure for 1990 was not recorded, the area under management is unlikely to have increased. The widespread lack of forest management is highly disturbing, also from the point of view of conservation of genetic and biological diversity of NWFP species presently used and other species growing in association with them.

Despite the fact that existing conservation areas have frequently been established with little or no regard to ecological criteria for their selection, they can be considered important for the protection of NWFP resources. Their proper management can support conservation of genetic wealth and variability of NWFP resources. Notwithstanding the potential benefits from the use of NWFPs and the enormous extent to which they are already used throughout the tropics, it has proved very difficult to find ways in which the NWFP sector can be further developed as a prime force for forest conservation. However, effort should be made at country and regional levels in order to establish conservation areas primarily for the maintenance and sustainability of the existing NWFP resources.

According to the FAO (1993) definition, "Sustainable forest management will ensure that the values derived from the forest meet present-day needs while at the same time ensuring their continued availability and contributions to long-term development needs." Forest management, however, does not comprise everything desirable that might be done but is rather a matter of selecting and prioritizing the tasks that can and should be carried out for a particular area (Bramble, 1987).

It is important to understand that conservation of NWFP resources through management is not the same as preservation through protection or a policy of non-interference. In neither case can alteration be prevented. Ecosystems will continue to change even if left completely untouched by humankind. Management intervention in a forest, no matter how carefully or lightly carried out, inevitably alters the structure and ecology more quickly and in different directions than a policy of preservation; if poorly carried out, it runs the risk of causing serious and permanent damage.

NWFP resources, if properly managed, will play a vital role in human welfare and development in the coming decades. In fact, this is already demonstrated by a number of projects which aim to conserve areas of rainforests of outstanding importance for biological diversity. Conservation through more rational use of NWFPs and their protection is reported by Sayer (1991). (Examples are given, elsewhere in this paper, of areas being managed for the conservation of genetic resources of species providing NWFPs and biological diversity.)

An important component of NWFP resources is wildlife. Wildlife is now generally recognised as a renewable natural resource, but unfortunately it is rarely managed to this end. Certainly, conservation of endangered species is an essential part of wildlife management, and where species have been over-exploited, preservation of these animals through protection in national parks or other rigidly controlled areas may be the only practical solution to ensure survival. But protection must be viewed as a means to an end and not an end in itself. As with other renewable natural resources, including forests and wooded areas that are the primary habitat for wild animals, the key to long-term conservation of wildlife and of biological diversity is management based on the concept of sustainable utilization. Sustainable management is particularly important in view of the role of wildlife resources as a source of food and income for rural people.

In regions where growing population pressures are leading to intensive land use, captive or semi-captive rearing of wildlife for food and other products is taking an increasing importance. FAO (1990) provides examples of wild animals successfully managed for food, either in isolation or integrated into existing agricultural systems. Some individual countries have made important progress in confronting the challenges of wildlife management, in cooperation with international organisations. FAO has assisted India, Papua New Guinea and Ethiopia to ensure the conservation of crocodile resources and promote their management and sustained utilization. Also, in Latin America technical cooperation network on national parks and other conservation areas is being implemented with the

assistance of FAO. It aims to ensure conservation and management of wildlife resources such as capybara, crocodiles (*Caiman crocodilus*), and river turtle (*Podocnemis* spp).

Integrated Management for Wood and NWFPs in Natural Forests

Forest management for wood production implies "controlled applications of harvesting regulations, complemented by appropriate silvicultural and protective measures designed to maintain and improve the productivity of the forests." Since 1980 a number of intensive studies on forest management have been carried out by FAO and the International Tropical Timber Organization (ITTO). ITTO made detailed investigations on the current status of forest management and presented them in several volumes by continent. FORIS database has collected information on a country basis.

In general, tropical forest management for more than a century has been geared for wood production. Silvicultural systems for enhancing the growth of non-wood resources in forests, such as wild fruits, edible nuts, mushrooms, gums and latex which can be harvested non-destructively and in combination with timber, have received much less attention. In recent years, however, the concept of forest management has expanded to include NWFPs, and national forest agencies are working to adapt their management to address this.

Generally speaking, we can say that integrated multipurpose management of forests for wood and NWFPs is highly demanding on scientific knowledge and technology. It involves, in addition to the essential tools of management for wood production, defining objectives as mentioned before, detailed investigation and prospecting of NWFP resources for different products. These investigations have to consider:

- the nature and extent of distribution of the specific plant resources and their density of occurrence;
- their active and valuable ingredients;
- their potential supply from wild sources and the value of the NWFPs that will be produced;
- their suitability to be grown in a multi-species environment (e.g. enrichment planting under natural forest cover and agroforestry systems) or under monoculture.

Important points to be stressed in promoting integrated management of forests are the need and urgency of developing proper scientific and situation-specific management systems, and the need for adequate institutional arrangements. Without the latter, commodity-based natural resource management led by market forces alone could lead to fast depletion of resources (Chandrasekharan, 1993).

The complexity of integrated management of forests for wood and non-wood forest products suggest the need for appropriately balanced and integrated systems, combining ecological and economic prudence. These systems should consider that trees and plants yielding wood and non-wood products can co-exist in the forest, and indeed many non-wood products are available from timber species. Therefore harvesting of wood and non-wood products is not mutually exclusive, but it requires great care. Wood harvesting, if improperly done, can be destructive of NWFPs; likewise management of some NWFPs may substantially affect production of others.

Integrated management of forests for wood and non-wood products and services can be an essential strategy. In 1984 Norman Myers proposed the creation of "industrial forests"; in 1993 Clay and Clement preferred the term "income-generating forests". Such forests are designed to conserve or enhance biological diversity while exploiting the economically useful fraction of this diversity. In Myers' conception, an income-generating forest would contain a large number of economic species with an equal or larger number of industrial uses, as well as an even larger number of species with no known current use. Myers suggested that species producing latex, resins, gums, oils, essential oils, alkaloids, or medicinal products could form the basis for these forests. This concept of income-generating forests is, in fact the concept of integrated management of wood and NWFP resources.

Important aspects to be considered in integrated management of forests related to the knowledge both of wood-producing trees and the NWFP resources; for example, the type of products produced by particular species, the measurement of productivity, and the sampling procedures to be used in field studies.

The type of product(s) produced by particular species can have a major influence on its potential for sustainable exploitation and management. Harvests of bark, stem tissue and roots almost invariably kill the plant, and, as is the case with wood, sustainability can only be achieved by ensuring that the death of every adult tree is replaced by growth of another. Unfortunately, maintaining continual recruitment of a desirable species when the seed-producers in the population are being routinely eliminated can be an extremely difficult and expensive proposition. The harvest of latex, fruits, oil seeds and leaf tissues, on the other hand, do not necessarily kill the adult tree or alter the initial size-class distribution of the population.

Measurement of plant population productivity is different when the target is to manage wood and NWFP species. For wood, this information is collected by monitoring the radial increment of trees. There is a large and detailed literature on the growth and yield characteristics of commercial wood species. However, for NWFP species virtually nothing is known about fruit, oil seed, latex and resin yield. Just as foresters use growth data to avoid cutting timber at a faster rate than that which is produced by the forest, the sustained-yield management of NWFP resources also requires a knowledge of the productive capacity of the species being exploited. That this knowledge is frequently lacking sheds some doubt on the long-term viability of many current efforts to promote increased utilization of NWFP resources.

Sampling procedures used in the yield studies is another important aspect of managing wood and NWFP resources. These will vary with the type of NWFP species being measured. Three main groups are recognised for NWFP species based on the origin of the plant tissue or ingredients of value: reproductive propagules, plant exudates and vegetative tissues. Although fruit, nuts and oil seeds are different commodities, their production by individual trees can be measured using a similar methodological approach. Reproductive propagules, plant exudates and vegetative tissues will require different sampling procedures. For example, the production of reproductive propagules is measured at discrete intervals throughout the fruiting season, using either direct counts or a random sample of the area under the crown of adult trees. For small trees that produce few fruits of large size (e.g. certain palms and cauliflorous trees), direct counts may be employed with reasonable precision. Direct counts have been used successfully to estimate fruit production in a number of ecological studies (Sork, 1987; Peters and Hammond, 1990). Tall forest trees that produce more fruit than can be counted individually (e.g. most commercial fruits, nuts and oil seeds, which are relatively large and heavy) must be sampled using small plots or specially constructed fruit traps.

The measurement of plant exudate yield requires some *a priori* knowledge of the traditional tapping techniques used with that species. Information on the frequency of tapping is particularly important. Depending on the tapping regime employed, daily, weekly, or monthly production rates are then calculated for each sample tree and exudate type under study.

The variety of plant parts exploited (e.g. stems, leaves, bark, roots and apical buds) can be divided into two groups, based on the physiological response of a plant species to harvesting: (1) where the tissue extracted is naturally regenerated (e.g. leaves and the bark and apical buds of certain species), or (2) where the plant is killed by harvesting (e.g. most types of stem tissue, roots and bark). Different sampling methodologies are required to estimate the productivity of these two groups. In South-Central Chile, for example, the primary productivity of two bamboo species, *Chusquea culeon* and *C. tenuiflora*, was measured through a study of biomass and dry-matter production of culm and foliage. Net primary production of standing crop above-ground was estimated for a pure stand of *C. culeon*, and standing crop for *C. tenuiflora* in the understorey of a mixed *Nothofagua betuloides-N. pumillo* forest near the timberline at 1,040 m in the Andes (see Veblen *et al.* (1980) for details on the methodology). Estimates of dry-matter yields are available for some

stands of bamboo managed for paper production in several localities in Asia (Huberman, 1959 and Ueda, 1960). The same methodology developed in Chile has been applied in the Philippines for bamboo species.

Consideration should also be given to the benefits afforded by the management of multi-purpose NWFP species. Specific examples of this include species which produce both oil seeds and a valuable oleo-resin (e.g. certain species of *Shorea* in Southeast Asia), or those that produce edible fruits and also have leaves which are useful for cordage or thatch (e.g. numerous palm species in the Amazonia region). Management focusing on a single multiple-use species can generate two sources of revenue without the expense of monitoring the regeneration and population dynamics of two separate NWFP plant populations. Integrated management of wood and multi-use NWFP species is still more complex than management of wood and a single-use NWFP species.

All of this requires prioritization of the objectives for multipurpose management (wood vs. NWFPs) in order to facilitate selection among the conflicting demands on the forests under management. One main objective must be given priority over the others. However, in striving to achieve this objective, forest managers must see that all the other objectives are at least partially fulfilled (FAO, 1991).

One example of integrated forest management well-adapted to local socio-economic conditions is the Plan Piloto Forestal (PPF) project in Quintana Roo, Mexico. Initiated in 1983 by GTZ and the Instituto de Investigaciones Forestales, the project aimed to promote forest conservation and local development through community participation in natural forest management for wood and non-wood products. The project's first step for securing popular participation was to have logging rights assigned to the "ejidos", the local communities. The PPF then helped local forest communities to organise themselves to manage the forest in a way that would ensure they received the economic benefits. The project focused on two species: mahogany (*Swietenia macrophylla)* and chicle gum (*Manilkara Zapota)*. Essentially, the PPF applied:

- better harvest planning to reduce destruction of residual trees (e.g. directional felling);
- enrichment planting of logged areas;
- strict adherence to a permanent forest reserve, in which conversion to agriculture was prohibited.

Management for chicle gum does not involve logging. Production of the latex and honey provides about half of the total forest income. The project is also a good example of how to avoid conflicts in resource use by local people. (The following section provides additional discussion and examples of integrated wood and non-wood resources management.)

Conventional and Indigenous Systems of Forest Management

As outlined above, foresters have been testing, developing and refining silvicultural techniques for managing tropical forests for over 100 years. However, silvicultural systems for NWFP resources have received much less attention. Many indigenous or other local communities in the tropics have developed their own form of silviculture for managing their NWFP resources. Such indigenous or local systems of forest management have been little studied.

Many of these indigenous silvicultural systems are quite sophisticated and, not surprisingly, are comprised of many of the same operations routinely employed by trained foresters. The major difference is that these indigenous systems have yet to be formally codified or scientifically accepted as operationally valid. Both indigenous silvicultural practices and conventional forestry can contribute in designing or improving systems for managing NWFP resources on a sustainable basis (Chandrasekharan, 1993).

Conventional Systems of Forest Management

Conventional systems of forest management and the silvicultural treatments applied primarily for commercial timber trees have been described and discussed in numerous publications and textbooks (e.g. Schmidt, 1987; FAO, 1989b, 1989c, 1991a; Baur, 1964; Synnott, 1979; Matthews, 1989). This section emphasizes only some features of common silvicultural systems applied in the management of tropical forests.

The primary objective of any silvicultural intervention is to selectively modify the biotic and/or abiotic environment in a tropical forest to favour regeneration and growth of a restricted number of tree species (Smith, 1962). Every silvicultural system is composed of a series of individual operations or components which contribute in different ways to fulfil the overall management objective. Although their exact details vary from system to system, the most common silvicultural operations in tropical forests may be divided into seven basic groups: (1) harvesting, (2) refinement, (3) thinning, (4) liberation, (5) selective weeding, (6) diagnostic sampling, and (7) enrichment planting. The specific purpose and impact of each operation is quite distinct.

There has been a great deal of experience with the silvicultural treatment of tropical forests in Asia and Africa (Schmidt, 1987). Such experience is sorely lacking in the Amazonia region; some estimates maintain that less than 14,000 ha of forest are subjected to any type of management at all (Lanly, 1982).

The silvicultural systems which have been developed for tropical forests can be divided into two groups: polycyclic and monocyclic systems. The selective felling systems, as officially practised in Indonesia, is an example of a polycyclic silvicultural system. In these systems, the commercial trees are harvested repeatedly in a continual series of felling cycles. The length of these felling cycles is usually about half of the time required for the species to reach merchantable size. The Malaysian Uniform System and the Tropical Shelterwood System are both examples of monocyclic systems. In these systems, all of the merchantable trees are harvested in a single felling operation, with the length of the cycle more or less equal to the rotation age of the species. Polycyclic systems rely on the existing crop of seedlings, saplings and poles in the forest to produce the harvestable crop for the next felling cycle, while monocycling systems ignore the accumulated growth of these smaller size classes and rely almost entirely on new seedlings to produce the next crop of trees.

This paper does not analyze in detail each of these silvicultural systems. However, in order to compare these conventional forms of forest management with the indigenous forms of NWFP resource management, it is important to give the basic composition of the systems. The selective felling system is composed of diagnostic sampling, harvesting, weeding, and enrichment planting operations. The Malaysian Uniform System includes diagnostic sampling, harvesting, refinement, weeding and thinning. Logging is preceded by regeneration sampling and the inventory and marking of harvestable trees; harvesting is deferred if an insufficient seedling crop is encountered. The Tropical Shelterwood System is composed of diagnostic sampling, refinement, weeding, harvesting and thinning operations.

These conventional silvicultural treatment of tropical forests are generally related to commercial timber production. These treatments are effective techniques for manipulating forest structure and composition in such manner as to favour the abundance of desirable resources, including NWFP resources. The ultimate success of these techniques, however, largely depends on the particular species and site being managed.

There is no single silvicultural system that can be blindly applied in every forest. Also, experience has shown that periodic sampling of the response of the forest to individual treatments is essential for guiding and refining subsequent silvicultural operations. The most successful silvicultural systems are information-rich, and the greater the understanding of a species' ecological behaviour, the easier it is to develop a viable system of silvicultural treatment. Of greater importance in the long run

is the ability of the resources manager to actually implement these activities. to change prescriptions as necessary, and to be able to withstand the pressure and encroachment from conflicting forms of land use that inevitably occur. Many of the failures of silviculture in the tropics are directly attributable to social and economic, rather than technical, constraints (Buschbacher, 1990).

Indigenous Systems of Forest Management

Forest clearing for agriculture and intensive management of re-growth or secondary vegetation in these cleared areas is a type of agroforestry activity commonly used in shifting cultivation in the tropical forests of Asia, Africa and Latin America. In fact, most of these systems are monocyclic in nature. Its many forms and applications have been documented by many studies. The systems used by indigenous peoples are low-intensity or "polycyclic" systems and are of great interest to the present discussion.

The forms or systems adopted by indigenous peoples to manage tropical forest have been documented by only a few researchers (e.g. Chin, 1985; Gomez-Pompa *et al.* 1987; Posey and Balee, 1989; and Anderson, 1990). The few systems that have been studied, however, appear to exhibit several common characteristics:

- They are low-intensity polycyclic systems and usually focused on the management of a large variety of different species and products. Fruits, latex, resins and, in some cases, wood species are all managed simultaneously.

- They rarely involve any type of drastic canopy opening. Tree harvesting, if employed at all, is usually of a low-intensity and selective in nature. The obvious reasons for this is that most of the species managed are NWFP resources which can be harvested non-destructively. The fact that many of these species are shade-tolerant, primary forest species which require only minimal canopy openings for establishment and growth, however, is also undoubtedly an important factor.

- These indigenous systems are applied in a casual manner. Management activities are usually conducted extemporaneously as part of harvesting or collection operations, or are carried out between work obligations of the community (e.g. tending of agricultural fields, fishing or hunting).

Indigenous Management System of the Daret of Balai, West Kalimantan, Indonesia

The indigenous system of NWFP management developed by the Daret of Balai includes rattan palm (*Calamus* spp.), sugar palm (*Arenga pinnata)*, illipe nuts (*Shorea* spp.), bamboo, edible fruits — including durian (*Durio zibethinus*), rambutam (*Nephelium* spp.), langsat (*Lansium domesticum),* and mangosteen (*Garcinia mangostana*) — and wood species like *Eusideroxylon zwagerii,* which produces pole for house construction. The Daret have consciously enhanced distribution and abundance of all of these resources, both wild and introduced. They have planted many fruit tree species in the managed forest, often as social rituals, e.g. to commemorate the dead (Padoch and Peters, 1992).

The essential silvicultural components of the Daret management strategy are:

- **Selective weeding** around durian and illipe nut tree during harvest season to facilitate the location and collection of fruits. The seedlings and saplings of particularly valuable species are spared during weeding.

- **Enrichment planting** is carried out with rattan palm, medicinal plants, fruit trees, and bamboo, and with wood species that are transplanted.

- **Occasional selective**, low-intensity harvesting of wood species provide the light canopy openings in the forest needed to drive the system, as well as wood for house construction, mainly poles. Some of the NWFPs produced in the managed area (e.g. durian and illipe nut) are sold to local traders, but most products are for subsistence.

Indigenous Management System of the Ilha das Onças, State of Pará, Brazil

The management techniques used on Ilha das Onças near the city of Belém, State of Pará, Brazil, are described by Anderson *et al.* (1985), Anderson and Maria Ioris (1989), and Anderson (1988 and 1990). The floodplain forests — called varzea forest — of eastern Amazonia of Brazil, is characterised by the dominance of the açai palm (*Euterpe oleracea*) of high commercial value and a variety of species providing NWFPs (e.g. fruit and latex) and wood (e.g. "andiroba" *Carapa guianensis* and "ucuuba" — *Virola* spp.). Special attention is given to the açai palm.

The essential silvicultural components of the Ilha das Onças management strategy are:

- **Selective weeding** is applied to maintain good access, to remove undesirable species (e.g. *Astrocaryum* palms) and mainly to favour regeneration of desirable fruit bearing species (inga — *Inga* spp. and "buriti" — *Mauritia flexuosa)* and also "seringueira" or rubber tree. Some important commercial fruit species (e.g. cacao, "cupuaçu" — *Theobroma grandiflorum* and coconut) are carefully protected during the thinnings operations.

- **Enrichment planting** — seedlings or cuttings are transplanted specifically to increase the regeneration of species like cacao, mango, cupuaçu, coconut and also "genipapo" — *Genipa americana*. Açai, mango, inga and annatto are propagated by unconscious human dispersal of seeds in the management area. Several varieties of banana are also reported to be introduced in the area.

- **Liberation thinnings** are employed to stimulate growth of desired species, as well as to refine the floristic composition of the stand. In these operations timber species and firewood are the target species. Wood species with large canopies and little commercial value are girdled rather than felled to reduce damage to the residual trees. Trees that interfere with the mature crowns of açai palms are prone to elimination. The products from these liberation thinnings provide an important source of firewood for household use. Açai palms are then regularly pruned to harvest its palm hearts.

Differences in the Indigenous Management Systems

The major differences between the indigenous management systems of Daret of Balai and Ilha das Onças are:

- The Ilha das Onças system is more intensive and market-oriented than that of the Daret. This is due to the facts that the varzea forest contains a high initial density of useful wood and NWFP resources and a smaller complement of associated tree species, and the managed forest is close to the city of Belém, a major market centre.

- The Daret of Balai employ a more casual approach to selectively manage a larger number of species providing NWFPs and some wood species, most of which are destined for subsistence use.

Each of these systems, in its own way, is well-adapted to existing forest and market conditions. The level of accomplishment of these two systems, in large part, can be associated to the result of the intimate knowledge possessed by the indigenous peoples about the ecological behaviour of different forest resources and a long history of continual experimentation of trial and error. The

lesson gained from these indigenous systems is that the ultimate selection of silvicultural operations for use in the management of NWFP resources should always be relatively easy and inexpensive to apply, should involve the minimum canopy disturbance, should involve regular and frequent impact monitoring, and should be appropriate for gradual, rather than instantaneous, manipulation of resource density and abundance. The combination of the philosophy of the indigenous systems of forest management with the experience gleaned from conventional silvicultural practice and periodic diagnostic sampling should be included as an important component to provide quantitative information about the relative success of each intervention. A field exploration of the response of different NWFP resources and species to silvicultural treatments is also necessary. These are recommendations based on the above discussion for managing and conserving NWFP resources.

HARVESTING AS THE VITAL LINK BETWEEN RESOURCE MANAGEMENT AND RESOURCE USE

Earlier when discussing the complexity of integrated management of wood and NWFPs in natural forest, it was pointed out that management for wood and NWFP resources is not mutually exclusive and requires great care. In this context, harvesting should be seen as a silvicultural operation linked to the initial inventory. The most critical element in the implementation of a management plan is the degree of control and supervision exercised over harvesting operations of wood and NWFP resources. Because harvesting of NWFPs can, when improperly done, be deleterious to the resource base, any attempt to promote integrated management of NWFPs has to consider the product and its sources. Moreover, it is necessary to consider the harvest technology that should be adopted because, in many cases, the issue of sustainability of resources providing NWFPs, particularly from tropical forests, has more to do with harvesting technology than with actual levels of current off-take. For example, pau rosa (*Aniba roseadora*), an essential oil whose harvest has almost eliminated the species from the Amazon region, can probably be harvested sustainably. Likewise, copaíba oil (*Copaífera multijuga*), chicle (*Manilkara zapota*), and other latexes, and certain palm and fruits (e.g. *Mauritia* species that grow in the lowland jungles of Brazil and Peru, and buriti, or *Mauritia flexuosa*) can be harvested sustainably, even though they often are not. Sapodilla trees, tapped for chicle and felled for timber, have been depleted over large areas of Guatemala and Mexico. Commercial sassafras oil is manufactured by the steam distillation of the trunk wood of certain species of the Lauraceae family (*Ocotea pretiosa* in the Mata Atlântica region of Brazil and varieties of *Cinnamomum camphora*, in Southern China and Viet Nam). In each case, the industry is based on the destructive harvesting of not only wild mature trees but also juvenile trees. Concern exists, therefore, over sustainability and conservation in all these producer countries, and over the long-term availability of the resource base and consequently of sassafras oil to consumers. In general, the existing systems of harvesting and collection of NWFPs do not have adequate technological and management back-up, and its linkage to the chain of middlemen and traders is not conductive to sustainable management. Also, harvesting is a particularly weak link in the utilization of NWFPs due to the variety of tools, techniques and situations involved. Poor harvesting results in product wastage and resource damage.

NWFPs are produced from different parts of plants or trees. Harvest sustainability can depend on the part harvested. One good example is the cycle of harvesting of bayleaf palm (*Sabal morrisiana*) in the Rio Bravo Conservation and Management area in Belize. Its leaves are harvested for both subsistence and market use, in the constructions of thatched roofs for work shelters, homes and resort cabanas. The harvest of bayleaf timber and palm heart kills the plant, while the harvest of leaves does not. Leaves are harvested from natural forest stands. Leaf harvesting typically occurs between the full moon up until two days before the new moon. Reportedly, leaves harvested outside this period deteriorate significantly and more rapidly than those cut in the correct phase of the moon. Ideally, all but two leaves are harvested from each individual plant. Two young leaves are left intact in order to ensure future growth (O'Hara, 1994).

The harvesting techniques, including pre-harvest and post-harvest treatment, for the various NWFPs will vary considerably for both wild and cultivated sources (see the paper by Lintu on "Trade and Marketing of NWFPs" for examples of post-harvesting operations).

In many cases, the harvest technique adopted is of fundamental importance in guaranteeing the sustainability of the resource. One example is *Prunus africana* (african cherry), a multiple-use tree species with economic and medicinal value (Cunninghan and Mbenkun, 1993). Bark is the major source of an extract used to treat benign prostatic hyperplasia. All bark is taken from wild *P. africana* populations in Afromontane forests of Cameroon, Zaire, Kenya and Madagascar. This occurs in Afromontane forest "islands" surrounded by savanna that provide habitat for important endemic birds, mammals and plants in both Madagascar and continental Africa. *P. africana* has a remarkable ability to withstand bark removal, however, die-back and felling of trees are frequent in high-priority conservation sites. A real effort has been made to ensure that all bark harvesters are shown the correct procedure of removing bark "quarters" from the tree trunk, starting the bark removal above ground level, not above the first branch.

The harvesting standard for many NWFPs is poor and rudimentary, and when confronted with higher and more regular commercial demand it has tended to be wasteful, destructive and unsustainable. That is the case of products such as copaíba oil, chicle gum and Brazil nuts from the Amazonia region. The collectors and extractors of these products can be unskilled and in scientific (and even in practical) methods. Some new techniques would require education rather than tools and equipment, others the reverse. For example, copaíba oil (*Copaífera multijuga*) should be harvested by drilling a hole with a brace and bit, which could be found cheaply at the depot where the copaiba is purchased, rather with an axe, which causes wounds that do not heal.

For many NWFP resources, the pre-harvesting preparations are of fundamental importance for the success of the entire harvesting operation. Guaranteed land and resource rights (or usufruct rights) are the first step in encouraging the sustainable harvest of NWFPs. Such rights, in fact, can allow producers to develop sustainable processing techniques. Furthermore, they allow harvesters to develop long-term harvesting strategies for single species and multiple species associations. Finally, they allow harvesters to make financial investments in the equipment and tools needed to harvest or add value by processing their products. Also, there are different systems of organising harvests of NWFPs prior to the start of actual harvesting operations. One common system is collection by local people under extractive rights and with some form of patronage and financial help from the purchasing agent. Another is by the employment of casual or contract labour by those who have obtained collection rights on lease. In the Amazon region the extractors and collectors of rubber and Brazil nut are often exploited by middlemen who control access to the market, or by those who have access to the resource. The system known as "aviamento" is common in the region. In this system, market goods needed by the extractors and collectors are supplied by middlemen or purchasing agents at inflated prices on credit, to be repaid in extracted products.

Post-harvest treatment is important to avoid product losses. For example, for some latexes like rubber, the crude exudate is collected then boiled to pasty consistency, and cooled into balls or blocks for packing and transport. However, for many NWFPs little is known about post-harvest treatments. For example, most NWFPs from the Amazon region have well-defined and relatively short harvest seasons. Markets for such products, however, could easily be sustained throughout the year if produce were available. Harvest itself is usually an arduous task. Transportation to market is difficult and often must wait until a change of season. Post-harvest treatment and proper storage of products is of fundamental importance for the success of the enterprise.

Harvesting is thus seen as the vital link between resource management of NWFPs and resource use. Therefore, when developing integrated management plans, forest managers should keep in mind the necessity to rationalize and improve harvesting systems and practices. This could involve improved tools and techniques, training and skill improvement, incentive systems institutional and legal arrangements, promotion of local processing and value addition, and linking harvest to processing.

RESOURCES IN PARKS AND RESERVES: BUFFER ZONES

As mentioned earlier, parks and reserves and buffer zones around these conservation areas play an important part in national and international efforts to conserve the genetic diversity of species providing NWFPs.

One significant aspect of NWFP resources is the rational use of buffer zones around conservation areas, mainly parks and reserves, where they help reconcile the needs of communities with the need to protect natural forests. In fact, NWFP resources have proven to be efficient in buffer zones in different situations. Buffer zones schemes, with their emphasis on meeting local needs, can provide ideal opportunities for the conservation of semi-cultivated NWFP resources and land uses which may not be possible in strictly protected natural parks and reserves (Bompard and Kostermanns, 1988).

In this section, examples are given of NWFPs in parks, reserves and buffer zones.

NWFPs from the Maya Biosphere Reserve in the Peten Region of Guatemala

The one-million ha Maya Biosphere Reserve was established in early 1990 to protect the natural resource and traditional way of life of the local people. Much of the area is managed as a buffer zone for several totally protected zones in Peten. The Peten region of present-day Guatemala was the centre of the classical Mayan empire from the ninth to the twelfth centuries A.D. A modest local economy then developed based on the harvesting of mahogany (*Swietenia* sp.), cedar (*Cedrela* sp.) and chicle, the resin of *Manilkara zapota*, for the manufacture of chewing gum. Subsequently, allspice (*Pimenta dioica*) began to be exploited as condiment and xate, the fronds of two species of *Chamaedorea* palms, for use in making wreaths in the United States. At present more than 7,000 families earn a living from the extraction of chicle, allspice and xate from Peten. The forest has remained in a near-natural state and retained much of its conservation value (Sayer, 1991).

The Damar Gardens Adjacent to Barisan Selatan National Park

On the western border of Barisan Selatan National Park, Sumatra, Indonesia, Pesisir villagers have learned to protect trees and restore a forest ecosystem in the lands they have cleared, thus creating a true buffer zone adjacent to the national park. The Pesisir area is located in Lampung Province, Sumatra, and covers about 300,000 ha. About 150 years ago, villagers started to establish, on their own initiative, complex tree gardens, including fruit trees and other species, mainly based on the cultivation of the forest tree *Shorea javanica,* a dipterocarp tapped for resin. These plantations have thus been dubbed "damar gardens". The clear resin is exported to the United States and Japan for use in the paint and varnish industry. Patterns of species diversity and structural complexity in the damar gardens are similar to those of natural forest ecosystems (ITTO, 1993).

The conventional management of "opened" lands is a classic taungya-like process of tree plantation establishment. Damar gardens fulfil several functions commonly recommended for buffer zones. In supplying wood and other forest material for home consumption and in allowing the maintenance of commercial resin collection traditionally related to the forest ecosystem in the area, they relieve human pressure on the remaining natural forests. They also represent an uninhabited belt of several km wide between villages and the park, the ecological value of which should not be neglected.

Another example is rattan palm collection, cultivation and processing, which provides an important source of income for people living around conservation areas. Planting indigenous species can help to rehabilitate logged forests and justify the maintenance of forest cover. Already, rattan palm plantations are being established in the Sinharaja Biosphere Reserve, Sri Lanka, and are planned for Dumoga Bone National Park, Sulawesi, Indonesia (Sayer, 1991).

Game Management Reserve Areas in Zambia

In many African countries, wildlife management in national parks and reserves has typically been based on punitive measures designed to maintain barriers between wildlife resources and local residents, drawing little or no distinction between traditional hunters and organised criminal gangs poaching on a commercial scale for big game. At the same time, the official practice of culling (or selectively slaughtering) over-large herds of protected game animals has became more and more widespread. Local people are often not sufficiently involved in the distribution of the meat and other benefits arising from culling. Other market benefits from protected areas, such as safari tourism revenues and visitors fees, are not always fairly shared with the local community whose ancestral lands were, in many cases, set aside to form the parks and reserve areas in the first place. A number of community-based projects in different parts of Africa, notably Botswana, Zambia and Zimbabwe, are inviting local participation in wildlife management and in the management of tourism facilities. One good example is the project being developed in Zambia.

Zambia has had more than a decade of experience in dealing with wildlife management and an especially serious poaching problem. Intensive law enforcement campaigns were waged in selected parts of the country, involving large amounts of money. However, despite increased arrests, wildlife losses continued; in some cases the problems even increased in areas where such programmes operated. National losses in wildlife resources during this period included near extinction of the black rhino and the reduction of over 50 percent of the elephant population. Similar trends have been documented in Tanzania, Uganda, Namibia and Kenya. Zambia's National Park and Wildlife Service undertook experimental studies and a technical workshop during 1984-1989 to identify the underlying causes of illegal hunting. As a result, a new national policy of wildlife management, called the Administrative Management Design (ADMADE), for reserved game management in reserved areas, was formulated. Based heavily on participation of people in the areas where it has been implemented, ADMADE has proved to be highly effective. In a three-year period, poaching of elephants declined by over 90 percent in one wildlife reserved area in Zambia where local participation was actively promoted. Furthermore, a resident population of black rhino suffered not a single instance of poaching during this period, despite adequate numbers to attract illegal hunters (Lewis *et al.*, 1990).

In Zimbabwe, similar programmes have been carried out. One example is the CAMPFIRE programme (Communal Areas Management Programme for Indigenous Resources) with the objective to give full control of wildlife management to rural communities in conservation areas set aside for this purpose. The theory behind CAMPFIRE is that communities will invest in environmental conservation if they can exploit these resources on a sustainable basis for their own benefit (Murindagomo, 1992).

RESEARCH AND DEVELOPMENT

Research needs of NWFP resources for improving technology are tremendous, touching upon all aspects of their management and development. Some specific areas are the following:

- Enhance knowledge about NWFP resources;

- Prospect, screen, evaluate and classify NWFP-yielding plant species (by pharmacological and toxicological studies on forest-derived medicinal plants), and identify candidate species for development of new drugs and products, including aspects related to their potential supply from wild sources;

- Develop inventory and yield models for different NWFP resources. This deserves special research effort due to its importance as discussed above;

- Promote the domestication and cultivation of commercially viable NWFP-yielding plant species to be grown under multi-species environments (e.g. enrichment planting of natural forests and agroforestry), and as mixed crops or under monoculture;

- Develop on-farm research including species-introduction trials, plant breeding and genetic improvement, as well as the use of germplasm resources in the wild for improving yield and resistance of established crops to pests and diseases;

- Improve agronomic-practices of plants yielding NWFPs;

- Develop agroforestry system for utilizing NWFP species;

- Improve harvesting methods and systems, including pre-harvest preparations and post-harvest treatments, for various NWFP resources, to reduce product wastage, resource damage and improve yield; research is also needed to harmonise harvest of wood and non-wood resources;

- Develop proper scientific and situation-specific management systems. This is an important point to be stressed in promoting integrated management of wood and non-wood resources;

- Develop silvicultural systems for enhancing the growth of wood resources in forests (such as wild fruits, edible nuts, gums, mushrooms, latex, etc.) which can be harvested non-destructively and in combination with timber. In this regard, research is needed on ecology to understand the dynamics of regeneration of most NWFP species;

- Conserve natural forests and their species richness (e.g. *in situ* and *ex situ* conservation of genetic resources and biodiversity). Develop scientific management systems for NWFP resources including wildlife in parks, conservation areas and buffer zones also require research efforts;

- Improve processing, storage and distribution of NWFPs (e.g. perishable products such as forest fruits and vegetable);

- Diversify products, including improvement of quality, is an area that requires particular research.

The need for strengthening research for solving problems and improving technology cannot be over-emphasised. Transfer of technology and adaptive research also need to get adequate emphasis in the overall scheme of NWFP development. Cooperation in research among countries through collaborative programmes can help to avoid duplication and speed the process of NWFP development. Specifically, regional cooperation should link up with international research in forestry and agroforestry. A regional information network on NWFPs can also be used to exchange research information (Chandrasekharan and Frisk, 1994). Research-extension linkage and dissemination of research information also deserve special consideration.

Development of NWFPs depends on success in the marketplace. The most prominent aspects related to trade and marketing of NWFPs are analyzed in the paper by Lintu.

Institutional support is also lacking for development of NWFPs. In fact, one of the major ills affecting the NWFP sector is the institutional neglect relating to policy, strategy and plans, legal rights and arrangements, incentives, development of skills, health and safety considerations, access to information, controls and regulation related to production and marketing authorizations, and streamlined support from public administration. These questions are analyzed and discussed in the theme paper on institutional aspects by Sène.

FACTORS INFLUENCING SUSTAINABILITY OF RESOURCE

CONSERVATION OF GENETIC RESOURCES AND BIOLOGICAL DIVERSITY

To ensure a sustainable NWFP supply, attention must be given not only to the regeneration, silviculture and management of the resource, but also to the conservation of biological diversity in ecosystems supporting them and to the conservation of their genetic resources.

The concepts of conserving biological diversity on the one hand, and genetic resources on the other, need to focus attention and action at different levels, i.e. on the level of the ecosystem and its component species in the former, and on within-species variation in the latter. In any genetic conservation programme it is fundamentally important to clearly specify objectives of conservation, as it is possible to conserve an ecosystem and still lose specific species. It is also possible to conserve a species and lose genetically distinct populations, or genes which may be of value in adaptation and future improvement of the species. Conversely, the loss of an individual species, of distinct populations, or of individuals of genes, may pose a threat to the continued existence of species. At the same time it is important to recognize that co-existing organisms interact, and that different levels of organisation are to a certain degree inter-dependent. A number of publications at various levels of sophistication are available on this subject and its practical implications (see for example FAO, 1989a, and references given in that text).

In situ and *ex situ* are important conservation methods. The first one is aiming to conserve plant and animal resources in their natural habitat while the second type (including gene banks, botanical gardens, conservation stands, etc.) are essential for plant breeding and protecting populations in danger of physical destruction. In other cases, however, *in situ* conservation has a number of advantages: it is especially adapted to species that cannot be established or regenerated outside their natural habitats. For example, the reproduction of many plant species depends on the presence of a particular insect, bird or animal for pollination. *In situ* conservation also allows natural evolution to continue and ensures protection of associated species of no present economic value (FAO, 1993d). This aspect is particularly important for NWFP plant species in tropical forests, because many of these species have not yet been studied for their economic and scientific values.

The following are some examples of actions initiated by international organisations and national governments aimed at conserving the genetic resources and biological diversity of NWFP species.

Mango Conservation in the Kutai National Park, Kalimantan, Indonesia

Joint investigations piloted by the International Board for Plant Genetic Resources (IBPGR) and the International Union for Conservation of Nature (IUCN) in Kutai National Park, Kalimantan, Indonesia, have confirmed that the area is an important centre of genetic variation for several important tropical fruit trees, including mango, breadfruit and durian. Of the 16 species of mango in East Kalimantan Province, 13 are edible. Most of these edible species have been brought under semi-cultivation and these, together with their wild relatives, represent a unique gene-pool which is closely linked to traditional lifestyles in the area, particularly those of the local Dayak people, whose knowledge of the diversity and growing requirements of the mango stock is unsurpassed (FAO, 1993c).

A scheme is now under way to conserve the genetic resource and to guard the local knowledge of Dayak people from loss, as part of plans to manage a buffer zone around the park perimeter.

Conservation *in situ* of *Pinus merkusii*

Pinus merkusii is an important oleo-resin pine which occurs naturally in Myanmar, Thailand, Kampuchea, Laos, Viet Nam, the Philippines, and Indonesia. In the last few decades, population

pressure has been causing the depletion of *P. merkusii* populations. Due to the importance of this genetic resource, the government of Thailand has established a conservation area of 100 ha in Nong Khu, Surin Province, for *in situ* conservation of *P. merkusii*. A second conservation area, of 640 ha located in Kong Chiam, Ubon Province, has also been created by the government. The communities living near the conservation areas have been called to collaborate and participate in conservation activities (FAO, 1989a). The action taken for *in situ* conservation in Thailand needs to be complemented by covering other parts of the range, in other countries, as well.

The INBio-Merck Agreement to Save Tropical Biological Diversity in Costa Rica

The National Biodiversity Institute of Costa Rica (INBio) entered into an innovative agreement with the multinational pharmaceutical company, Merck & Co., to enable Costa Rica to obtain the funds and experience necessary to conserve its biological diversity. INBio's work is based on the premise that the only way to save tropical biological diversity is to learn more about it and to use it sustainably, for intellectual or economic purposes. One of the cornerstones of INBio's programme lies in Costa Rica's System of Conservation Areas, a network of parks and protected areas that comprise nearly a quarter of the nation's territory. It is felt that most of the estimated 500,000 species of plants, animals and micro-organisms thought to exist in Costa Rica are being protected through this network. As part of the agreement, ten percent of the payment received by INBio goes directly into Costa Rica's conservation programme (i.e. conservation of the extraordinary and endangered biological diversity of the Isla del Coco National Park). Also, a national biological diversity inventory of fauna and flora, including NWFP resources, is being conducted (Sittenfeld and Gamez, 1993).

Actions are being taken by different international organisations and national governments (e.g. by FAO in Brazil, Indonesia, Malaysia, Peru and Rwanda) aimed at monitoring genetic resources of heart-of-palm (*Bactris* spp.), NWFPs medicinal plants, and research related to *in situ* conservation of ecosystems and species of the Atlantic forests of Brazil and rattan palm genetic resources in Malaysia. Networks between institutes in the arid and semi-arid zones were promoted for genetic resources work in *Acacia* and *Prosopis* species, and for neem (*Azadirachta indica*).

Avoiding Conflicts in Resource Use

Like any other land use, the gathering and utilization of NWFPs can give rise to conflict. There may be competition among interested industries or groups of consumers for the utilization of the same NWFP raw material, causing demand conflicts. Conflicts are likely to arise in situations where rights are separately assigned to wood and NWFP resources. There may be competition with foresters who wish to harvest timber or between conservation and utilization interests for the plant and wildlife resources. The absence of well-defined boundaries of government-decreed reserve, community forest land, and private concessions also invites land disputes and conflicts in the gathering and utilization of NWFP resources. At the community level, conflicts may also arise between indigenous and migrant users or between groups seeking to use the resource in different ways.

These conflicts are important because the long-term sustainability of the forest resources and their residents depends upon the development of successful strategies to harmonise these interests so that the economic needs of people can be met while maintaining biodiversity. These conflicts in resource use have to be considered because they can be the major causes of resource destruction.

Nair (1990) gives one example of demand conflict in Kerala, India, due to shortage of bamboo reed (*Ochlandra travancorica*), an important raw material for traditional cottage industries and for modern large-scale pulp and paper industries.

In order to avoid conflicts in resource use between farmers and land-owners on the one side and Amerindians, rubber tappers and NWFP harvesters on the other side, the Brazilian Government decreed the formulation of 14 extractive reserves in the Amazon region, of which four were operational in 1989 (Fearnside, 1989). Here, the land is leased for an initial minimum period of

30 years to the extractivists/rubber tappers and ownership is retained by the Government, promoting change from aviamento to autonomous system of management in more accessible areas. Security and autonomy, and consistent and equitable income from harvesting of NWFP resources give the people involved an incentive to conserve and sustainably manage the forest. This was also the strong rationale for the Guatemalan National Congress to pass the Maya Biosphere Reserve Law in 1990. About one half of the reserve (750,000 ha) is designated as an extractive reserve for xate, allspice, chicle and other important products.

In Nigeria, in order to avoid conflicts related to the conversion of areas with highest potential for sustainable forest and wildlife management to other land uses, the Government in May 1990 decided to give village communities usufruct and management rights over local forest as long as management plans were drawn up and agreed upon (ARD, 1991).

CONSTRAINTS ON RESOURCE SUSTAINABILITY AND DEVELOPMENT

In general, the obstacles to using and developing NWFPs are not greatly different in degree from the problems that have confronted other land uses or commodity sectors in the past.

A most serious obstacle to better use of NWFP resources is neglect by policy-makers, planners and forest managers. In most forest policies, NWFPs receive only passing mention, without clear objectives, targets, or strategies for development. NWFPs are not treated at all in official statistics and surveys. Other serious land-use issues relegate NWFP development to low priority. The same attitude persists also in most international agencies. Some planners are prejudiced against what they see as the retrograde or archaic "back-to-nature" aspect of NWFPs. On the trade side, major exporters of these products are often cautious about releasing data about quantities and revenue, which they regard as trade secrets.

Several factors constraining the sustainable development of NWFP resources are purely of forest origin. These include: lack of inventory/assessment, including its planning, which often lacks a scientific basis, and effective conservation measures; lack of management systems applied to NWFP resources; lack of appropriate cultivation practices mainly in the tropics and lack of harvesting techniques including pre-harvest and post-harvest treatments. The competing demands on forests which change the land use in particular and large-scale timber production are potential threats to NWFP resource sustainability. Poor harvest results in resource damages, as discussed above. Little knowledge exists about: the inter-relationship between the majority of NWFP species and their surrounding environment; the extent of their variation in nature, productivity, quality standards of products, characteristics and uses; processing and storage technologies; profitability; development potential and management regimes for sustainability of the resources including regeneration techniques. Information on production and domestic consumption is strikingly lacking for most NWFPs. This makes it still harder to integrate their use into development schemes at their outset. Also, extensive gathering and inappropriate management regulation have often caused NWFP resource depletion. Gathering or extraction of natural resources can only support low human population densities, and increasing population pressure have negatively affected the sustainability of the resource.

Recently countries have taken action to address some of these constraints. In Brazil, the government is negotiating a loan with the World Bank for strengthening conservation measures related to the national conservation programme (national parks, conservation areas, reserves, etc.), including demarcation of boundaries of these conservation areas, land tenure rights within conservation areas, research and strengthening of institutions (e.g. of the government agencies responsible for administering parks, conservations areas, reserves, etc.). The project on Conservation for Sustainable Development in Central America (OLAFO), conducted by researchers of the Tropical Agricultural Training and Research Centre (CATIE) in Guatemala, Costa Rica and Panama, is an example of efforts to develop appropriate management systems for NWFP resources.

Serious constraints affecting NWFP resource sustainability and development stem from the fact that the right to these resources and their benefits is rarely specified in detail in forestry concessions, permits or land deeds. As a matter of fact, in most cases, NWFP resources are not mentioned at all. In many countries, government legislation allow collection of NWFPs by an extractive community or user groups only for subsistence, but not for commercial purpose. Clear and legal land tenure and resource rights for forest residents are essential first steps towards creating an economy based upon the sustainable development and use of the forest and a wide diversity of NWFPs, and for conserving biological diversity. The extractive reserves established by the Brazilian government in the Amazon region is an example.

RECOMMENDATIONS FOR MANAGING NWFP RESOURCES

As outlined above, most conventional methods developed by foresters are primarily for timber productions, with emphasis on cutting cycles and silvicultural techniques to increase merchantable volumes of timber. Even plant ecologists working in the tropics have only rarely addressed the problem of managing NWFP resources.

As discussed above, controlled harvesting and periodic regeneration surveys alone can frequently provide a simple and effective method of achieving a sustainable harvest of forest resources. In this method, the intensity of human intervention is adjusted to account for the ecological dynamics of the target plant species population, not the other way around. The conventional methods of forest management however, require a more intensive form of resource intervention through silvicultural techniques or treatments.

A strong and continued political commitment at the highest national governmental level is indispensable for sustainable forest management. National land-use policy should aim at sustainable use of all natural resources, including the establishment of a permanent forest base. As part of that, an agreed forest policy should be supported by appropriate legislation (ITTO, 1992).

The procedures suggested in this section for managing NWFPs on a sustained-yield basis can be applied to almost any class of NWFP resources (i.e. reproductive propagules, plant exudates or vegetative tissues). Furthermore, their application permits great flexibility, so that operations can be tailored to suit the ecological requirements of a particular site or plant population.

PLANNING

Proper planning is an essential component of long-term sustainable forest management, and at the operational level reduces economic and environmental costs.

Forest Ownership, Institutions, Socio-Economic and Financial Aspects

Important points to be considered in the first step of planning non-wood resources management are the needs for adequate forest ownership, institutional, labour and capital arrangements. Resource access and right for benefits should be specified in detail, regardless of whether the management area is a national forest or a privately owned or customarily held forest. Clear and legal land tenure and resources rights (i.e. for forest residents) are essential first steps towards creating an economy based on sustainable forest development. Institutional arrangements regarding who is responsible for the enterprise, including all management activities, should be considered (i.e. is it a private company, or a government agency, or is it a joint-venture between government and private company). Broad-based and organised participation encompassing local groups, women, and indigenous communities is an essential means of strengthening the institutional structure for planning management activities and for the success of the enterprise. Adequate investment and efficient institutions, including credit facilities on easy terms, extension support, and effective incentives linked to key objectives and target groups, are of fundamental importance. Also important is the availability of multidisciplinary trained human resources for planning, field work and analysis and interpretation of data on management.

Selection and Definition of the Management Area

The next step in planning is to select, define and delineate the precise boundaries of the management area within which the activities are to occur. Without this information, it is not possible to do detailed forest mapping, conduct suitable inventory, define forest management units or estimate the total harvestable resources.

Supporting information about the forest management area should be collected. Information should include soil or geologic survey maps, large-scale topographic base maps, standard aerial photographs, satellite images, climatological data, descriptive analysis of vegetation, inventory data forest maps, etc. A literature review should be conducted on the forest area, including possible information from herbaria about plant species in the area.

Management Inventory and Mapping

A management inventory supported by a detailed map is indispensable in preparing working plans for each forest management unit.

An assessment of NWFP resources by appropriate categories and a detailed prospecting for specific products (e.g. gums, resin, fruits, phytochemicals etc.) in the area is an essential part of the management process. This will help to identify candidate species or groups of species and distribution of suitable areas to be developed for specific products. This will also serve as a sound basis for planning the management activities. To achieve this objective, detailed forest inventory and mapping should be carried out.

As outlined earlier, forest inventories involve extensive work and the counting and measuring of plant species. Quantitative information should also be gathered on timber species, both commercial and non-commercial species. During this inventory, other aspects of the forest, such as its importance for wildlife populations, can be qualitatively assessed. Different aspects related to forest inventory for NWFP resources have been discussed above. From the earlier discussion, it is suggested to use a systematic sample of fixed-width transects, with lower diameter limit of 10 cm DBH (except for certain palms, lianas and shrubs) and sample intensities not below 3 to 5 percent of the total management area.

The inventory will provide information related to the overall ecological potential of the NWFP plant resources to be managed (i.e. reproductive biology, regeneration and growth strategies, life cycle, abundance of occurrence in different forest types, population structure and size class distribution, end-uses types of products produced, etc.). Also, the inventory data and additional baseline field information related to different forest types occurring within the management area are important for determining the actual pattern and intensity of forest exploitation. At the same time, attempts should also be made to identify and delineate the different forest types and plant communities using photogrammetric analysis of aerial photographs or photo interpretation. These features should then be mapped and the total area under each forest type can be estimated planimetrically using this map based on the floristic composition of different forest types or plant communities. These forest types contain different NWFP resources that must be managed in different ways.

Selection of NWFP Resources to be Managed

The inventory, together with economic and social criteria, provide data needed for selecting the NWFP resources to be managed. As discussed in previous sections, aspects related to botanical characteristics provided by the inventory and additional baseline field information can determine the management potential of NWFP resources.

Division and Demarcation of the Management Area into Management Units

The subdivision of the management area into distinct management units should be based on estimates of total population and their productivity, carried out through a yield study, for different sites. The basic objective of the measurement of productivity is to estimate the quantity of the desired product to be produced by the NWFP resources within a particular habitat. The measurement of productivity has been discussed earlier; Peters (1992) describes criteria for subdividing the area into management units.

The selection of these units should be based on a *posteriori* statistical comparison of the density and yield data, both between habitats (for a single species) and between species within a single habitat. Regression analysis and simple analysis of variance can accomplish this task.

The plant species or combination of plant species providing NWFPs that are most productive in a particular forest type or habitat are then identified. Those areas containing the most productive populations of the desired species selected for management should be located and outlined on the forest type map of the area. This procedure will generate a second forest type map (defined by the productivity of specific plant species yielding NWFPs). The finished map is an important document that will serve as the basis for all subsequent management planning in the area.

The determination and mapping of management/production units is a routine part of management operations on large timber estates. This procedure, however, is not reported in the literature relating to the management of NWFP resources. The practices that most closely conform to this logic are the delineation of different "estradas" by the rubber tappers in Brazil, as observed by the author in the Amazon region of Brazil, or the qualitative division of forests by the Daret of Balai, West Kalimantan (see above). Both of these groups use resource abundance and productivity as a criteria for subdividing the forests.

HARVESTING

As discussed in an earlier section, efficiency and sustainability of forest management depend to a large extent on the quality of harvesting operations. Pre- and post-harvest prescriptions are important to: minimize logging damage; attune harvesting with the silvicultural concepts adopted; assess logging damage, the state of forest regeneration, the need for release and other silvicultural operations to assure the future of the NWFP crop.

Sustainable Harvest Level

The inventory and yield studies are used to estimate the total harvestable yield from the forest. The next step is to estimate a sustainable harvest yield or harvest level. As outlined previously, from a management perspective, a truly sustainable system for exploiting NWFP resources is one in which fruits, nuts, latexes, gums, and other non-wood forest plant products can be harvested indefinitely from a limited area of forest with negligible impact on the structure and functions of the plant populations. By collecting and analyzing data on the growth, mortality and reproduction of different individuals within the population, certain predictions can be made about the impact of harvesting before the resources are actually extracted from the forest. The importance of this technique is that over-exploitation can be identified first in a computer simulation, not 20 to 50 years later in the field when it may be too late to remedy. Two procedures can be used to estimate a sustainable harvest level or intensity:

- The "successive approximation" method, which requires establishment of permanent regeneration plots that are monitored at five-year intervals. In this method, the intensity of human intervention is adjusted over time to account for the ecological dynamics of the targeted plant populations, instead of the other way around. As mentioned before, controlled harvesting

and periodic regeneration surveys alone frequently provide a simple and effective method of achieving a sustainable harvest of NWFP resources.

- Plant demographic studies, coupled with matrix models of population growth and computer simulations, provide a more quantitative method of approaching a sustainable harvest intensity.

Controlling the Intensity of NWFP Resource Extraction

Two different management strategies are available to achieve the control of the intensity of NWFP resource extraction. Harvests can be controlled by regulating: (1) the number or size of the trees exploited or (2) the total area from which the NWFPs are extracted (see Peters, 1992, for details about these two methods).

PROTECTION

The forest management area should be protected from activities that are incompatible with sustainable production of NWFPs, such as encroachment by shifting cultivators often associated with the opening up of the forest. Fire is also a serious threat to future productivity and environmental quality of the forest. Access to logging roads that are not part of the national infrastructure (i.e. through-roads) should be strictly controlled. A fire management plan should be established for each forest management unit, taking into account the degree of risks (ITTO, 1992).

FINAL CONSIDERATIONS

The above recommendations have shown that the combination of inventories, yield studies and monitoring can provide the resource manager with the essential ingredients required for developing management programmes. This is information about: (1) the density and distribution of resources within the forest, (2) population structure and productivity of NWFP resources to be managed, and (3) the ecological or demographic impact of resource harvest.

In many cases, simply defining an effective compromise between harvest intensity and population recruitment is sufficient to ensure the long-term sustainability of resource extraction. Some species, however, may not be so easy to exploit. They may occur at low densities in the forest, exhibit marginal productivity, or be extremely sensitive to the effects of harvesting. For these reasons, in addition to controlled harvesting the sustainable management of these species will require some form of direct silvicultural manipulation. As discussed earlier, controlled interventions through silvicultural treatments can stimulate the abundance, productivity and regeneration of plant species that yield NWFPs.

Readers are referred to the scientific literature (e.g. ITTO, 1992a, 1992b, 1993; FAO, 1989b, 1989c, 1991a) for suggestion and guidelines for sustainable managements of natural tropical forests. The recommendations in this paper should be complemented, wherever appropriate, with the suggestions and guidelines contained in that literature.

REFERENCES

Adlard, P.G. 1990. Procedures for monitoring tree growth and site change. Trop. For. Paper No. 23. Oxford, Oxford For. Institute.

Alcorn, J.B. 1989. An economic analysis of Huastec Mayan Forest Management. *In* Brunder, J.O. (ed.) *Fragile lands of Latin America: strategies for sustainable development*. Boulder, West View Press.

Allegretti, M.H. 1990. Extractive reserves: an alternative for reconciling development and environmental conservation in Amazonia. *In* Anderson, A.B. (ed.). *Alternatives to deforestation in Amazonia: towards sustainable development*. New York, Colombia Univ. Press.

Aksornkoae, S., Maxwell, G.S., Havanond, S., and Panichsuko, S. 1992. Plants in mangroves. Bangkok, IUCN Regional Office.

Anderson, A.B. 1988. Use and management of native forests dominated by açai palm (Euterpe oleracea) in the Amazon estuary. *Adv. Econ. Bot.* 6:144-154.

Anderson, A.B., Gely, A., Strudwick, J., Sobel, G.L. and Pinto, M.G.G. 1985. Um Sistema agroforestal na varzea do estuário amazônico (Ilha das Onças, Município de Barcena, Estado do Pará. *Acta Amazônica Supl.* 15(1-2):195-225.

Anderson, A.B. and Marta Ioris, E. 1989. The logic and extraction: resource management and income generation by extractive producers in the Amazon estuary. Paper presented at the Traditional Resource Use in Neotropical Forests Workshop, Center for Latin America Studies, University of Florida, Gainsville.

Anderson, A.B. 1990. Extraction and forest management by rural inhabitants in the Amazon estuary. *In* A.B. Anderson (ed.) *Alternatives to deforestation: steps toward the sustainable use of the Amazon rain forest*. New York, Columbia University Press.

Associates in Rural Development. 1991. *A conceptual approach to the conservation and management of natural forests in sub-Saharan Africa*. Washington D.C., USAID.

Asian Development Bank. 1992. Non-Wood Forest Plan. Forestry Master Plan, Bangladesh. Dhaka, ADB.

Asibey, E.O.A. 1974. The grasscutter, *Thryonomys swinderianus* in Ghana. *Symp Zool. Soc. London* 34:161-170.

Avery, T.E. 1983. *Forest measurements*, 3rd edition. New York, McGraw-Hill.

Balick, M.J. 1988. Jessenia and Oenocarpus neutropical oil palms worthly of domestication. FAO Plant Production and Protection Paper 88. Rome, FAO.

Baur, G.N. 1964. *The ecological basis of rainforest management*. Forestry Commission of New South Wales.

Bompard, J.M. and Kostermans, J.G.H. 1988. Preliminary results of an IUCN/WWF sponsored project for conservation of wild mangifera species *in situ* in Kalimantan. Rare Tropical Timbers. Gland, Switzerland, IUCN.

Bramble, B.J. 1987. The debt crisis: the opportunities. *Ecologist* 17(4/5):192-199.

Buschbacher, R.J. 1990. Natural forest management in the humid tropics: ecological, social and economic considerations. *Ambio* 19:253-258.

Campbell, C. and Brigham, T. 1993. NWFPs in Zimbabwe. Rome, FAO.

Chandrasekharan, C. and Frisk, T. 1994. Development of NWFPs in Latin America and the Caribbean. Paper presented at the Expert Consultation on Non-Wood Forest Products in Latin America and the Caribbean. Santiago, Chile.

Chandrasekharan, C. 1993. Issues involved in the sustainable development of non-wood forest products. *Proc. Expert Consultation of NWFPs for the English-Speaking African Countries*, held in Tanzania. Rome, FAO.

Chin, S.C. 1985. Agriculture and resource utilization in a lowland rainforest Kenyah community. *Sarawak Museum J.* special monogr. No. 4. Kuching, Sarawak Museum.

Clay, J. W. and Clement, C.R. 1993. *Selected species and strategies to enhance income generation from Amazonian forests*. FO Misc/93/6 Working Paper. Rome, FAO.

Cunningham, A.B. and Mbenkum F.T. 1993. Sustainability of harvesting *Prunus africana* bark in Cameroon. A medicinal plant in international trade. People and Plants working Paper. Paris, Unesco.

de Beer, F.J. and Mc Dermott, M. 1989. *Economic value of non-timber forest products in South East Asia.* Amsterdam, IUCN Committee for the Netherlands.

FAO. 1981. *Manual of forest inventory.* FAO Forestry Working Paper 27. Rome, FAO.

FAO. 1983a. Crocodile breeding and management in India. Project findings and recommendations. FO:DP/IND/74/046. Terminal Report. Rome, FAO.

FAO. 1983b. Importancia de las plantas medicinales. *Unasylva* 35(140). Rome, FAO.

FAO. 1984. *Changes in shifting cultivation in Africa.* FAO Forestry Paper No. 50. Rome, FAO.

FAO. 1988. *The current state of knowledge of Prosopsis juliflora.* Rome, FAO.

FAO. 1989a. Plant genetic resources: their conservation *in situ* for human use. 38 pp. Rome, FAO.

FAO. 1989b. *Review of forest management systems of tropical Asia.* FAO Forestry Paper No. 89. Rome, FAO.

FAO. 1989c. Forest management for sustainable production and conservation in Indonesia. Ministry of Forestry and FAO, UTF/INS/065/INS: Forestry Studies Field Document No. 12, Jakarta.

FAO. 1990. FAO wildlife management for rural development. *Unasylva* 41(161).

FAO. 1991a. Sustainable management of tropical forests. Secretariat Note. FAO Committee on Forest Development in the Tropics. Tenth Session. FO:FDT/91/5. Rome, FAO.

FAO. 1991b. *Forest products.* Unasylva 42 (162). 165 p.

FAO. 1993a. *FAO Forestry resources assessment 1990.* Tropical Countries. FAO Forestry Paper 112. Rome, FAO.

FAO. 1993b. *The challenge of sustainable forest management: what future for the world's forests?* 126 pp. Rome, FAO.

FAO. 1993c. *More than wood.* Forestry Topics Report No. 4. Rome, FAO.

FAO. 1993d. Plant genetic resources development education. Exchange Papers. Rome, FAO.

FAO. 1994a. *Bamboo in Asia and the Pacific.* Proc. 4th international bamboo workshop on bamboo in Asia - Pacific Region, held Chiangmai, Thailand. Bangkok, FAO-RAPA.

FAO. 1994b. *Mangrove forest management guidelines.* FAO Forestry Paper 117. Rome, FAO.

FAO. 1994c. *Non-wood news* 1(1). Rome, FAO.

Fearnside, P.M. 1989. Extractive reserves in Brazilian Amazonia. *Bioscience* 39(6):387-393.

Gentry, A.H. 1988. Tree species richness of upper Amazonian forest. *Proc. Natl. Acad. Sc.* 85:156-159.

Gillis, M. 1986. *Non-wood forest products in Indonesia.* Chapel Hill, NC, USA, Department of Forestry, University of North Carolina.

Gomez - Pompa, A. Flores and Sosa, V. 1987. The "pet-Kot": a man-made tropical forest of the Maya. *Interciencia* 12:10-15.

Gordon, A. and Coppen J.J. 1993. Trends in demand for Amazonian gums, resins and rotenoid insecticides and an assessment of their development potential, with particular reference to Brazil. Leeds, Natural Resource Institute.

Gupta, T. and Guleria A. 1982. *Non-wood forest products in India*. New Delhi, Oxford and IBM Publishing Co.

Hamilton, L.S. 1988. The environmental influences of forests and forestry in enhancing food production and food security. Presented at the Expert Consultation on Forestry and Food Production/Security. Rome, FAO.

Hoogesteijn Reul, R. 1979. Productive potential of wild animals in the tropics. *Wld. Anim. Rev.* 32:18-24.

ITTO. 1991. Status and potential of non-timber products in the sustainable development of tropical forests. ITTO Technical Series No. 11. Yokohama, ITTO.

ITTO. 1992a. *ITTO guidelines for the sustainable management of natural forests*. ITTO policy development series 1. Yokohama, ITTO.

ITTO. 1992b. The Celos Management System. *ITTO tropical forest management update* 2(3):4-8. Yokohama, ITTO.

ITTO. 1993. Tropical forest management. *ITTO tropical forest management update* (3)3. Yokohama, ITTO.

Kahn, F. 1988. Ecology of economically important palms in Peruvian Amazonia. *Adv. Econ. Botany* 6:42-49.

Kirme, R.D., Constantino, L.F. and Guess, G.M. 1993. Prospects for improved management of natural forests in Latin America. Laten Dissemination Note No. 9. Washington, DC, The World Bank.

Lanly, J.P. 1982. *Tropical forestry resources*. FAO Forestry Paper No. 30. Rome, FAO.

Lewis, D.M., Mwenya, A. and Kaweche, G.B. 1990. African solutions to wildlife problems in Africa: insights from a community-based project in Zambia. *Unasylva* 161(141):11-20.

Lundgren, B. and Raintree, J.B. 1983. Sustained agroforestry. *In* B. Nestel, ed. *Agricultural research for development: potentials and challenges in Asia*. The Hague, ISNAR.

Mann, H.S., and Saxena, S. K. 1980. *Khejri (Prosopsis cineraria) in the Indian desert: its role in agroforestry*. CAZRI monograph No. 11.

Marmillod, D., Ocampo, R., Robles, A.G., and Chinchila, C. M. 1994. La evaluacion de recursos no maderables tropicales: las experiencias de CATIE-OLAFO en America Central. Turrialba, Costa Rica, CATIE.

Matthews, J.D. 1989. *Silvicultural systems*. London, Clarendon Press.

Menon, K.D. 1989. *The rattan industry: prospects for development*. Rome, FAO.

Mukerji, A.K. 1989. Development of pine resin tapping industry. Indonesia UTF/INS/065/INS: Forestry Studies. Field Document No. 3-2. Jakarta, FAO.

Murindagomo, F. 1992. Wildlife management in Zimbabwe: the Campfire programme. *Unasylva* 168(43):20-26.

Myers, N. 1984. *The primary source: tropical forests and our future*. New York, Norton.

Myers, N. 1988. Tropical forests: much more than stocks of wood. *Tropical Forest Ecology Journal* 4:209-211.

Nair, R.S.S. 1990. Conservation, development and utilization of India's non-timber forest wealth: the prospects and priorities. In *Status and potential of non-timber products in the sustainable development of tropical forests*. ITTO Technical Series No. 11. Yokohama, ITTO.

O'Hara, J. L. 1994. The ecology of bayleaf palm (*Sabal morrisiana*) and implications for its sustainable management in the Rio Bravo Conservation and Management Area, Belize. *TRI News* 13(1):11-14. Tropical Resources Institute.

Pacific Coconut Community. 1990. *Proc. XXVII Coco Tech. Meeting*.

Padoch, C. and Peters, C. 1992. Managed forest gardens in West Kalimantan, Indonesia. *In* J. Cohen and C. Potter (eds.), *Case studies of genetic resources*.

Padoch, C. 1992. Traditional management of forests and agroforests in West Kalimantan, Indonesia. *Proc. Pacific Anthropology Congress*, Honolulu.

Pedersen, H.B., and Balslev, H. 1990. Ecuadorian palms for agroforestry. Botanical Institute, Aarhus Univ.

Pedersen, H.B. 1992. Uses and management of *Aphandra natalia* (palmae) in Ecuador. *Bull. Int. Fr. études andines*. 21(2):741-753.

Peters, C.M., Gentry, A.H., and Mendelsohn, R.O. 1989. Valuation of an Amazonian rainforest. *Nature* 339:655-656.

Peters, C.M., and Hammond, E.J. 1990. Fruits from the flooded forests of Peruvian Amazonia: yield estimates for natural populations of three promising species. *Adv. Econ. Botany* 8:159-176.

Posey, D.A., and Balle, W. 1989. Resource management in Amazonia: indigenous and folk strategies. *Adv. Econ. Botany* 7.

Poulsen, G. 1981. Important forest products in Africa other than wood and wood extractives. Rome, FAO.

Peters, C.M., Balick, M.J., Kahn, and Fance Anderson, A.B. 1989. Oligarchic forests of economic plants in Amazonia: utilization and conservation of an important tropical resource. *Conservation Biology* 3(4):341-349.

Reville, J.A.V., Soemarna, K., and Sumarna, Y. 1990. Sagu palm (*Metroxylon* spp.) yield model for Indonesia. UTF/INS/066/INS. Indonesia National Forest Inventory. Field Document No. 10. Jakarta, FAO.

Saenger, P., Hegerl, E.J., and Davie, J.D.S. 1983. *Global status of mangrove ecosystems*. Commission on ecology paper No. 3. Gland, Switzerland, IUCN.

Sayer, J.A. 1991. Using non-timber products to support forest conservation programmes. In ITTO Technical Series No. 11. Yokohama, ITTO.

Schmidt, R. 1987. Tropical rain forest management: a status report. *Unasylva* 156:2-17.

Sittenfeld, A., and Gamez, R. 1992. Building partnerships to save tropical biodiversity: the INBio-Merck agreement. *Network* 92.

Sork, V.L. 1987. Effects of predation and light on seedling establishment in *Guatavia superba*. *Ecology* 68:1341-1350.

Synnott, T.J. 1979. Tropical rain forest silviculture: a research project report. Occasional Paper 10. Oxford, Common. For. Institute.

Smith, D.M. 1962. *The practice of silviculture*. New York, John Wiley and Sons.

Veblen, T.T., Schlegel, F.M., and Escobar, B.R. 1980. Dry-matter production of two species of bamboo (*Chusquea culeou* and *C. tenuiflora*) in South-Central Chile.

Vooren, A.P. 1990. Appropriate buffer zones management strategies for the Tai National Park. Côte D'Ivoire, Actes de l'Atelier sur l'Aménagement et la Conservation de l'Ecosystème Forestier Tropical Humide. Cayenne, French Guyana, MAB-Unesco/IUFRO/FAO.

Wood, G.B. 1989. Ground sampling methods used to inventory tropical mixed/moist forest: the challenge before us. In W. Razali Wan Mohd., H.T. Chan and S. Appanah (eds.), *Growth and yield in tropical mixed/moist forests*. Kuala Lumpur, Kepong, FRIM.

World Resources Institute (WRI/IIED). 1988. *World Resources 1988-89*. New York, Basic Books.

ENVIRONMENTAL DIMENSIONS OF NON-WOOD FOREST PRODUCTS

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INTRODUCTION

This paper considers the environmental merits of non-wood forest products (NWFPs), and the potentials and constraints in their realization. It also identifies the environmental dimensions of NWFPs and provides broad guidelines for incorporating environmental considerations in NWFP management and utilization.

The increasing demand for NWFPs and the disappearance of forest ecosystems have prompted an important decision by many countries to protect the existing forest ecosystems, especially those of tropical forests which have high levels of biological diversity.

NWFPs are more amenable for sustainable harvesting and use than wood products; they tend to have greater environmental benefits, including conservation of biodiversity, if carefully managed; they provide improved possibilities for "eco-ventures" covering small-scale NWFP-based enterprises, supply of genetic materials, buffer zone management, wildlife and wilderness-based tourism; they support upland community needs and welfare. Probably NWFPs are more vulnerable to mismanagement than wood. Sound forest management is the key for their sustainable and successful management.

Development, including development of NWFPs, is considered important to improve people's welfare. Development is hardly ever linked with the disutility of many resources. In fact, however, development produces both useful products and "wastes" or "disutility". The benefit to the communities of useful products are emphasized, while the cost and risk to the communities of "wastes" or "disutilities" are de-emphasized.

Development is usually linked to the economy and environment is usually related to ecology. In the modern world, both are supposed to be linked to the market mechanism governing supply and demand of any commodity — goods and services. Evidently, both words — economy and ecology — signify a confined and limited space. However, in our world, like in a house, everything is internal and its resources are limited and interrelated. It is somewhat of a paradox that economy and ecology came to be thought of as antithetical.

This paper is meant only to serve as a basis for discussion and to stimulate ideas and suggestions. Environmental implications of NWFPs pervade all other topics discussed at this consultation. Several specific to resource management are addressed in the paper by Reis on Resource Development.

GENERAL BACKGROUND

The relationship between humans and forests has culminated at various times in wood shortages of great political and economic importance, and which led ultimately to the development of forestry as a scientific discipline. Early attempts to conserve and sustain wood supplies were largely

unsuccessful, and natural forests are still quickly disappearing. Natural forests are being converted to commercial plantation forests to produce more wood of "better" quality.

Natural forests also provide many NWFPs vital to local communities. Increased medicinal and industrial knowledge has also recognized the importance of NWFPs to support new medicines, new molecules and genes to engineer new products.

TERMINOLOGY

NWFPs generally include tangible products other than timber, fuelwood and charcoal derived from forests or woody plants. The purpose of a discussion on NWFPs is the inclusion of these products in planning and managing forestry activities. This will promote investment to improve NWFPs and the output of non-wood products can be planned along with wood products.

Both plantation and natural forests can produce NWFPs. In fact, some plantation forests are developed specifically to produce NWFPs, including: pine and rubber plantations for producing resin; cinnamon plantations for producing bark; *myristica* plantations for producing nutmeg; and *schleichera* plantations to host insects for lac production. Another "product" is forest-based recreation and hunting.

We can divide NWFPs among two categories: (1) tangible products, i.e. flora and fauna, and (2) intangible products provided by the existence of forests in a certain area, e.g. a stable hydrological system, erosion control, scenic beauty, climatic regulation, and biodiversity.

ENVIRONMENTAL ASPECTS

The environmental values of NWFPs have a direct correlation to the type of forest from which they are harvested. In natural forests, where diversity is generally much greater than in plantation forests, the environmental value of NWFPs is much higher since these products are part of the forest ecosystem where every component, living and non-living, of the forest relates to each other. The roles of NWFPs in the forest ecosystem, include nutrient supply for other living organism in the forests, regeneration of the forest itself and the maintenance of forest habitat quality.

COMMODITY VALUES

NWFPs are no longer "minor forest products" but major products of great socio-economic value. They are harvested not only from natural forests, but also from areas under similar use and plantations. They may be part of woody plants such as bark, gum, leaves, fruits, oils, and flowers, or they may be part of the forest ecosystem, such as wildlife or grass. Some of the NWFPs are intangible, for example, recreational facilities.

NWFPs have a broader base of production than timber. In many countries, timber can only be harvested from production forests, while NWFPs can be harvested from all forests, whether plantation, protected forests or nature reserves.

New NWFPs are being developed continuously, such as medicines and other chemicals, genetic materials of flora and fauna to improve agricultural productivity. Availability of some of these new products depends on the existence of natural forest habitat and its exploitation poses another threat to the sustainability of the forest.

SUSTAINABILITY

The term *sustainability* has different meanings for different people. In the context of forests, sustainability means the ability of each generation to maintain and pass on to the next generation a stock of forest resources no less productive, protected and utilizable than what it inherited, including

natural forests and other sensitive ecosystems. Just as sustainability of NWFPs depends on the sustainability of forests, the sustainability of forests will depend on the way that NWFPs are harvested.

Sustainability of forest production, including NWFPs, requires management. Since NWFPs in many countries have traditionally been considered by-products, their production has not been managed at all. It has been a "hunter and gatherer" type activity and its sustainability is questionable.

To improve the sustainable management of NWFPs, more knowledge is needed, especially of forest ecology and the ecology of NWFPs, that is, the role of plant and animal matter in the intricate and interrelated ecological system. An understanding of the role of NWFPs in the forest ecosystem is essential to understand the impacts of exploitation on the environment.

The criteria and methodology of NWFP management can be developed most quickly through an understanding of the sustainable relationship between the forest and the indigenous communities living in the forests.

ENVIRONMENTAL ROLES OF NWFPs AND IMPACTS OF THEIR EXPLOITATION ON THE ENVIRONMENT

In the forest ecosystem, biotic and abiotic factors are linked together in an intricate relationship, supporting and enriching each other. Biotic components such as plants, insects, mammals, and birds, are linked in the cycles of energy, nutrients, water, and material. Many other cycles also link biotic factors with abiotic factors such as water and soil. NWFP resources play a part in these relationships.

Energy Cycles

Forest productivity is closely related to the foliage or leaf area of the vegetation. In this respect, leaf and other biomass may be considered as NWFPs and an important component of the energy cycle in the forest ecosystem.

By the beginning of the 1980s, it became apparent that biomass was about to make a comeback as a significant contributor to national energy budgets in developed countries, although developing countries have never escaped from this dependency. With the real possibility of a world shortage of wood in the next few decades, wood appears to be about to regain some of its historic importance as a major factor in human cultural evolution.

Nutrient Cycles

The dynamics of chemical nutrients in terrestrial ecosystems can be identified with one or more of the following three cycles: the geochemical cycle, involving the input and loss of nutrients from a particular ecosystem; the biogeochemical cycle, involving the intake, storage and loss of nutrients from plants within an ecosystem, including the movement of nutrients through grazing and detritus-trophic-webs; and the biochemical cycle, involving an internal redistribution of nutrients within organisms that permit them to satisfy some of their nutritional requirements for new growth from within their own nutrient capital. Dead leaves and litter, for example, may be considered NWFPs or fertilizer, but they also form an important component of the biogeochemical cycle of the forest ecosystem.

Various mechanisms have evolved to conserve and store nutrients within an ecosystem. Plants on uncolonized mineral substrate will gradually remove available nutrients from the mineral layers and transfer them to the living plant biomass with a surface accumulation of decomposing organic matter. Atmospheric inputs also accumulate within the ecosystem. Trees are particularly well adapted to accumulate nutrients from the geochemical cycle into a tight biogeochemical cycle, and in time a forest may be able to live in virtual nutritional independence of the underlying mineral layers. This important

phenomenon permits reasonably productive forest growth on exceedingly nutrient-poor mineral substrates, and is a major reason why forests are such a successful form of vegetation.

In managing ecosystems, the biogeochemical mechanisms responsible for sustainable production must be identified and conserved. Over the past 2,000 years, and especially in the past 50 years, humans have disturbed nutrient cycles on an ever increasing scale. In many areas the nutrient reserves that have taken centuries, or even millennia, to accumulate have been dissipated. Natural processes remain fully capable of rebuilding these reserves in time, but generally too slowly for human purposes. To continue life as we know it will require that we conserve available nutrients by maintaining biogeochemical cycles intact. Thus nutrient management will become as important in NWFP forestry as it is in agriculture.

Shoot and root systems are especially active nutrient absorbers for plants. Shoots actively absorb CO_2, O_2, H_2O, NH_4^+, SO_4^+, and roots absorb P, Si, B, Na, K, Mg, Ca, Fe, Cu, Mn and Mo (Isermann, 1980). However, many shoots and roots are also important NWFPs harvested by mankind. In traditional communities those materials are used for foods, medicines, and animal feeds. Harvesting shoots, roots, and fruits is, in effect, harvesting the nutrients of the trees and the forests.

Genetic and Evolutionary Aspects

Ecosystems are specialized biogeochemical systems that have evolved to trap, concentrate, and accumulate energy. Each has become specialized in competing, surviving, and reproducing itself in particular types of physical-biotic environments, but is also capable of adaptation to changing conditions. This ability arises from the natural variation in morphology, physiology, and behaviour present in all natural populations of organisms. As condition change, different genotypes within the population become the best adapted and are favoured by natural selection. In this way species evolve. Consequently, harvesting wild species from the forests may have some profound impacts on the evolutionary pathways of the forests.

Biodiversity

Biological diversity, or biodiversity, encompasses the variety and abundance of plants, animals, and microorganism as well as the ecosystems and ecological processes to which they belong. Biodiversity is usually considered at three levels: genetic, species, and ecosystem diversity. Genetic diversity is the total genetic information contained in the genes of an individual organism. Species diversity refers to the variety of living organisms. Ecosystem diversity relates to the enormous diversity of habitats and biotic communities, as well as to the variety of ecological processes within ecosystems (MacNeely *et al.*, 1990).

Biological diversity is more than just the sum of species numbers. It encompasses the variety and variability of genes, species and ecosystems where they occur. Most of the world's biodiversity is located in the tropics, and some 40 to 90 percent of the world's species live in tropical forests (Raven, 1988; Myers, 1980; Reid and Miller, 1989).

With its wide range of natural habitats, and rich plant and animal resources, Indonesia has been recognized as a major world centre for biological diversity. Although it covers only 1.3 percent of the Earth's surface, the country harbours about 10 percent of all flowering plants species, 12 percent of the world's mammal species, 16 percent of the world's reptile and amphibian species, 17 percent of all bird species and more than a quarter of all marine and freshwater fish species. This rich biodiversity can be attributed to the fact that Indonesia spans two major biogeographical realms, Indomalaya and Australasia.

Remarkably little is known about species diversity in quantitative terms. Estimates of the earth's total number of species range from 2 million to 100 million, of which fewer than 1.5 million have been named. And only a small fraction of these have been considered for their economic value

(Reid, 1992). Reid and Miller (1989) among others, have estimated that 5 to 10 percent of these species are presently being lost each decade, a rate not seen since dinosaurs died out 65 million years ago. Population growth and climatic changes could accelerate such extinctions even beyond these figures.

Biological diversity in forest ecosystems produces an enormous variety of NWFPs; they vary from forest type to forest type. Plantation forests tend to have lower biodiversity than natural forests. The tropical rain forest has the highest biodiversity among all types of forest.

Some argue that biodiversity is valuable because it is the raw materials of further evolution; or alternatively, it is the evolution of biodiversity which gives a value to what is essentially a random process. Biodiversity is seen as an important source of therapeutic drugs. One of the most frequently cited examples is that of rosy periwinkle, a tropical forest plant which yields an extract used for treating leukaemia (Lee, 1993).

Efforts to conserve and sustainably use bio-resources face enormous challenges. Population increases and the improvement of community welfare require more land and forests to be cleared for cultivation, for housing and for infrastructure. The effect of human activity on biodiversity depletion has been profound. Some estimates suggest the loss of as much as 90 percent of the genetic diversity of the biosphere that existed in human history (Vida, 1978).

In the past 25 years Indonesia has launched many efforts to conserve bio-resources in their natural habitats as well as in captivity. The objective of *in situ* conservation in Indonesia is to set aside 10 percent of representative habitats as nature reserves. Currently, there are 125.5 thousands sq.km (6.6 percent of terrestrial habitat) already under nature reserves. Including new planned nature reserve areas, 189.9 thousands sq.km (9.8 percent of terrestrial habitat) will become nature reserves within the next 5 years.

MAJOR ENVIRONMENTAL ISSUES

Anomaly of the Market Mechanism

The market mechanism is a regulatory instrument in the economy. The well-functioning market will manage resources efficiently. Abundant resources will command a lower price and no justification to be conserved and managed carefully. However, resources that are not part of anyone's environment or for whatever reasons remain outside the domain of markets cannot benefit from careful management and conservation that goes with increasing scarcity. Unfortunately, resources without a price lack a scarcity and value register and hence they are inevitably overused, wasted and degraded since their zero price communicates a message of abundance or economic insignificance.

Considering the economic theory and market function in efficient resource management, why is there the degradation of natural resources and environment in many parts of the world? One possible explanation is that natural resources have never been in the marketplace, but have always been open-access resources (everybody's and nobody's property). The price of such resources communicates a message of abundance or economic insignificance.

Considerations of Sustainable Development

There are hundreds of definitions of sustainable development, ranging from a very conservative to very liberal. The most conservative one suggests that sustainable development is development with no damage to resources and the environment. A less conservative one suggests development to be with no damage whatsoever to the functioning of the natural ecosystem. A liberal one proposes that sustainable development is development without reduction of the future productive capacity of the economy, including possible substitution of natural resource depletion by new man-made resources.

Sustainable development seems to be related to specific products or benefits derived from specific resources and it means different things to different people with different interests. As a result of this ambiguity, many policy-makers consider the concept unworkable.

The definition of sustainable development referred to by most economists is: "development that does not result in reduction of future productive capacity of the economy depending on the stock of natural, human and man-made capitals, and technology". None of these stocks should diminish, but depletion of a particular stock may be compensated by repletion of others. Some limitation is imposed upon the above definition by the possible extent of compensation among stocks relating to irreversible loss of a particular characteristic of the stock, especially of natural and human capitals.

The Brundtland Commission defined sustainable development as "a process in which the exploitation of resources, the direction of investments, the orientation of technological development, and the institutional changes are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs and does not imply in any way encroachment upon national sovereignty."

Achievement of sustainable development involves cooperation within and across national boundaries. It implies incorporation of environmental concerns and considerations into development planning and policies and does not solely represent a new form of conditionality in financing the development (WCED, 1987).

Inherent in the concept of sustainability is continuity — perpetuating the flow of benefits from the resource stock and maintaining its productive potential. However, a definition based on maintaining or increasing the flow over time is difficult to justify because the rate of removal/utilization of the resources is influenced by the size of the resource stock. An example in relation to natural forests: a natural forest with plenty of over-mature trees will provide a large first harvest, followed by a lower, sustainable harvest.

Sustainability requires certain conditions, including: (1) only sustainable yield is extracted from renewable resources and their long-term productivity is maintained, (2) profits (rents) from depletion of non-renewable resources are invested in human and man-made capitals and technology, and (3) capacity of the environment to receive and assimilate waste is not exceeded or damaged. Sustainability is impossible without management. Hence, management is another requirement for sustainability.

Production capacity of resources is often the criteria used to determine sustainability. The problem here is that, the term *resource* is actually undefined. For example, a tropical forest is an entity that covers so many things; it is an ecosystem that consists of many components, living and non-living. Some have monetary value, some cannot be valued at all. To measure its production capacity is to define its product. Using criteria of production capacity of a resource in terms of a specific product would justify a uniform development of the resource, such as agriculture estate crops and single species forest plantations. A common criteria of economic scales, however, fails to recognize the value of diversity in nature. Another condition of sustainability, then, is the availability of options for diversity in the decision making process.

Ecologically, sustainability is the continuous functioning of the ecological life-support system. Since an ecosystem has a certain tolerance limit, the measure of sustainability will vary from ecotype to ecotype, within a certain range. In nature conservation, for example, 10 percent or more of an undamaged ecotype is sufficient to protect biodiversity. About 30 percent of the land area under forest cover is considered sufficient to maintain/support the ecological functions of a watershed system. If this criteria is used, many areas in the world are already unsustainable, including parts of Western Europe and North America. Clearly, visual degradation of resource productivity is not always an indication of unsustainability.

Economically, sustainability is the continuous functioning and contribution of natural resources to support growth. The depletion of one resource results in the increase of productivity of the other resources. How much economic growth is needed by any community depends on the community's economic-cum-social value system. Economic measures will have to work within this value system. In the 1930s, depletion of natural forests in Western Europe and Northeastern USA was instrumental in developing high productivity of other resources (human resources, technology, man-made resources). This development was acceptable. Now, we hear that a degradation of tropical forest is not acceptable, even though this degradation of the forest has improved productivity of other resources (cattle ranches, estate crops, industries, real estate, human resources and technology, etc). Here is a paradox. Also, depletion of certain resources in the Third World, even though it enabled development of other resources in developed countries, did not result in continuous and sustained functioning of the ecosystem supporting worldwide development.

Without a clear definition (and criteria) of sustainability, it is impossible to identify the symptoms of unsustainable development. Clearly, the measure of sustainability is directly related to the value system of the community. Objectives of resources development must be determined by the community. Most importantly, the owner of the resource must have a dominant role in determining the objectives of resource development. So far, we have heard only the objectives defined by "international communities" for sustainability of natural resources, especially of tropical forests and genetic resources. We seldom hear about the objectives established by local, regional or national communities for sustainability of natural resources. Conflicting objectives among local, regional, national and international interests for a certain resources are very common. Clearly, every community has its own objective and value for a certain resource and, therefore, every community has its own measure of sustainability.

Economy, Ecology and Social Values

It seems clear that economy has to work within an ecological value system, and both have to work within the social value system defined by the community. For a community living in a desert, a condition without trees is acceptable, although it would like to have trees if possible. For the industrially and economically advanced community of the temperate "North", a condition without natural forest is acceptable, but it would like to keep the tropical forest intact in the "South".

Physically, evidence of unsustainability can be traced to the earth's ecological life-support system in relation to the human race. Increasing CO_2, ozone layer depletion, warming of the earth and toxication of the sea are important topics for discussion and have obtained political support. Regionally, it can be traced to the deterioration of the function of the ecosystem. The problem is that the ecosystem boundary usually is not a country's boundary. Cooperation among countries worldwide is important.

Evidence of sustainability in the economic sense, such as apparent non-scarcity, results in wastage and consequent environmental degradation. But in an ecosystem there is no waste. Here, again, the concept of scarcity and abundance in economic terms is not a proper yardstick to be applied in ecology. The economy works on options, the art of making a good choice among many. Ecology relates to the entire integrated life-support system where everything is important in its own way.

All common evidences of unsustainability cited by many experts are either related to economic disutility of a resource or physical depletion and degradation of a natural resource. The capability of the ecosystem to recover after a certain time is not considered. It seems that the ability to recycle resources into development is an important consideration in analyzing the evidence of sustainability and unsustainability.

Although visual impression of resource degradation and fall in productivity are not always itself a good measure of unsustainable development, these can indicate the potential risk of slipping into unsustainable development. In many countries, increasing soil erosion and water pollution are

considered as indicators of unsustainable development of land and water resources and the watershed ecosystem. Depletion of the land and water resources has so far not been accounted as a cost in systems of national accounts. Due to the assumption of abundance, no priorities on institutional development have ben set at the regional or national levels to deal with the problem of soil and water quality degradation.

THE CASE OF NWFPS

Sustainability of NWFPs will certainly depend on the sustainability of the forests, and the interaction among natural systems, man-made production systems (technology) and social systems. Hence, it has become a more complex issue than just "optimal harvest" or "biodiversity conservation".

At the field level, however, we need to define sustainability in more practical terms. In the context of extractive reserves, the following issues are important: understanding optimal harvest rate and resource stock, effects of property rights on resources, and effects of increasing demand.

Optimal level of harvest and the corresponding stock of resources depend on environmental and economic objectives of the extractors. Many trees can produce a steady flow of exudates daily, and optimal production will depend on the health of the tree and the forest ecosystem. In the dry season, production of exudates is lower than in the rainy season.

Unlike wood products, non-wood products may be harvested from production forest, protected forest and nature reserves. From production forests, all material NWFPs may be harvested. From protected forests, some NWFPs, such as flower, fruits and animals, should be harvested with caution. In nature reserves, only non-consumptive uses, such as recreational activities, may be allowed; also some medicinal herbs may be harvested as cultivars. Any calculation of the total production of NWFPs will have to include all type of forestland uses other than production of wood.

In most countries, the objectives of forest management are related to the category of uses. In general, production forests produce timber, protected forests and nature reserves produce environmental services such as protection of the hydrological system and preservation of genetic resources and biodiversity.

In most cases, the production of environmental services has been the responsibility of national governments. But maintaining and sustaining the services requires investments; and someone must pay for the services. Therefore, the pricing of the services becomes crucial.

The considerable uncertainty over the potential value of genetic resources has been compounded by the emergence of new biotechnologies. Controversy surrounds genetic resource ownership and access. At the root of the current debates is the knowledge that genetic resources found in many developing countries are assets that, if managed properly, could make significant contributions to local and national economies. The potential value of genetic resources for developing countries is demonstrated by Costa Rica, where INBio has signed a contract with a pharmaceutical company in the United States to collect plant species and carry out primary screening for potential pharmaceutical and other uses. As part of this contract, Costa Rica will receive a 5 percent share of the revenues (a potentially enormous sum) of any commercial product that might eventually result.

ECOLABELS

Increasing awareness of the world's environmental problems in the consuming countries has created a lot of pressure on most industries to seek more acceptable production and distribution processes. The main focus was originally on the major polluting industries. But, in due course, all the natural resource-based activities, particularly forestry and forest-based industries, have become the subject of increasing attention. Many in the consuming countries consider certification or "eco-

labelling" for timber and NWFPs necessary to achieve sustainability of forest management and to assure consumers that they are not contributing to deforestation when buying tropical forest products.

A survey by MORI and WWF on public attitudes towards tropical rain forest revealed that: 33 percent would accept higher prices if it would guarantee that raw materials come from countries protecting the forests; 50 percent find that labelling of wood products very or fairly important; 15 percent would avoid buying or buy less tropical hardwoods for health, environment, moral and other reasons; 35 percent would be prepared to pay an average of 13 percent extra for sustainably produced timber. But the main factor in buying wood products is quality (for 66 percent), price (50 percent) and style of product (48 percent) (MORI and WWF, 1991; Simula, 1993).

In its early stage of development, eco-labelling was used to mark traded goods that conserve the environment, such as biodegradable bottles and electric bulbs. Some consider that eco-labelling of biodegradable forest products as a means to protect the forest resources is an irrelevant issue, and only a trade gimmick to protect the interests of forest industries in developed countries. Issue of eco-labelling has become a political football (Kay, 1993; MORI and WWF, 1991; Barbier, 1993; ITTO, 1992).

Currently, eco-labelling is being directed at forest management practices. Forest products from well managed forests are automatically eco-labelled. Several criteria of forest eco-labelling are being developed by institutions such as ITTO and Forest Stewardship Council (ITTO, 1992; FSC, undated). Considering the potential negative impacts of NWFP harvesting on the forest ecosystem and environment, a regulatory measure like eco-labelling is probably needed.

NEED FOR ENVIRONMENTALLY SOUND MANAGEMENT OF NWFPs

One of the most basic, and rarely questioned, assumptions underlying much of the current interest in extractive resources is that commercial exploitation of NWFPs has little or no ecological impact on the forest ecosystem. As NWFPs are harvested from the trees in the forests, many are of the opinion that NWFP harvesting does not have any impact on the environment as long as the trees are not cut. This assumption seems to have originated from an inadequate interpretation of two simple observations: (1) local people have been harvesting fruits, nuts and latex from forests for thousands of years, and (2) a forest exploited for NWFPs, unlike a logged-over forest, maintains the appearance of being undisturbed. Of course, without appropriate explanation both could be incorrect and potentially very dangerous. Therefore, two qualifiers should be added to these observations. First, the intensity of subsistence harvesting as traditionally practised by forest people is usually substantially lower than that of commercial extraction. Second, the gradual extinction of a plant species which takes place over time is rarely a visible phenomenon. Collecting fruits and tapping latex are clearly less damaging than felling trees or building roads, but this certainly does not imply that the former activities are entirely benign from an ecological perspective. Every NWFP resource has a site specific, maximum sustainability level of harvest. If this harvest level is exceeded, the plant populations that are being exploited, as well as the faunal community that depend on them, will all be adversely effected.

Uncontrolled hunting and grazing in the forests and rangelands may result in the depletion of the animal population and soil fertility. Forests in South America and Africa are disappearing at a fast rate due to grazing activities (WRI-UNEP-UNDP, 1994). Even recreational activities may have a detrimental effect on the forest ecosystems, reducing the production of NWFPs in the long run.

IMPACTS OF HARVESTS

The way NWFPs are harvested have contributed to much disturbance of the forests. For example, in many tropical countries it is a common practice to simply cut down forest trees to harvest fruits or barks. This practice is under no circumstances sustainable and it can have dramatic impact on the distribution and abundance of fruit or bark resources within a forest.

Managing forests for wood and non-wood product harvests requires a comprehensive scheme. A single-product harvest, whether wood or non-wood, will produce less compared to a balanced output of both, in terms of financial and ecological benefits. Although financially appealing perhaps, mass production of a single commodity will always have negative impacts on biodiversity and ecological processes. mass production will normally direct the development toward the establishment of plantations which have more negative impacts on the environment. For example, high resin production from pine plantations which use sulphuric acid will gradually destroy the trees and the ecosystem. Excessive hunting of tigers and panthers will create overpopulation of hogs which will destroy many tree seedlings.

Benefits of good management and costs of bad management of NWFPs have been acknowledged by many countries in terms of species loss, biodiversity loss and damage to the ecosystem.

In the Peruvian Amazon, for example, female trees of the dioecious aquaje palm (*Mauritia flexuosa*) are frequently felled by commercial fruit collectors. After very few of these harvest cuts, the forest is left with a preponderance of barren male palm trees; with time, the species disappears completely from the forest (Kahn, 1988; Vasquez and Gentry, 1989). Forests surrounding Iquitos, Peru, have no female palm trees left, and fruit collectors are now forced to travel upstream for up to three days to find unharvested palm stands.

There has been some accidental loss of diversity due to over-exploitation by those possessing more sophisticated technology but less ethology than hunter-gatherers. However the main loss of diversity has been due to deliberate forest ecosystem destruction (Ehrlich, 1985). There is growing concern over possible effects of pollution. Global warming could cause habitat destruction on a massive scale (Cohn, 1989).

Fruits and seeds left in the forest after harvesting will almost certainly be subjected to an unusually high level of consumption by animals of the forest. Commercial collectors, in effect, are competitors with fruit-eating ground animals, and their activities reduce the total supply of food resources available to ground foraging animals. Decreased fruit densities could mean increased foraging and a corresponding increase in the overall percentage of fruits and seeds destroyed. As a consequence of the decreasing fruit and seed supply on the ground, the animal will migrate trying to find new foraging ground (Sutton *et al.*, 1983). This response could have a serious impact on seedling establishment for those species whose seeds require scarification by animals to germinate (Ng, 1983). Without a dispersal agent, a relatively high proportion of the fruits and seeds produced will fall directly under the crown of the parent tree where they are more easily gathered by collectors, more easily encountered by potential seed predators, and more susceptible to the effects of intraspecific competition (Augspurger, 1983; Clark and Clark, 1984; Howe *et al.* 1985; Schupp, 1988).

In addition to its impact on seedling establishment, population structure and the foraging behaviour of local animal populations, harvesting of fruits, nuts, and oilseeds in commercial quantities can also affect the genetic composition of the tree population being exploited (Peters, 1990). In this case, the important question is not so much how many fruits or seeds are harvested, but rather which ones. Tropical tree populations usually exhibit a high degree of genetic variability (Hamrick and Loveless, 1986; Bawa and Krugman, 1991).

For example, a single population of forest fruit trees will invariably contain individuals that produce fruits of intermediate size and quality, and a few individuals that produce fruits that are commercially inferior in terms of size, (bitter) taste, or (poor) appearance. If this population is subjected to intensive fruit collection, the "inferior" trees will be those whose fruits and seeds remain in the forest to regenerate. Over time, this will result in a population dominated by trees of marginal economic value.

ECONOMIC IMPLICATIONS AND LINKAGES

The world economy in a broad sense is an integral part of the earth's ecosystem, which creates the conditions that make life possible. The industrial revolution, which began around the year 1750, brought the first real change in the interaction between human activities and the ecosystem. "Control" over nature has paradoxically resulted in the actual destabilization of the ecosystem in many areas. Worldwide, the function of the ecosystem to support life is threatened by the human quest to improve material life.

The seriousness of biodiversity degradation was acknowledged in the United Nations Conference on Environmental Development, held in Rio de Janeiro, Brazil in 1992. But the expected actions to mitigate the causes have not been forthcoming. Many developed countries have blamed the economic recession for the inaction or inadequacy of measures for conservation of ecosystem and biological diversity.

Yet this ignores the fact that from an economic point of view, the ecosystem plays several important roles: as a production factor in production (especially in agriculture and fisheries), as a supplier of consumer services (e.g. health, nutrition, recreation, and aesthetic and spiritual needs), and as a source in technological progress. The last is perhaps the least known, but biological diversity, in particular, supports agricultural and pharmaceutical research with a vast gene bank in the form of potential fruits, crops and medicines.

In performing these economic functions, the ecosystem contributes to the human quest for prosperity, unbounded by national borders. For example, Brazil nuts (*Bertholletia excelsa*) have been exported mostly to European and Northern American countries. Sustainable harvesting of the nut depends, therefore, not only on the behaviour of the indigenous population of Brazil, but also of the world market. For sustainable harvesting, it is important that the product is not underpriced in the developed market countries and that consumer demand remains consistent.

VALUATION OF GOODS AND SERVICES

Today, the production of non-timber goods and services has become an issue because the demand for these goods and services has increased, and is competing with timber for the use of lands. But timber has a more readily determined dollar value, while most of the other goods bring goodwill and often ample, but unquantified, satisfaction. Again, while timber and some recreational facilities are market priced, water, wildlife, and other recreational activities such as hunting and fishing are provided free or at a low token price. The outputs associated with preservation of endangered species or scenic beauty present difficult valuation problems. Opportunity costs can be estimated on different assumptions, but this still begs the question of what the spotted owl or scenic view is worth. The U.S. Forest Service in 1981-1982 estimated a total opportunity cost for spotted owls based on the value of timber left unutilized in the National Forests for their protection to be somewhere in the neighbourhood of US$ 3.6 billion dollars, or about US$ 500,000 per breeding pair.

The most politically appealing and economically attractive argument in favour of maintaining biodiversity is that it provides enormous direct economic benefits in the form of food, medicines, and industrial raw materials, and has the potential for generating many more (Ehrlich and Wilson, 1991; McNeely, 1988). Many countries earn substantial foreign exchanges from natural ecosystems with touristic values. Such direct economic values of biodiversity are, conceptually at least, rather easy to quantify and value, even though relevant scientific and economic data are lacking in all but a handful of examples (Braatz, 1992).

Besides direct contributions in terms of goods and services, the value of forests includes indirect contributions of soil conservation, carbon sink storage capacity, recreation and amenities, watershed stability, and the protection of biodiversity.

ECOVENTURES

Ecotourism represents an NWFPs with high potential economic value. Such tourism can generate support for conservation by:

- providing attractive financial return, it can justify setting aside large areas of forestlands for conservation;
- gate fees/entry fees that can generate substantial funds to support parks and reserves management;
- tourist expenditures in and around the parks (on lodging, transportation, goods, guides, and souvenirs) can be an important source of income for communities near protected areas and forests, compensating them for the loss of access to traditional resources and giving them incentive to conserve the protected areas.

The total benefits accrued from ecotourism have proven to be very significant sources of income for countries like Kenya, Nepal, Thailand, and Costa Rica (Braatz, 1992).

Economic benefits of ecotourism in some of Thailand's protected areas far exceeds the government's direct management expenditures. Tourist spending at Khao Yai National Park amounted to between US$ 3.8 to US$ 7.7 million per year during 1982-88. But this apparent economic benefit has been slow to persuade the government to establish adequate park management to ensure protection and sustainability (Dixon and Sherman, 1990).

Another potential ecoventure is the harnessing of the recreational value of forestlands. Recreation in the forest is generally free to the general public, although some fee may be imposed on game hunting, fishing and camping.

BUFFER ZONES

To meet local communities' traditional needs for NWFPs from the forest while preserving the forest, forest agencies have established buffer zones around forest areas. If properly managed, NWFPs can be harvested sustainably from the protected forestland by the local community and the forest can be saved from destruction.

In general, communities harvest NWFPs in small-scale operations using appropriate technology. Many communities possess substantial indigenous knowledge about the sites and the seasons for harvesting these products. The prospect of local benefits from primary processing of NWFPs provides an incentive for communities to manage the forest sustainably.

LOCAL ENVIRONMENTS AND MARKET NICHES

Many commercially important NWFPs can only grow in very particular kinds of natural habitat, within a narrow range of ecological conditions and micro climate. This often means that they cannot be systematically cultivated despite known demand in distant and local markets. For example, black mushrooms or morels are gathered almost exclusively in wooded areas of north-central Pakistan and traded internationally. There are many more examples of NWFPs produced locally by small-scale operations and simple technology that reach the world market (e.g. gum arabica, natural silk, honey, truffles, snails, berries, and traditional medicines).

INSTITUTIONAL CONSIDERATIONS IN SUSTAINABLE FOREST MANAGEMENT

Although the issues of forest resource depletion and degradation have been widely recognized by policy-makers in both developed and developing countries, improvements in instruments to address

these problems are still in their infancy. Practical instruments for policy implementation (e.g. government regulations, market mechanism, an accepted social value system) have not developed sufficiently to mitigate resource degradation or resource depletion.

Policy and Institutions

In addition to the failure of market instruments mentioned earlier, poverty is another cause of unsustainable development. A poor community concentrates on meeting basic needs, and cannot afford to consider the future of the environment.

In many developing countries, natural resources have been used as the base for increased investment, especially in remote areas. Subsidies and fiscal incentives — common tools for increasing investment — create an impression of abundance and disincentives for managing the resources on a sustainable basis. The rationale behind such subsidies is that the short-term competitive advantage is more important than the long-term environment.

To translate sustainable development principles into practice requires knowledge of both the ecosystem and the economic and social behaviour of the parties involved. Interaction among ecology, economics and sociology would lead to harmonious development.

Even though sustainable development has often been interpreted as a dynamic interaction among the production system, natural system and social system, planners have tended to focus on the production system as an easy and practical way of planning economic development in the initial stages. The natural and social systems are assumed to be able to adjust to a changing production systems. This does not always happen. Most production systems are linked to the improvement of social welfare; they are linked to the natural system only to the extent that natural resources supply inputs to the production system.

Basic strategies in improving sustainable development, regionally, should:

- develop public awareness and community organisation to address environmental issues;
- improve capability in spatial planning with environmental objectives;
- develop human resources and improve capability in the area of environmental planning and management;
- improve knowledge and information on the regional ecosystems;
- develop institutions to integrate the production, natural, and social systems into development practices;
- establish appropriate procedures in national and regional accounting systems to take environmental costs into account.

Research Needs

Much research needs to be done to improve our understanding of the behaviour of ecosystems and social systems, material balance in production systems, and dynamic interaction of production-nature-social systems. Sustainable development in a global sense is an aggregation of development action at local and regional levels. Research is needed to measure the impacts and roles of regional actions in sustainable development, as a step toward assessing the global situation.

Productivity and biodiversity conservation are both part of sustainable management of tropical rain forests. Therefore, the ecological and economic aspects of these parameters should be incorporated as tools for management (Fantini *et al.*, 1992).

Because NWFPs are part of the forest ecosystem, each with a specific role in its functions, considerations relating to sustainable forest management are also applicable to non-wood forest resource management.

Because the viability of a management system under a sustained yield regime should foresee the multiple use of forests for both wood and non-wood products, the sustainable management of forest should be based upon two fundamentals: the cyclical character of exploitation and the specific nature of the exploitation of individual species.

As always, evaluation of the available stock of non-wood forest resources through an inventory is the starting point for a plan to adequately exploit the forest (see the paper by Reis). Projecting growth and yield of NWFPs may proceed using a correlation with biomass production over time. Certainly the correlation will differ with different ecotypes and situations. Understanding ecological cycles is also important for balancing the harvest of NWFPs to maintain sustainability and harmony in forest composition and growth.

In many cases, increases in the sustainable supply of NWFPs will require more intensive management of the resource through domestication. Domestication of a species may weaken the species over time. Thus such production programmes should establish nature reserves with wild varieties of the domesticated species as a resource for genetic improvement.

Traditional knowledge about NWFPs on their production, utilisation, and maintenance should be understood, adapted, and incorporated into forest management schemes.

Conservation Strategy

The World Conservation Strategy outlines ways in which conservation objectives should be integrated into broader land-use plans in order to obtain more benefits and sustained yields from the world's natural renewable resources (IUCN, 1980; MacKinnon and MacKinnon, 1986). Since NWFPs are renewable natural resources, both the Conservation Strategy and Sustained Yield of NWFPs are linked together by relevant environmental considerations. Healthy forests with a high level of biodiversity are the objectives of Conservation Strategy. Similarly, the objective of non-wood forest resource management is to obtain sustainably high production, dependent on and consistent with the management of a healthy forest.

At the regional and local levels, sustainable development follows this sequence:

- Step 1. allocate space considering the capability of the ecosystem to function sustainably in producing specific products such as NWFPs;
- Step 2. improve the efficiency of the production system, including increased use of recycling technology;
- Step 3. employ "waste" treatment and reduction and "disutility" management of the forest resources, i.e rehabilitate degraded ecosystem through application of appropriate technology friendly to the environment.

In other words, site selection is the first step in sustainable management, and environmental considerations have to be the guiding principles in site selection. This is followed by selection of technology that increases efficiency and reduces the use of resource inputs. Considerations of environment as well as social suitability/acceptability are important in this regard. And the last step

relates to disutility management to improve the capacity of the resource-base to withstand damage caused by developmental activities such as harvesting.

Spatial Planning

In the case of Indonesia, the great diversity of natural systems is linked directly to a high diversity of social systems. This diversity provides a large number of options for development. A primary consideration in selecting options for sustainable development, as part of spatial planning, is to preserve the existence of the natural system. Many countries have set aside some of their forestlands as protection and nature reserves. Indonesia has set aside 10 percent (19.5 million ha) of its terrestrial area for nature conservation; of this, 16.2 million ha have already been gazetted (Anon., 1991b).

The broader system of protected areas covers conservation areas (nature reserves, wildlife sanctuary, protection forests) and protected areas (such as aquifer recharge areas, coral reefs, mangroves, deep-peat forests, swamps, vulnerable natural forests and coastal zones, river banks and lake shores). Conservation areas are closed to any development activities except for those in support of their management, while protected areas are open to specifically approved development activities that will not cause damage to the function of the ecosystem.

Once a development area is demarcated, spatial planning requires that it be sub-divided into categories such as permanent agricultural lands, forests, urban settlements and industrial zones. The categorization is usually based on policy considerations and criteria.

Balancing Efficiency with Improved Resource Accounting

Reducing negative developmental impacts on the environment requires minimizing consumption and/or improving production through more efficient technology. Production efficiency is often motivated by the prospect of minimizing costs. Many operations reduce costs by externalizing many environmental costs. The result is degradation of the natural ecosystem. This improves a firm's profits but increases losses to the community and the ecosystem.

Introduction of "rent" for the use of natural resources such as forests, land and water is an effective means to counteract attempts to externalize natural resource costs. Rent on natural resources should be imposed consistently. At present, NWFP resources are drastically undervalued. Rent on land and water is still very low and does not yet represent the resource's real value in terms of benefits provided. Poverty alleviation is one of the factors that must be considered in fixing rent for lands and water.

Efficiency through Waste Reduction

Recycling technologies can improve efficiency of production systems (thus minimizing necessary resource extraction) and minimize wastes discharged into the environment. Pollution control regulations can foster use of recycling technologies. Waste treatment/utilization and waste management may still be needed to process the wastes before they can be discharged into the environment.

The Importance of Regional Development

Most national governments put the production system as its first priority in development, to produce materials and services and increase government revenue. In many developing countries, local governments are less equipped to manage sustainable development than the national government. They have very little knowledge about the environmental impacts of development, and lack information on sustainable development.

There is much research to be done to improve knowledge and understanding of the ecosystem and social system behaviour, material balance in production systems, behaviour and dynamic

interaction of production-nature-social systems, and the impact and role of local and regional actions in sustainable development. Action for sustainable development takes place at the local and regional levels, and that is where attention to sustainability should be focused.

SUMMARY AND CONCLUSIONS

Sustainable forest management should include NWFPs in relation to the dynamic process of development and holistic ecosystem approach. Institutional systems, including policy and market instruments, should be developed to mitigate unsustainability. Wherever the non-market economy supports traditional communities, it should receive policy consideration.

A basic problem in the sustainable development and utilization of NWFPs is that every region and country considers environmental costs as externalities. The benefits and costs of environmentally sound forestry and NWFP development need to be incorporated into accounting systems at the local, regional and national levels. Proper pricing of NWFPs in the market is important in this regard.

Commercial exploitation of non-wood forest resources, if not properly carried out, will have potential negative impacts on the sustainability of the forest and on the social and economic well-being of the local community. Sustainable management of forest resources to improve the ecological, economic and social quality of the forest will eventually improve the potential productivity of NWFPs.

In conclusion, the major issues which the participants may like to discuss would include, among others:

- advantages and disadvantages of alternative approaches to NWFP management;
- considerations in prospecting and developing of NWFP resources;
- environmental criteria and approaches to domestication;
- *in situ* and *ex situ* conservation of genetic resources for NWFPs;
- screening and patenting of life forms in the forest;
- links to national conservation policies and strategies and international conventions (e.g. CITES);
- management of transition of NWFP from subsistence to market economy;
- implication of emerging green consumerism as an opportunity as well as a danger to sustainable utilization of NWFPs;
- economic and environmental viability of eco-ventures;
- methods of quantifying environmental costs and benefits of NWFP utilization;
- specific aspects to be considered in environmental guidelines for NWFP utilization.

REFERENCES

Ajayi, S.S. 1979. Utilization of forest wildlife in West Africa. Report FO:MISC/79/26. Rome, FAO.

Anon. 1989. Fifth five-year development plan. Jakarta, Republic of Indonesia.

Anon. 1991a. Indonesian biodiversity action plan. Jakarta, BAPPENAS.

Anon. 1991b. Indonesian Tropical Forest Action Programme. Jakarta, Ministry of Forestry, Indonesia.

Anon. 1994. Trade and the environment, towards a sustainable playing field. Report SOU 1994:76. Stockholm, Swedish Environmental Advisory Council.

Augspurger, C. 1983. Offspring recruitment around tropical trees: changes in cohort distance with time. *Oikos* 40:189-196.

Barbier, E.B. 1993. *Policy issues and options concerning linkages between the tropical timber trade and sustainable forest management*. London, London Env. Econ. Centre. Intl. Inst. for Env. Dev.

Bawa, K.S. and Krugman, S.L. 1991. Reproductive biology and genetics of tropical trees in relation to conservation and management. *In* Gomez-Pompa, A., Whitmore, T.C. and Hadley, M., eds., *Rain forest regeneration and management*. MAB Series Vol. 6. Paris, Unesco and Parthenon.

Burkhill, I.H. 1935. *A dictionary of the economic products of the Malay peninsula*, 2 vols. Kuala Lumpur, Ministry of Agriculture and Cooperation.

Braatz, Susan. 1992. *Conserving biological diversity: a strategy for protected areas in the Asia-Pacific region*. World Bank Technical Paper 193. Washington, DC, World Bank.

Chandrasekharan, C. 1993. Issues involved in the sustainable development of non-wood forest products. *Proc. expert consultation on non-wood forest products for English-speaking African countries, held in Arusha, Tanzania, 17-22 October, 1993*. Rome, FAO.

Clark, D.A. and Clark, D.B. 1984. Spacing dynamics of a tropical rainforest tree: evaluation of the Janzen-Connell Model. *Amer. Nat.* 24:769-788.

Cohn, J.P. 1989. Gauging the biological impacts of the greenhouse effect. *Bioscience* 39: 142-146.

CPB. 1992. *Scanning the future: a long-term scenario study of the world economy, 1990-2015*. The Hague, Central Planning Bureau, The Netherlands, SDU.

de Beer, J.H. and McDermott, M.J. 1989. *The economic value of non-timber forest products in Southeast Asia*. Amsterdam, Netherlands Committee for IUCN.

Dixon, J.A. and Sherman, P.B. 1990. *Economics of protected areas: a new look at benefits and costs*. Washington, DC, Island Press.

Ehrlich, P. 1985. Evolution. *In* Myers, N., ed. *The Gaia atlas of planet management*. New York, Pan Books.

Ehrlich, P.R. and Wilson, E.O. 1991. Biodiversity studies: science and policy. *Science* 253:758-762.

Fantini, Alfredo Celso *et al.* 1992. Sustained yield management in tropical forests: a proposal based on the auroecology of the species. *Sellowia* 42-44: 25-33.

FAO. 1991. *Non-wood forest products: the way ahead*. FAO Forestry Paper No. 97. Rome, FAO.

FAO. 1993. *Forest resources assessment 1990: tropical countries*. FAO Paper No. 97. Rome, FAO.

FAO. 1993. *More than wood*. Forestry Topic Report No. 4. Rome, FAO.

FAO. 1994. *Non-wood news*. Rome, FAO.

FSC. no date. Working draft of the principle and criteria. Draft No. 7 Forest Stewardship Council.

Hamrick, J.L. and Loveless, M.D. 1986. The influence of seed dispersal mechanisms on the genetic structure of plant populations. *In* Estrada, A. and Fleming, T.M., eds. *Frugivores and seed dispersal*. The Hague, Dr.W. Junk Publ.

Howe, H.F., Schupp, E.W. and Westley, L.C. 1985. Early consequences of seed dispersal for neotropical tree (*Virolnamensis*). *Ecology* 66:781-791.

Isermann, K. 1980. Recent findings in plant nutrition and new development in fertilizer research. *Plant Research and Development* 12:7-48. Tubingen, Germany.

ITTO. 1992. *Criteria for the measurement of sustainable tropical forest management*. ITTO Policy Development Series No.3. Yokohama, ITTO.

IUCN. 1980. *World conservation strategy: living resources conservation for sustainable development*. Gland, Switzerland, IUCN-UNEP-WWF.

Kahn, F. 1988. Ecology of economically important palms in Peruvian Amazonia. *Adv. Eco.Bot*. 6:42-49.

Kay, S.G. 1993. Eco-labelling: a political football. PPI May 1993.

Kimmins, J.P. 1987. *Forest ecology*. New York and London, Macmillan and Collier.

Lee, S. 1993. *Biodiversity*. Washington, DC, Shell and WWF Tree Plantation Review.

MacKinnon, J. and MacKinnon, K. 1986. *Managing protected areas in the tropics*. Gland, IUCN-UNDP.

McNeely, J.A. 1988. *Economics and biological diversity: developing and using economic incentives to conserve biological resources*. Gland, IUCN.

McNeely, J.A., et.al. 1990. *Conserving the world's biological diversity*. Washington DC and Gland, WRI, World Conservation Union, World Bank, WWF-USA, and Conservation International.

MORI and WWF. 1991. Survey of public attitudes towards tropical rain forests and the environment. Washington, DC, WWF.

Myers, N. 1980. *Conversion of tropical moist forests*. Washington, DC, National Academy of Sciences.

Ng, F.S.P. 1983. Ecological principles of tropical lowland rainforest conservation. *In* Sutton, S.L., Whitmore, T.C. and Chadwick, A.C., eds. *Tropical rain forests: ecology and management*. Blackwell Sci. Publ.

Peters, C.M. 1990. Plant demography and the management of tropical forest resources: a case study of *Brosimum alicastrum* in Mexico. *In* Gomez-Pompa, A., Whitmore, T.C., and Hadley, M., eds. *Rain forest regeneration and management*. Cambridge, Cambridge Univ. Press.

Raven, P.H. 1988. Biological resources and global stability. *In* Kawano, S., Connell, J.H., and Hidaka, T., eds. *Evolution and co-adaptation in biotic communities*. Tokyo, University of Tokyo.

Reid, W.V. and Miller, K.R. 1989. *Keeping options alive: the scientific basis for conserving biodiversity*. Washington, DC, World Resources Institute.

Reid, W.V. 1992. How many species will there be? *In* Whitmore and Sayer, J., eds., *Tropical deforestation and species extinction*. London, Chapman and Hall.

Schupp, E.W. 1988. Factors affecting post-dispersal seed survival in a tropical forest. *Oecologia* 76:525-530.

Simula, M. 1993. Consumer initiatives on eco-labelling of tropical timber and their implications for Indonesia. *Proc. Seminar on Forest Product Eco-labelling*. Jakarta, Ministry of Forestry, Republic of Indonesia.

Sutton, S.L., Whitmore, T.C., and Chadwick, A.C., eds. 1983. *Tropical rain forest: ecology and management*. Blackwell Sci. Publ.

Torres, Hermes *et.al.* 1993. Traditional uses of native shrubs in the south of Puno. Network Paper No. 16e. Winter 1993. Rural Development Forestry Networks. London, Overseas Development Institute.

Vasquez, R., and Gentry, A.H. 1989. Use and mis-use of forest-harvested fruits in the Iquitos area. *Cons. Biol.* 3:350-361.

Vida, G. 1988. Genetic diversity and environmental future. *Env. Conservation* 5:2.

WCED. 1987. *Our common future*. Oxford and New York, Oxford Univ. Press.

WRI-UNEP-UNDP. 1994. *World Resources 1994-95*. New York and Oxford, Oxford Univ. Press.

DEVELOPMENT OF NON-WOOD FOREST PRODUCTS THROUGH AGROFORESTRY: ISSUES AND STRATEGIES

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INTRODUCTION

In the past two decades, agroforestry has been vigorously promoted and researched. Often called a new name for a set of old practices, agroforestry is recognised as a promising land-use technology and an interface between agriculture and forestry, especially in the developing countries of the tropics and subtropics. With recent research, the principles underlying age-old agroforestry practices are gradually being understood, and improved practices introduced.

The scientific foundation of agroforestry is the multipurpose tree (MPT) (Young 1989; Nair, 1990 and 1993). Naturally, most efforts in agroforestry have placed a heavy — sometimes exaggerated — emphasis on the MPT. Dozens of MPTs have been identified, with about 50 being actively promoted, and about a dozen receiving most of the attention in agroforestry today (Nair, 1993; MacDicken, 1994). Two important attributes of MPTs are their ability to produce multiple products, from one or more plant parts, and their ability to provide benefits and services that may be intangible but nonetheless environmentally significant. Soil improvement and microclimate amelioration are two principal service benefits.

Among the many recognised products and benefits of MPTs, most agroforestry projects are oriented towards the production of fuelwood and fodder (e.g. Kerkof, 1990). Very little has been done to exploit the non-wood forest products (NWFPs) in agroforestry systems. Considering that agroforestry places a strong emphasis on smallholder, low-input, multiple-output systems and many of the trees and other species that produce NWFPs are amenable to integrated management, agroforestry as a land-use approach and NWFPs as an output are closely integrated. Thus it is somewhat paradoxical that the role of agroforestry in the promotion of NWFPs has not been examined in any detail so far. This little-studied, but extremely promising subject is the subject of this paper.

NON-WOOD FOREST PRODUCTS

It can be argued that because MPTs have a central role in agroforestry systems, and because the emphasis of MPTs is on non-wood products and services, most agroforestry systems deal inescapably with non-wood forest tree products. But the concept of NWFPs is such that the "dominant" tree products such as fuelwood, fodder, and charcoal that have received the major share of attention in agroforestry and social forestry are excluded from this category (although, botanically, some of them are "non-woody" in nature). For example, the definition of NWFPs that has been proposed for this Consultation is "NWFPs include all goods of biological origin, as well as services, derived from forest or any land under similar use, and exclude wood in all its forms" (Chandrasekharan, 1995). This focuses attention on the forest products that have hitherto received little attention, and encompasses all tangible products other than timber, fuelwood, fodder, and charcoal, derived from forest and other similar land-use systems (Chandrasekharan, 1993). Common NWFPs include food and food additives; fibre and flosses; phytochemicals and aromatics; oils; resins, and other exudates; and decorative articles. Products such as fodder and latex are also included, although for this paper prominently commercial species such as coconut and rubber are excluded.

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The ensuing discussion is based on the concept of NWFPs outlined above. A detailed discussion on what does — and what does not — constitute NWFPs is beyond the scope of this paper.

NWFPs AND AGROFORESTRY

CONCEPTUAL SIMILARITIES AND CONTRASTS

NWFP extraction, as practised today, shares several features with many agroforestry practices. Both agroforestry and NWFP extraction are predominantly subsistence practices; they make minimal use of costly external inputs, but heavy use of human labour; and each has location-specific characteristics. However, there are also subtle differences between NWFP production and the practice of agroforestry. First, agroforestry systems are, generally, more intensively managed, with a higher degree of species domestication, than most NWFP species. Second, agroforestry systems place emphasis on not only the productive role of their woody components, but also of their protective roles such as soil amelioration and environmental protection. This need not necessarily be so in the case of NWFP species. A third difference is that although agroforestry is often described as an interface between agriculture and forestry, most agroforestry practices are on the so-called agricultural and marginal lands and some in the buffer zones around forests, with very little or no agroforestry in the forests. NWFPs, with some notable exceptions are extracted mostly from forest and/or marginal land, with relatively lesser quantities from agricultural lands.

Identification of such similarities and contrasts between common agroforestry practices and NWFP extraction can help in examining opportunities for integrating NWFPs and agroforestry systems. By placing NWFPs in a production system context, this may also help explore new benefits of NWFP species. Before pursuing such an analysis, we will briefly review the nature of NWFPs.

NATURE OF NWFPs

All the available literature on NWFP production deals with one or more of the following topics in decreasing order of abundance:

- an inventory (listing) of the major species, giving such details as their local/vernacular, as well as scientific names, and the specific part(s) of each plant that is economically used;
- socio-cultural values, conservation strategies, and policy issues;
- species description of a botanical/ethnobotanical nature;
- economic assessment of some practices and products; and
- chemical and biochemical descriptions of certain products and/or processes.

Thus, information on the quantity and value of these products are either non-existent or unreliable and most are estimates. Considering that NWFPs represent a hitherto ignored area of scientific and academic interest, this state of affairs is not unexpected. Many of the species are known for their multiple products; therefore, it is not realistic to group the NWFPs plants strictly into any definite classes. Nevertheless, some sort of grouping and classification is required for further discussion. The commonly reported NWFPs (and the species that produce them) can be grouped under two broad categories: i) food and food derivatives, and ii) raw materials.

Food and Food Derivatives

The role of forestry and trees in food production and food security has been well recognized (FAO, 1988; 1992). Although fruits and leaves are the most widely used parts of most of the edible NWFPs, there are reports of all other parts (such as bark, stem, calyx, and even roots) of some trees

being used as food or food derivatives. Table 1 lists a variety of food products that are obtained from various trees in Africa. Kainer and Duryea (1992) identified more that 150 species of wild and domesticated species of plants, including many trees, that are exploited by women in the extractive reserves in Acre, Rondonia, Brazil. As mentioned earlier, several other such lists are available from different parts of the world often based on location-specific studies, rather than on a regional or country-wide basis. Also, the lists are usually species-oriented, rather than production-statistics-oriented.

Table 1: Some examples of indigenous multipurpose trees used as food sources in Africa

Class	Tree Species	Major Uses
Main Food	*Treculia africana*	Edible fruit, kernels, fuel, pulp for paper industry
	Parkia biglobosa	Edible seed, fodder, timber, fuel, fertility drug
Food Supplement	*Garcinia cola*	Edible seed, chew sticks, snake repellent
	Afzelia africana	Fermented leaf as vegetable
Condiments	*Xylopia aethiopica*	Tobacco substitute
	Monodora myristica	Nutmeg substitute
Leafy Vegetable	*Pterocarpus milbaedii*	Edible leaf, dye, camwood
	P. santalinoides	Edible leaf, fodder, boundary line
	P. soyauxii	Edible leaf, timber, religious
Fats/Oils	*Elaeis guineensis*	Oil, wine, thatch, mulch
	Butyrospermum paradoxum	Kernel oil, edible fruit
Fruits	*Spondias mombin*	Fruit, jam, jelly, fodder
	Vitx doniana	Fruit, fuel, timber
Jams/Jelly	*Chrysophyllum albidum*	Fruits, tools, religious
Drinks	*Raphia hookerii*	Wine, mats, raffia, piassava
Masticatory	*Raphia nitida*	Chew sticks, fodder, fence
Fodder	*Moringa oleifera*	Edible flowers and leaves
	Canarium schweinfurthii	Edible leaves and fruits

Source: Nair (1990).

A special mention needs to be made here of the importance of fruits and fruit trees in NWFPs. Each major geographical/agroecological region is bestowed with a wide range of such species, some of which though quite important locally, are seldom known outside that region.

The Regional Research Network of Tropical Fruit Trees (TFT) in Asia and the Pacific (established under the auspices of the International Centre for Underutilized Crops-ICUC, Switzerland, and the Commonwealth Science Council-CSC, London, U.K.) conducted a survey on the extent of TFT utilization in the Asia Pacific region in 1993; the top ten species identified were *Mangifera indica, Artocarpus heterophyllus, Musa spp., Psidium guajava, Zizyphus mauritiana, Syzygium cuminii, Litchi chinensis, Emblica officinalis, Annona squamosa*, and *Aegle marmelos* (Non-Wood News, FAO, Rome; Vol. 1, March 1994). Most of these species have been included in the list of more than 30 fruit trees described by Nair (1993) as components of agroforestry systems. It is also interesting to note that the above survey did not show such TFTs as durian (*Durio zibethinus*), Longan (*Euphoria longana*), mangosteen (*Garcinia mangostana*), and papaya (*Carica papaya*) that are common TFTs (as well as components of agroforestry systems) in the Asia Pacific Region. Good accounts of several indigenous fruit trees of Africa and Latin America, especially of the Amazon region, are also available (FAO 1983; 1986 a).

Raw Materials

In the absence of a better definition, all non-edible NWFPs are considered as "raw materials". These include such diverse products as aromatic oil, browse, cosmetics, dye, fibre, fodder, fuel, gum, ink, insecticide, latex, masticatory, mat, medicine, mulch, oil, polish, resin, stimulant, tannin, thatch, and varnish. There are reports of various trees producing these and other products; but, even more significantly, there might be innumerable other NWFPs produced by trees in different parts of the world that have not been reported in scientific and technical literature.

NWFPs IN AGROFORESTRY SYSTEMS

Because of the descriptive nature of most NWFPs and agroforestry literature, it is difficult to make a quantitative assessment of the extent of NWFPs use in agroforestry systems. ICRAF's global inventory of agroforestry systems during the 1980s, which provides the most comprehensive account of agroforestry systems in developing countries, lists 380 perennial woody species reported as components of existing agroforestry systems and their main uses in different regions (Nair, 1989: Appendix III; pp 642-655). Since then, several more reports dealing with specific sites/regions have also become available (Kainer and Duryea, 1992; Anderson *et al.*, 1991; Cunningham, 1993; FAO, 1992; Clement, 1991; Clement and Villachica, 1994; Leakey and Maghembe, 1994). Most of the available reports describe systems where NWFP-yielding plants are grown in association with commercial tree crops. Examples include rattan, (*Calamus* spp.) under rubber in southeast Asia (Weinstock, 1983; Godoy, 1990), medicinal and aromatic plants under and other timber species (FAO, 1986 b), a variety of domesticated and semi-domesticated palms in association with a number of cultivated woody or herbaceous species in many parts of lowland humid tropics (Johnson, 1984; Johnson and Nair, 1984), and a large number of indigenous fruit trees in association with agricultural/forestry species in the forestry-agriculture interface (Nair, 1993). These reports identify a number of localized, under-exploited tree species that produce NWFPs in a variety of ecosystems and outline the potential for their improvement through agroforestry; some reports also deal with the soil-improving potential of some such species (e.g. Fernandes *et al.*, 1994). The reports re-emphasize two points that have already been made:

1. NWFPs have a major role in many indigenous agroforestry systems; and

2. Agroforestry offers a viable approach to realizing the potential of several under-exploited NWFPs.

STRATEGIES FOR NWFP DEVELOPMENT: EXPERIENCE FROM AGROFORESTRY

Chandrasekharan (1993) has identified a large number of issues related to the development of NWFPs; these are summarized in Table 2. This table would seem to suggest that nothing goes right or proper for NWFPs at the present time; and perhaps it is rightfully so. However, these issues are so general that agroforestry need not/cannot be employed as a strategy for addressing them. On the other hand, there are certain issues for which agroforestry can be the best or a viable approach. In the following section we will examine some issues of NWFP development that need to be addressed on a priority basis. First, the issues that can be addressed through agroforestry or be benefitted from agroforestry experience will be discussed. This will be followed by identification of issues that are common to development of both NWFPs and agroforestry; but agroforestry experience to date does not have as significant a contribution to make in the resolution of these as of the previous group of issues.

INVENTORY OF NWFPs IN AGROFORESTRY SYSTEMS

A serious hindrance to NWFP development is the lack of authentic and reliable statistics on the classification, production, and value of NWFPs. Product grouping followed in statistical reports and the aggregation of products in International Standard Trade Classification (ISTC) makes it

impossible to separate out NWFPs by specific products and sources. Many NWFPs fall under the category of "vegetable materials and vegetable products". For example, all edible nuts are grouped together such that this category is dominated by such important items as cashew, groundnuts, and almond. Similar situations exist for other groups of other products as well (e.g. oils, fibres, fruits, and so on). Because of this, even if statistical data on NWFPs are available,they cannot be reported adequately under existing data reporting systems. This is somewhat similar to the data reporting systems for plantation crops such as black pepper, cacao, cashewnut, coffee, oil palm, and rubber in agroforestry systems. A "solution" to this problem was found by reporting data on mono-crop and mixed-crop stands of these species separately. While sole stands account for most commercial production of these crops, mixed-crops are mostly in smallholder agroforestry systems (Nair 1983, 1993).

Table 2: Constraints and areas of action for the development of NWFPs

Constraints	Areas of Action
- Neglect of scientific management and conservation strategies - Inappropriate and unsustainable harvest methods - Lack of land-use planning - Lack of integration in forest management - Lack of processing and storage facility - Potential competition from domesticated or synthetic sources - Lack of clear policy support and bias against NWFPs - Lack of research and technology development for NWFPs - Poor data and statistics on NWFPs - Insufficient incentive for sustainable management	- Assessment of NWFP resources by appropriate categories - Enhance planning for integrated forest management - Domestication for forest conservation and improved production - Improve pre and post-harvest techniques - Increase value-added processing at local level - Stabilize supply for local and international markets - Improve database on NWFP species and products - Strengthen research and enhance technology transfer - Augment supporting institutions - Access international assistance

Source: Adapted from Chandrasekharan (1993).

Thus, production and area statistics on these crops in agroforestry systems are now available. The situation of NWFPs is slightly different from that of plantation crops in that they (NWFPs) are seldom, if ever, produced on a commercial scale or in single-crop stands. However, agroforestry inventory methods can be applied to NWFPs, and there is an urgent need to compile the basic statistics of NWFPs.

CLASSIFICATION OF NWFPS

In order to make systematic efforts in the improvement of NWFPs, it is essential that there should be a logical classification scheme. As mentioned above, NWFPs are currently being identified in long lists of product categories. However, the plant parts that yield these diverse products, the management attention, harvesting regime, valuation criteria, and several other factors are all different for different products. A classification scheme should be devised to group the products according to common characteristics or action-oriented parameters. This will then enable us to devise appropriate development strategies for each group of products. For example, the development strategy for the fruit and food-producing plants could be different from that of raw material-producing plants. There is an advantage in choosing biological characteristics rather than agroecological factors as the first set of criteria for such a classification, because of the application of these characteristics over wide regions. Ideally, the inventory data should lead to the selection of broad-based criteria. In the absence of such data bases, available information suggests that characteristics such as plant morphology, nature of

products, frequency and method of harvesting, and type of processing needed, could be taken as some such criteria.

Here again, the experience from agroforestry-systems development provides a valuable example. Based on the inventory data of agroforestry systems, a classification system was developed for agroforestry systems (Nair, 1985), which then become the basis for further developments in agroforestry.

Domestication of NWFP-Yielding Trees

NWFP-yielding trees are, almost without exception, non-domesticated species. One of the most urgently needed tasks in NWFP development, therefore, is the domestication of promising, under-exploited species. Given that "domestication" is a somewhat qualitative term (as discussed earlier), it may not be possible to set exact standards for domestication. However, some general strategies can be considered.

In the long evolutionary history of plant domestication, annual or other agricultural crops vastly outnumber tree crops. Although our knowledge of the evolution of the tree crops is, with a few exceptions, still rather poor (Simmonds, 1985), we are now far more conscious of the importance of trees, than we were a couple of decades ago. Several tree crops have been domesticated to varying extent and are being commercially exploited, however, two recent success stories are oil palm (*Elaeis guianeensis*), and rubber (*Hevea brasiliensis*), both supported strongly by commercial plantation industries.

The NWFPs that are now only gathered have to become domesticated if they are to survive in appreciable quantities. The domestication process involves several stages of organised scientific efforts, as discussed by Leaky and Newton (1994). These are characterization, germplasm exploration, vegetative propagation, genetic selection, and incorporation into a sustainable land-use system. Leaky and Maghembe (1994) have identified four groups of wild trees that could be domesticated for NWFPs/agroforestry:

- the food and food-derivatives;
- industrial/pharmaceutical raw materials;
- commercial timbers and woods; and
- soil improving species, especially nitrogen-fixing trees.

The first two of these are of special interest in the context of NWFP domestication, as mentioned previously.

Since tree domestication by breeding is a long and slow process, vegetative propagation and clonal selection that have been developed for tropical trees are particularly promising techniques in this context (Leakey *et al.*, 1990; Leakey and Newton, 1994). In some instances these techniques are already in practice (Okafor, 1978; 1980). The ideotype concept, originally proposed by Donald (1968) is an approach that has been successfully applied to cereal-crop improvement, and is being increasingly talked-about in the genetic improvement of agroforestry tree crops (e.g. Dickman and Gold, 1994).

An important point here is that the NWFP domestication process and sustainable use have to be strongly linked with social and cultural characteristics of the people. All plant domestication efforts are linked to economic needs for the products of such plants. This is especially true in regard to NWFPs. Additionally, cultural and social values, and indigenous knowledge of the local use of species are key issues in NWFP domestication. Realistic assessment may be made of these values, and the information will need to be integrated into the strategy for domestication.

Genetic Conservation

Domestication and conservation of genetic resources are two issues that need to be considered jointly. Characteristically, domestication leads to substantial decline, and in some cases, total extinction of the wild populations. Both domesticated and wild populations may coexist for some time, but eventually the wild sources will be lost. Several species that currently coexist in their wild and domesticated forms (e.g. timbers such as pines, spruces, and eucalypts; sugar and starch (sago) palms; and various fruit, nut and drug plants) will probably survive — if they do at all — only in cultivated forms. This conjecture is based on the fact that the wild forms that may have given rise to the cultivated forms of such commercially important tree crops as breadfruit, citrus, coconut, and mango are either non-existent or unknown (Simmonds, 1985). such a situation should not be allowed to happen in the case of today's NWFPs.

The importance of conserving genetic resources is well known. However, a point that needs special emphasis is the potential effect of selection pressures in the process of domestication. Given that most NWFPs give diverse products, it is certain that they must have already experienced diverse selection pressures during their evolution, including natural selection for growth and survival, followed by selection for adaptation to new habitats and ecological conditions, and semi-natural selection for survival and adaptation to specific socio-cultural circumstances. Our efforts to domesticate these plants for specific products may cause them to develop in forms that are high in certain traits and low in, and eventually devoid of, other traits (as has happened in several agricultural species). In other words, the wild forms of NWFPs could be lost forever.

Agroforestry offers a very good opportunity for avoiding such a danger and maintaining genetic conservation. Since the emphasis of agroforestry systems is not on the output of a single commodity but on the total output from the systems, semi-domesticated NWFPs can be integrated very well into agroforestry systems, and thus could be genetically conserved. In other words, NWFPs have to be developed for situations that are non-conventional for forestry; and this approach is implicit in the concept of agroforestry.

Valuation of Products

In most cases the value of NWFPs may be underestimated for a number of reasons. For example, many products do not enter commercial markets as they are consumed locally in markets characterized by a lack of definite periodicity and site; some product are exchanged for goods in a non-monetary fashion; and small quantities are traded by several individuals. The weakness of extractive reserves as an economically viable activity for producing the necessary monetary benefits and social incentives has been well brought out in a number of studies from the Amazon region (e.g. Browder, 1992). In a recent study of harvest of *Aquilaria malaccensis* and *Cinnamomum mollissimum* in Malaysia, LaFrankie (1994) reported that the current extractive harvest was not economically feasible and that increasing the density of harvestable products could be a possible strategy for NWFP management. In reviewing the recent estimates of the opportunity cost of NWFP extraction in primary forests, Godoy *et al.* (1993) noted estimates ranging from US$ 0.75/ha/year for experimental caiman farming in Venezuela (Thorbjarnarson, 1991) to US$ 420/ha/year for a complete inventory value of the forest in Iquitos, Peru (Peters *et al.*, 1989). Other activities that were considered in that report included such diverse ones as medicinal plants in Belize, net present value of cultivated rattan in Indonesia, valuation of wildlife in Venezuela, management of domesticated elephants in southern India, and extraction of semi-wild cacao, açaí (*Euterpa oleracea*), and rubber in Brazil. Admittedly it may be inaccurate to compare and contrast these range of values because of the wide assortment of products and locations considered. The fact remains that valuation of NWFPs is difficult, variable, and there are no standard procedures.

In this aspect also, parallels can be drawn between NWFP extraction and agroforestry practices. Valuation of hard-to-quantify goods and services has been a major obstacle to realistic assessment of agroforestry systems. For a long time, *ex-ante* analyses involving conventional economic

evaluation procedures of benefit/cost ratio, net present value, and internal rates of return had been adopted. Now, with field data from actual agroforestry projects becoming available, these methods are currently being refined and adapted for agroforestry situations (e.g. Sullivan *et al.*, 1992, Ramírez *et al.*, 1992). A similar approach would be useful for NWFPs as well. Furthermore, as Chopra (1993) and Saulei and Aruga (1994) have pointed out, the value of NWFPs must be measured in both market and non-market terms.

Conventional agronomic concepts of valuation of intercropping efficiency through measures such as land equivalent ratio (LER) and its analogue income equivalent ratio (IER) have been considered but found unsuitable for agroforestry valuation (Nair, 1993). As an improvement over these, Johnson (1994) has developed a heuristic model of whole-farm efficiency index based on efficiency evaluation of biological, human, and monetary factors, and the model has been applied to an evaluation of the multistorey agroforestry homegarden systems in Jamaica. Such comprehensive evaluation procedures may not be immediately applicable to NWFP valuation, but the valuable experiences that are being gained from agroforestry studies will certainly be applicable to NWFP systems in the future.

Ecological and Economic Harvest of NWFPs

There is the opinion that NWFPs present an opportunity to increase the extractive resource value of forests (Peters *et al.*, 1989) in a sustainable manner. However this statement, an issue that must be carefully considered, is the centre of some contention. Richards (1993) states that it is unlikely that extractive reserves will play an important part in the sustainable resource management of the Amazon, citing Browder (1992), Anderson (1992), Homma (1992), Cleary (1992), and Torres and Martine (1992) in support of this claim. Godoy and Lubowski (1992) describe the schools of thought on the sustainability of NWFPs as divided among those who believe that indigenous populations actively manage the forest for long-term production and those who believe that the traditional extractive processes are unsustainable and that an increase in the demand for the products will lead to the degradation of the resource base.

There is growing concern that the harvest methods for NWFPs are unsustainable (Godoy and Bawa, 1993; Ganesan, 1993). Increased marketing and attention to NWFPs has in some cases led to their destruction (Wilkens, 1991). For example, in Central America evidence of unsustainable harvest is shown by the over-tapping of chicle latex from the *Manilkara zapota* in Belize under the high level of demand during the years 1930-1950 (Alcorn, 1994). The latex is harvested from trees with 20 centimetres diameter and larger by a series of angled cuts connected to a central, vertical channel. The lateral cuts intersect the vertical approximately every 40 centimetres, and can be cut to a height of 30 meters. The tree needs three to eight years to heal and as many as five tappings have been recorded (Alcorn, 1994). This indicates that there is potential for long-term production with correct management but also the potential for damage through over use. However, because the market for chicle has declined dramatically the current harvest level is in fact sustainable (Reining and Heinzman, 1992). Indicators of the importance of the market in determining whether the extraction methods are ecologically sound.

Hall and Bawa (1993) also point out that many harvest methods are not ecologically sustainable giving an example of a 78 percent decrease in bamboo yields in the Tamil Nadu State of India, and cite several other authors giving examples of unsustainable harvest of NWFPs. Thus, in addition to the economic issue related to the harvest of NWFPs the biological sustainability must be evaluated. Hall and Bawa (1993) describe extractive sustainability as harvest that has no long-term detrimental impact on the resource compared to non-harvest natural population. This may be described as an ethnoecological approach to understanding the potential products from the rain forest (Toledo *et al.*, 1992), which attempts to consolidate the ecological requirements for resource maintenance and human needs.

Perhaps this is one area in which agroforestry experience may not have much to offer to the development of NWFPs. Sustainability is a corner stone of the foundations of agroforestry of agroforestry; this means that all agroforestry practices should ensure long-term production without degradation of the resource base on which the production is dependant. Ecological harvesting of agroforestry components is therefore implicit in the concept of agroforestry, and destructive harvesting of agroforestry components has not surfaced as a serious issue.

MARKETING OF NWFPS

Markets for NWFPs can be differentiated into two categories: 1) the local markets and cottage industries; and 2) the industrial and/or export markets. In many instances, the dynamics of local markets are not well understood (Pendleton, 1992). Other problems in local markets include periodic flooding of products which drive prices down especially significant for products that have low elasticities of demand, and high levels of substitute products (Pendleton, 1992). Local markets present an important source of rural income (Padoch, 1988) and cottage industries will improve marketability of the products (Okafor, 1991). As examples of potential commercialization of edible products from African fruits Okafor (1991) lists jams and jellies from *Irvingia gabonensis*; fruit juice from *Dalium guineese, Tamarindus indica, and Parkia biglobosa*; and confectioneries, soup mixes and non-alcoholic beverages from *Treculia africana*. However, in the case of a strong product demand, the problem may arise when cultivators or extractors specialize to fulfil the market needs, leading to situations of risk due to dependence on one product as a primary source of income.

International/export markets are often fickle and yet demanding in products availability and quality. When producing or collecting for the export market, the products must meet the requirements of 1) reliability of supply; 2) consistency of quality, including regulated size and appearance; and 3) transportation costs and sanitation conditions, that are far more stringent than for local markets.

Clay (1992) lists 11 general principles for the development of NWFPs in the markets of North America and Europe. These are:

- **Start with what is already on the market** — existing products offer the best chance of quickly creating and benefiting from international markets.

- **Diversify product and reduce dependence on a few products** — diversification is essential but should be created one product at a time.

- **Diversify the markets for raw and processed forest products** — broaden the number and type of end-users to lower risk of market fluctuations.

- **Add value locally** — determine the best way to capture as much value from the product before it leaves the source.

- **Capture value that is added further from the source** — capture the value added from transportation, transformation and transaction of the product.

- **Proposed solutions must equal the scope of the problems** — can start with small projects but replicability and sustainability are important in the large picture.

- **No single forest group can provide enough commodities for even a small company in North America or Europe** — must establish most profitable method to sell the product and the ability to supply the market.

- **Controlling a large market share of the commodity allows considerable influence over the entire market** — useful in assuring that the producers receive fair enumeration for their work.

Control is wielded primarily from the buyer end of the transaction whether local or international.

- **Make a decent profit in the market place, not a killing** — rather do not expect to make a killing in the market place.

- **The markets in North America and Europe are for saving the rain forest and for conservation rather than for forest people** — awareness of the rain forest outside the areas where they exist is limited to a concern for plants and animals.

- **Certification of environmental sustainability is the key** — the conservation, or green, market demands that products taken from the rain forest do not destroy that resource.

These issues of marketing of products are common to agroforestry and NWFPs. Although it is an important issue, the experience in agroforestry is not substantial enough to provide a definitive guideline to be followed for NWFP development.

Policy and Institutional Support

When considering the use of a NWFPs as an input to an industry there are two aspects of market integration that must be considered: (i) the markets that the product faces, whether domestic or international, and (ii) fulfilling the market requirements without depletion of the resource. The rattan industry serves as a useful illustration of some of the issues related to the judicious development of NWFPs as raw material inputs to industry. Rattan (*Calamus* spp.) is a valuable NWFPs with an estimated worldwide market for the unprocessed cane in excess of US$ 160 million and US$ 2.5 billion for furniture (Whitehead and Godoy, 1991). Rattan presented an example of tremendous potential economic returns for rural people as shown by Godoy (1990) who describes the internal rates of return for green and processed rattan in Indonesia as 21 and 22 percent respectively. However due to the attraction of these economic returns from rattan harvest the extraction levels, in many cases, have become unsustainable. Governments from the four major suppliers of rattan, Indonesia, Malaysia, the Philippines, and Thailand have responded with legislation aimed at both protecting the resource and encouraging value-added processing in the country of origin. Although designed with good intention, the policies are having some deleterious effects, which include depressing rural income (Safran and Godoy, 1993). Furthermore, as these policies restrict the supply of raw material, causing world prices to rise, substitute sources and products become more attractive (Whitehead and Godoy, 1991).

The implication is that if a NWFPs is to compete on the international market it is subject to the unpredictable price movements that accompany this market. This is also true for smaller domestic markets and thus careful consideration must be placed on the markets and market stability if investment is to be encouraged in industries based on NWFPs.

Some lessons can be learned from the experiences in agroforestry in this area as well. It is well recognized that institutional and policy support for agroforestry programme implementation is as important as the biological performance of the promoted technologies. In many countries, programme implementation is hampered by the lack of supportive policies and institutions (Chew, 1989; Mercer, 1992; Gregersen *et al.*, 1992). In most literature, the components of policy frameworks for agricultural/forestry development projects are presented as a uniform set of factors and issues, but the importance of each of these factors will vary by location and situation. Based on a case-study evaluation of two large-scale agroforestry projects in Ecuador, Follis and Nair (1994) identified land tenure, extension and research support, marketing and pricing situation, and credit availability as the key policy issues in the study areas. While access to land was found to be a major constraint to programme implementation in the Ecuadorian highlands (*Sierra*), it was not so in the lowlands (*Oriente*). Therefore, as noted by Follis and Nair (1994), universally applicable procedures for agroforestry-related policy analysis are not likely to evolve owing to the strong location-specificity of

the practices. This could be true in the case of NWFPs as well; the situation could be compounded by the near-total neglect of the importance and value of NWFPs in the existing agricultural and forestry policy framework in most countries.

THE NEED FOR GUIDELINES

Guidelines can only be developed on the basis of accumulated experience and data, but development experience and quantitative data on production and value of NWFPs are lacking. This appears to be a vicious circle. In order to overcome this dilemma and move forward, we need to make some strategic planning and embark on a realistic and relevant action programme. As mentioned earlier, the situation is similar to what it was when organised efforts in agroforestry started about two decades ago. In the circumstances we will explore how and to what extent the experience from agroforestry can be used to initiate the efforts in NWFP development.

The major role of NWFPs in many indigenous agroforestry systems, and the potential role of agroforestry as an approach to NWFP development have already been identified. The accumulated experience in agroforestry has been analyzed to establish some strategies for NWFP development. In this section, these issues and strategies will be presented in an agroforestry perspective, which will serve as a starting point towards preparing detailed guidelines for NWFP development through agroforestry. This is attempted in Table 3. It needs to be emphasized that a paper of this nature must limit its efforts to mere presentations of issues and ideas. Elaboration of research protocols and action agendas for various items is the next step.

CONCLUSIONS

NWFPs are a group of under-exploited, but potentially promising resources, which could become an integral component of sustainable forestry in many developing countries. In this sense, there are close similarities between NWFP production and the practice of agroforestry. NWFPs have a major role to play in many indigenous agroforestry systems and agroforestry offers a viable approach to realizing the potential of several NWFPs. Many of the problems and issues that hinder NWFP development are similar to those faced by agroforestry development when organised efforts in that direction started about two decades ago. It is therefore prudent to draw upon the experiences of agroforestry development while initiating serious efforts in NWFP development.

Systematic and scientific efforts need to be undertaken in a number of critical areas of NWFP development. These include:

- Undertaking a comprehensive inventory of the production and economic value of NWFPs;
- Development of a systematic, logical, and broad-based classification scheme to serve as a basis for formulating organised research and development plans;
- Identification of promising NWFP species and domestication of their wild forms, with due consideration of the cultural and social context of the species and their products;
- Conservation of genetic resources to avoid potential danger of eventual extinction of wild forms of preferentially domesticated species;
- Standardization of product valuation methods for NWFPs;
- Development of sustainable harvest methods and local as well as international markets for NWFPs;
- Strengthening of policy and institutional support for NWFP development.

Table 3: A tentative basis for preparing guidelines for development of NWFPs through agroforestry

No.	Issue	Suggested Action	Agroforestry Options/Experience
1.	Lack of quantitative data on production and values of NWFPs	Inventory of NWFPs	Experience from agroforestry can be used to develop a comprehensive plan for a systematic inventory; can be organised on the basis of pilot studies from selected regions.
2.	Diversity of issues, species, and social conditions necessitate a scheme for coordination and prioritization of development programmes	Classification of NWFPs according to validated criteria	Agroforestry experience is quite relevant. Once the issues, products, and conditions are grouped, efforts can be focused on representative examples of each. A multiple-matrix type of classification scheme will need to be considered.
3.	Multiplicity of species and products	Identification of most promising NWFP species in specific ecological and socio-economic strata	Again, the procedure that has been adopted in agroforestry would be relevant. Special attention will need to be focused on the most promising species: e.g. rattan, fruit trees, and palms in humid lowlands; *Acacia* spp., *Adansonia digitata, Borassus aethiopum*, and *Vitellaria paradoxa* in Sub-Saharan Africa; and *Acacia mearnsii, Alianthus* spp., *Alnus* spp., *Ficus* spp., and *Robinia pseudoacacia* in tropical highlands.
4.	Most NWFP species exist only in "wild" forms	Species domestication and improvement	This involves a long drawn-out process with slow, time-consuming procedures. Some of the procedures adopted from agroforestry/tropical fruit tree development can be made use of: e.g. germplasm collection and evaluation, vegetative propagation, and clonal selection. The ideotype concept could be applied and "model" species for specific categories of trees that yield certain types of products could be developed; social concerns need to be taken into account.
5.	Poor and erratic yields from NWFPs	Development of appropriate management techniques	This is an area in which agroforestry techniques are most relevant. Experience in agroforestry and NWFPs shows that NWFP species are components of agroforestry systems in most places. The low-input, integrated, multiple-output nature of agroforestry offers excellent opportunities for incorporation of NWFPs as components of new and improved agroforestry systems. A whole host of plant management and manipulation techniques need to be developed for integrating little-exploited and promising NWFPs into agroforestry systems.
6.	Available genetic resources need to be conserved	Genetic conservation	Combined systems such as agroforestry (as opposed to monocultural systems such as plantations) offer the best scope for the conservation of genetic resources. *In situ* conservation will be a preferred strategy, and this can best be accomplished through agroforestry.
7.	Harvest methods of most NWFPs are destructive	Development of sustainable harvest methods	Agroforestry is mostly a managed system involving domesticated plants with the harvest of most agroforestry products conducted in a sustainable manner. While developing harvest methods of NWFPs, example of sustainable harvests of agroforestry products could be taken as relevant models.

No.	Issue	Suggested Action	Agroforestry Options/Experience
8.	There is considerable loss of products due to poor pre- and post-harvest techniques	Development of efficient pre-and post-harvest techniques for NWFPs	The examples from managed agroforestry systems are relevant in this case also. An important step in improving harvest and processing techniques would be to modify the current method of extractive "harvesting" to more managed types of harvest techniques. The effect of post-harvest techniques on product quality and storage will also need to be investigated.
9.	Product valuation methods are weak or non-existent	Establish norms of value-added transformation, so that more of the final product value is captured in the region/nation concerned	This is a concern common to agroforestry as well; less work has been done in this aspect of agroforestry development. As NWFPs become components of agroforestry systems the established norms of agroforestry-product-valuation might be applied to the newly developed NWFPs as well.
10.	Market structure is weak, and there is no assured supply of products	Build reliable market mechanism for assured supply of NWFPs	Agroforestry experience does not have much to offer in this context; one reason is that agroforestry products are either "basic needs" that are consumed locally or are well-established commercial products such as coffee and cacao, for which efficient market-supply mechanisms exist. However, this is also an area of concern for some agroforestry products.
11.	There is no coherent policy for NWFP development in most countries	Policy reform to recognize the value, importance, and need for developing NWFPs on a sustainable basis	The agroforestry experience is quite relevant in this context. Compared to the situation that existed about two decades ago when agroforestry was a non-entity, today most countries have recognized, at least in principle, that agroforestry is a viable approach to land management. Concerted efforts by technical experts, policy planners, and non-governmental and donor agencies are needed for such a development.
12.	Institutional infrastructure for NWFP development is non-existent	Build up institutional capability within existing forestry and agricultural set-up to deal with NWFP development	Again, drawing from experience of agroforestry development, it will be prudent to organise NWFP development units within existing bureaucracy rather than trying to start new structures for NWFPs.
13.	There is no research support for NWFP development	Develop an efficient and competent research support system for NWFP development	Understanding the principles of agroforestry and employing these principles for improvement of such systems or developing new ones was the strategy for agroforestry development. Experience to date shows that this strategy has paid off well. Efforts to develop NWFPs are unlikely to succeed unless they are based on sound principles. As is the case with agroforestry, the effort should be on applied rather than fundamental research. Scientific evidence that is available in the relevant areas of biological and social sciences needs to be synthesized for their application to solving or addressing NWFP issues. A sound research strategy should include procedures to address the 12 issues outlined earlier (and other potentially important ones). Research protocols and methods that are appropriate for each issue/topic could then be developed by groups of disciplinary experts. A central, coordinating entity (such as ICRAF for agroforestry) could be the nerve-centre for these research efforts.

While addressing these issues of NWFP development, agroforestry experiences can help in three ways:

1. The procedures, methodologies, and criteria that have been developed for agroforestry can be applied with necessary modifications and adjustments. For example, research methods and procedures encompassing biophysical and socioeconomic characteristics are now available in agroforestry for systems inventory, component characterization, field experimentation and data analysis, biological manipulation of components and systems, economic evaluation, and policy evaluation.

2. Operational procedures for species domestication, product valuation, and holistic evaluation of systems are also available.

3. Because of the high emphasis that is implied on the system's rather than the component's performance in agroforestry systems, these systems could provide excellent opportunities for species domestication and genetic conservation of NWFPs.

Exploiting these procedures, methods, opportunities, and experiences of agroforestry will greatly facilitate systematic and rapid development of NWFPs.

REFERENCES

Alcorn, P.W. 1994. The chicle tree (*Manilkara zapota*) in Northwest Belize: natural history, forest floristics, and management, Unpublished M.Sc. Thesis, Botany Department, University of Florida, 136 p.

Anderson, D.M.W., *et al.* 1991. Gum arabic (*Acacia senegal*) from Niger: comparison with other sources and potential for agroforestry development. *Biochemical Systematics and Ecology* 19:447-452.

Anderson, D.H.W. 1993. Some factors influencing the demand for gum arabic (*Acacia senegal*) and other water-soluble tree exudates. *Forest Ecology and Management* 58:1-18.

Browder, J. 1992. The limits of extractivism. *Bioscience* 42:174-182.

Chandrasekharan, C. 1993. Issues involved in the sustainable development of non-wood forest products. *Proc. Expert Consultation on Non-Wood Forest Products for English-Speaking African Countries*, held in Arusha, Tanzania. Rome, FAO.

Chandrasekharan, C. 1995. Terminology, definition, and classification of forest products other than wood. Paper prepared for Expert Consultation on Non-Wood Forest Products, Yogyakarta, Indonesia.

Chew, S. 1989. Agroforestry projects for small farmers: a project manager's reference. Special Study No. 59. Washington, D.C., USAID.

Chopra, K. 1993. The value of non-timber forest products: an estimation for tropical deciduous forests in India. *Economic Botany* 47:251-257.

Clay, J. 1992. Some general principles and strategies for developing markets in North America and Europe for non-timber forest products. In Plotkin, M., and Famolare, L., eds., *Sustainable harvest and marketing of rain forest products*. Washington, DC, Island Press.

Clement, C.R. 1991. Amazonian fruits: a neglected, threatened, and potentially rich resource requires urgent attention. *Diversity* 7:56-59.

Clement, C.R. and Villachica, H. 1994. Amazonian fruits and nuts: potential for domestication in various agroecosystems. In Leakey, R.R.B. and Newton, A.C., eds., *Tropical trees: potential for domestication*. London, HMSO.

Cunningham, A.B. 1993. African medicinal plants: setting priorities at the interface between conservation and primary health care. People and Plants Working Paper 1. Paris, Unesco.

Dickman, D.I. and Gold, M.A. 1980. The ideotype concept and the genetic improvement of tree crops. *Plant Breeding Reviews* 12:163-193.

Donald, C.M. 1968. The breeding of crop ideotypes. *Euphytica* 17:385-403.

FAO 1983. *Food and fruit-bearing forest species*, 1, Examples from East Africa. Rome, FAO.

FAO 1986a. *Food and fruit-bearing forest species*, 3, Examples from Latin America. Rome, FAO.

FAO 1986b. *Some medicinal forest plants of Africa and Latin America.* Rome, FAO.

FAO 1989. *Forestry and food security*. FAO Forestry Paper 90. Rome, FAO.

FAO 1991. *Non-wood forest products: the way ahead.* FAO Forestry Paper 97. Rome, FAO.

FAO 1992. *Forests, trees, and food.* Rome, FAO.

Fernandes, E.C.M., Garrity, D.P., Szott, L.T., and Palm, C. 1994. Use and potential of domesticated trees for soil improvement. In Leakey, R.R.B. and Newton, A.C. eds., *Tropical trees: potential for domestication.* London, HMSO.

Follis, M.B. and Nair, P.K.R. In press. Policy and institutional support for agroforestry: an analysis of two Ecuadorian case studies. *Agroforestry Systems.*

Ganesan, B. 1993. Extraction of non-timber forest products including fodder and fuelwood, in Mudumali, India. *Economic Botany* 47:268-274.

Godoy, R. 1990. The economics of traditional rattan cultivation. *Agroforestry Systems* 12:163-172.

Godoy, R. and Bawa, K.S. 1993. The economic value and sustainable harvest of plants and animals from the tropical forest: assumptions, hypotheses, and methods, *Economic Botany* 47:215-219.

Godoy, R. and Lubowski, R. 1992. Guidelines for the economic valuation of non-timber tropical-forest products. *Current Anthropology* 33:423-432.

Godoy, R., Lubowski, R. and Markandya, A. 1993. A method for the economic valuation of non-timber tropical forest products, *Economic Botany* 47:220-233.

Gregersen, H.M., Oran, P. and Spears, J., eds. 1992. *Priorities for forestry and agroforestry policy research.* Report of an International Workshop. Washington, DC, International Food Policy Research Institute.

Guinko, S. and Pagso, L.J. 1992. Harvesting and marketing of edible products from local woody species in Zitenga, Burkina Faso. *Unasylva* 168 (43):16-19.

Gunatilake, H.M., Senaratne, D.M.A.H. and Abeygunawardena, P. 1993. Role of non-timber forest products in the economy of peripheral communities of Knuckles National Wilderness Area of Sri Lanka: a farming systems approach. *Economic Botany* 47:275-281.

Hall, P. and Bawa, K. 1993. Methods to assess the impact of extraction of non-timber tropical forest products on plant populations. *Economic Botany* 47:234-247.

Johnson, D.V. 1984. Multipurpose palms in agroforestry: a classification and assessment. *International Tree Crops Journal* 2:217-244.

Johnson, D.V., and Nair, P.K.R. 1984. Perennial-crop-based agroforestry systems in northeast Brazil. *Agroforestry Systems* 2:281-292.

Johnson, T.R. 1994. Agroforestry performance evaluation: development of a heuristic method and its application to the central highlands of Jamaica. M.S. thesis. Gainesville, University of Florida.

Kainer, A.K. and Duryea, M.L. 1992. Tapping women's knowledge: plant resource use in extractive reserves, Acre, Brazil. *Economic Botany* 46(4):408-425.

Kang, B.T. 1993. Alley cropping: past achievements and future directions. *Agroforestry Systems* 23:141-155.

Kerkof, P. 1990. Agroforestry in Africa: a survey of project experiences. London, Panos.

King, K.F.S. 1987. The history of agroforestry. In Steppler, H.A. and Nair, P.K.R. eds., *Agroforestry: a decade of development*. Nairobi, Kenya, ICRAF.

LaFrankie, J.V. 1994. Population dynamics of some tropical trees that yield non-timber forest products. *Economic Botany* 48:301-309.

Leakey, R.R.B. and Maghembe, J.A. 1994. Domestication of high-value trees for agroforestry: an alternative to slash and burn agriculture. ICRAF Position Paper 1.Nairobi, Kenya, ICRAF.

Leakey, R.R.B. and Newton, A.C., eds. 1994. *Tropical trees: potential for domestication*. London, HMSO.

Leakey, R.R.B., Mesen, J.F., Tchoundjeu, Z., Longman, K.A., Dick, J.M., Newton, A.C., Matin, A., Grace, J., Munro, R.C. and Muthoka, P.N. 1990. Low technology techniques for vegetative propagation of tropical trees. *Commonwealth Forestry Review* 69:247-257.

MacDicken, K.G. 1994. *Selection and management of nitrogen-fixing trees*. Bangkok, FAO and Winrock International.

May, P.H. 1992. Babassu palm product markets. In Plotkin, M. and Famolare, L., eds., *Sustainable harvest and marketing of rain forest products*. Washington, DC, Island Press.

Mercer, D.E. 1992. The economics of agroforestry. In Burch, W.R. and Parker, J.K. eds., *Social science applications in Asian agroforestry*. New Delhi, Winrock International and South Asia Books.

Nair, P.K.R. 1983. Agroforestry with coconuts and other plantation crops. In Huxley, P.A., ed., *Plant research and agroforestry*. Nairobi, Kenya, ICRAF.

Nair, P.K.R. 1985. Classification of agroforestry systems. *Agroforestry Systems* 3:97-128.

Nair, P.K.R., ed. 1989. *Agroforestry systems in the tropics*. Dordrecht, the Netherlands, Kluwer.

Nair, P.K.R. 1990. *The prospects for agroforestry in the tropics*. Technical Paper 131. Nairobi, ICRAF.

Nair, P.K.R. 1993. *An introduction to agroforestry*. Dordrecht, the Netherlands, Kluwer.

Nair, P.K.R. 1994. Agroforestry. In *Encyclopedia of agricultural science*. New York, Academic Press.

Nair, P.K.R., Kang, B.T., and Kass, D.C.L. In press. Nutrient cycling and soil-erosion control in agroforestry systems. in *Agriculture and the environment: bridging food production and environmental protection in developing countries*. Madison, Wisconsin, Am. Soc. Agronomy.

Nair, P.K.R., Rao, M.R., and Fernandes, E.C.M. 1994. Tree crop interactions in sustainable agroforestry systems. in *Transactions of the XV World Congress of Soil Science*, Commission VI: Symposia — Soil Technology for Sustainable Agriculture, pp.110-137. Mexico City, Int'l Soc. Soil Sci. and The Mexican Soc. Soil Sci.

Nepstad, D.C. and Schwartzman, S., eds. 1992. *Non-timber products from tropical forests: evaluation of a conservation and development strategy*. Advances in Economic Botany 9. Bronx, New York, New York Botanical Garden.

Okafor, J.C. 1978. Development of forest tree crops for food supplies in Nigeria. *Forest Ecology and Management* 1:235-247.

Okafor, J.C. 1980. Edible indigenous woody plants in rural economy of Nigerian forest zone. *Forest Ecology and Management* 3:45-55.

Okafor, J.C. 1993. Improving edible species of forest products. *Unasylva* 165 (42):17-23.

Padoch, C. 1988. The economic importance and marketing of forest fallow products in the iquitos region. In Denevan, W.M., and Padoch, C., eds., *Swidden-fallow agroforestry in the Peruvian Amazon*.Bronx, New York, New York Botanical Garden.

Peters, C.M., Gentry, A.H., and Mendelsohn, R.O. 1989. Valuation of an Amazon rainforest. *Nature* 339:655-656.

Ramírez, A., Seré, C. and Uquillas, J. 1992. An economic analysis of improved agroforestry practices in the Amazon lowlands of Ecuador. *Agroforestry Systems* 17:65-86.

Reining, C. and Heinzman, R. 1992. Non-timber forest products in the Petén, Guatemala: why extractive reserves are critical for both conservation and development. In Plotkin, M. and Famolare, L., eds., *Sustainable harvest and marketing of rain forest products*. Washington, DC, Island Press.

Richards, M. 1993. The potential of non-timber forest products in sustainable forest management in Amazonia. *Commonwealth Forestry Review* 72:21-27.

Safran, E.B. and Godoy, R.A. 1993. Effects of government policies on smallholder palm cultivation: an example from Borneo. *Human Organization* 52:294-298.

Saulei, S.M. and Aruga, J.A. 1994. The status and prospects of non-timber forest products development in Papua New Guinea. *Commonwealth Forestry Review* 73:97-104.

Simmonds, N.W. 1985. Perspectives on the evolutionary history of tree crops. In Cannell, M.G.R. and Jackson, J.E., eds., *Attributes of trees as crop plants*. Midlothian, U.K., Inst. Terrestrial Ecology.

Sullivan, G.M., Huke, S.M., and Fox, J.M., eds. 1992. *Financial and economic analyses of agroforestry systems*. Proceedings of a Workshop held in Honolulu, Hawaii, July 1991. Paia, Hawaii, Nitrogen Fixing Tree Association.

Szott L.T. and Kass D.C.M. 1993. Fertilizers in agroforestry systems. *Agroforestry Systems* 23:157-176.

Toledo V.M., Batis A.I., Becerra R., Martinez E., and Ramos C.H. 1992. Products from the tropical rain forest of mexico: an ethnoecological approach. In Plotkin, M. and Famolare, L., eds., *Sustainable harvest and marketing of rain forest products*. Washington, DC, Island Press.

Weinstock, J. 1983. Rattan: ecological balance in a Borneo rainforest. *Economic Botany* 37:58-68.

Whitehead, B.W. and Godoy, R. 1991. The extraction of rattan-like lianas in the new world tropics: a possible prototype for sustainable forest management. *Agroforestry Systems* 16:247-255.

Wickens, G.E. 1991. Management issues for development of non-timber forest products. *Unasylva* 165 (42):3-8.

Young A. 1989. *Agroforestry for soil conservation*. Wallingford, U.K., CAB International.

INFORMATION REQUIREMENTS AND PLANNING PRINCIPLES FOR MANAGING NON-WOOD FOREST RESOURCES IN MANGROVE FORESTS

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BASIC CHARACTERISTICS OF MANGROVE ECOSYSTEMS

Mangroves are characteristic littoral plant formations of tropical and subtropical sheltered coastlines. Generally mangroves are trees and bushes growing below the high-water level of spring tides. Their root system is regularly inundated with saline water, even though it may be diluted due to freshwater surface run-offs and flooded only once or twice a year.

Mangrove forests are evergreen. The paucity of tree species occurring in them is due to the peculiar conditions of their existence, few plants being able to tolerate and flourish in saline mud and to withstand frequent inundation by sea-water. They also differ from inland forests in that certain tree species are practically gregarious over extensive areas.

Due to their situation along coastal lines, mangrove formations are constantly controlled by marine and terrestrial factors, such as coastal erosion and accretion, tidal waves, geomorphology, salinity and other edaphic characteristics. These, together with the distance from the sea, the frequency and duration of inundation and tidal dynamics, govern to a great extent the local distribution of species and their succession.

Best developments of the mangroves are found at locations with deep, well-aerated soils, rich in organic matter and low in sand, usually in river estuaries.

IMPORTANCE OF NON-WOOD RESOURCES IN MANGROVE FORESTS

The importance of the mangrove forest resource stems from the many products taken directly from the mangroves, both wood and non-wood products, as well as products and amenities provided from within and beyond their boundaries, such as fish, crustaceans and crabs. Wood products range from timber, poles and posts to firewood, charcoal and tannin. Non-wood products include thatch, honey, wildlife, fish, fodder and medicine. In addition, mangrove lands are often converted to salt ponds or to agriculture or aquaculture purposes.

The intangible benefits of mangroves, often taken for granted, include:

- coastal protection against wave and wind erosion ;
- moderating the effects of coastal storms and cyclones;
- shelter and habitat for diverse wildlife, particularly avifauna;
- nutrient sink-effect and reduction in excessive amounts of pollutants;
- entrapment of upland runoff sediments thus protecting near-shore reefs and reducing water turbidity.

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Mangroves also provide opportunities for education, scientific research, recreation and eco-tourism. Annex 1 contains a list with some examples of mangrove-based wood and non-wood products.

The many types of products and the multiple roles of mangrove forests make a multidisciplinary approach towards their management essential, covering the full range of products and services which can be obtained from these areas.

INFORMATION AND PLANNING REQUIREMENTS FOR MANAGEMENT

The ultimate goal of managing non-wood mangrove resources, economic considerations aside, is to exploit to the fullest the natural energies and resources available for any given site so as to produce maximum carrying capacity for the production of desired products and services. In this respect, a careful examination of forest site conditions and the collection of all relevant information regarding the objectives for managing the forest will prove to be a worthwhile investment, both in time and effort, for any forester in so far as it portrays the potential stand productivity under ideal conditions. Equally important is the full assessment of the socio-economic benefits and environmental impact of managing these mangrove resources.

Need for Multidisciplinary Information

The effective management of non-wood resources calls for large amounts of additional information as compared to the kind and amount of data required when managing wood resources only. For most mangrove areas, such primary information needs include: the extent, distribution and dynamics of forest cover and water/river bodies; identification and assessment of the available and potential non-wood forest resources; and assessment of woody biomass, including vegetative and animal production. Due to the particular forest structure, composition and limited accessibility of mangrove forests and the mangrove area in general, the task of collecting this information is complex, time consuming and more expensive than similar assessments in dryland forests.

The implementation of such a survey should result in the classification and mapping of the resources and the potentials of the area, particularly in relation with the non-wood products and services. Studying mangrove ecosystems for management purposes also requires a broader multi-disciplinary approach than dry-land forests. The complex nature of the mangrove resources (covering both aquatic and terrestrial outputs) and the very closely interrelated land-uses mangroves may be allocated to (agriculture, fishery and forestry) call for the concourse of expertise from many disciplines, including forestry, wildlife management, ecology, geomorphology, aquaculture and agriculture.

Kinds of Data Required

In order to save time and money, data needs should be clarified in function of the chosen management objectives *before* embarking on data collection. Data are collected to assist in formulating realistic courses of action, to allow possible courses of action to be evaluated and thus ultimately to facilitate the decision-making process. Five classes of data are required:

- resource data;
- utilisation data;
- socio-economic data;
- operational data;
- institutional data.

Resource Data

For each non-wood resource, the main information required is (a) availability, (b) biological productivity, and (c) economic potential.

Utilisation Data

There should be an effective demand-forecasting system for the non-wood forest products and forest services expected from the mangrove forests at various levels. This data type is essential for mangrove forests set aside for productive purposes. Even for environmental management areas, the objective may change over time to include production functions. Relevant factors to consider are:

- Preferred species — type and properties;
- Spacing — size assortment, quality, etc.;
- Area — volume, size and types of cottage industries;
- Growth rate — production schedule;
- Location of forest, processing units and transport facilities, villages, etc.;
- Site conditions affecting the harvesting potential;
- Profile on traditional and potential uses.

Most of these data can be collected from a review of past management and utilization and/or from specialized demand studies.

Socio-Economic Data

Economic considerations are required over and above purely financial ones, simply because strict analysis of cash expenditure and revenue do not fully account for the real costs and benefits to the community as a whole. In multiple-use management of mangroves, timber production may be reduced or even curtailed to preserve or enhance aquatic and/or terrestrial non-wood products or services. The trade-offs between the alternatives should be compared. As the economic quantification of intangible benefits (and costs) of many non-wood mangrove resources is still at an early stage, estimates may be used instead.

The socio-economic data needed are:

- Shadow labour costs;
- Labour opportunity costs;
- Associated social costs (e.g. public investments in housing, water supply, canalization, crossings);
- Discount rate to be used;
- Shadow price for produce to reflect price distortions due to taxes, duties and price control mechanisms;
- Value of non-marketable benefits (e.g. improved environment, water quality, health, shelter, erosion control, recreation, fish stocks etc.);
- Development impact of intangible benefits to local or regional economy, training, etc.

Operational Data

The preferred operational management interventions to enhance the potential of the non-wood resource should be prescribed and the work activities defined as follows: (a) extent covered (ha); (b) the input (man-days, machine hours, materials, etc.); (c) the output (ha/day, km/day, etc.); and (d) the cost per unit area or effort. The anticipated increase in Mean Annual Increment (or any other

measurable indicator such as survival rates) are useful benchmarks for measuring performance. The operational data requirement may usefully be summarized as follows:

- Site preparation(s) for enhancing the potential of the non-wood resources;
- Nursery establishment, seed collection, etc.;
- Planting (full scale or enrichment), natural regeneration;
- Maintenance and protection of the resource;
- Improvement and production control and harvesting;
- Required logistic to implement the above (e.g. river transportation, forest clearing, pond or canal construction, base camps).

Institutional Data

Institutional factors are generally political by nature, but also include the legal framework. The management plan should include the following statements:

- Legal obligations;
- Legal privileges and rights;
- Policy guidelines;
- Institutional support to communities, education and training;
- Local attitudes and impact on local society;
- Research linkage and support.

MANAGEMENT PLANNING PRINCIPLES

The following principles can be used as a guide in preparing management plans for non-wood mangrove resources.

- *Wood and non-wood resources should be managed in an integrated way and used to meet local, regional or national needs.* This implies a knowledge of what the people want. An assessment of needs and public participation is an integral part of the planning process.

  The importance of a resource supply is not determined by its physical or biological characteristics alone, but by the priority that society places on its use. This prioritization among management objectives should be clearly reflected in the management plan.

- *Plans must be objective oriented.* When the problems or issues are understood, a set of objectives should be framed to address key issues. Objectives should be quantifiable targets that serve to focus management effort and measure performance.

- *Plans must try to achieve the greatest good for the greatest number of people in the long run.* Minority interests must be weighed in relation to the general well-being of larger communities. In practice, it is impossible to achieve complete or unanimous support for all the management objectives. Compromises between local and national interests are necessary.

- *The ecological carrying capacity should never be exceeded and resource sustainability should be given high priority.* This is a non-negotiable requirement if sustainable production is to be achieved. This requirement should be given high priority in the management planning agenda. For example, a code of conduct for responsible harvesting of given non-wood products might be elaborated.

- *The need for biodiversity and wildlife conservation should be recognized.* This should be incorporated into the plan appropriate to the scale of the management area. For a small and/or highly fragmented area, it is impractical to reserve large tracts of pristine vegetation for conservation purposes. The establishment of well placed control plots may be more feasible.

- *Planning is an on-going dynamic process.* Planning must be flexible enough to accommodate shifts in demand/supply dynamics and priorities. Because societal values change over time, planning is an on-going dynamic process. Change must be anticipated.

  In general, the larger the geographic unit, the longer the planning horizon (time-frame). Regional policy objectives are necessarily long-term and are based on general trends that are affected only by macro changes. Management plans at the forest management unit, on the other hand, are based on short to medium-term plan objectives and are revised more frequently as the information base expands.

- *The plan must provide for improvements in data collection to reduce areas of uncertainty associated with an incomplete or weak information base.* The ultimate objective may be achieved in phases, taking into account an improved information base over time and applying a conservative approach where the uncertainty is perceived to be great.

- *The decision-making process must be visible and equitable.* Involving the public in the decision-making process is necessary to promote local support and acceptance for integrated forest management planning. Just as it will be the duty of the forest service to explain to the public the implications of various decisions, the greatest value from the public will most likely be in using their knowledge of local conditions and needs.

  Customary rights should be respected where possible. Decision-making should not marginalize the traditional incomes of local people, nor their access to reasonable amount of forest products, without offering practical and acceptable alternatives.

- *Planning functions and responsibilities.* The responsibility for planning functions should be clearly spelled out at different levels, from the local forest management unit level up to the national level. Various forest management levels and responsibilities are shown in Annex 2.

Annex 1: Mangrove-based products

A. Mangrove Forest Products

Fuel
- Firewood
- Charcoal

Construction
- Timber,scaffolds
- Heavy construction
- Railway sleepers
- Mining props
- Boat building
- Dock pilings
- Beams and poles
- Flooring, panelling
- Thatch or matting
- Fence posts, chipboards

Fishing
- Fishing stakes
- Fishing boats
- Wood for smoking fish
- Tannin for net/lines
- Fish attracting shelters

Textile, leather
- Synthetic fibres (rayon)
- Dye for cloth
- Tannin for leather preservation

Food, drugs and beverages
- Sugar
- Alcohol
- Cooking oil
- Vinegar
- Tea substitute
- Fermented drinks
- Dessert topping
- Condiments (bark)
- Sweetmeats (propagules)
- Vegetables (fruit/leaves)

Household items
- Glue
- Hairdressing oil
- Tool handles
- Rice mortar
- Toys
- Match sticks
- Incense

Agriculture
- Fodder

Paper products
- Paper — various

Other products
- Packing boxes
- Wood for smoking sheet rubber
- Fuelwood for:-
  - salt making
  - brick kilns
  - bakeries
  - tobacco drying
- Medicines

B. Other Natural Products

- Fish/Crustaceans
- Honey
- Wax
- Birds
- Mammals
- Reptiles/Other fauna

Source: Adapted from UNEP, 1983.

ANNEX 2

FOREST MANAGEMENT PLANNING LEVELS AND RESPONSIBILITIES

Level	Objective	Documentation	Content of Plans	Prepared by
National Policy	To provide the policy framework and define the criteria for management actions of forest resource ministries at federal or national level	Acts, Statutes, Regulations, Ministry and Departmental directives	National Policy Objectives and Priorities. Status Report on forest situation or to satisfy defined requirements of the Forest Acts	The Minister in charge of forestry matters based on draft prepared by the Director General of Forestry/CCF
Regional Plan	To establish broad resource management and development policies for the development of an entire geographic region or its major sub-areas or any specified region which includes a number of administrative divisions and township zones	Forestry programme of the Director General of Forestry/Chief Conservator of Forests (DGF/CCF) or State/Divisional/ Regional Forest Officers outlining one or more management alternatives based on a resource analysis	A plan where regional goals and priorities for integrated use are identified and production objectives determined (includes socioeconomic opportunities/ constraints)	Divisional Working Plan Officer/Staff Working Plan Division in consultation with other Ministries/ Departments
Forest District Management Plan	Prepare plans and development programmes based on defined management unit area needs/goals and land use. (includes a number of Working Circles)	A Forest Management plan approved by the Divisional Forester/SFO with the consent of the DGF/CCF for use by the Regional/District Forest Officers	Long-term: Fix Annual Allowable Cut from an analysis of demand, inventory and resource use data Short-term: Schedules on roading; wood and non-wood harvesting, conservation, amenities and silvicultural activities	Divisional/ Regional/District Forest Officers Forest Department Working Plan Division together with Divisional/ Regional Forest Officer concerned
Working Plan	To resolve resource use conflicts and prepare guidelines and prescriptions for forest management implementation at operational level	A Working Plan, approved by the Divisional Forest Officer/SFO and endorsed by the DGF/CCF, providing specific guidelines for resource development and use	Prescription of operating techniques and silvicultural treatments	Usually Regional/District Forest Officer working with Divisional Headquarters staff
Local Operational Plan	To identify what site-specific measures will be taken by the timber contractor (permittee/licensee) to ensure orderly extraction conforming to defined resource management objectives and priorities	A detailed plan. In the case of timber, a Felling or Cutting Plan which, when approved becomes an integral part of the license/permit document.	Detailed specifications for on-site operations: e.g. logging systems, road specifications, layout of landings and skid trails, species selection, felling girth, order of felling blocks, etc.	District Forest Officer/Area Foresters and Senior Ranger/Range Staff

NON-WOOD FOREST PRODUCTS: THE INSTITUTIONAL ASPECTS

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SUMMARY

Although the importance and relevance of non-wood forest products (NWFPs) in the livelihood of rural populations and local economies, and more broadly for urban populations and national economies, are well-recognized, their long history and their limited coverage in economic statistics maintain NWFPs in some oblivion, especially in institutional measures and structures. The document reviews this situation and shows that in many cases, general policies of rural development and in particular the conservation and development of forests, include a number of dispositions favourable to NWFP development. The need is for actual implementation of these elements of policy, and of the organisation of inter-institutional cooperation. Education and research, use of local knowledge and expertise, awareness of local culture and values are stressed as important ingredients accompanying the development of policies, setting up organisations and promoting local groups.

INTRODUCTION

NWFPs in this paper refer to "all tangible goods of biological origin, other than timber and firewood, from forests or land under similar use". By extension, included in this definition are all tree and shrub products left or introduced in cultivated land-and-fallow complexes that characterize village lands in developing countries.

NWFPs contribute substantially to the livelihood systems and local economies of rural and urban societies. Taken together, the social and economic services they provide may be far more important than timber. The paradox is that, despite this importance and the fact that a number of them have gained worldwide relevance in international trade, these products have been ignored by national economies and the institutional arrangements that concern all aspects of forestry, trade and industry.

Traditional societies and national economies have continuously taken these products for granted or simply ignored their status as economical goods. They have not, in most of cases, raised any awareness and attention from modern administrations to take them into account in measures relating to legislation, policy, valuation of their contribution in national economies and measures addressing needs in education, research, training, processing and marketing.

However, a number of trends and developments are changing the tide. There is a surge of interest in three main directions:

- more attention is given to the indigenous communities for which NWFPs have great significance;
- modern consumer societies are giving more and more value to natural and biological products as a result of the "green is good" movement;

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- increased attention is being given to the plant and animal biological diversity and its role in the well-being of local communities and thus products they are likely to harvest in nearby forests and tree formations.

This paper introduces the discussion of the main institutional aspects concerning NWFPs, from the management of the resource base to their marketing. The paper will examine the institutional status of NWFPs and its evolution. In so doing, the major focus will be on: the knowledge and awareness of NWFPs; the institutional framework under which they are usually recognized, managed and developed; the institutional base needed to develop adequate knowledge on NWFPs; the organisations for conservation and management of NWFPs; and finally the need for building capacity and promoting involvement and various functions of all layers of society in the valorization of NWFPs. Considerations for the way ahead will then be developed and recommendations proposed.

SITUATION AND EVOLUTION OF INSTITUTIONAL ASPECTS OF NWFPs

The Institutional First Step: Defining and Recognizing NWFPs

Despite the definition used for this paper, institutional hesitation over NWFPs is in large part due to the difficulty in defining this group of products, and the lack of awareness about their contribution in the economy. Initiatives dealing with the institutional organisation of the use of these products have at best been opportunistic and dependent on the occasional fortune they have known at different periods.

Forest services worldwide, mainly oriented towards timber production, have given NWFPs a residual definition which in all the normative activities of man, denotes lack of knowledge, interest and perspective. They have been named *secondary forest products*, *other forest products*, *accessory forest products*, and *non-wood forest products* under the assumption that they are of far lower economic importance than timber and wood for fuel. Hammett and Messersschmidt (1993) propose *alternative forest resources*, claiming "these so-called minor products are often very major alternatives". Unfortunately, even countries in which a number of NWFPs have strong economic value and social relevance have stuck to these superficial denominations and scant recognizance. This situation has discouraged strong initiatives to look at these products from the point of view of their own value and socio-economic importance, except in a few cases in which the products had a definite strategic importance and such a strong social relevance that they could not safely be ignored by authorities.

In some prominent situations, regulatory measures have been taken to maintain a system in which the product fills a very important economic niche. From this important perspective, NWFPs have often played strategic roles in colonial economies. Forestry Administrations were thus prompted to take measures by the objective political importance of the product, and consequently by the need to conserve the resource base and secure the sustainability of the resources *vis-à-vis* harvesting practices.

The case of the gum arabic in colonial Francophone dry West Africa illustrates this point. Relatively early, the General Commissioner of this region (covering Burkina Faso, Mali, Mauritania, Niger and Senegal) tried to codify the tapping of the gum arabic, intending to halt the devastating tapping practices that were tending to exhaust and kill the trees. The ultimate goal was to maintain the flow of goods in the colonial trading systems in which gum arabic formed an important link.

Given their social importance and sizeable domestic trade, the same move could have been expected for the shea butter tree (*Vitellaria paradoxa*) and the locust bean tree (*Parkia biglobosa*) further south in the African woodlands, but this did not happen as these products had no such strategic importance for the state economy and the products were neglected for a long time. Even today, notwithstanding their regional socio-economic relevance and in some cases their strong potential to support small-scale/family processing enterprises (in the case of shea butter), no institutional

arrangement has been established to support the economic activities regarding these species. A number of authors have attributed this to the predominant European approach to forests, in which until recently the essential production of the tree is timber, and any other production is perceived as secondary (Bergeret and Ribot, 1990).

The gum arabic case offers the best example of good trading systems established with *ad hoc* regulations for harvesting, grading, trading and exportation under: the aegis of an hoc corporation (in Sudan), an entity dealing with other agricultural crops (e.g. Niger), or left in the hands of private organisations and enterprises (Senegal-Mauritania). In Ghana, a country with important forest resources, the Cocoa Marketing Board deals with the purchasing and marketing of the seeds of the very important shea butter tree.

In other cases, the non-wood forest commodity may have known temporary importance as long as it satisfied a specific need, but for lack of research and marketing support, it has not been able to changing demand, and has declined rapidly. In the West Indies, the collection, processing and trade of rosewood oil from *Aniba rosae-odora* and of the gum Balata[2/], which played an important role in the early 1900s, have progressively declined due to lack of interest in identifying alternative markets once the traditional use disappeared. These products, like many others, yielded to synthetic alternatives and disappeared rapidly from the international markets.

These examples from Africa and the West Indies could be repeated for Latin America (e.g. the various products of the Amazon have received careful study only in the last ten years, although they have long played important local socio-economic functions; or the many products of the cactae and Palmacae families recently so well developed in Mexico) and in Asia. They show the slow progress in recognizing the importance of various NWFPs, and as a consequence these products — and the resource management concerning them and their collection, processing and marketing — have been left in institutional oblivion.

Signs of Change

Due to new interest in the many aspects of their contribution to the life and well-being of local people and the international economy, the importance of these products is gaining recognition now.

At the national level, a number of developments are pushing towards greater recognition of these products, stemming from: (1) a strong move towards natural products from the demand side; (2) a call for equity for local and indigenous communities in the management of local resources and the distribution of benefits accruing from them; (3) in many parts of the world, economic and social adjustments have forced some strong re-orientations towards the use of local substitutes of a number of commodities, many of which are forest products. The institutional responses to these moves have been in the identification, classification of these products, the organisation of their collection and trade, and in some cases, policy definition.

China is an example worth mentioning for its efforts to promote collection, processing and sale of NWFPs. There, many products are extracted from the leaves, blossoms, wood and seed of a number of plant species, ranging from pines to the seeds of the *Caragana* shrub used in sand dune stabilization; and many small-scale extractive units have been established and contribute to the economy of local communities.

International programmes focusing on eco-development, integrated rural development and use of local resources, food security, poverty alleviation and more recently, the promotion and empowerment of local communities, have tended generally to promote the better use of all resources,

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2/ Extracted from *Manilcara bidentata*, a sapotacae from French Guyana; the product was used by European industry as an alternative to rubber in some of its applications.

and particularly forest resources and their non-wood products. The following paragraphs describe some examples.

Unesco's Man and Biosphere (MAB) programme has accorded great interest and importance to the use of forest and tree formations by local people. A number of studies of the various livelihood systems of forest dwellers and their complete dependence on non-timber forest products have been conducted, highlighting not only the use of wood for many local domestic needs but also the use of forest food items, material for clothing, garments and adornment, dyes and others. The need for income beyond subsistence has also been studied.

In FAO, efforts to move forest administrations towards local community development have been marked since the early 1970s by efforts to enlarge the field of forest resources and forestry beyond simply the production of wood. The search for establishing "areas of forest prosperity" for local communities has tended to promote diversified use of forest resources. The whole programme of forestry for local community development, and the present Forests, Trees and People Programme, have raised the awareness of foresters and forestry institutions on the potential of NWFPs and the need to include them in the management of forest resources. In the past 10 years, the Tropical Forests Action Programme (TFAP), which covers forestry policy and planning, has duly recognized the role and functions of NWFPs; the then proposed Action Programme on Forestry in Land Use highlighted the role of these products in "broad-based rural development with emphasis on diversification of rural economic activities" and in efforts to enhance "direct economic benefits for the local communities from forests and forest products and from the generation of employment" always linked to timber harvesting. Effectively, various national forest plans both in and outside the TFAP framework (especially after the revamping process), have progressively given special importance to planning and management for NWFPs, including medicinal plants, food from the forests, and wildlife products. Examples include Cameroon, Ghana, Sudan and Senegal in Africa; Indonesia in Asia; and Mexico and Panama in Latin America.

More recently, the Programme Committee of FAO recognized the importance of NWFPs and "endorsed the emphasis given to NWFP development and underlined the need to pursue the inventory and valorization of these resources. The Committee recognized the importance of a code of environmentally friendly harvesting techniques for all forest products and urged its timely publication" (FAO, 1994b). This is an important institutional backing that considers nearly equally the need for recognition and good harvesting practices for wood and NWFPs; it also confirms the direction taken by the FAO Medium- and Long-Term Programme, which mentions among others, two broad objectives very relevant to the development of NWFPs: (1) "realizing the *full potential* of forest production — both wood and non-wood — and increasing its value in order to meet the evolving demand for forest and tree products; (2) to support full participation and equitable sharing of benefits among all people dependent on forests activities, particularly as an off-farm source of livelihood for the most vulnerable groups".

Among non-governmental organisations (NGOs), recognition of NWFPs has been strong for a long time. The Conservation Strategies of the International Union for the Conservation of Natural Resources (IUCN) stresses the sound use of natural and especially forest resources for yielding various products, to cater to the multiple needs of local populations. Many NGOs have focused interest on the local products of village and community lands and provided alternatives that have helped fill institutional gaps in support of the assessment, management and use of these products. The assistance provided by NGOs in organising local producer groups has raised the awareness of these groups on the potential of local NWFPs and the income that can be obtained from their exploitation.

Many voices however, have cautioned against unrealistic optimism on the development of non-wood forest related markets and any sustainable livelihoods based on them. Mok (1991) notes that "the rediscovery of the major importance of minor or NWFPs in most developing countries led to euphoric conclusions on their economic values and future prospects. However, most of the conclusions are

unsubstantiated and are therefore unwarranted and likely to be untenable". He went further in stressing the frequent changes over time in the supply and demand of NWFPs.

Talking about the rural people of the Amazon, Vantomme (1991) indicated that they were either falling back to subsistence agriculture, providing hired labour to nearby projects or heading to urban centres. He estimated that the recently created and highly advocated "forest extractive reserves, will not alter significantly these trends".

These voices of caution are necessary for a realistic view of NWFPs and hence the institutional measures their development would reasonably warrant.

Considerations on the Institutional Framework

NWFPs have a number of objective characteristics that make them difficult to support with a suitable institutional governance:

- In most cases, they have remained in the informal economy; ignored by national economic and statistic services and neglected by natural resource management; their economic recognizance is hampered by a general lack of documented facts;
- the resource base is in most cases scattered and hardly known; the forest resources themselves are not well known, let alone the part that produces NWFPs;
- the command of the resources is largely based on collective management and its sustainability is very fragile and rarely survives when a product achieves national and international demand;
- like all natural products, they are intrinsically variable and location dependent; the degree in which this variation occurs very strongly affects the possibility to evolve common approaches in their collection, handling, processing and valuation;
- the accessibility of the resource is often difficult, as producing areas are often remote and products are submitted to a number of transfers that may affect their quality and freshness (especially edible products such as wild fruits or tubers, mushrooms or honey); collecting areas may also be economically disadvantaged, which may not be favourable for fast establishment of feeder roads;
- many climatic and human factors affect the products themselves or the yield; in sub-humid, semi-arid and dry regions, where NWFPs are relatively more important to local subsistence and economy, drought and forest/bush fires often affect the non-wood production of forests and trees;
- the traditional technologies that in most of the cases are used to process NWFPs vary from location to location, making standardization difficult if not impossible;
- the demand for NWFPs is very variable and susceptible to changes in mode and fashion; the chemical industry is always on the look-out to replace with synthetic products any NWFP when supplies dwindle or become erratic;
- a major weakness in promotion of NWFPs is that the markets of those with international significance are dominated by international trade forces, which establish prices beyond the influence of national institutions, producer groups and their organisations.

These elements should always be kept in mind when dealing with the institutional options and set-up for NWFP.

Economic Recognition of NWFPs

Except the hundred or so NWFPs that are internationally traded, national statistics offer hardly any reliable data to document their economic role. Information is scattered, anecdotic and irregular. Even data concerning these traded commodities are often not precise, at least at the production level. In the often remote producing areas, products circulate unrecorded from one region to another, and even across national borders. It is totally impossible to trace locally consumed products. In many countries, however, Forestry Department statistics based on figures provided by administrative arrangements for revenue collection (e.g. licensing practices and permits) allow some appreciation of the flow of products and related monetary circulation. This problem of the statistic survey of NWFPs is most difficult to solve, as harvesting areas are remote, harvesting and subsequent transactions on products are informal and elusive; but it is the most important step towards recognizing the role of these products in the economy of developing countries. The situation may be better in developed countries and countries in transition, in which more and more products are gaining national and international relevance and statistic services are getting more and more specific. Even in these countries, however, Parant (1991) notes the difficulty in properly assessing the economic circuit followed by NWFPs. Taking the case of mushrooms in France, he notes that part is commercialized and directly benefits the owner; another portion is fraudulently removed; a third part is directly consumed and a last portion is not harvested at all. Statistics, even well organised, can capture only a portion of the actual production.

In such a situation, good description of the potential remains useful and might be helpful; comparison of non-traded products with similar traded products may be a good alternative to sensitize producers, intermediaries and processors. The new efforts towards community management of resources and their integrated use will probably succeed in interested areas to reveal potential and opportunities and prod further development.

Organising the Harvesting of NWFPs

Harvesting is central to the sustainability of the resource and the economics of the product it sustains. It is essential to overall conservation of the producing ecosystem and to biological diversity. Yet only sporadic institutional support, if any, is currently provided to the harvesting of NWFPs. In many cases harvesting takes place in the realm of free and uncontrolled access, and with the pressure of urban markets has become destructive and turned to real plunder of resources. This is especially true in the case of edible products, the sale of which makes easy cash possible. In many cases, however, local groups have organised harvesting to minimize degradation of the resource and secure proper, balanced and equitable access.

The most publicized examples that come to mind are the ones of gatherers working in the Amazon region, especially the Amazonian *seringueiros* in their plea to get organised for a better use of the wealth of the Amazonian forest[3/]. This plea includes elements of better education of gatherers, organisation for better practices and marketing conditions, and promotion of social prosperity.

In close connection with the above situation, the recent moves to establish extractive reserves translate, in terms of management, into the need for social equity, low impact and sustainable use of resources and conservation of biological diversity. These moves are a management alternative for NWFPs, with minimum intervention on the ecosystem; they involve "other important benefits, such as genetic resources conservation and ecosystem protection" (Kageyama, 1991). Kageyama maintains

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3/ The extractive resources of this forest include a number of NWFPs which have drawn international attention, including the Brazilian nut from *Bertholletia excelsa*, the babassu from *Orbignia martiana* and *O. oleifera*, the tucuma fibre from *Astrocaryum tucuma*, the patau oil from *Oenocarpus batau*, the açai from *Euterpes oleacea* and the copaiba from *Copaifera langsdorfii*.

that "this proposition of land use is both socially fair to local communities, and ecologically compatible with the Amazonian ecosystem characteristics".

The present efforts for sustainable and participatory management of the forest hold strong promises for a new approach to forestry and forest management that: (1) takes account of the complete range of products and opportunities of the forest; (2) provides support for many non-timber uses of forests; and (3) helps local organisations to be full if not principal partners in the management, conservation and use of the forest resource. Many initiatives have been started in this vein, especially in management of dry forests, in which use of NWFPs is an unavoidable alternative.

New initiatives in the management of acacia stands in Sudan and Chad and management of sub-humid and dry woodlands in West and Southern Africa are examples worth mentioning. In these cases, the management schemes are participatory and multiple-use oriented, and also secure the conservation of local ecosystems and biological diversity.

In dryland Latin America, the *ejido* system of management of natural woodlands in Mexico, the Chilean type of mixed individual and communal (*lluvia común*) management of local natural resources are examples of land uses and resource management systems that promote common access and utilization of NWFPs and the conservation of the resource.

Many examples exist also in Asia, including the many documented indigenous forest management systems in Nepal, some of which are totally traditional and others supported by new development initiatives in which the local communities develop a set of simple rules that govern use and conservation of the resources. These rules include conditions of collection of dry fuelwood, collection of litter, and strict regulation (or prohibition) of live tree cutting.

Recognition of the need to develop new management approaches is a first step that will naturally pave the way to legislative, regulatory, educational and organisational measures that the state should take or facilitate for better use and development of NWFP resources.

However, one should not ignore the limitations facing all these extensive or moderately intensive management systems:

- their productivity is often limited;
- they may not appeal to people with no other complementary sources of income;
- they face difficulties related to common property management;
- they need inputs from research, education and extension that are not always forthcoming.

Legislation and Regulation

Forest legislation has been very limited in what concerns the extraction of NWFPs; most laws refer only to the indication that local populations could collect and use the secondary products, provided methods used would not harm natural regeneration and affect growing stock. In most advanced legislation, further developments and details may cover:

- the list of NWFPs for which access by neighbouring populations is free;
- conditions and limitations in harvesting;
- more rarely the quantities allowed, but often understood as limited to personal consumption;
- the necessary protection of regeneration areas.

Most regulations have neglected the physiological status of the material to be harvested, and offer no indication of maturity of edible items, or tapping intensity in the case of gums and resins, or intervals between removal periods of rattan or bamboo. These regulatory gaps are not damaging as long as traditionally experienced people are using the resources. However, when alien users or less experienced persons intervene (as always happens when a product gains market importance or when

drought and resulting poor crops increase the need for off-farm income), they introduce destructive harvesting methods that threaten the resource base.

Regulations regarding processing, transport and marketing of products exist for products generating important market demand. They have been often been introduced to:

- introduce corrective measures;
- safeguard the quality of produce;
- protect the producer or in some cases the entity engaged in marketing of the produce;
- normalize transactions.

Specifications dictated by international markets or processing units are often the source and base from which regulations are derived, leaving very slight possibility to the producer to intervene.

A balanced set of legal framework and regulation calls for the simultaneous intervention of national institutions, primary producers and marketing and processing circles. Such an approach has in some countries helped normalize practices. In the case of gum arabic in dry West Africa, producers, wholesale dealers and foreign processors are trying to establish linkages among themselves.

Marketing and Pricing

The characteristics mentioned in the section above, "Considerations on the institutional framework", should be taken into account in marketing NWFPs. Depending on a very variable source ranging widely in quality, they are not easily addressed by any marketing strategy. The primary producer has little leverage in shaping consumption patterns, and the market is largely dominated by demand. Questions to which a marketing strategy should respond are: how to know market needs; how to influence production to better respond to needs; how to secure sustained offer and capacity to respond to increase in demand; how to correct variability in quality of products often collected in natural systems. The producer needs information, contact, organisation and flexibility to respond.

The issues raised by proper marketing include local organisation of producers, information gathering and use, and organising assistance from the government or other public and collective entities.

To be able to influence the market, producers must get organised. Associations and cooperatives are indispensable to implement some of the educative, extension and training functions at the benefit of community. Such organisations may have many forms and be smooth or aggressive or politically oriented, depending on local and national situations. In many countries, it is likely that the move towards democratic approaches will give some political tones to local groups. These should be understood and proper assistance and suitable education and training facilitated. From the extreme cases of the Amazonian *seringueiros*, a number of gradations are possible; the best mix of concrete and objective needs and political expressions that serve the interest of the farmer or forest dweller should be promoted.

The knowledge of the demand itself, factors affecting it and its likely evolution are important elements for establishing a clear marketing strategy. The producers are not, in most cases in the position to gather such information. A number of facilitating linkages will be indispensable to the producer groups to secure credible market intelligence. The national economic services, development projects, NGOs and activist or humanitarian groups have often provided valuable assistance in such situations. In countries where national federations of cooperatives exist, they assist their member organisations in gathering relevant information on specific products; such services should be provided in a participatory way with a view to training beneficiaries to make them rapidly self-sufficient.

The pricing of products is an important issue. In many situations, it is an artificial process that goes from the imposed international market price and works out the farmgate price after deduction of

taxes, intermediary benefits, transport costs and handling risks. The producer plays little role in this process. All efforts the producer-group level should aim to establish an objective value for the product and for the producer's labour.

The Forest Resources and the Forest Products divisions of the Forestry Department of FAO are developing a forestry paper on the marketing of agroforestry products. This document would provide extensionists with some principles in marketing so as to better assist producer groups in the subject.

Institutional Structures in the Management and Use of NWFP Resources

Due to their variety and to the large range of uses in which they are solicited, NWFPs interest a number of statal institutions whose interventions are needed in many areas: harvesting, processing and final utilization. The issues to be considered relate to identifying the administrative units that should be responsible for the sector and the local organisations that should be set up to assist in development activities. Some preliminary considerations include:

- Due to the decentralized nature of the activities generating NWFPs, one could expect to have many institutions involved in the economic channels covering their handling from production to consumption.

- These institutions should serve as facilitators in resolving problems affecting the common access to and use of resources, the conservation and management of resources, technology assessment and transfer, and organisation of the framework in which activities will be developed.

- Local entities involving producers and processors should be preferred to heavy state involvement and the number of intermediaries should be minimised to secure larger profit to producers.

A short review of institutions usually involved in the development of NWFPs would include forestry departments, veterinary and livestock services, food crop services, health and medical services, industry services and the commerce services. The relative importance of each of these varies largely from one country to the next, and within countries from area to area, depending on the use and destination of the product considered. The multiplicity of interveners clearly demonstrates that this economic sector should be considered an area for cooperation and complementarity.

Forestry departments have of course played a central role in assessing and managing the resources. Within the forest estate, they have usually delivered the regulatory functions that govern access to resource and mode of harvesting. In many cases they have levied taxes and fees to legitimate the private use of the resources. The evolving roles of forestry administrations have de-emphasised taxation and sanctions and strengthened the development of community forestry and participatory management, creating a more relaxed interface between forest users and foresters. This situation is rapidly and positively evolving.

Veterinary and livestock services have been involved as users of fodder and browse, and managers of grasslands, but also in many countries as the institutional units in charge of beekeeping, and also involved in wildlife management. In dry regions, pastoral groups have developed an extensive body of indigenous knowledge on grazing practices, meat and dairy technologies and animal health. These have been collected in many areas by the veterinary and livestock services and their extension units.

Agricultural departments have been traditionally too focused on classic food production and, unless they have been in charge of livestock or forests, have not much contributed to the development of NWFPs. However, the conservation of traditional agricultural practices (broadly including trees,

and to-day, the development of agroforestry) offers occasions in which NWFPs have been promoted. In rather rare occasions, agricultural marketing assistance to farmers has included the sale of NWFPs.

Health and medical services have been very much engaged in investigations on the use and efficiency of medicinal plants, and also on surveying traditional healing practices based on the use of plants. In many cases they have contributed to interesting first approximations of the medicinal uses of plants in many regions. Their role will remain important in assessing the value of medicinal plants.

Research services, especially anthropologists, other social scientists and ethnobotanists, have largely contributed to the existing knowledge on the various uses of forest vegetation. The immense role that research will retain for a long time in the proper development of NWFPs give them a pivotal position in future programmes for their promotion.

The economic and statistical services have the important role of calculating into the national, regional and local economies the economic contribution of forests in general and NWFPs in particular. This integration has been far from adequate and much effort is still needed; new orientations of national statistics in their endeavour to include most natural resources and their products in national accounts will probably improve the situation.

The NGOs have contributed in documenting local knowledge, collecting traditional technologies, promoting use of NWFPs and income-generation activities. They have organised local groups. Their role is central in the future development of NWFPs.

Instead of placing emphasis on the leadership among institutions involved with NWFPs, the orientation should be on clearly identifying the need for support and the major functions to be carried out, stressing inter-disciplinary cooperation. This need is strong for political recognition of and policy considerations about NWFPs, assessment and management of the resources, information on resources and technologies, identification of opportunities and appraisal of potential at the community level, support from research for technology generation and transfer and organisation of trade and marketing.

Promoting Policy Options for NWFP Development

Some key aspects of policies to develop NWFPs have been developed here and there but not always in a systematic way. A number of these aspects seem to converge towards a compact of policy options that could only support the development of NWFPs. The following are some of the most important aspects:

- National forest administrations and economic and statistical services should definitely include NWFPs in their institutional set-up and their development and monitoring activities.

- The policy option of a truly integral development and conservation of forest and tree resources should be developed and implemented. This has been too much voiced in the past without enough follow-up.

- Almost all governments have adopted the policy of promoting local community participation, and forestry administrations are more and more considering them as full/principal partners in the development of all forest resources. This policy option is fundamental in the use of non-wood goods and services of forests. The policy of participatory forest management should be fully applied in a growing proportion of the forest estate.

- The policy of poverty alleviation and promotion of food security calls for the complete use of forest-derived food items and promotion of forest/tree-based income-generating activities, including NWFPs.

- The policy supporting conservation of biological diversity should be quite compatible with the development of sound harvesting methods of NWFPs.

- Promoting the rehabilitation of suitable tenure systems that conserve the resource base and respect equitable access to resources, and complementing this with modern legislation, are indispensable policy elements.

- Human resources should be developed through education at all levels and use of local knowledge and expertise at the maximum.

These elements that favour the development of NWFPs are featured in most national forestry policies. Their actual implementation is all that is presently needed to realize the potential of these products. Market conditions and forces should be investigated in each case to assess the economic wisdom of promoting specific products.

Research and Development

Research is essential at any step in the use of natural resources. As NWFPs are still to be better known, they need research on: better assessment of the resource and products; management and harvesting practices; processing technologies; and regeneration of individual species, either within the natural ecosystems or through establishment of plantations. The social and socio-economic background of the harvesting and overall economics of NWFPs need also to be better studied. Community involvement would command further investigation from the social sciences.

Forestry research institutions seem to have had the same problems of resources and priority setting in the area of NWFPs as forestry administrations. Although some forestry research institutions have been active very early in their identification and study, the general situation, especially in developing countries, has been of neglect or indifference. On the other hand, a number of non-forestry research organisations have been involved, especially in the study of potentials for production of oil seeds and medicinal plants.

National-Level Considerations

National research institutions: The mandate of national forestry research very clearly includes NWFP research . Research on the presence, use and management of the resources comes mainly under the aegis of forestry or agroforestry research, but also interests all national research institutions dealing with conservation. Whatever the institutional set-up for research, a clear agenda for non-wood products is needed that should back any policy initiative. The objectives of such an agenda should include: (1) the effective definition of a programme; (2) the identification of actors, as the interdisciplinary nature calls for shared responsibility; (3) the definition of the programme elements that would respond more rapidly to the needs and questions, including:

- better knowledge of the resource and products;
- defined management methods for the resource and their natural or artificial regeneration;
- improved technologies;
- genetic improvement and vegetative reproduction.

For wild fruit and other food trees, these last two elements are of special importance in the enhancement of the contribution of forest to food security.

Beyond the remit of the research institutions dealing with the primary resources and raw products, a number of research topics concern the final products and their various formulations and conditioning. This research, often in the areas of food technology, pharmacy and cosmetics, holds much promise for many species that are presently underutilized. Examples common to many tropical regions of limited resources includes *Azadirachta indica*, so much researched and still quite underused;

Vitellaria paradoxa, which is just being explored for a promising cosmetics industry; *Jatropha curcas* for energy production; and many other promising food species.

Regional and International Considerations

Cooperation between countries needs to be further developed; a number of cooperative arrangements among research centres should be investigated. Lindell (1991) recognized the need for more cooperation between research institutions dealing with forest products. The programme he suggested is also valid for non-wood products, and includes the elements of: (1) twinning under the aegis of IUFRO; (2) supporting specific cooperative programmes in developing countries in a number of ways, such as through developing common projects, sponsoring training for researchers, and donating surplus library equipment; and (3) exchanging scientists.

Cooperation between developing countries in the region has the advantage of exchanging experiences valid under similar socio-economic conditions. A number of countries which have been very active could share their rich experience within the same region or among regions. This consultation and the interregional Nairobi Workshop on Agroforestry, co-organised in May 1994 by ICRAF and FAO, represent initiatives that promote this indispensable cooperation.

In Asia, the FAO programme developed for Forestry Research Support for Asia-Pacific (FORSPA) provides a regional institutional framework to promote an Asia-Pacific research agenda, at least on NWFP resources. Some national institutions already very strong in the study of NWFPs could be identified as centres of excellence on specific commodities.

Although there is no such programme in Latin America, a number of networks (agroforestry, dry land development, wildlife and protected areas) could identify areas for cooperation to be spearheaded by several strong institutions.

In Africa, the objectives of the programme being prepared to support forestry research and forest research networking in sub-Saharan Africa (FONESSA) have identified development of NWFP resources as a priority area.

The AFC/EFC/NEFC Committee on Mediterranean Forestry Questions considers NWFPs in the work of the networks on stone pine, cork oak and multipurpose species for dry lands.

Research on NWFPs in the CGIAR agenda: There is scope for strong support from the Consultative Group on International Agricultural Research (CGIAR) system for NWFPs. As these products can potentially contribute to alleviating poverty and contributing to food security of the poor through production of food items and rural employment, they are at the centre of the CGIAR objectives. The Centre for International Forestry Research (CIFOR) includes NWFPs broadly in its work, in the programme, Conservation and Management of Natural Forests. The activity relating to Management for Diverse Products features sustainability of non-wood forest production in traditional forest management systems. The Products and Markets programme includes activities on: management for NWFPs by local communities; market requirements and possibilities for under-used, NWFPs; and expansion and harmonization on properties and uses of tropical timbers and non-timber forest Products. The whole programme of the International Centre for Research on Agroforestry (ICRAF), especially the Multipurpose Tree Improvement and Systems Improvement programmes, are relevant to non-wood tree production. The International Plant Genetic Resources Institute (IPGRI) has become much aware of the needs of forestry in the conservation and management of plant resources. The whole CGIAR system will hopefully support cooperative programmes and networking initiatives on research on NWFPs at national and regional levels.

Capacity Building and Information

Education, training and information are the areas of most urgent need for sustained action for the development of NWFPs. Original approaches are necessary, as a considerable amount of knowledge and expertise is available at the level of the population. Assessing this knowledge and incorporating it in any capacity-building initiative is a challenge much stronger here than anywhere else. Also, with many non-wood products, there is a strong cultural basis, the understanding of which is indispensable as it determines the degree of acceptability of modifications of the technologies or product characteristics. This consideration also highlights the need, at the vocational level, to use the local skills and technologies and promote their dissemination among community groups.

Education for NWFPs should cover the whole range from general information and awareness-raising to specialization.

Information and awareness-raising: So little is said or disseminated on the existing resources, on traditional and local skills for processing these resources, knowledge among ethnic and community groups, and the overall potential and role of NWFPs.

Local transfer of technologies and skills: Many cases exist of a resource being intensively used in one area and totally ignored elsewhere in the same country. In many cases, when no cultural barriers exist, this underdevelopment could be remedied with some exchange between groups to transfer know-how (e.g. basket weaving, processing of edible items). Such exchanges, often effected by local development projects and NGOs, should be encouraged and promoted.

Primary education: The exposure to natural sciences, geography and knowledge of village or local land should include local resources and products, particularly non-wood forest resources and their contribution to local economy. Applied manual work should start developing children's skills.

Secondary education: Secondary education should continue the work started at primary school and include within programmes of education relating to the environment, the economic potential of all local resources, including NWFP resources. Awareness-raising should prepare vocations and provide students with information needed by those who envisage early settlement or would otherwise "drop out".

Job-oriented training, vocation and professional training: The 17th Session of the FAO Advisory Committee on Forestry Education examined NWFPs in forestry education; the suggestions made then to enhance the content of NWFPs in Forestry Education and Training (Chandrasekharan, 1993) are quite adequate and are reproduced in Table 1.

To conclude this section on education, the following points are highlighted:

- The wide range and nature of NWFPs may not authorize a compact set of education/ training needs to be tackled by classical educational institutions. A pragmatic approach should consider a strategy aiming at: (1) increasing by all means the awareness and knowledge about non-forest resources and products; and (2) establishing for each group of products a specific capacity building programme. This should be facilitated by previous inclusion of NWFPs in national policy and planning.

- Forest education institutions should consider, according to their location, special courses on selected products for which they may have excellence. This would be facilitated by the basic acceptation by forest educators to review, adapt and enlarge their curriculum to better meet the various needs of the society and the evident potential of regional, national and local resources.

Table 1: Suggestions for enhancing the content of NWFPs in forestry education and training

Level of Education/Training	Suggestions
Specialization	• Increase the areas and avenues of specialization to include aspects and interfaces related to NWFPs • Promote research and post-graduate work related to NWFPs in universities • Support multidisciplinary approaches and programmes in specializations • Encourage both pre-service and in-service specializations in areas related to NWFPs
Pre-Service	
Professional/Managerial	• Provide better balance of courses by adding/incorporating relevant NWFP topics • Establish facilities for teaching subjects related to NWFPs including teaching materials, reading materials, improved methods and qualified teachers • Widen the base for student selection allowing diverse skills into forestry • As part of the instruction, incorporate NWFPs in planning and policy analysis at the sectoral level and in studies related to inter-sectoral linkages
Technical and Vocational	• Establish new facilities for training in the different aspects of NWFP management and utilization, and for specific products, as relevant • Improve the existing facilities in polytechnic institutes and forestry schools by incorporating courses on NWFPs
In-Service	
Professional/Managerial	• Upgrading/enhancement training to keep up with technical, scientific and methodological developments • Refresher training
Technical and Vocational	• Short training programmes on specific aspects of NWFPs or technology related to specific non-wood products • Retraining related to the use of tools and techniques
Extension and Public Information	• Establish and/or strengthen the system of extension and information dissemination including materials and methods related to conservation and sustainable development, cultivation and management, harvesting, processing, marketing and trade of NWFPs, aimed at target groups — farmers, rural groups, processing establishments, trading organisations and academic community

Source: C. Chandrasekharan (1993).

- Forestry departments, training and research institutions should endeavour to study and disseminate the enormous wealth of technologies and practices rapidly falling in obsolescence or oblivion, but which should be documented, conserved and/or eventually put back to use.

- Exchange among community groups, countries and regions should be explored to assist in a better use of resources, through informal training, workshops, visits, etc.

CONCLUSIONS AND CONSIDERATIONS FOR THE FUTURE

Many of the institutional aspects discussed in this paper are not exclusive to NWFPs. It is very clear that they also concern many other aspects of national development to which their promotion is very tightly linked. The concluding discussion should, however, help focus on ideas for solutions to the most important clusters of concerns, problems and constraints that hamper their development. Eight areas of concentration are proposed.

Set up a specific policy to promote NWFPs: It would be over-optimistic to think that comprehensive policy-setting exercises will easily and rapidly take place; there is therefore merit in reviewing all areas of national development and identifying the pertinent policy elements that favour development of NWFPs. These should then be regrouped, eventually completed and made coherent for use in the particular need of NWFPs. This exercise should be encouraged by the responsible services in charge of NWFPs and NGOs and interested operators and groups.

Put together relevant administrations and institutions to assist in a coherent way the development of NWFPs: The sector of NWFPs needs focused governmental assistance of an interdisciplinary and cooperative nature; efforts should be made to bring the interested administrations together to better deliver the state role collectively. Groupings such as councils and boards should be explored.

Promote knowledge of and safe access to resources: This requires that (1) national services assessing natural resources, in particular the national forest inventory units, are given enlarged mandate and orientation to integrate progressively identification and evaluation of non-wood forest resources; and (2) that measures and specific actions are taken when necessary to remove institutional limitations to access.

Respond to needs for legislation and regulations: Legislation, when essential to the use and conservation of resources, should be taken and reinforced. It is, however, more likely to be effective when inspired by genuine need and enlightened by local and traditional knowledge and experience. Laws then will be made with and not against users and will guarantee safe — that is *sound* — and *legal* access to resources.

Assess and improve technologies: The operational tool of this is research, but institutional facilitating measures are needed, such as the involvement and interest of institutes of food technology in the production and processing of food from the forest, and the organisation of commodity based groups.

Organise producers: The already rich experience gained by local groups, NGOs and also in many cases by some administrations (including forestry administrations) should be expanded. Initiatives relating to networking, exchanges among producer groups and at a larger level, technical cooperation among developing countries (TCDC) should be encouraged.

Build capacity and promote human resources: This task needs a larger than usual approach, involving professionals of training and education extensionists, but also local groups and communities and experienced artisans. The objectives are not only to train skilled human resources and specialists, but also to raise awareness and provide resource conservation-oriented education and culture. Local values should not be neglected in the process.

Look forward with research: Broad-based cooperation should be encouraged to facilitate establishment and cooperative implementation of a wide spectrum research agenda, including management of the resources, the forest/agriculture interface and agroforestry, harvesting practices, improvement of producing species, processing technologies and socio-economic considerations.

REFERENCES

Anderson, K. 1991. Wild plant management: cross-cultural examples of the small farmers of Jaumove, Mexico and the Southern Miwok of the Yosemite Region. In *Arid lands newsletter* 31. Tucson, Arizona, University of Arizona.

Anonymous. 1988. La forêt nourricière. Nogent-sur-Marne, France, *Silva* 6.

Anonymous. 1991. Community-based ecosystem management for Humla, Nepal. Kathmandu, Appropriate Technology International.

Bergeret, A., and Ribot, J.C. 1990. L'arbre nourricier en pays sahélien. Nogent-sur-Marne, France, Silva.

Bradley, P.N. and McNamara, K., eds. 1993. Living with trees: policies for forestry management in Zimbabwe. World Bank Technical Paper No. 210. Washington, DC, The World Bank.

Broekhaven, G. and Murrieta, J.R. 1994. Extractivism and potentiality of multiple use forest resources in Africa. Report of a workshop held in Kenya, 8-13 May 1994. Gland, Switzerland, IUCN/EU.

Castro, A.H.P. and Brokensha, D. 1987. *Institutions and food security: implications for forestry development*. Rome, FAO.

Chandrasekharan, C. 1993. Non-wood forest products in forestry education. Paper presented to the FAO Advisory Committee on Forestry Education, Bangkok, Thailand 13-15 December 1993. Rome, FAO.

Chao, Zhongyi. 1991. The exploitation and utilization of Caragana seeds and their relationship with shelterbelt establishment. *Proc. 10th World Forestry Congress*, Vol. 6, 131-139.

Chauduri, D.C. 1994. Future strategies of researches on medicinal plants. *MFP News* 4(1). Dehra Dun, India, Non-Wood Forest Product Division, Forest Research Institute.

FAO. 1989. *Review of forest management systems of tropical Asia*. Forestry Paper No. 89. Rome, FAO.

FAO. 1991. *Non-wood forest products: the way ahead*. Forestry Paper No. 97. Rome, FAO.

FAO-RAPA. 1992. *Local organizations in community forestry extension in Asia*. Bangkok, FAO-RAPA, Regional Wood Energy Development Programme for Asia-Pacific.

FAO. 1992. *Small-scale forest enterprises*. Forestry Paper No. 79. Rome, FAO.

FAO. 1993. Development of non-wood forest products in Latin America and the Caribbean. Secretariat Note of the 18th Session, Regional Forestry Commission. Rome, FAO.

FAO. 1994a. Advisory Committee on Forestry Education: Report of the 7th Session, held in Bangkok, 13-15 December 1993. Rome, FAO.

FAO. 1994b. Report of the 17th Session of the Programme Committee, 12-16 September, 1994. Rome, FAO.

Guinko, S. and Pasgo, L.J. 1991. Récolte et commercialisation des produits non ligneux des essences forestières locales dans le département de Zitenga, Oubritenga. Burkina Faso.

Kageyama, P.Y. 1991. Management of forests for non-wood products: the case of extractive reserves in Brazilian Amazonia. *Proc. 10th World Forestry Congress*, Vol. 4, 369ff.

Lindell, G. 1991. Role of the forest products laboratory in facilitating international forestry cooperation in forest products. *Proc. 10th World Forestry Congress*, Vol. 6, 39ff.

Maldonado Aguirre, J.L. 1986. *Sistemas de manejo por le vegetación leñosa en zonas aridas y semi-aridas en Mexico*. Rome, FAO.

Messerschmidt, D.A. and Hammett, A.L. 1993. Indigenous knowledge of alternative forests resources extraction and marketing: significance for community forestry planning and management. *Banko janakari* 4(1).

Mok, S.T. 1991. Production and promotion of non-wood-forest products. *Proc. 10th World Forestry Congress*.

Parant, N. 1991. La filière économique des produits secondaires de la forêt. *Proc. 10th World Forestry Congress*, Vol. 6, 131-135.

SARH (Subsecretaría Forestal y de la Fauna). 1993. Mexico City, PROAFT (Programa de Accíon Forestal Tropical).

Vantomme, P. 1991. Importance of non-wood forest products for the regional trade in the Brazilian Amazon. *Proc. 10th World Forestry Congress*, Vol. 6, 119-124.

Von Maydel, H.J. 1986. *Trees and shrubs of the Sahel: their characteristics and uses*. Eschborn, Germany, GTZ.

TERMINOLOGY, DEFINITION AND CLASSIFICATION OF FOREST PRODUCTS OTHER THAN WOOD

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ABSTRACT

The contributions of forest products, particularly of products other than wood, are not adequately valued to reflect their importance. The establishment of appropriate terminology, clear definitions and a system of classification of products and activities can help to improve the situation.

On reviewing the different terms currently in use for economic forest products (goods and services) other than wood, the paper proposes the term *non-wood forest products* (NWFPs) as appropriate for universal use. The paper proposes a simple definition: *"Non-wood forest products include all goods of biological origin, as well as services, derived from forest or any land under similar use, and exclude wood in all its forms"*. Non-product benefits, influences and work in progress are proposed to be part of, or improvements to, capital forest stock, rather than treating them as part of NWFPs.

The paper calls for an adequate system of classification and statistical compilation for NWFPs, and emphasizes the need for considering the total value of forests in an integrated manner in the System of National Accounts. It also proposes a framework for international classification of NWFPs suitable for adoption and use at the national level. The framework corresponds generally to the Central Product Classification at the aggregate level and is harmonized with other systems. There remains a need to assign an appropriately defined place for forestry, with adequate treatment of NWFPs, in the International Standard Industrial Classification of All Economic Activities (ISIC), probably as a separate annex.

The paper recommends the elaboration, implementation and refinement of a classification system for NWFPs by stages.

INTRODUCTION

The contributions of the forestry sector to the socio-economic domain of human life have been known for ages. These include both wood and non-wood products. Yet their valuation is limited essentially to wood products. It is necessary not only to value the non-wood products of the forests, but also to identify them clearly.

Agenda 21 and Forest Principles adopted at the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992, identified forest products other than wood as an important area requiring increased attention, as a source of environmentally-sound and sustainable development.

As a broad group, the forest products other than wood exhibit a high degree of heterogeneity in terms of their source, production systems, characteristics, and utilization. These products, of both plant and animal origin, fall under a large number of product groups, with each group having considerable variety. In order to understand their scope, boundaries, and linkages, it is necessary to

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have appropriate terminology, clear definitions of terms, and an adequate system of classification. However, these are lacking for the group of forest products other than wood.

The ISIC divides economic activities into several sectors. According to this classification, activities related to NWFPs are spread over a number of different activity sectors. Because of this, any assessment of the contribution of forest products other than wood, using ISIC as a basis, requires a cross-sectoral approach.

This paper attempts to point out the nature and magnitude of the problem involved in these regards and how they can be addressed.

TERMINOLOGY

Terminology refers to the system of words used to express and delimit definite concepts in different disciplines of study. Here we will confine ourselves to the appropriate term to represent all forest products other than wood. Several terms are seen used in dealing with these products. Scope and coverage of these terms are somewhat different. In some cases, their coverage varies depending on the situation. Others are vague about their scope and coverage. In spite of the differences, they are often used interchangeably.

The following are some of the terms in use:

- minor forest products;
- other forest products;
- other economic forest products;
- special forest products;
- non-wood forest benefits;
- non-wood goods and services;
- non-timber forest products;
- NWFPs.

The term *minor forest products*[2/], which has been in use for many years in some countries, assumes timber or wood as the major product. But timber is less important in some countries compared to other forest products, for example gums and resins. Terms based on assumed importance tend to be inconsistent. Since what is minor in one situation may be major in another, the term is not appropriate for universal application.

The terms *other forest products* and *other economic forest products* (apart from the vagueness of what is economic or otherwise) suffer similar inconsistencies and inadequacies. Since the main forest product(s) varies from one situation to another, the composition of *others* also varies.

The term *special forest products* is also vague about its coverage and scope, as it refers to particularity and can change from situation to situation. Moreover, it does not refer exclusively to products other than wood.

Due to its all-embracing nature, the term *non-wood forest benefits,* covering marketable and non-marketable as well as measurable and non-measurable benefits, frustrates attempts at a proper definition of its scope and quantification of benefits. Also, forest influences/benefits such as watershed

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2/ As far as the author is aware, only Minor Forest Products (MFP), among the terms mentioned, has a definition authorized by the Joint FAO/IUFRO Committee on Forestry Bibliography and Terminology. Having defined major forest products as timber and fuelwood, MFP is defined as all others, including leaves, fruit, grass, fungi, resins, gums, animal parts, e.g. hides and horn and — in some regions more important than any other product — water; also soil, gravel, stone and other minerals on forest land.

values, environmental conservation, amenity values, etc., cannot be categorized as either wood or non-wood. They are generated by the forest ecosystem as a whole, and not only by wood or non-wood.

In the term *non-wood goods and services*, the word *services* is often interpreted to include environmental influences of forests, scenic beauty, heritage values and so on, even though services in the strict sense are *products* or services produced (e.g. managed grazing).

The terms *non-timber forest products* and *non-wood forest products* are comparatively precise and suggestive of their scope. A tendency is however seen often to use the words *timber* and *wood* loosely and interchangeably.

It is likely that all these terms will continue to be used in a general way in describing different situations. It is, however, necessary that an appropriate term be decided upon for universal use and for purposes of scientific investigations.

The key words/terms to be considered in this regard are:

Forest	A plant association predominantly of trees and other woody vegetation.
Wood	Stem, branches and roots of plants/trees characterized by lignified, water-conducting, strengthening and storage tissues.
Timber	Wood in forms suitable for heavy construction; sawnwood of more than a specified width and thickness; excludes fuelwood, wood for carving, pulp wood, small wood.
Goods	Things, articles, objects worth attaining; movable properties; merchandise; wares; services of valve. An economic good is defined as any physical object, natural or man-made, or service rendered, which could command a price in a market.
Services	Provision of assistance; act of serving; work done to meet some needs; intangible, non-transferable economic goods, as distinct from physical commodities.
Products	Things/substances/articles produced by a process; output of goods and services resulting from the input of resources or factors of production used to produce them.
Benefit	Advantage; favourable effect; output; profit. In forestry, includes products and favourable influences.
Non-	As a prefix, it is freely used as a short form to mean *other than* and does not imply lack of importance or other negative connotations.

It is the view of the author that the term *non-wood forest products* is more specific in its scope, precise and consistent, has greater universal applicability and incorporates components which are better quantifiable. It excludes all products/commodities which retain their characteristics as wood. Within its scope, it will be necessary to include products (apart from those from non-woody plants and non-woody parts of woody plants) derived by processes of chemical extraction and destructive distillation of wood, e.g. sandalwood oil, bio-diesel.

Many of those forest products other than wood are also produced in non-forest land. Considering them as forest products will be anomalous. Therefore, it becomes necessary to identify and classify sources. Accordingly, the adjective *forest* qualifies the product. Forest products should cover only those originating from forests or obtained from a system of land use which can be included under the general heading of forestry.

DEFINITION

The proper use of terms conveying specific concepts requires that they be defined adequately. Since definitions serve to interpret the scope and coverage of the term, different definitions are likely depending on the purpose for which, or the situation wherein, they have been made. The importance of having a clear, consistent, generally-acceptable and universally-applicable definition — particularly for international use and exchange of information — cannot be overstated.

The term *non-wood forest products* is a relatively new term used generally to mean forest products other than wood. This term therefore is not seen defined in the dictionary or glossary of technical terms relevant to forestry (forestry terminology). However, several proposals can be found in reports, proceedings of meetings and so on.

From a legal point of view, forest products are defined in some countries as *all those products found in or brought from a forest*; and forest is any land classified as such under law. Under this definition, forest products other than wood would include soil, sand and stones (and also water in some cases).

One attempt at defining NWFPs reads as follows: *NWFPs can be defined as all goods and services for commercial, industrial and subsistence use, other than wood, derived from forests and their biomass which can be sustainably extracted, i.e. extracted from a forest ecosystem in quantities and ways that do not alter its basic reproductive functions* (FAO, 1992). By implication, this definition is concerned with products of plant origin, from natural forests. Also, the use to which the product is put, ways of sustainable extraction and basic reproductive functions are extraneous to product definition.

The Expert Consultation on Non-Wood Forest Products for Asia and the Pacific, held in Bangkok, Thailand in November 1991, adopted a definition applicable to most countries of the region:

> *The term non-wood forest products implies all renewable and tangible products, other than timber, firewood and charcoal, derived from forests or any land under similar use as well as woody plants. Thus, the products like sand, stones, water, eco-tourism will be excluded.*

This is a clear statement, but as a product definition it has some problems. Renewability is a management concept and outside the scope of product definition. By confining it to tangible products, or commodities, it excludes produced services such as camping grounds, grazing blocks, hunting/viewing of wildlife, etc. Products from *woody plants* tend to include horticultural products such as apple and mango. This does not appear rational.

The Regional Expert Consultation on Non-Wood Forest Products for Africa, held in Arusha, Tanzania in October 1993, proposed a definition similar to the one for Asia, but specifically mentioned faunal products:

> *All vegetal and faunal products (other than wood) derived from forests and other wooded land and trees outside the forests; excluded are industrial round wood, wood used for energy, horticultural and livestock products.*

Including products from all trees outside forest irrespective of the type of land use may lead to some of the same problems explained earlier. Specific exclusion of industrial round wood only would imply the inclusion of non-industrial round wood used in rural construction, handicrafts, etc.

The Expert Consultation on Non-Wood Forest Products for Latin America and the Caribbean, held in Santiago, Chile, in July 1994, suggested a formulation very similar to the one proposed at the Africa Regional Expert Consultation in Arusha[3/].

Based on discussions at several levels of the different proposed definitions, a modified version for international use is suggested as follows, to be considered by the Consultation:

> *Non-wood forest products include all goods of biological origin, as well as services, derived from forest or any land under similar use, and exclude wood in all its forms.*

This modified version takes the aspects discussed earlier into consideration. Only products of biological origin are included, as it is not rational to consider soil, sand, stones, water, etc., as forest products. Services such as gazing and camping facilities, wilderness trails, viewing and hunting of wild life, etc., as distinct from environmental influences, are included. Benefits such as watershed values, environmental conservation, and protection of biodiversity are forest influences to be considered separately, and mixing them with NWFPs appears inappropriate. Exclusion of wood in all its forms is meant to cover timber, poles, small wood, small-dimension wood materials, and wood fuel (including fuel wood and charcoal)[4/].

Forestry sector covers more than the large stretches of forests and includes other woodlands. NWFPs can be derived from lands managed under systems similar to forestry (village wood lots, farm forests, agro-forestry plots), and therefore, the *forestry origin* of the goods and services should be understood in the proper context and interpreted accordingly.

The existence and adoption of an agreed and acceptable definition of universal applicability (and for international use) should not prevent countries and regions from developing their own definitions to meet their specific needs. Actually, national definitions can be made consistent with an international definition, by indicating where and how their scope has been changed[5/].

A rational system of classification of NWFPs can help to improve the compatibility of definitions.

CLASSIFICATION

IMPORTANCE AND SCOPE

The word *class* refers to a group of things having the same or similar characteristics, and *classification* refers to assignment to, or arrangement by, hierarchical classes. In arranging by classes, classifications provide a rational system of relationships wherein distinction and coherence between elements are put into shape by a logical structure and ordering, within defined boundaries.

Classifications are essential to help provide data by homogenous categories and to display interconnections between categories. By providing boundaries to classes and avoiding overlaps and

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3/ In Spanish it reads: "Todos los productos vegetales y animales y servicios derivados de los Bosques y Otras Tierras Forestadas y de Arboles Fuera del Bosque excluyendo la madera rolliza industrial, la madera para energía y los productos hortícolas y animales domésticos".

4/ Charcoal being a product of incomplete combustion is treated along with fuelwood. Details of production and trade in charcoal are also currently being reported under forest (wood) products. Liquid fuel of forest origin in the form of alcohol and bio-diesel will fall under non-wood products.

5/ Apart from defining the encompassing term non-wood forest products, it is also necessary to define and/or provide notes on the component items of products. In most cases, these do exist under the different systems of product/commodity classification.

inconsistencies, classifications add to the clarity and comparability of information. Classifications are thus important for data gathering and management, scientific investigations, analysis and evaluation of trends and outlook, aggregation and dissemination of information, planning and policy making. By following classification systems, bridges can be built between various statistics even when different units are used.

Product classification, specifically, helps to trace the flow of goods and services through the economic systems from the producers to the eventual users and facilitates systematic analysis of trade to support development. It helps to assess relative importance of the classes of products and indicates substitution possibilities.

Nature and details of classification are decided by considerations influencing its rational structure and relationship with other systems. In designing a product classification, it is necessary to consider one or more of the following: source and nature of raw materials; intermediate products; production systems and technology; primary products; nature of goods and services; end uses and contribution to economy.

Details and scope of classification are enhanced by adopting a multi-digit coding system. Coding criteria are based on the relationship of the categories, divisions, groups and specific headings involved, where successive digits of the code represent hierarchical relationship. For example, the products nutmeg and mace are classified under three major international systems of classification as follows:

1. Harmonized Commodity Description and Coding System (1987)

09	:	coffee, tea, mate and spices
0908	:	nutmeg, mace and cardamoms
090810	:	nutmeg
090820	:	mace

Note: The last (sixth) digit can be used to indicate specific quality/type/source of the product

2. Standard International Trade Classification Rev. 3 (1986)

0	:	food and live animals
07	:	coffee, tea, cocoa, spices and manufactures thereof
075	:	spices
0752	:	spices, except pepper and pimenta
07525	:	nutmeg, mace and cardamoms

Note: Additional digit(s) can be added to desegregate the products under the specific heading.

3. Provisional Central Product Classification, 1991

0	:	agriculture, forestry and fishery products
01	:	products of agriculture, horticulture and market gardening
016	:	beverage and spice crops
0162	:	spices whether or not processed
(01620)		

Note: Additional digit(s) can be used to specify spices and their types.

In an interdependent world where exchanges in the form of trade and technology transfer are common, standardized international classifications are essential to promote such exchanges as well as to facilitate inter-country comparisons and analysis of comparable information. Such international classifications of universal applicability provide a flexible framework and structure for collecting, collating and aggregating statistical information. These can serve the purpose of countries with modifications as necessary. Countries can add digits to the code for country-specific use or gather/provide information only at the aggregated digit levels as appropriate or possible. It is also possible to add new items specific to some countries, using unallocated numbers at appropriate digit levels.

EXISTING INTERNATIONAL SYSTEMS

In order to understand how an international classification for NWFPs can be developed and harmonized with the existing systems of other relevant international classifications, we may briefly review the following:

- International Standard Industrial Classification of all Economic Activities (ISIC), Rev. 3, 1990;
- Standard International Trade Classification (SITC), Rev. 3, 1981;
- Harmonized Commodity Description and Coding System (HS), 1987;
- Provisional Central Product Classification (CPC), 1991;
- System of National Accounts (SNA), 1993.

International Standard Industrial Classification of All Economic Activities (ISIC)

The ISIC defines an industry as the set of all production units engaged primarily in the same or similar kinds of productive economic activity. Such an activity is characterized by an input of resources, a production process and an output of products.

The ISIC consists of 17 tabulation categories[6/], 60 divisions, 159 groups and 292 classes, each of them with specified scope and coverage. The classes of activities under ISIC represent the industry of origin (i.e. the activity leading to the production) of products classified elsewhere. In this regard, it is harmonized with the commodity description and coding system so that the activity and the resulting product can be related.

Statistical classification reflects compromises between theoretical principles and practical considerations, and it is difficult to meet all the needs for aggregated data, by simple aggregation through various levels of ISIC. It has therefore included annexes covering cross-classification of industries. This helps an international understanding about the combination of activity categories that could be regarded as representing a particular sector. ISIC Rev. 3, 1990, has included annexes dealing with activities related to two sectors, namely energy and tourism. The list of annexes is open-ended and more can be added in the future.

6/ The 17 tabulation categories are: agriculture, hunting and forestry; fishing; mining and quarrying; manufacturing; electricity, gas and water supply; construction; wholesale and retail trade including repairs; hotels and restaurants; transport, storage and communications; financial intermediation; real estate, renting and business activities; public administration and defence; education; health and social work; other community, social and personal service activities; private households with employed persons; and extra-territorial organizations and bodies.

Since ISIC includes all economic activities, its four-digit coding[7/] allows only broad classes. The classes of activity which have (or could include) forestry components (related to wood and NWFPs and services) are the following:

0111	Growing of cereals and *other crops* n.e.c.;
0112	Growing of vegetables, horticultural specialities and nursery products;
0113	Growing of fruits, nuts, beverage and spice crops;
0122	Other animal farming; production of animal products, n.e.c.;
0150	Hunting, trapping and game propagation, including related service activities;
0200	Forestry, logging and related *service activities*;
1511	Production, processing and preserving of meat and meat products;
1513	Processing and preserving of fruits and vegetables;
1514	Manufacture of vegetables and animal oils and fats;
1549	Manufacture of *other* food products, n.e.c.;
1820	Dressing and dying of fur; manufacture of articles of fur;
1911	Tanning and dressing of leather;
All classes under division 20	Manufacture of wood and of products of wood and cork; manufacture of articles of straw and plaiting materials;
All classes under division 21	Manufacture of paper and paper products;
2423	Manufacture of pharmaceuticals, medicinal chemicals and botanical products;
2429	Manufacture of other chemical products, n.e.c.;
2519	Manufacture of other rubber products;
3699	Other manufacturing, n.e.c.;
9249	Other recreational activities;
9309	Other service activities, n.e.c.

The explanatory notes on the classification indicate what are included under each class of activity, as well as exclusions.

It is difficult to clearly recognize NWFP-related activities in the classification and they mostly fall under the residual classes, i.e. others or those not elsewhere classified/specified. Even the division (02) related to forestry has only one activity which is a "catch all" for forestry, logging and related services activities.

Once a classification for NWFPs is developed, it will be possible to relate them to the relevant activity classes.

Standard International Trade Classification (SITC)

The SITC is a classification made according to physical properties of the product, duly considering the materials from which the product is made and also the stage of fabrication and industrial origin. The main purposes of SITC are to help international comparison of product situation, provide greater comparability in foreign trade and provide a basis for systematic analysis of world trade. Thus, only commodities entering external merchandise trade are included. In SITC, Rev. 3, the

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7/ First two digits represent the division, third digit the group and fourth the class.

products are classified into ten sections[8/], 67 divisions, 261 groups and 1,033 sub-groups. Seven hundred twenty sub-groups are further divided into 2,805 items, providing 3,118 basic sub-groups. All products are provided as precise a definition as possible.

SITC, Rev. 3, follows a five-digit coding. To illustrate:

Section	0	Food and live animals
Division	05	Vegetables and fruit
Group	057	Fruit and nuts (not including oil nuts)
Sub-group	0577	Edible nuts, fresh or dried
Basic item	05772	Brazil nuts
	05775	Hazel nuts
	05776	Walnuts
	05777	Chestnuts
	05779	Edible nuts, fresh or dried, n.e.s., whether or not shelled or peeled

The basic headings can be further divided by providing additional digits as desired for meeting specific needs of the countries. For example, there are a number of edible nuts of forest origin which are not specifically mentioned (e.g. gnali nuts from *Canarium* spp.). It is possible for countries to add a sixth digit to 05779 to include such edible nuts.

The classification also allows for adding new items at various digit levels. It is also to be noted that one out of ten sections (section 9) deals with commodities and transactions not classified elsewhere in SITC.

Since the classification covers only internationally-traded commodities and is dealt with under a five-digit system (compared to the four-digit system for ISIC), it is quite detailed. SITC provides a number of specific headings relevant to NWFPs and covers:

> Live plants and parts of plants; live animals/birds; seed materials for sowing, bulbs, tubers; flowers and foliage; wild meat, eggs and fish; wild vegetables, mushrooms, truffles; fresh or provisionally-preserved fruits; other edible parts of plants; edible nuts; oil seeds and nuts; syrups and sugars; honey; beverages; spices, flavourings; gums, balata, gutta percha, chicle and other natural gums; resins and related products; materials used for perfumery, pharmacy/medicine, insecticides, fungicides; fodder and feeds; cork and cork products; natural fibres; animal hair; cocoons and raw silk; yarn and ropes; non-wood ligno-cellulosic raw materials; pulp/hand made paper; bio fuels, excluding fuelwood; bio-fertilizers; plaiting materials, bamboo, rattan (including non-wood construction materials); hides, skins and furs; mats, felts, hats, bags, baskets; non-wood furniture; stuffing, brooms, brushes; other products of (wild) plant and animal origin; feathers, plumes, horns, ivory; oils, fats and waxes of plant and animal origin; organic acids and chemicals; rosin, turpentine and derivatives; dying, tanning and colouring materials; lac and lac products; saponiferous substances; essential oils and odoriferous substances; camphor; medicinal and pharmaceutical products.

SITC, Rev. 3 is harmonized with other international classification systems and is fully correlated with the harmonized commodity description and coding system.

8/ The sections are based on broad economic categories: 0: food and live animals; 1: beverages and tobacco; 2: crude materials, inedible, except fuels; 3: mineral fuels, lubricants and related materials; 4: animal and vegetable oils, fats and waxes; 5: chemicals and related products, n.e.s.; 6: cork and wood manufactures (excluding furniture); 7: machinery and transport equipment; 8: miscellaneous manufactured articles; 9: commodities and transactions not classified elsewhere in SITC.

Harmonized Commodity Description and Coding System (HS)

The HS, issued by the Customs Co-operation Council, is the revised and extended version of its previous classification, Customs Co-operation Council Nomenclature (CCCN). CCCN was a four-digit system containing only 1,011 headings. HS has 21 sections[9/], divided into two-digit groups or chapters, 1,241 four-digit headings and 5,019 six-digit headings. The system representing the separate categories of goods corresponds well to SITC Rev. 3, and the industrial origins of goods. Also, the higher number of digits in the HS codes makes it capable of providing more details.

All the SITC headings relevant to NWFPs are covered in HS, and some are further subdivided at the sixth digit level.

Other Trade Classifications

Apart from SITC and HS, there are regional/national classification systems which are more elaborate, namely:

CN	Combined Nomenclature. An eight-digit classification system of the European Union which is based on the six-digit HS, with two additional digits for more detailed subdivision.
HATUSA	Harmonized System Tariff USA. A ten-digit classification system of USA which is based on the six-digit HS, with four additional digits.

Provisional Central Product Classification (CPC)

The CPC constitutes a complete product classification, covering transportable and non-transportable goods[10/], services[11/] and assets. CPC includes categories and codes for all products that can be the object of a domestic or international transaction or that can be entered into stocks. In other words, it includes not only products that are an output of economic activity (i.e. goods and

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9/ The 21 sections are: (1) Live animals; animal products; (2) vegetable products; (3) animal or vegetable fats and oil and their cleavage products; prepared edible fats; animal or vegetable waxes; (4) prepared food stuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes; (5) mineral products; (6) products of the chemical or allied industries; (7) plastics and articles thereof; rubber and articles thereof; (8) raw hides and skins, leather, fur skins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silkworm gut); (9) wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw, of esparto or of other plaiting materials, basket ware and wicker ware; (10) pulp of wood or of other fibrous cellulosic materials; waste and scrap of paper or paper board; paper and paper board and articles thereof; (11) textiles and textile articles; (12) foot ware, headgear, umbrellas, sun umbrellas, walking sticks, seat sticks, whips, riding-crops and parts thereof; prepared feathers and articles made thereof; artificial flowers; articles of human hair; (13) articles of stone, plaster, cement, asbestos, mica and similar materials; ceramic products; glass and glass ware; (14) natural or cultured pears, precious or semi-precious stones, precious metals, metals clad with precious metals and articles thereof; imitation jewellery, coin; (15) base metals and articles of base metal; (16) machinery and mechanical appliances, appliances, electric equipment, parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such article; (17) vehicles, aircrafts, vessels and associated transport equipment; (18) optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof; (19) arms and ammunition; parts and accessories thereof; (20) miscellaneous manufactured articles; (21) works of art, collectors pieces and antiques.

10/ Goods are physical objects for which a demand exists, over which ownership rights can be established, whose ownership can be transferred.

11/ Services are not separate entities over which ownership rights can be established; cannot be traded separately from their production; mostly confined to activities that are capable of being carried out by one unit for the benefit of another (e.g. insurance, advisory services).

services[12]), but also non-produced assets, including tangible assets such as land, and intangible assets arising from legal contracts such as patents and copyrights[13]. It takes into consideration the linkage that exists between activities and their outputs at a broad level of aggregation. Any thing that is an object of transaction is covered in CPC.

In developing CPC, consideration has been given to raw or base material involved, stage of production and degree of processing, physical properties, related economic activities and the purpose or intended use of the product. In this regard, categories of goods in CPC are defined in such a way that each consists of one or more complete HS six-digit category[14]. These serve as building blocks for the part dealing with transportable goods[15]. Also, each class of CPC consists of goods or services that are predominantly provided in one class of ISIC[16]. Furthermore, the basic categories of economic supply and use as specified in the System of National Accounts (SNA), has also been taken into account in defining CPC classes.

The five-digit coding system of CPC is hierarchical (and decimal), consisting of sections (identified by the first digit), divisions (identified by the first and second digit), groups (identified by the first three digits), classes (identified by the first four digits), and sub-classes (identified by all the five digits taken together). The CPC has ten sections[17], 69 divisions, 293 groups, 1,050 classes and 1,811 sub-classes. Of the total number of 1,811 sub-classes, 1,136 are transportable goods (with 1,022 sub-classes accounting for manufactured products) and 675 are non-transportable goods and services.

The main purpose of CPC is to provide a general framework of comprehensive coverage for international comparison of data in respect of all products, regarding production, intermediate and final use, capital formation and trade.

The CPC serves as a guideline for product-type classification for specific areas or sub-areas of economy (e.g. forestry; NWFPs) and presenting product statistics at different levels of aggregation.

System of National Accounts (SNA)

SNA is prepared under the auspices and joint responsibility of five organisations: Commission of the European Communities — Eurostat; International Monetary Fund; Organization for Economic Co-operation and Development; United Nations and the World Bank. It is a system of macro-economic accounts intended for use of both national and international statistical agencies, and it reinforces the

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12/ CPC contains a description and classification of services/outputs of heterogenous service industries (e.g. recreational and cultural services, hotel services), incorporating specific services as well as those comprising a bundle of goods and services.

13/ Although the non-processed assets are not regarded as products in the System of National Accounts (SNA), CPC considers it useful to include them because there is substantial national and international trade in them, and many users are interested in such data.

14/ Also for transportable goods, all five-digit items of SITC are equal to, or a part of, a single CPC sub-class.

15/ Since HS deals only with transportable goods, no correspondence exists between the two systems for the reminder of CPC.

16/ Since ISIC is based on industrial origin, it is difficult to have one to one correspondence between ISIC and CPC.

17/ The sections are: 0: Agriculture, forestry and fishery products; 1: Ores and minerals, electricity, gas and water; 2: Food products, beverages, tobacco, textiles, apparel and leather products; 3: Other transportable goods, except metal products, machinery and equipment; 4: Metal products, machinery and equipment; 5: Construction work and constructions; land; 6: Trade services, hotel and restaurant services; 7: Transport, storage and communications services; 8: Business services, agricultural, mining, and manufacturing services; 9: Community, social and personal services.

central role of national accounts in economic statistics. It provides an accounting framework within which economic data can be compiled and presented for economic analysis, decision-taking and policy-making.

The SNA provides a coherent, consistent and integrated set of macro-economic accounts, balance sheets and tables based on internationally-agreed concepts, definitions, classifications and accounting rules. All the other systems discussed earlier feed into SNA. It is thus harmonized with related statistical systems.

The SNA covers all aspects of economy. Central framework of SNA contains detailed supply and use tables that record how supplies of different kinds of goods and services originate and how these supplies are allocated between various intermediate and final users. It defines aggregate actual production and final consumption. It also compiles an integrated set of price and volume indices for flows of goods and services, gross value added and GDP.

The SNA provides separate sets of tables to record changes in, and re-evaluation of, assets. It provides a satellite framework for environmental accounting to assess interactions of environment and economy. It delineates transactors of economy, defines boundaries of products and assets and provides detailed explanatory notes, definitions, steps and guidelines to make assessments and calculations.

Of the different aspects of national accounts covered in SNA, this paper will look into production, capital stock and environmental accounting.

Production

Within the framework of SNA, no distinction is made between production of goods and services. Production covers non-factor service, remunerations to the production factors, merchandise products (involving stock of materials) and non-merchandise products, i.e. services. Incomes are generated continuously by production and it is the basis for national income. Definition of production specifies production boundary.

Production is understood as a physical process carried out by institutional units that use labour and assets to transform inputs of goods and services into outputs of other goods and services. The outputs of goods and services are products. The institutions entering into production-related transactions are financial corporations, non-financial corporations, government units, non-profit institutions serving households and, households. The defined boundary of production determines the amount of value added, included in GDP. Often, production boundary problems arise due to the difficulty in recognizing/recording certain increase in value as resulting from production, e.g. natural growth increment of wild, uncultivated forests, which involves no direct input. A purely natural process, without any human involvement and direction is not considered as production in the economic sense. Production of services for final consumption within the same household is also outside the production boundary.

Product classification of SNA is harmonized with international product classifications either by using their categories or by referring to them. In SNA, all goods and services produced and used are treated under ten categories of activities, nearly identical with CPC: agriculture, forestry and fishery products; ores and minerals; electricity, gas and water; manufacturing; construction work and construction, land; trade services, restaurant and hotel services; transport, storage and communication services; business services; community, social and personal services, excluding public administration; and public administration.

The goods and services account of SNA traces the transactions of products through the economy from their original producers to their users. The different types of outputs from varied types of production units (capital goods, intermediate goods, consumption goods; market, own-account and

non-market productions of goods and services) are all linked and brought together in SNA in a single accounting unit. Some types of productions may extend over months or years (e.g. growing of forest produce); they are treated in the accounts as work in progress, i.e. output which is not sufficiently processed to be in the from ready for the market. Value of production within a unit, industry, sector and economy is thus represented by value of sales, value of other uses plus changes in inventories, including additions to work in progress, suitably aggregated. Non-market goods and services (i.e. those provided to individual households, free or at prices which are not economically significant) often do not get accounted. However, non-monetary transactions involved can be valued at market price for similar goods or by proxy measures.

Capital/Accumulation Accounts

These are concerned with values of assets owned by institutional owners or sectors (and their liabilities) at a particular point in time. These provide a measure of wealth of the nation.

Assets are entities over which rights are exercised and benefits derived by owners. According to this definition, some of the environmental benefits/services (such as scenic beauty) cannot qualify as economic assets, even though some others can be included. Assets are mainly of two kinds: financial assets and non-financial assets. Non-financial assets include those which are produced (i.e. came into existence through production process) and those which are non-produced (e.g. land, forests). Different kinds of benefits may be derived from different kinds of assets (e.g. use, income, stored value).

The accumulation account provides the balance sheet of asset position. Previous balance of asset stock plus assets created/discovered minus assets used/lost provides the new asset position. Within this concept, it is possible to bring in changes in the quality (value) and quantity of natural resources stock, such as of forests.

Most assets consist of financial claims; this makes valuation easier. While ownership is easily established over some natural resources such as forest, topsoil, surface water in lakes, rivers and reservoirs, etc., valuation of these assets is difficult because of lack of information. Once these resources become a factor of economic production (of goods and/or services), information flow on them will improve (e.g. new items of NWFPs).

Environmental Account

Environmental account is developed as a satellite system. Satellite accounts and related analysis are special constructs, which are semi-integrated with the central framework of SNA. They serve special needs such as: to make apparent and to describe in more depth aspects that are hidden in the accounts dealt with in the central framework; to deal with specific requirements when they conflict with concepts of the central framework or overburden it; to elaborate complementary elements. This approach is resorted to because of the difficulty in enlarging the production boundary by incorporating some of the environmental benefits which are not quantifiable.

Satellite accounts or systems generally stress the need to expand the analytical capacity of national accounting for selected areas of concern in a flexible manner. It helps to provide additional information on particular social concerns, and helps use of complementary or alternative concepts when needed to introduce additional dimensions to the conceptual framework.

The latest (1993) SNA brought in environmental accounting in a satellite accounting framework, i.e. the System of Environmental Economic Account (SEEA). This makes it possible to deal in a compatible manner with economic and environmental concerns, and thus to make operational the concepts of sustainable growth and development.

The most important difference in SEEA as compared with SNA, is the extension of the asset boundary. The SEEA does not distinguish between national assets that are economic assets and those that are not, focusing on environmental impacts irrespective of particular institutional arrangements of ownership and control.

Many costs and capital items of accounting for natural resources are identified separately in the classification and accounts dealing with stocks and other volume change of assets. These facilitate the use of SEEA as a point of departure for environmental accounting.

Some of the feasible approaches in environmental accounting are the following:

- natural resources accounting in physical terms;
- satellite monetary accounting of environmental benefits and costs, gains and losses;
- welfare measures and similar approaches.

Natural resources account in physical terms measures changes in area, volume or other physical quantities. Wherever applicable and feasible, it may also include changes in environmental quality of natural assets in proxy measures.

Environmental account in monetary terms, generally measures the expenditure for addressing environmental problems. It may also include some sort of environmental adjustments developed, imputing values for depletion/degradation and enhancement/expansion of related natural resources.

Welfare measures and similar approaches attempt to develop environmental sustainability standards and assess impacts of environmental changes on social well-being. The environmental services provided free and the damage borne can be considered as transfers by and to nature. However, in these cases, imputed values have different economic significance compared to monetary values.

Linkages

As we have seen, the systems of international classifications and national accounts are strongly interrelated. These help to put one sector/sub-sector of the national and international economy into perspective *vis-à-vis* the other sectors. To get the correct perspective, therefore, it is necessary that each sector and sub-sector obtains adequate and comparable coverage reflecting their real comparative significance.

The discussion of the different systems of classification and its linkage to SNA highlights the importance of adopting a comprehensive classification (and accounting) system for forestry, including NWFPs, in order to be able to claim its due importance in the scheme of national and world economy. The discussion also touched upon the benefits of internationalization of statistical concerns.

However, it may be understood that a national-level classification need not necessarily be identical with the international classification. National governments can adopt a classification with such modifications as may be necessary to meet national requirements within the international framework.

The fact that priorities and capabilities, and immediate data needs, may vary from country to country does not justify construction of different systems. In cases where countries are so constrained, it would be preferable to start with a reduced set of accounts or aggregated accounts. It is however incumbent to adopt standard definitions. Internationally-comparable statistics cannot be realized unless standardization is applied to both definitions and classification (of transactions as well as transactors).

TOWARDS A BETTER INTERNATIONAL CLASSIFICATION

Past efforts to develop ä classification and statistical system for NWFPs have proven insufficient, and attempts to develop an international system for compiling statistical information on NWFPs have mostly failed. The Forestry Department of FAO attempted to collect and publish statistical information related to production and trade of *other forest products (forest products other than wood)* in the Yearbook of Forest Products during 1954 to 1971. It covered only a limited number of products: raw cork; bark and other materials for tanning; bamboo; materials for plaiting; natural rubber, balata, gutta-percha; oil seeds, oil nut, oil kernels; vegetable oils and waxes. After 17 years, the effort was abandoned in 1971 due to the difficulty of obtaining adequate information to provide a reasonable picture of the NWFPs sector.

The Need

A number of countries use various local classifications. These are, in most cases, listing of products historically included under Minor Forest Products (MFP) in those countries and often use different undefined terms. While one classification lists berries and wild fruits, forest botanicals, flavourings, medicinals and pharmaceuticals, weaving and dying materials, cork and bark, and Christmas trees, others list edible products, ornamental materials, palm sugar, honey and wax, exudates, oils and extractives. Yet others list food products, nuts, oil seeds, medicinal plants, bamboo, and animal products. The items included are not linked hierarchically with clear product boundaries. They are mostly listed on the basis of local importance. Thus, these classifications in most cases serve the limited local purposes such as administrative reporting or identifying products for specific purposes.

In most cases, they lack the consistency required to be aggregated or compared for such purposes as trade analysis, provision of market information, investigating export potential, conducting outlook studies and planning for product development. Because of this, these products rarely feature in official statistics or national accounts, thus wrongly suggesting a relatively low contribution of forests to GDP and national welfare.

The reasons leading to the situation are several:

- NWFPs form a heterogeneous group;
- transactions related to these products largely take place in households and small-scale units;
- while NWFPs are very important in local economies, they mostly form part of an informal sector and are outside the established marketing system.

NWFPs in the formal sector often get reported under other sectors, (e.g. agriculture, horticulture, manufacturing) in the absence of a relevant classification and accounting structure. Services such as grazing in forest land are not, in most cases, reported at all. Consequently, we have only limited knowledge about their productivity, development potential, and role in supporting sustainable development. In spite of their NWFP potential, forests which are not important from the point of view of wood production are often perceived wrongly as of no real value and soon converted into alternative land uses leading to deforestation and related environmental costs.

While NWFP-related activities have not received the attention they deserve, other formal sectors like manufacturing and mining get fully reported. Due to this imbalance in reporting, these formal sectors have been accorded more than their real proportional importance in statistical analysis (and development funding). Within the forestry sector, wood products receive a reasonably elaborate treatment under national and international statistical systems. As a result, they tend to be considered as much more important than other products and benefits, often undeservedly (especially because their cost in terms of resource depletion and degradation is not considered in most cases), perpetuating the *minor* status of NWFPs. Hence the functional need for a better classification of these products.

Recently, there have been attempts at various levels to develop or improve classification of NWFPs. Most of them, however, call for further modifications and refinements. An international classification framework facilitated by broadening experience and expertise in the general area of product classification can greatly help in that regard.

While it may remain difficult to obtain relevant quantitative information on NWFPs (and other benefits), there have been improvements in the systems of product classification and national accounting, as already noted. The systems, as they have evolved, provide considerable flexibility for incorporating estimated or imputed values. Methodologies are being developed and improved continuously through research and trials for estimating values of goods and services for which no market information exists. Additional information can be generated on other benefits/influences through satellite analysis without affecting the consistency of product classification. Therefore, it is time to review the situation and initiate feasible improvements to avoid distortion of relative roles and priorities.

Improvements in the classification and accounting of NWFPs have to take place within an improved system for forestry as a whole. While the focus of this paper is NWFPs, it is to be underlined that it is artificial to treat NWFPs in isolation since forest benefits, wood and non-wood goods and services, are inextricably linked. Forest influences and many intangible benefits (for example conservation of bio-diversity) cannot be classified either with (or as part of) wood or non-wood products.

Forest accounts should consider forest influences/intangible benefits, wood products and NWFPs as separate components of an integrated whole. These, together with valuation of forest resources stock would provide a more realistic and meaningful representation of the value of the forest sector. In this regard, classification of products (including services) can be developed within the framework of CPC/SITC Rev. 3/HS and benefits can be incorporated through the system of satellite accounts within the framework of SNA. Already a comprehensive system exists for wood products even though deficiencies can be seen in their reporting, indicating the need for increased attention in the collection of statistical information.

Satellite Analysis

While quantitative increases in the area under forests (e.g. man-made forests) can easily be measured as asset increase or work in progress, quality improvements to the capital stock through conservation in the form of improved amenity values, watershed values, water quality, soil stability, environmental quality, conservation of bio-diversity, forest and wildlife-related recreational experiences, etc., are difficult to measure. These can be taken into account only through a system of satellite analysis, as they involve non-consumptive uses and un-priced values. Often, these benefits are enjoyed by a community at little or no cost.

An increasing number of efforts have attempted to improve and make use of economic techniques to value the changes in these environmental contributions and assets; and different techniques are being tried in different situations, depending on specifics. These non-market evaluations are carried out using methods such as replacement cost, shadow prices, surrogate market, compensation, sample questionnaire surveys, travel cost/travel time valuation, participant observation and field investigations, hedonic pricing, and contingent valuation (of willingness to pay or bear loss). These methods do, however, overlap. Some of these approaches, for successful application, involve research to arrive at approximate values, e.g. on cost involved in watershed improvement to value the damages adverted. These have opened new ways of providing some form of measure or orders of magnitude to previously unmeasurable benefits. They have helped to improve the system of valuation for decision-making.

Three methods, more often applied with some success, to value forest and wildlife-related recreational experiences are: travel cost method, hedonic pricing method and contingent valuation method[18].

These methods consider consumers surplus and seek to place a value on the benefits derived from a public good or denied when the public good is no longer available[19].

The valuation methods for determining economic use values, with due corrections for biases, can be applied successfully and there are important opportunities to use some of these methodologies even though not yet applied extensively. But methods for estimation of non-use values (e.g. option values) are virtually non-existent.

A Classification Scheme for NWFPs

In spite of the integrated nature of wood and NWFPs and services, it is advisable and necessary to have a sufficiently detailed sub-system for NWFPs. As indicated elsewhere, wood products are fairly well covered in the existing systems, but not NWFPs.

A general tentative classification scheme for NWFPs is given in Annex 1. In classifying NWFPs, consideration has been given to: the group of organisms from which products originate; specific parts of plants/animals providing the products; manner of collection or harvest; properties of products and predominant intermediate or end uses[20] in industry and trade. Highly processed consumer goods (such as golf balls, cosmetic products, confectionary) in which NWFPs form an essential but not a dominant component are excluded as they are covered under *manufacturing*.

The classification has full harmony and correspondence with the existing international classification, particularly the CPC. It has included tangible/storable/transportable goods and non-tangible/non-storable/non-transportable services, realizing that there may still be several borderline cases. It also has taken into consideration the several regional and local classifications.

The tentative classification scheme is to be considered as a framework and needs to be refined into a more elaborate and realistic system for use at international and national levels by improving and expanding it in the future to encompass a broader range of specifics. Of course, the level of detail required for purposes of international comparison is generally less than what is needed for national analyses. It should be pointed out that refinement and harmonization of the existing functional classifications such as SITC, HS, and CPC took several years (in fact, decades).

Appropriate Treatment in ISIC

While several classifications exist, as already seen, none of them brings out adequately the importance of forest products, and particularly, of NWFPs. The main purpose of this paper is to highlight this deficiency and to indicate the crucial need for developing an appropriate product classification.

18/ Travel cost method is an indirect approach to estimate the implicit price the recreationists are willing to pay to the site attributes. This method does not include the public benefits from preservation of resource quality. Hedonic function considers quality differences and demand for goods/properties and services based on the characteristics of their surroundings. Contingent valuation method uses a survey approach to elicit consumers maximum willingness to pay for the benefit (or accept compensation for loss of it).

19/ These methods can also be used to estimate value of the non-market use and transactions of fuelwood and NWFP such as medicinal plants and edible forest products.

20/ Specifically in respect of those which have several uses.

In this regard, it is also essential that a properly defined place is found for forestry activities (with appropriate treatment of activities related to NWFPs) in the ISIC, reflecting the linkages between products and activities. For example, in ISIC, all tourism-related activities are brought together as an annex. Probably such an approach would be feasible also for forestry.

NWFPs Statistics

Since an important purpose of classification is to compile statistical information, and a statistical system hardly exists for NWFPs, development of this will have to be approached in stages, starting with those products for which statistical information will be comparatively easy to collect, e.g. bamboo, rattan, gum arabic. In this regard, several situations could be encountered:

- products in international trade on which trade information is available;
- commercialized products of regional or national importance on which limited information can be gathered;
- products on which some information related to value of trade alone is available;
- products in subsistence use on which no information is available (in some cases rough estimation may be feasible).

The cost involved in establishing an elaborate statistical system for NWFPs may well be beyond the capacity of many countries; this also makes it necessary to adopt a phase-by-phase approach.

Even though it is possible to identify, count, weigh and measure NWFPs, and there have been improvements in this direction, lack or inadequacy of institutions and arrangements still present serious problems. It is necessary also to decide on the correct measures to be adopted for different products. A most difficult part is where the products are to be assigned a monetary value, based on shares of NWFPs going to the households (including subsistence non-market use) and to the market. There is surely need to give more attention to continuous improvement of the methods and systems.

CONCLUSION

Definition, classification and a system of accounting are crucial in providing valid statistics for assessing the real significance and comparative roles of sectors and sub-sectors of the economy, for making realistic projections of sectoral outlook, and for planning sectoral developments. The intention here is to underline the need for these in respect of NWFPs.

This paper does not pretend to present an authoritative definition or a definitive classification for NWFPs. Its purpose is to facilitate discussion and elicit views and suggestions in that regard. It also seeks to promote and encourage national and international initiatives to collect and disseminate statistical information on NWFPs.

REFERENCES

Adamowicz, Wicktor. 1992. *Non-timber values of Canadian forest: an assessment of uses, techniques and data availability*. Project Report 92-02. Edmonton, Alberta, Department of Rural Economy, Faculty of Agriculture and Forestry, University of Alberta.

Bannock, G., R.E. Baxter and E. Davies. 1998. *Dictionary of economics*. London, Penguin.

Chandrasekharan, C. 1993. Issues involved in the sustainable development of non-wood forest products. Paper presented at the Expert Consultation on Non-Wood Forest Products for English-speaking African countries. Arusha, Tanzania, October 1993.

Chandrasekharan, C. 1993. Non-wood forest products in forestry education. Paper presented at the 17th session of the FAO Advisory committee on Forestry Education. Bangkok, Thailand, November 1993.

Customs Cooperation Council. 1987. *Harmonized commodity description and coding system*. Brussels, CPC.

FAO. 1990. *The major significance of minor forest products*. Community Forestry Note 6. Rome, FAO.

FAO. 1991. Non-wood forest products: report on expert consultation. *Tiger paper* Vol. XVIII, No.4. Bangkok, October-December 1991.

FAO. 1992. *Information notes on some issues related to forests*. Rome, FAO.

FAO. 1993. *International trade in non-wood forest products — an overview*, prepared by Mohammad Iqbal. Rome, FAO.

Fletcher, J., W.L. Adamowicz, J. Graham-Tomasi. 1990. The travel cost methods of recreation demand: theoretical and empirical issues. *Leisure Sciences* 12: 119-147.

Ford-Robertson, F.C., ed. 1971. *Terminology of forest science: terminology practice and products*. Washington, DC, Society of American Foresters.

Godoy R., R. Lubowski and A. Markandya. 1993. A method for the economic valuation of non-timber tropical forest products. *Economic Botany* 47 (3):220-233.

Johansson, Per-Olov. 1987. *The economic theory and measurement of environmental benefits*. New York, Cambridge University Press.

Munasinghe, Mohan and Ernst Lutz: 1993. *Environmental economics and valuation in development decision-making*. Environment Working Paper No. 51. Washington, DC, World Bank.

Ontario Ministry of Natural Resources. 1992. *Measuring unpriced values in Ontario's Forests: an economic perspective*. Annotated bibliography. Sault Ste. Marie, Canada, OMNR.

Pearse, David W. and R. Kerry Turner. 1990. *Economics of natural resources and the environment*. Baltimore, John Hopkins University Press.

Peters C.M., A.H. Gentry and R. Mendelshon. 1989. Valuation of an Amazonian rainforest. *Nature* 339(29) (June 1989): 655-656.

Rockel, M.L. and Mary Jo Kealy. 1991. The value of non-consumptive wildlife recreation in the United States. *Land Economics* 67(4):422-34.

Smith, V.K. 1993. Non-market valuation of environmental resources: an interpretative appraisal. *Land Economics* 69 (1):1-26.

Society of American Foresters. 1964. *Forestry terminology: a glossary of technical terms used in forestry*. Washington, DC, SAF.

Tobias, D. and R. Mendelshon. 1991. Valuing ecotourism in a tropical rainforest reserve. *Ambio* 20(2), April 1991.

United Nations, Dept. of Economic and Social Affairs. Statistical Office. 1968. *A System of National Accounts*, Studies in Methods Series F. No. 2, Rev. 3, New York, UN.

United Nations, Dept. of Economic and Social Affairs. Statistical Office. 1986. *Standard International Trade Classification*. Statistical Papers Series M., No. 34, Rev. 3. New York, UN.

United Nations, Dept. of Economic and Social Affairs. Statistical Office. 1990. *International Standard Industrial Classification of all Economic Activities*. Rev. 3, Statistical Papers Series M, No. 4, Rev. 3. New York, UN.

United Nations, Dept. of Economic and Social Affairs. Statistical Office. 1991. *National accounts statistics: main aggregates and detailed tables*. New York, UN.

United Nations, Dept. of Economic and Social Affairs. Statistical Office. 1991. *Provisional Central Product Classification*. Statistical Papers Series M, No. 4., Rev. 3. New York, UN.

United Nations, Dept. of Economic and Social Affairs. Statistical Office. 1993. *System of National Accounts* (prepared under the auspices of Eurostat, IMF, OECD, United Nations and World Bank). New York, Brussels, Washington, UN.

United Nations, Dept. of Economic and Social Affairs. Statistical Office. 1994. *Commodity indexes for the Standard International Trade Classification*. Statistical Papers Series M, No.38, Rev. 3. New York, UN.

USDA Forest Service. 1993. *Income opportunities in special forest products: self-help suggestions for rural entrepreneurs*. Agriculture Information Bulletin 666. Washington, DC, USFS.

Weisbrod, Burton A. 1964. Collective consumption of individual consumption goods. *Quarterly Journal of Economics* 78: 471-477.

Whittington, D., J. Biscoe, X. Mu and W. Barron. 1990. Estimating the willingness to pay for water services in developing countries: a case study of the Contingent valuation surveys in Southern Haiti. *Economic Development and Cultural Change* 38(2), January 1990.

ANNEX 1

A TENTATIVE CLASSIFICATION SCHEME FOR NON-WOOD FOREST PRODUCTS

GROUP	*SUB-GROUP*	*HEADING*	*CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS*
A. LIVE PLANTS AND PARTS OF PLANTS			
Live plants			CPC 015
	Seedlings of commercial forestry species		SITC29262/HS060299
		Broad leaved species	
		Conifer species	
	Wild palms		
	Herbs		
	Orchids		
	Other lower plants		HS060499
		Ferns	HS060410
		Lichen	
		Algae	SITC29297
		Moss	
		Fungi	
		Micro organisms	
	Other live plants		HS060299
	Bulbs and Tubers		CPC01510/SITC29261/HS060110
	Seeds, Fruits, spores for reproductive purposes		SITC29259/HS120999
Parts of plants (fresh, cut, dried or crushed), collected for specific uses			SITC2924
	Materials for fodder, forage		SITC29249
		Leaf fodder	
		Grass fodder	
	Materials for thatching		
		Thatching grass [1]	
		Golpatta [2]	
		Hantal [3]	
		Hogla [4]	
		Others	

[1] Eg. Sungrass (*Imperata arundinacea*)

[2] Leaves of *Nipa fruticans*

[3] *Phoenix palidosa*

[4] *Typha elephantina*

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
	Other non-wood construction materials		
		Palm trunks [5]	
		Bamboo	
		Others	
	Materials for use in medicines [6], aromatics, perfumery, insecticides and fungicides		HS121120/121190/SITC29242
	Materials used for food		CPC012/HS071230/071290
		Mushroom	SITC05458/HS060281
		Palm heart [7]	
		Shoots of bamboo/plants	
		Edible roots	CPC01240
		Others	
	Materials used for beverages		CPC016
	Materials for sugars and sweeteners		CPC018
	Materials used for tans, dyes		CPC03930/HAS140410
	Materials used for fibres		CPC029
	Materials for plaiting		CPC03930
		Bamboo [8], split bamboo	HS140110/SITC29231
		Reeds	
		Rattan [9]	HS140120/SITC29232
		Murta [10]	
		Willow twigs [11]	
		Palm leaves [12]	
		Others	HS140190
	Materials for stuffing and padding		CPC03930
		Kapok [13]	SITC29292/HS140210
		Others	HS140299
	Materials for bio-fertilizers		CPC03920/SITC56299

5 Palms such as Palmyrah (*Borassus spp*)

6 It is estimated that some 30 000 plant species have at one time or other been used in some culture or other for medicinal purposes.

7 Apical meristem of palms, e.g. *Euterpe edulis* and *Bactris gasipaes*.

8 Bamboos are arborescent grasses and have a number of genera, and species in each. Also used for rural housing, furniture making, etc.

9 There are several species and varieties of rattan. Based on post-harvest treatments the products are classified as raw rattan, deglazed rattan, washed and sulphurized rattan, semi-finished rattan, finished rattan and split rattan (peels).

10 Stem of non-woody plant *Schumannianthus dichotoma*, used for making fine sleeping mats, bags, baskets, etc, in Bangladesh.

11 Of *Salix* species.

12 Of palms such as Palmyra (*Borassus spp*), raffia (*Raphia ruffia*, and *R. venifera*) and Toquilla (*Carludovica palmata*).

13 Cotton-like material surrounding the seeds of *Ceba pentandra.*

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
		Litter	
		Dry foliage	
		Mulch	
		Humus	
		Others	
	Non-wood ligno-cellulosic materials		
		Sabai grass [14]	
		Esparto [15]	
		Lokta [16]	
		Bamboo	
		Others	
	Materials used for decorative purposes		CPC015/039
		Ornamental foliage	CPC03920/HS060499/SITC2927
		Wild orchids	
		Potpourri	SITC29272
	Materials used for other purposes		
		Chewing sticks [17]	
		Incense materials [18]	
		Materials for animal bedding	
		Others n.e.c.	
Specific parts of plants with multiple uses, not included under the previous group			
	Fruits, fresh or dried		
		Wild berries	
		Edible fruits [19]	HS080450/121299/CPC0134/ SITC05798
		Oleaginous fruits	CPC014/015/SITC2227
		Other fruits	HS080490
	Flowers/fronds		
	Seeds		CPC014

[14] *Eulaliopsis binata*.

[15] A grass, *Stipa tenacissima* growing in Spain and North Africa.

[16] *Daphne spp* used in Nepal for making hand-made paper.

[17] Small sticks cut from branches or roots of certain species such as *Acacia modesta, Salvadora oleoides, Garcinia spp., Azadirachta indica*, etc. and used as tooth brush.

[18] E.g. resinous incense wood produced by diseased tissues of *Aquilaria* trees, known as gharu.

[19] E.g. wild mangosteen (*Garcinia mangostina*), other tree fruits.

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
		Edible seeds	SITC2227
		Oil seeds	
		Other seeds	
		Palm kernal	
		Others	
	Nuts, fresh or dried		CPC0136/SITC0577
		Edible nuts	
		Chest nuts [20]	CPC05779/HS080240
		Brazil nuts [21]	CPC05772/HS080120/SITC05772
		Walnut [22]	CPC05776/HS080222
		Hazelnut	CPC05775/HS080212
		Shea nut [23]	
		Other edible nuts [24]	CPC05779/HS080290
		Oil nuts	
		Other nuts [25]	
	Bark		CPC039
		Cork [26]	CPC03910/HS450110
		Other bark [27]	
	Leaves		HS090140
		Leaves for wrapping	
		Beedi leaves [28]	
		Boldo [29]	
		Others	
	Roots/tubers		
	Culinary herbs		
Vegetable materials not elsewhere classified			CPC03930/HS0790/140490/ SITC05429/29299
Raw exudates and similar natural products			

[20] *Castane spp.*

[21] Species *Bertholletia excelsa.*

[22] *Juglans regia.*

[23] *Butyrospermum paradoxum.*

[24] Several others such as gnali nut (*Canarium spp*) of Solomon Islands, cola nuts of West African tress of genus *cola* (*C. nitida and C. pendula*); Pendula nut (*Covepia longipendula*) in Brazil; Malva nut (*Sterculia spp*) in Viet Nam.

[25] E.g. Tagua, *Phytelephas aequatorialis.*

[26] Cork is bark of cork oak (*Quercus suber*).

[27] For example, *Broussonetia papyrifera* used for making bark cloth in Pacific Island countries.

[28] Leaves of *Dyospyros melanuxylon* used for rolling Indian cigarettes.

[29] Leaves of *Peumos boldus* used as a substitute for tea in Chile.

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
	Natural gums [30]		
		Exudate gums	CPC032/SITC2922
		Gum arabic [31]	SITC29222/HS130120
		Other *Acacia* gums	
		Tragacanth [32]	
		Karaya [33]	
		Benzoin [34]	
		Others	
		Seed gums	
		Locust bean [35]	
		Mesquite	
		Technological gums [36]	
		Other natural gums	SITC29229/HS130190
	Resins [37]		CPC 032/SITC2922
		Pine resins	
		Fragrant resins [38]	
		Amber [39]	
		Other resins/oleoresins	
		Copal [40]	
		Damar [41]	
		Copaiba [42]	
		Jotoba [43]	
		Gamboge [44]	
		Others	
	Latex		

30 Natural gums are often distinguished also as true gums and hard gums.

31 Exudate of *Acacia Senegal.*

32 From several shrubby plants of the genus *Astragalus.*

33 Exudate from species of genus *Sterculia*, mainly *S. urens.*

34 Fragrant aromatic resin of East Asian tree of *Styrax* spp.

35 Also known as carob gum, obtained from the endosperm of the bean of carob tree (*Ceratonia siliqua).*

36 These are not permitted in food industry, but used in technological application such as printing inks, textiles, foundry and ceramic processes (e.g. Gum combretum from *Combretum nigricans.*

37 Resins are also distinguished as oleo-resins and gum resins.

38 Resins of *Boswellia spp* and *Commiphora spp.*, known as olibanum or frankincense, is used for burning as incense.

39 Ambers are fossilized resins occurring in few isolated regions. Baltic ambers are probably from pre-historic forests of *Araucaria spp.*

40 Resins tapped from *Agathis dammara* tree, in South East Asian countries

41 A resin primarily produced from *Dipterocarp* trees in South East Asia.

42 Exudate from trunks of various *Copaifera* species in the Amazons, known as Copaiba balsam.

43 From *Hymenaea courbaril.*

44 Bright yellow resin of several *Garcinia spp.*

GROUP	*SUB-GROUP*	*HEADING*	*CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS*
		Natural rubber	SITC2311/2313/HS400110/ 400121
		Chicle [45]	HS/400130
		Sorva [46] Jelutong [47] Balata Macaranduba Guttapercha [48]	
		Others	HS400299/SITC23129
	Other exudates		
		Vegetable saps [49] and extracts	CPC03230/SITC29294/HS130219
		Mucilaginous substances	HS130239
		Waxes [50]	
		Others	
B. ANIMAL AND ANIMAL PRODUCTS			
Live animals			HS01/CPC021/SITC0019
	Insects		
		Butterflies Beetles Other insects	
	Birds		
	Reptiles		
		Snakes Crocodiles Other reptiles	
	Fish		SITC03411/HS030199
		Game fish Ornamental/aquarium fish	
	Larger animals		
	Other live animals		CPC02129/HS010600
Animal products			CPC029
	Edible animal products		

[45] Laex tapped from *Manilkara zapota* trees, used in chewing gum.

[46] Latex of Amazonian tree *Couma spp.*, used in chewing gum.

[47] From *Dyera costulata*, used in chewing gum.

[48] Latex of species such as *Palaquium* spp. which is not elastic, and used for such uses as in golf balls and electric insulations.

[49] Examples include those of maple tree (*Acer* spp) and Lacquer (*Rhus vermicifera*) tree.

[50] E.g. Candelilla wax from *Euphorbia antisyphillilica* and Jojoba wax from *Simmondsia chinensis* and S. *californica*.

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
		Meat	CPC211/212/SITC01299
		Rabbit	HS020810
		Other	HS020890
		Eggs in shell	CPC02920/SITC0251/HS040700
		Birds nest [51]	
		Fish, fresh, dried or chilled	CPC041/SITC037/HS030629
		Honey [52]	CPC02930/HS040900
		Other edible products of animal origin	CPC02950/HS041000
	Hides and skins		CPC0297/HS410229/SITC21112
		Skins of reptiles	
		Skins of larger animals	
		Pelts	
		Fur skins [53]	SITC21129
		Others	SITC21119
	Other animal products		SITC2911/HS05
		Quills/feathers/plumes	
		Wool/coarse animal hair	CPC02963
		Ivory	SITC2919
		Horns/antler/claws/bones	SITC2911
		Insect waxes/bees wax [54]	
		Silkworm cocoons [55]	CPC02964/SITC2614/HS500100
		Crude lac/stick lac [56]	HS30110/SITC29221
		Insect galls	CPC02980
		Others n.e.c.	SITC29199
C. PREPARED/MANUFACTURED PRODUCTS			
Prepared (provisionally preserved) edible products			
	Prepared/preserved food		HS16
		Sago [57]	
		Palm starch	
		Others	
	Prepared/preserved fruits		HS200600/CPC214/SITC0582

[51] Edible birds nest are built by two species of cave dwelling swiftlets, *Collocalia fuciphaga* and *C. maxima*, found in Malaysia and Thailand and some parts of Kalimantan in Indonesia.

[52] Produced by insects belonging to the family *Apidae* of which *Apia florea, A. dorsata, A. cerana*, and *A. mellifera* are most common.

[53] Raw fur skins include heads, tails, paws and other parts suitable for furries.

[54] Natural wax secreted by insects, mainly honey bees. Cosmetic industry is the largest user of bees wax.

[55] Silk worms can be reared in mulberry and non-mulberry plant leaves.

[56] Lac is the resinous secretion of insect *Laccifera lacca*.

[57] Starch of sago palm (*Metroxilon spp.*)

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
		Jams	SITC09109/0989
		Juices	
		Others	SITC0599
	Prepared/preserved nuts		HS200899/SITC0582/CPC215
		Palm nuts	
		Pine nuts	
		Other nuts	
		Nut pastes	SITC0723
	Preserved mushrooms		HS200310/20
		Morels [58]	
		Truffles [59]	
		Pine mushrooms	
		Oak mushrooms	
		Other mushrooms	
	Prepared syrups		
		Maple syrup	SITC06192
		Palm syrup [60]	
		Other syrups	SITC06199
	Sugars and sweeteners		SITC51692
	Spices		CPC01620/SITC075
		Allspice [61]	SITC075
		Cinnamon [62]/Cassia	SITC07522/HS090610/20
		Nutmeg [63]	SITC07525/HS090810
		Mace [64]	HS090820
		Mate [65]	SITC0741/HS090300
		Cardamon [66]	HS090830
		Galanga [67]	
		Cloves	SITC07524/HS090700
		Caraway [68]	
		Prepared culinary flavourings	
		Other species/flavours n.e.c.	SITC07529/HS091099

58 Morels, known as black mushrooms, are produced from some dozen species of genus *Morchella*.

59 Produced mainly from three species of genus *Tuber*; they grow beneath the ground attached to roots of oak and hazel trees.

60 E.g. syrup from Chilean palm, *Jubaca chilensis*.

61 Ripe fruits of *Pimenta* spp.

62 Bark and leaves of *Cinnamomum* spp.

63 Seeds of nutmeg tree (*Myristica fragrans*).

64 Aril that surrounds the seeds of nutmeg.

65 From sp the species, *Ilex paraguayensis*.

66 Fruits of *Elettaria cardamomum*.

67 Roots of the herbaceous plant, *Alpina officinarum*.

68 Fruit of Umbelliferous plant, *Carum carvi*.

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
	Food additives Yeasts and enzymes Other edible preparations n.e.c.		HS210220/210390/SITC51691 CPC23999/HS200490/ SITC05896
Prepared beverages			CPC242
	Wine/beer		
		Palm wins	
		Fruit wines	
		Honey beer	
		Others	
	Other beverages		CPC23913/SITC0741/1110
		Boldo [69]	
		Kawa [70]	
		Others	
Prepared animal feed/fodder			HS121300/121490/SITC08
	Made of grass/stalks		SITC0811
	Made of pods/leaves		SITC0812
	Oil cakes		HS230250
	Animal feed n.e.c.		SITC0819
Vegetable oils/fats			CPC216/SITC42111
	Edible fatty oils		
		Palm oil	CPC21640/SITC4222
		Babassu [71]	SITC4224
		Tea oil [72]	
		Others	
	Medicinal oils		
		Kusum oil [73]	
		Kokain butter [74]	
		Chalmugra oil [75]	
		Wahua oil [76]	
		Tung oil [77]	SITC42291
		Others	

69 Leaves of *Peumos boldus*.

70 Mildly intoxicating beverage from root juice of the plant *Piper methysticum*, ceremoniously used in South Pacific Islands.

71 From kernels of babassu palm (*Orbignya phalerata*) in Brazil and Bolivia.

72 From *Camellia oleifera*, in China.

73 From seeds of *Schleichera trijuga*.

74 From seeds of *Garcinia indica*.

75 From seeds of *Hydnocarpus* spp.

76 From Illipe nuts (*Madhuca spp*).

77 Oil of *Aleurites fordii, A. montana*.

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
	Industrial oils		
		Neem oil [78]	
		Tengkawang oil [79]	
		Antiroba [80]	
		Sal oil [81]	
		Others	HS380300
	Other oils n.e.c.		SITC42291
		Meals of oilseed	SITC2239
Animal fats/oils			SITC41139/CPC216
	Reptile fats		
	Fats of larger animals		
	Others		
Prepared waxes of animal or vegetable origin			SITC4313
	Prepared animal wax		
		Prepared bees wax	SITC43142
		Lac and lac products	
	Prepared vegetable waxes		SITC43141
Dying and colouring extracts of plant or animal origin			CPC34320/HS320300/SITC53113
	Vegetable colorants [82]		
		Bixin/annatto [83]	SITC53222
		Indigo [84]	
		Kamala [85]	
		Others [86]	CPC34340/SITC53222
	Animal colorants		

[78] Oil of Neem (*Azadirachta indica*) seeds.

[79] Oil from seeds of *Shorea spp*, in Indonesia.

[80] Seed oil of *Carapa guianensis*.

[81] From seeds of sal (*Shorea robusta*), in India.

[82] Vegetable dyes are obtained from trunk wood, bark, flowers and fruits, roots and leaves.

[83] From seeds of *Bixa orellana*.

[84] From *Indigofera* spp.

[85] From fruits of *Mallotus Philippinensis*.

[86] E.g. *Bahia nitida, Elaeocarpus pyriiformis, Aleurites triloba*.

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
		Cochineal [87]	CPC343400
		Refined lac pigments	
		Others	CPC34340/SITC53222
	Tannin extracts of vegetable origin [88]		CPC34320/HS320290/SITC5322
		Wattle [89]	HS320120
		Gambir [90]	
		Quebracho [91]	
		Cutch and katha [92]	
		Other tannins	HS320100
Phytopharmaceutical/medicinal extracts, galenicals, medicaments			CPC35290/SITC5423
	Indigenous plant-based medicinal preparations/ medicaments [93]		SITC5423
	Indigenous animal-based medicinal preparations		HS300190
	Ingredients for medicine manufacture		
		Alkaloids of cinchona	SITC54142
		Strychnine	
		Other plant-based alkaloids	SITC54149
	Toxins		
		Vegetable toxin	
		Mycotoxin	
		Animal toxin	
		Others	
	Medicaments n.e.c.		SITC5429/HS300390/490
	Cultures of micro-organisms		HS300290
	Indigenous veterinary medicaments		

87 Obtained from dried body of the insect *Dactilopious coccus.*

88 Tannins are phenolic compounds which have preservative, adhesive and dying properties.

89 Tannin from Australian *Acacias,* mainly *A. decurrens.*

90 Tannin from *Uricaria gambir.*

91 From wood of *Schinopsis lorentzii.*

92 A tannin containing resinous extract from heart wood of *Acacia catechu.*

93 No attempt is made here to list them as there are so many of them and they can be grouped in several different ways.

GROUP	*SUB-GROUP*	*HEADING*	*CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS*
Essential oils [94] and their concentrates			SITC5513/CPC354
	Essential oils, terpineless or not		HS3301
		Vetiver oil [95]	HS330126
		Sandal oil [96]	
		Eucalyptus oil [97]	
		Kayuputih oil [98]	
		Lawan oil [99]	
		Sassafras oil [100]	
		Wintergreen oil [101]	
		Rosewood oil [102]	
		Cubeba oil [103]	
		Other essential oils	HS330119/330125/SITC55132
	Aqueous distillates of essential oils		
		Resinoids	HS330130/CPC35410/SITC55133
		Other odoriferous substances and fragrance matter	HS330119/CPC353
Rosin and rosin derivatives			SITC513/516/CPC34400
	Rosin and rosin acids		HS 380610/SITC59814
		Salts of rosin	HS380620
		Rosin spirit	
		other rosin derivatives [104]	
	Pine oil		HS380520
	Turpentine oil and derivatives		SITC59813/HS380510

[94] Essential oils contain an aroma stemming from an important group of organic compounds known as terpenoids.

[95] From *Vetiveria zizanioides*.

[96] From heart wood of *Santalum spp*.

[97] Leaf oil mainly of *Eucalyptus globulus*.

[98] Oil from the leaves of *Melaleuca leucodendron*.

[99] From leaves and bark of *Cinnamomum* spp.

[100] True sassafras oil is from the roots of *Sassafras albidum*. Brazilian sassafras oil is from the trunk wood of *Ocotea pretiosa*.

[101] From leaves of *Gaulteria fragrantissima*.

[102] From the trunk wood of *Aniba rosaeodora*.

[103] Fruit oil of *Litsea cubeba*.

[104] They include modified rosin, hydrogenated rosin, disproportioned rosin, polymerised rosin and other rosin derivatives.

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
		Turpentine acid Alpha penine Turpinol	
	Other rosin-based products		HS380590
Processed gums and latex			CPC34400
Fuels and alcohols			CPC34130/SITC512/HS29
	Bio diesel		HS291590
	Bio ethanol		HS291590/SITC51211
	Methanol		HS291590/SITC51211
	Ethyl alcohol		SITC51216/HS290121
	Others		
		Special nut and shell charcoal Activated carbon	
			HS380210
Other basic organic/ phyto-chemicals			CPC341/HS38/SITC5986
	Saponin		CPC35321
		Organic preparations used in soaps [105]	
	Mosquito repellents		
	Insecticides, fungicides and rodenticides		HS350810/380820
		Derris [106] Pyrethrum [107] Others	
	Camphor [108]		
	Wood tar		SITC59819/HS38700
	Extracts/essences n.e.c.		CPC23914
	Other organic acids/solvents n.e.c.		HS291619/639/SITC53355
	Other organic compounds n.e.c.		HS294200
Prepared bark products			
	Cork products [109]		

[105] E.g. from soapnut (*Sapindus spp.*), bark of Quillaia (*Quillaia saponaria*).

[106] Refers to formulated insecticides or crude products from roots of *Derris* species.

[107] From dried flowers of a herbaceous plant, *Chrysanthemum spp.*

[108] Extracted from *Drybalonops aromatica*, often for medicinal purposes, but having other uses.

[109] Used for packaging, sound absorbing and thermal insultation.

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
		Stoppers	HS450310/390/SITC63311
		Agglomerated cork	SITC6332
		Blocks, strips, tiles	SITC63321/HS450410/450490
		Other	SITC63322
	Other bark products		
		Tapa (bark cloth) [110]	
Plaited products			CPC26/HS460110
	Utility products		
		Mats, hats	HS460110
		Baskets	HS460120
		Bags, belts	
		Other plaits	HS460210/290
	Fancy articles		HS460199
		Wall hangings	
		Decorative items	
		Others	
Products of natural fibre			CPC261/SITC26313
	Silk yarn/products		HS500200/400/SITC65192
		Mulberry silk [111]	
		Tassar silk [112]	
		Other silks [113]	
	Sisal fibre and products		SITC26541/HS530410
	Products of animal hair		SITC26819
	Other products		
		Hand-made paper	SITC26549/26589/HS530490
		Non-textile yarn [114]	SITC6519
		Ropes [115]	SITC65199
		Other fibre products	SITC25792
Tanned leather, fur and products of taxidermy			CPC283/291/HS410790
	Leather		
		Made of wild animal skins	
		Made of reptile skins	
		Others	

[110] Bark cloth in Pacific Islands are made by beating, treating, colouring and painting the bark of *Broussenetia papyrifera.*

[111] Mulberry silk produced by silk worms of species, *Bombyx mori.*

[112] Tassar silk produced by silk worms of species *Antheraea spp.*

[113] E.g. Eri silk by silk worms of species *Philusamia spp.*

[114] E.g. Ixtels (fibres of *Agave lechuguilla* and *Yucca carnerosana.*

[115] For example, of *Sterculia villosa.*

GROUP	SUB-GROUP	HEADING	CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS
	Furs		
	Trophies		
		Mounted trophies	
		Stuffed animals	
		birds, reptiles	
		Fancy items	
Miscellaneous products manufactured from non-wood forest raw materials			SITC899
	Furniture		CPC38160/HS94/SITC82179
		Bamboo furniture	
		Rattan furniture	
		Others	
	Worked ivory		HS960110
	Utility articles		
		Brooms/Brushes	SITC29293/CPC38993/HS140390
		Leaf cups/plates	
		Containers	
		Others	
	Handicrafts/fancy items		
		Cultural products	CPC38991/HS950490
		Walking sticks	HS620200
		Toys	HS950299
		Nut carvings [116]	HS960200
		Buttons [117]	
		Festive articles	HS950590
		Handles/knobs	HS660310
		Others	
	Musical instruments		CPC383
	Others n.e.c.		HS960190
		Beedi [118]	
		Beads	
		Others	
Other non-wood plant and animal products n.e.c.			SITC59897
D. SERVICES			
Forest-based services			
	Recreation services		CPC96491/ISIC9249

[116] An example is tagua nut of the palm, *Phytelephas spp.* Tagua is a very hard, white endosperm, used as substitute for ivory.

[117] Tagua nut is also used for manufacturing buttons.

[118] Cheap type cigarettes rolled in beedi leaves, largely used in India.

GROUP	*SUB-GROUP*	*HEADING*	*CORRESPONDING OR RELATED CODES UNDER OTHER SYSTEMS*
		Hunting	
		Sports fishing	
		Camping	
		Picnics	
		Wildlife watching	
		Excursions	
		Hiking	
		Other recreation	
	Leases		CPC53100
		Wildlife farms	
		Other leases	
	Other services		ISIC9309
		Grazing	
		Others	

STATUS OF RESEARCH ON NON-WOOD FOREST PRODUCTS: THE ASIA PACIFIC SITUATION

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ABSTRACT

Although the long-term potential of non-wood forest products (NWFPs) is well understood, concomitant efforts to develop them are lacking. Current research efforts are far from sufficient and spread too thinly over several items, topics and organizations. Technological development has been particularly absent with regard to most of the products used in the subsistence sector. Product development continues to be one of the most neglected areas. The paper reviews the present situation and indicates the direction for future research on NWFPs. Unless concerted efforts are made, it is argued that the potential will go unrealised.

INTRODUCTION

Several reports and studies provide a general indication of the current and potential importance of NWFPs in the Asia-Pacific Region (Beer and McDermott, 1989). The region is reported to be the richest in terms of product diversity and the volume and value of trade of NWFPs (Iqbal, 1994) and every country has a long list of species, either used locally or traded in the local or international markets. There are nearly 1,000 plants yielding NWFPs in China (Shi Kunshan, 1994), 3,000 plants in India (Gupta, 1994) and 700 species of medicinal plants in Nepal (Khatri, 1994). More than 1,000 medicinal plants have been reported from Peninsular Malaysia (Rao, 1991). Of the 1,500 species of medicinal and aromatic plants in Pakistan, 300 are used in traditional medicine. In Korea 1,000 medicinal and aromatic plants have been reported (FAO, 1993a). Annual collection of beedi leaves from India is valued at US$ 200 million and 3 million persons are estimated to be employed in collection and processing (Rao, 1994).

Yet what is the capability for realizing the full potential of NWFPs? Inadequate research has been identified as one important constraint contributing to inadequate development of NWFP resources (Mok, 1991). Know-how on cultivation, management, processing and utilization of a large number of products is poor due to the weak research base (Saulei and Aruga, 1994). During 1992 the Forestry Research Support Programme for Asia and the Pacific (FORSPA) initiated the preparation of a directory of forestry researchers in the Asia-Pacific Region. At the time of publication of the directory (FAO, 1992) in 1992, information could be compiled on 881 persons, representing about 11 percent of the total forestry researchers in the Region. While collecting information, researchers were requested to indicate their areas of specialization. Less than 4 percent of the researchers indicated NWFPs (including bamboo, rattan, medicinal plants and fodder) as an area of their specialization. Notwithstanding the limited coverage (for example private sector institutions, other public sector agencies and some university departments dealing with NWFPs were not covered), possible overlaps with other topics (for example chemistry could deal with both wood and NWFPs) and the biases inherent in using information from a general directory, this nevertheless gives an indication of the state of research on NWFPs. Availability of material resources is in no way different from that of human resources.

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Further, within the broad group of NWFPs, the allocation of resources for research and development is extremely skewed. Some of the products have been traded for centuries and their production, harvesting and processing have been systematized whereas there are large number of products yet to be properly identified and whose uses are highly localized (FAO, 1991). It is a complex and fast-evolving scene, with new products and uses emerging, while some of the products which were important earlier have faded out or declining in importance due to changes in demand and competition from better and cheaper products. The research scenario in such a situation is as complex as the diversity of products. Substantial research inputs have gone into some of the highly commercialized items, while there remains a large number of items whose botanical identity remains unestablished, not to mention their production and processing.

This paper reviews the Asia-Pacific situation, specifically focusing on research in support of NWFP development. After considering the conceptual problem of classification, it provides an overview of ongoing research, indicating the constraints in the present approach. An alternative framework is then indicated, followed by general conclusions.

WHAT ARE NWFPs?

The large number of items which constitute NWFPs makes a general discussion on research issues extremely difficult. Historically all products other than wood are included under a residual category and further grouping is based on general end uses or source of the product. Products are thus grouped as fibre products, food products (including animals and animal derived foods), medicinal and cosmetic plant products, extractive products, animal and animal products other than foods and miscellaneous products (Anon., 1991) despite the significant differences in the systems of production, technology adopted and market characteristics. Thus, forest-derived foods include fruits and roots collected and consumed by forest dwelling communities with minimal processing as well as those grown under intensive management, subjected to complex processing to alter the characteristics and sold to high income consumers through super market chains. Medicinal plants include those collected from forests and homesteads for direct domestic use under traditional health care systems to those cultivated on a large scale and processed with the latest techniques for production of globally marketed pharmaceuticals. An alternative approach is offered here to provide the right perspective for a discussion on NWFPs and to avoid the pitfalls of existing classification.

ALTERNATIVE APPROACH

Considering the strong link between markets, production systems and the level of technology adopted at different stages, NWFPs could be grouped as subsistence products and commercialized products. Key characteristics of products under these two groups are indicated in Table 1 and discussed below.

Table 1: NWFPs and technology

Product / Activity	Subsistence Products	Commercialised Products	
		Semi-developed	Fully developed
Production/Collection	Local know-how	Local know-how	Highly developed technology
Processing	Local know-how	Well-developed technology	Highly developed technology

Subsistence Products

These are characterized by traditional technologies in production, processing and utilization, largely based on local know-how. Production is primarily nature dependent and the technology of harvesting and processing is simple and labour intensive. Since the products are consumed locally, no complex marketing is involved other than customary sharing and exchange. Several products (forest foods like roots, tubers, fruits and bush meat, medicinal plants, oil yielding plants, bamboos and rattans for construction and other artifacts, etc.) are included in the consumption basket and the relative importance varies depending on seasons and the socio-cultural setting. The extent of utilization of any specific product is related to the overall livelihood strategy of the household or community. Cultural factors play a dominant role in the utilization of the products. For example, some of the food yielding plants preferred by one community may be culturally unacceptable to those living in another area.

Commercialized Products

Market development has transformed a number of subsistence products to traded goods with substantial investment on improved technologies for production, processing and marketing. While the amplitude of development is extremely wide, based on the degree of commercialization, the level of technology and organisation of production two broad sub-groups can be identified. A large number of products are still in the early stages of development, with raw material production largely remaining traditional (collected/gathered from the wild by local communities), while processing and marketing have been well developed. Included under this are several medicinal plants, bamboos, rattans, gums, resins, dyes, and forest foods. The technology for collection/production remains traditional, while processing and trade are more systematized. Final processing into consumer goods often takes place in importing countries and trade involves complex channels.

The other end of the spectrum consists of highly commercialized products, which have moved out of the category of NWFPs and whose production, processing and marketing have been highly systematized. Rubber, oil palm, cacao, coffee, tea, coconut, arecanut, cashew and a number of spices belong to this group. While differences in the system of production exist (for example rubber may be cultivated under highly organised plantation or under small farmer managed mixed farms), close integration with the processing sector is a key characteristic of the system.

Organised production, especially through cultivation, emerges when supply from natural sources is inadequate or declining. At low levels of demand supplies from the wild remain profitable and high investment on cultivation tends to be uneconomical. Most products hence pass through phases of collection, depletion and cultivation.

Changing Nature of Product Markets

A variety of factors affect the development of a given product; of these, use characteristics and access to markets are critical. Traditional uses by local communities are primarily aimed at basic needs satisfaction (food, medicine, shelter, clothing, etc.) and the processing is focused on removing unacceptable characteristics and separating desirable properties. Growth of industrial processing has substantially enhanced the scope for diversified use of NWFPs involving a shift in emphasis on what is regarded as desirable characteristics. Processing technologies can substantially alter characteristics and introduce new combinations. While this undermines some traditional uses (for example substitution of bamboo baskets with plastic wares), new products and uses are continuously emerging (example bamboo plywood). Developments in biotechnology, especially recombinant DNA technology, will significantly alter the scene and ultimately individual genes and DNA molecules could become as or more important than the physical, mechanical and chemical properties. As indicated recently by Ruiz Perez (1995), the changes are multidimensional with several factors influencing NWFP development.

STATUS OF RESEARCH ON NWFPs

A review of research should consider such scenarios of development, and examine how developing countries (more particularly rural communities, which are traditionally dependent on NWFPs) can benefit from such changes. Diversity of products and their differing potentials make the design and implementation of a research programme complex. What are the ongoing research efforts and in what way are they going to enhance our capability to manage NWFPs? Are these qualitatively and quantitatively adequate to meet the emerging challenges?

INSTITUTIONS INVOLVED IN NWFP RESEARCH

National Initiatives

Broadly, the institutions involved in NWFP research can be grouped as public sector and private sector. Universities and specialized research institutions form the most important public sector agencies involved in NWFP research. Research priorities of these institutions vary and can encompass (a) all important NWFPs, (b) selected crops of high economic importance (rubber, coffee, oil palm, etc.) or (c) specific groups of products (e.g. medicinal and aromatic plants). The focus shifts depending on resource availability and the changing perceptions of the management.

Of the 137 forestry research institutions (including universities) in the region listed in the FAO Directory (FAO, 1993b), 23 have indicated NWFPs as one of the priority areas of their research. Although this in no way implies that others are not undertaking any NWFP research, it gives an indication of the overall importance assigned to this topic. Most of these institutions, although purportedly dealing with several products, generally focus on some aspects of selected items, such as production research concerning bamboo and rattan, *ex situ* and *in situ* conservation of medicinal plants, improved resin-tapping techniques, lac production, rearing of silk worms, post-harvest handling techniques, basic research on chemistry of selected products, etc.

Research on highly commercialized crops are undertaken by specialized institutions, which are designed to deal with all the problems related to a specific crop. Examples include the Rubber Research Institute of Malaysia, the Cardamom Research Institute in India and the Cocoa and Coconut Research Institute in Papua New Guinea. Export significance of these crops has led to high investment on research, often supported through special levies on export income (Antony, 1994). Research is strongly linked to extension and problems are dealt with in their totality, making research more user responsive.

Between those dealing with the broad category of NWFPs and of only selected crops are those undertaking research on a broad group of related plants. Medicinal and aromatic plants form an important group that has received considerable attention. There are several research institutions in the region specifically aimed at research on this important group, like the Institute of Medicinal Plant Development under the Chinese Academy of Medical Sciences, the Central Institute of Medicinal and Aromatic Plants in India, the Research Institute of Spices and Medicinal Crops in Indonesia, Herbs Production and Processing Company in Nepal and the Bandaranaike Memorial Ayurvedic Research Institute in Sri Lanka. Research efforts are generally focused on selected species of commercial importance, with most attention given to ethnobotanical studies, maintenance of germplasm, cultivation and identification and isolation of active ingredients.

Although private sector involvement in NWFP research, especially at the processing end, is substantial, reliable documentation on this is virtually non-existent for a number of reasons. First, it is spread over a variety of products and activities and the traditional sectoral surveys and studies are unable to capture the totality of the situation. Second, in-house research is often an integral part of production and no separate information is available. Finally, the private sector is reluctant to provide information on the nature of research undertaken which are mostly treated as trade secrets. In countries like China, India, Indonesia and Sri Lanka, with strong traditions of indigenous herbal

medicines, there has been significant private sector efforts to develop processing of medicinal plants, including allopathic formulations. Dependence of NWFPs using industries on government forests and other common lands for raw material supply has continued and often rules and regulations relating to land use have discouraged private or community investment in production. Declining supply has however encouraged investment in cultivation, as in the case of medicinal plants. Some of the major private sector institutions dealing with traditional medicines maintain research units, undertaking studies on the efficacy of different species of medicinal plants and their propagation. Production of cut flowers (especially orchids), honey, wax, mushroom, bamboo shoots, and sericulture are other important areas of private sector production oriented research.

There has been increasing interest among non-governmental organizations (NGOs) in the development of NWFPs. Here again, reliable information is not available on their capabilities and areas of research. Their efforts are mostly directed at supporting local communities with regard to cultivation, processing and marketing, relying on available research information. The Centre for Minor Forest Products and the Foundation for Revitalization of Local Health Traditions in India form important non-governmental efforts to strengthen NWFP research.

International Efforts

Supporting national efforts, there are several international NWFP research programmes, directed at a broad group of products or at specific items. Some of the important efforts in this direction are indicated in Table 2.

Table 2: Important regional NWFP research initiatives

Agency	Area/Activity
FAO	
- Regular programme	Technology transfer
- FORSPA	Field research projects
- FORTIP	Breeding and improvement
- ANMAP	Networking and information exchange
- APAN	Agroforestry with NWFPs components
IDRC/INBAR	Bamboo and rattan - production research - utilization research - socio-economic studies - information dissemination
	Medicinal plants
RECOFTC	Training and support for on farm research and studies on marketing
Unesco/WWF	Ethnobotany
UNIDO	Industrial processing
WHO	Traditional medicines in relation to primary health care

Of the efforts listed in Table 2, the International Development Research Centre (IDRC) supported bamboo and rattan research has been a pioneering effort, which has substantially enhanced national research capacity in the region. In addition there are several country-level activities supported by donor agencies and international NGOs. NGOs are particularly involved in developing appropriate local techniques and marketing studies primarily aimed at enhancing income accruing to local communities.

Establishment of the Centre for International Forestry Research (CIFOR) and the Southeast Asia Centre of the International Centre for Research on Agroforestry (ICRAF) will substantially strengthen NWFP research in the region. The policy focus of the former is expected to fill a major information gap, providing a clear direction for the development of NWFPs. ICRAF's efforts follow a system approach, specifically considering the integration of NWFPs in farming systems.

RESEARCH AGENDA

Current research on NWFPs can be broadly grouped as: (1) status surveys aimed to provide a general understanding of their uses and importance at different levels (household, local, national and international); (2) development of technologies to improve production, utilization and processing; and (3) socio-economic studies, including marketing.

Status Surveys

A large proportion of the studies come under this category, intended to indicate the overall significance of one or more products at various levels. Thrust areas include:

- ethnobotanical studies (including taxonomy, uses of different species, etc.);
- studies on distribution and availability;
- current systems and methods of use of products;
- economic significance (local, regional, national and global) especially with reference to employment, income, revenue to government and the volume and value of trade.

Development of Improved Technologies

Development of improved technologies is closely linked to development of markets and often focused on a limited number of products. In the case of some of the plantation crops like rubber, tea, coffee and coconut, the technology for both production and processing is well developed with substantial research on all aspects. But for most NWFPs, major technological changes have been in processing (which has largely taken place in the private sector), while production/collection has remained traditional.

Production Research

Production technologies generally develop in different stages depending on supplies from natural sources and prices. Generally, three distinct stages can be observed:

Traditional product-gathering systems: A substantial proportion of NWFPs (rattan, bamboos, gums, resins, dyes, medicinal plants, honey and wax) continue to be collected from natural sources (including reserved forests) largely based on local skills and know-how. Production is entirely dependent on natural factors. Tools used in harvesting are simple and locally produced. Local communities have an intimate knowledge of what to collect, when to collect and how to collect. Where traditional community structures are in tact and external pressures minimal, there are well developed local institutional mechanisms that regulate the use of community resources. These, however, tend to break down with increasing pressures, both internal and external, and development of local know-how is unable to keep pace with the rapid changes.

Collection under formal regulatory mechanism: Regulatory mechanisms, mostly at the instance of governments, emerge either out of genuine concern for conserving the resources or as a means of appropriating benefits from products that generate substantial income. These are generally aimed to restrict removal at the level of regeneration. Research has hence focused on: appropriate inventory techniques for estimation of growing stock; natural regeneration and studies on growth and yield; and effect of different harvesting intensities and techniques. Examples of prescriptions based on research include harvesting rules concerning bamboos and rattans (age and the number of culms/stems that can

include harvesting rules concerning bamboos and rattans (age and the number of culms/stems that can be extracted, method and season of harvesting), tapping gums and resins (the depth and length of incisions to be made, the season when trees should not be tapped), and extraction of medicinal plants (the part that has to be extracted, season of extraction, etc.). Regulatory measures prescribed to appropriate income tends to be *ad hoc* with very little research on critical aspects concerning sustainability. Invariably their ineffectiveness becomes evident through continued depletion, as has happened with several products.

Organised cultivation: Organised cultivation is a sequel to the high demand and inadequate supply from traditional sources. As indicated earlier, in the case of plantation crops, like rubber, oil palm, cardamom, coconut, arecanut, tea, coffee, cocoa and cashew, cultivation practices have been highly systematized with substantial research on breeding, cultivation, nutrient management, management of pests and diseases and processing, largely due to the efforts of crop specific institutions. High commercial potential has encouraged increased investment in research, which in turn has enhanced production and improved utilization. Large-scale cultivation (which is linked to a large market) has facilitated the realization of economies of scale keeping unit cost of research low. A strong demand pull for innovation is exerted by the multitude of farmers involved in cultivation. Supported through strong extension, research has made a significant impact on the technology of cultivation of these crops.

In contrast, for a large number of products like bamboo, rattan, gums, resins, essential oils, dyes and forest foods, production research is less organised and often compartmentalized between institutions and disciplines. Thrust areas of research are:

- studies on natural and artificial regeneration;
- measures to enhance germination of recalcitrant seeds, enhancing the viability and storage (including establishment of gene banks, phenology, distribution, seed technology and plantation establishment techniques);
- vegetative propagation techniques (using cuttings with or without treatment with growth-promoting hormones);
- micro-propagation, in particular tissue culture;
- appropriate planting and tending techniques.

In the case of gums and resins, research is focused on identifying high-yielding provenances and varieties and establishing the optimum intensity and frequency of tapping. Cultivation of medicinal plants is another focal area of research, especially with regard to commercially important species.

Recognition of the importance of agroforestry as a more viable land use has led to efforts at integrating NWFP cultivation with agriculture. There are several examples of traditional land-use systems with NWFPs as an important component, e.g. the case of rattan in Kalimantan (Peluso, 1992) and damar in Sumatra (Michon and Bompard, 1987). Agroforestry research has particularly focused on growing multiple-use species as well as species with varied uses, especially medicinal plants in different combinations (Paroda, 1993).

Utilization Studies

A review of the state of utilization research is made difficult due to the ambiguity of what constitutes utilization. It varies from direct and rather crude use of products, with no processing, to highly sophisticated techniques for isolation of active ingredients, which are subsequently used for the production of a variety of intermediate and final consumption products. Traditional uses, especially

by local communities, are largely based on experience gained through actual use, while modern uses rely on more systematic trials and supported through chemical characterization.

Usually the type of processing technology is dependent on the situation that exists in the area where processing takes place. This is particularly evident with regard to some internationally traded products, such as gums, resins, dyes, and medicinal plants. Harvesting techniques have remained traditional, largely dependent on resources and know-how of local communities. Utilization research in the producing locations (or countries) is mostly focused on primary processing, to facilitate transport and to minimize damage during storage. Examples include treatment of bamboos and rattan against borer and fungal attacks and to retain strength, colour and texture, preliminary cleaning and grading of gums, resins and lac. Final processing in the importing countries involves isolation of active ingredients and product development combining several ingredients.

Unfortunately, development of processing technologies in most countries in the region has stagnated at the level of preliminary processing. Production techniques are archaic and unorganised and hence countries are not able to take advantage of the immense potential for value addition, especially in the case of pharmaceuticals and cosmetics (Henle, 1993). Most research on product development is undertaken by processing units in importing countries, the benefits of which seldom trickle down to the raw material suppliers. Barriers to access to technology could become stronger, especially with the stringent enforcement of patent laws and stipulations concerning intellectual property rights.

Socio-Economic Studies

Socio-economic research continues to be the most neglected area with regard to NWFP development. Most efforts are directed at highlighting the overall economic and social significance of the products based on unreliable statistics (Nair, 1994) and broadly indicating their potential contribution to the economies in terms of employment, income and revenue based on questionable assumptions and extrapolations. Profitability studies on some of the commercialized products have primarily focused on estimating the rate of returns and the cost benefit ratios. Equity aspects seldom receive attention and very often some of the NWFP-based activities are nothing more than low-wage traps providing little scope for improvement of the livelihoods of the people involved.

The dynamics of NWFP activities is a major grey area, except for a few isolated location-specific studies on how technologies, markets and production relations interact with each other transforming the nature of the activity and the distribution of benefits. These studies on collection and marketing of rattan (Peluso, 1991), bamboo mat weaving (Smyth, 1986), rattan in Malaysia (Fui, 1994), clog-making in Indonesia (Hadi, 1991), and lacquerware in India (FAO, 1991), provide glimpses of the dynamics of NWFP development and indicate the constraints and the potentials. Unfortunately, these have not been followed up with a coherent policy and long-term strategy for NWFP development.

One of the most neglected area with regard to NWFPs is market research (Warner, 1994). Currently producers have no information on how a given product passes through different stages of trading and the nature of end uses and prices. Government agencies may at best have information on who purchases the products, but little is known about their flow through different trading channels and the prices prevailing at different stages. There has been some efforts to undertake systematic studies (e.g. in Nepal) and to provide information to the NWFP producers to enhance their bargaining power. Absence of market information has led to avoidable competition among developing country producers, to the advantage of the raw material importing countries.

Major Constraints

From what has been discussed earlier, it is evident that NWFP research is dominated by an *ad hoc* approach without a coherent long-term policy. Some of the major problems due to this are as follows.

Neglect of Traditional Sector

While a major proportion of the NWFPs are produced and utilized in the traditional sector, very little effort has been made to improve the level of technology. With the increasing external pressures, indigenous systems of management have broken down, contributing to rapid resource depletion. Developments in technology have largely benefited those not directly concerned with protection and management of NWFPs.

Emphasis on Product Approach

Most NWFPs research has understandably adopted a product-focused approach and efforts are directed at enhancing output of commercially important products, largely adopting the plantation system as the standard model. Integration of NWFPs in the farming system approach, which takes full cognizance of all resources and potentials, with the household as the focal unit, is yet to find wider application.

Supply-Driven Research

A substantial proportion of NWFP research is supply driven (and quite often donor driven), based on narrowly focused priorities, not related to clearly identified problems. Consequently there is considerable duplication of efforts in the "soft" areas (taxonomy, establishment of live collections, etc.), while the "hard" areas (multiple use management, processing technology, etc.) seldom receive adequate attention. Compartmentalized research focusing on a narrow aspect is another result of supply-driven research.

Lack of Linkages

A major drawback of supply-driven research is the lack of linkage between different institutions involved in NWFP development. Interaction between universities, research institutions and industries is poor, resulting in a substantial proportion of the research remaining unused, or no research being undertaken on priority concerns of the processing sector.

A COHERENT APPROACH

The NWFP scene in the developing countries is still a trader-dominated situation, where the emphasis is on generating income through trading. Impact of research on resource conservation, management and development of new products has been negligible and research tends to be preoccupied with traditional products with uncertain future. Enhanced awareness on the long-term potential is yet to be translated to action and the efforts to take advantage of the widening product markets are far from adequate. Countries in the region face a dilemma, in that while the potential is enormous, there are serious resource constraints in fully realizing this. While the strategy will vary depending on the situation in each country, there is an urgent need to articulate a coherent approach encompassing all aspects of NWFP development, including research. Some of the important aspects to be considered are indicated below.

Policy and Strategy for NWFP Development

There is an urgent need to articulate a long-term policy with regard to NWFP development. As indicated earlier, new technologies will substantially alter the scope for utilization of NWFPs; new

products and uses will emerge while traditional uses will fade out. A clear framework is necessary to take advantage of the changes; otherwise the potential of NWFPs will not be realized by the countries where they are produced.

Prioritization of Research

Given the resource constraints, countries in the Region cannot afford to spread their efforts too thinly — and hence ineffectively — on a large number of products; hence the need for prioritization. More than providing a wish list of projects, efforts should focus on clearly defining the principles and criteria for identifying research problems and there should be a close link with the eventual users of research results. Some of the key areas that require attention are indicated below:

Market Research

Well-planned market research will have an immediate impact by providing vital information on demand, sources of supply and prices to producers enhancing their bargaining power. In a trader-dominated sector like that of NWFPs, the producers/collectors have very limited access to critical information, compelling them to accept whatever prices are offered by the traders. No doubt the relationship between producers and traders are often determined by other factors; nevertheless, market information will be a major step in the empowerment of rural communities involved in production/collection of NWFPs. At the national and global levels, market research will facilitate decisions on what and how much is to be produced and to ensure that comparative advantage of countries is fully taken into account.

Product Development

A major weakness of existing research on NWFPs is the neglect of product development. The substantial efforts on studies on taxonomy and chemical characterization are not effectively followed up to develop marketable products. Countries in the region have to substantially invest in product development research. One area that will have an immediate impact on producers/collectors of NWFPs is the development of suitable post-harvest and processing technologies. This will be particularly relevant in the case of high-value products which are in limited supply.

Intensive Multiple Use Management

Multiple-use management is another important area that requires significant research inputs. The potential of this has been demonstrated by home garden systems. Local communities are dependent on an assortment of products, switching from one to the other within the framework of an overall livelihood strategy. Unfortunately, the single-product-focused approach of NWFP development has enhanced vulnerability to market fluctuations and undermined the product diversity. There is an urgent need to rediscover multiple-use systems and to improve them based on a better understanding of ecological and socio-economic factors.

Strengthening Linkages among Agencies

There seems to be enormous duplication of efforts largely due to lack of coordination between different agencies. Appropriate institutional environment does not exist in support of all activities and the government agencies, universities, research institutions and the private sector all work in isolation. Product development has been the weakest, while there is a lot of duplicated effort in the area of breeding and cultivation, although this is seldom effectively translated into practice. Ideally, most basic research would be undertaken by universities, while applied research and product development would be pursued by public-sector research institutions and industries, respectively. Such a partnership is essential to ensure that research is more focused and adequate financial support is available.

COMMUNITY PARTICIPATION IN RESEARCH

Most NWFP research has failed to take cognizance of local technical know-how and to facilitate local innovations. Given the large number of products and the limited resources, the conventional approach focusing on a limited number of items is unlikely to enhance the level of technology. A paradigm shift is necessary to tap local initiatives and innovation. In this, researchers will act as facilitators and problem solvers. At the operational level the traditional separation between research, training and extension must disappear to facilitate regular interaction between researchers and local communities. Due recognition and reward of local initiatives will go a long way to demystify research (and researchers) and to bring scientific thinking to the grassroots level.

CONCLUSION

While there has been recognition of the immense potential of NWFPs, there are yet no indications of serious efforts to realize this. On the whole, research efforts are far from adequate and spread too thinly on several aspects, contributing to their ineffectiveness. Impressive achievements with regard to production and processing have occurred mainly for plantation crops cultivated on a large scale. Technological improvements with regard to production and processing, especially with regard to a large number of products in the subsistence sector, have been negligible. In most countries research is focused on traditional areas and products, with very little effort to develop new products and uses. Significant value addition takes place in importing countries; the benefits of this seldom trickle down to the producers.

There is an urgent need for a clear policy and a well-directed approach to research. Research capacity has to be improved, both qualitatively and quantitatively. In view of the resource constraints, priorities will have to be clearly identified and research should focus on critical high-impact areas. Linkages between institutions have to be strengthened, so that research becomes more demand driven and leads to technologies for enhanced value addition. Considering the limitations of conventional approaches, an alternative framework that provides more scope for local innovations seems necessary. Empowerment of local communities through improved access to information and technology should be a major objective of research. Mechanisms to overcome barriers to technology transfer at all levels have to be devised; otherwise the potential of NWFPs will remain unrealized.

REFERENCES

Anonymous. 1991. Non-wood forest products: expert consultation. *Forest News* 5(4), pp 1-4 in *Tiger Paper* 18(4). Bangkok, FAO-RAPA.

Antony, G. 1994. Research priority setting in a small developing country: a framework and implications for Papua New Guinea. *Journal of Developing Areas* 28:325-344.

Beer, J.H. de, and Mcdermott, M.J. 1989. *The economic value of non-timber forest products in Southeast Asia*. Amsterdam, Netherlands Committee for IUCN.

FAO. 1991. *Non-wood forest products: the way ahead*. Forestry Paper 97. Rome, FAO.

FAO. 1991. *Case studies in forest-based small-scale enterprises in Asia: rattan, match-making and handicrafts*. Community Forestry Case Study No. 4. Rome, FAO.

FAO. 1992. *Forestry researchers: a directory of forestry researchers in the Asia-Pacific Region*. FORSPA Publication No. 3. Bangkok, FAO-RAPA.

FAO. 1993a. *Breeding and improvement of medicinal and aromatic plants in Asia*. Report of the Regional Expert Consultation 1-6 June 1993, RAPA Publication 1993/12. Bangkok, FAO-RAPA.

FAO. 1993b. Directory of forestry research organisations. FAO Forestry Paper 109. Rome, FAO.

FAO. 1993c. *Medicinal and aromatic plants in Asia*. Proceedings. RAPA Publication 1993/19. Bangkok, FAO-RAPA.

Fui, Lim Hin. 1994. Social, economic and cultural aspects of rattan in Malaysia. Paper presented at the Regional Expert Consultation on Non-Wood Forest Products: Social, Economic and Cultural Dimensions, 28 November - 2 December 1994. Bangkok, FAO-RAPA.

Gupta, B.N. 1994. India country report. In *Non-wood forest products in Asia*. RAPA Publication 1994/28. Bangkok, FAO-RAPA.

Hadi, S. 1991. Forest-based handicrafts in Indonesia. In *Case studies in forest-based small-scale enterprises in Asia: rattan, match-making and handicrafts*. Community Forestry Case Study No. 4. Rome, FAO.

Henle, H.A. 1993. *Socio-economic aspects of medicinal and aromatic plant production in Asia*. Proceedings of the Regional Expert Consultation on Breeding and Improvement of Medicinal and aromatic Plants in Asia. RAPA Publication: 1993/19. Bangkok, FAO-RAPA.

Iqbal, M. 1994. International trade in non-wood forest products in the Asia-Pacific Region. Paper presented at the Regional Expert Consultation on the Economic, Social and Cultural Dimensions of Non-Wood Forest products, 28 November to 2 December 1994. Bangkok, FAO-RAPA.

Khatri, D.B. 1994. Nepal country report. In *Non-wood forest products in Asia*. RAPA Publication 1994/28. Bangkok, FAO-RAPA.

Michon, G.F., and Bompard, M. 1987. Multi-storeyed agroforestry garden systems in West Sumatra, Indonesia. *Agroforestry Systems* 4:315-338.

Mok, S.T. 1991. Production and promotion of non-wood forest products. *Proc. 10th World Forestry Congress*, Paris, Vol. 6, 103-111.

Nair, C.T.S. 1994. Employment and income from non-wood forest products: what do we know? Paper presented at the Regional Expert Consultation on the Economic, Social and Cultural Dimensions of Non-Wood Forest products, 28 November to 2 December 1994. Bangkok, FAO-RAPA.

Paroda, R.S. 1993. Medicinal and aromatic plants based cropping systems in South Asia. *Proc. Regional Expert Consultation on Breeding and Improvement of Medicinal and Aromatic Plants in Asia*. RAPA Publication 1993/19. Bangkok, FAO-RAPA.

Peluso, N.L. 1991. Rattan industries in East Kalimantan, Indonesia. In *Case studies in forest-based small-scale enterprises in Asia: rattan, match-making and handicrafts*. Community Forestry Case Study No. 4. Rome, FAO.

Peluso, N.L. 1992. The political ecology of extraction and extractive reserves in East Kalimantan, Indonesia. *Development and Change* 23(4):49-74.

Rao, A.L. 1994. Beedi leaf collection and utilization in India. FORSPA Occasional Paper 24. Bangkok, Forestry Research Support Programme for Asia and the Pacific, FAO-RAPA.

Rao, Y.S. 1991. Non-wood forest products in the Asia-Pacific Region: an overview. *Forest News* 18(4):516.

Ruiz Perez, M. 1995. A conceptual framework for CIFOR's research on non-wood forest products. Working Paper No. 6. Bogor, Indonesia, Centre for International Forestry Research.

Saulei, S.M. and Aruga, J.A. 1994. The status and prospects of non-timber forest products development in Papua New Guinea. *Commonwealth Forestry Review* 73(2):97-105.

Shi Kunshan. 1994. China country report. In *Non-wood forest products in Asia*. RAPA Publication 1994/28. Bangkok, FAO/RAPA.

Smyth I.A. 1986. The weaving of women's life: a case study of rural non-agricultural activities in a Sudanese village (West Java, Indonesia). Ph.D Thesis. London, Anthropology Department, University College.

Warner, K. 1994. Marketing, valuation and pricing of non-wood forest products. Paper presented at the Regional Expert Consultation on the Economic, Social and Cultural Dimensions of Non-Wood Forest Products, 28 November to 2 December 1994. Bangkok, FAO-RAPA.

STATISTICAL INFORMATION ON NON-WOOD FOREST PRODUCTS

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INTRODUCTION

Statistics are about quantities and magnitudes. They are used in communicating information, keeping records and making comparisons. Forestry sector statistics should cover all aspects of the activities of the sector. The information may be needed for many different purposes, both by people within the sector and from outside.

In this presentation, four implicit characteristics (what, where, how, when) of the definition of an elementary *statistical unit* will be discussed in some detail.

Aspects about *who* produces forestry statistics on non-wood forest products (NWFPs) and *why* they vary from country to country according to national infrastructure and priorities. This paper attempts to encourage the appropriate authorities to take necessary initiatives to reinforce existing infrastructure or to create one for collecting and disseminating needed statistics.

In the wake of the United Nations Conference on Environment and Development (UNCED), the priorities in forestry statistics are:

- to maintain and strengthen basic statistics on production, trade and consumption of forest products in order to monitor the productive role of the forest in the economy. **These basic statistics should then be extended by gaining information on the role and magnitude of production, trade and consumption of forest products other than wood.**

- to strengthen the basic information-gathering capability, which corresponds to forest resource assessment and assessment of their productive capacity, and to extend that capability to monitor changes; **and to assess and monitor the forest's protective functions, such as soil and water conservation and the conservation of biological diversity.**

SOME EXAMPLES

When people use statistics, they very often use them to make comparisons. The following examples (see figures in Annex 1) come from the section "Non-wood forest products" in the FAO publication *Statistics today for tomorrow 1961-1991, 2010* (Annex 1).

The comparisons may be between **different products**, as in Figure 2, which compares natural rubber production value of Brazil compared with palm hearts production value of Brazil. The comparison may be **between the same product in different places**, as in Figure 5, Rattan Export Value of Indonesia compared with rattan export value of the Philippines and Malaysia. Or the comparison may be **between the same product in the same place at different times**: Figure 4 compares cork export values of Portugal with each five-year period since 1948.

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If a comparison is to be useful, we must know what are the products being compared, where they come from, how they are measured and when. In the graph on gum arabic (Figure 6):

the **product** and the **activity** have been named (What?):	Gum Arabic, Exports
the **place** has been named (Where?):	Sudan
the **units** are stated (How Measured?):	metric Tons, US Dollars
the **time** for which the export statistic is recorded (When?):	1980, 1981,..... 1990

Examples of other aspects of a comparison will be covered in other papers.

WHAT IS A PRODUCT?

When we speak of a product, we are talking about an object or thing which has been produced, harvested, processed, manufactured, and/or delivered to a household enterprise or market.

In the example above, we considered very few forest products other than wood: naval stores, natural rubber, palm hearts, cork, rattan, gum arabic. Some of these are large collections of products. For example, *natural rubber exports* may include natural rubber latex, whether or not pre-vulcanized and natural rubber (other than latex). Naval stores may include CTO/DTO, rosins, salts/esters, other rosin derived, turps, pine oil, other terpenes, terpene resins, etc.

When we are involved in the sale of a product, much more detailed specifications have to be considered, including the species and quality of the material. The total volume of gum arabic exports includes the volume of all types and all qualities.

Different systems of statistics show different degrees of detail. The important thing to recognize is that **any statistic must be accompanied by a definition if it is to be useful for comparison with other statistics**.

We hope to look at the major classifications and their definitions in more detail during this Expert Consultation in order to start to systematize NWFP activities involved, as well as identify major NWFPs, with the aim of establishing a framework, a structure and definition of basic statistical information.

During the regional expert consultations on NWFPs held in Asia, Africa, and Latin America, attempts were made to identify and classify NWFPs. Later, a deeper analysis was done at FAO headquarters of other international classifications (see the theme paper by Chandrasekharan).

It is worth mentioning the few examples of reporting Forest Products Other than Wood statistics at national and provincial level as part of their national yearbooks, e.g. the countries of Brazil, Chile, Philippines, Indonesia, Sudan and Tanzania.

WHERE: THE SPATIAL COVERAGE OF A STATISTIC

Statistics may be collected at a particular location in a country, for example, by province or region. The total for the country is the sum of data for provinces producing the product in the country.

The FAO international statistics gathered attempts to obtain estimates of the total for each class in any country. In the examples shown in Annex 1, the statistics were stated as the exports of a country. The assumption is that they include all exports of the product from that country.

Questions may be asked for products recognized outside a country:

- Do they include all the exports of that product?
- Are exports of all companies — large, small, government and private — included?

- Are the exports from all ports included?
- Is the cross-border trade with neighbouring countries included?

This question of coverage may be very significant in the case of domestic production (e.g. honey production, bushmeat, roots), where *market* does not mean a modern supermarket but a local market where the local product is brought and the local people purchase their daily needs.

When we speak of *location*, we should know from what type of land the products are gathered (see Annex 2 for their definitions).

- From the Forest and Other Wooded Land?
- From Meadows and Pastures?
- From Other Lands?
- From Agricultural Land?
- From Trees Outside the Forest?
- What about the ownership of the land and/or trees?
- Does it belong to the government, to communities or is it private?
- Is the product produced by a public enterprise or a private one?

Finally, are there accurate records or estimates for all of these types of land?

HOW: UNITS OF MEASURE

FAO international statistics use the metric system. National statistics may have their own measurement units and measurement conventions. As long as these are accurately known, they may be converted to FAO standard units.

Production and trade statistics are recorded in many countries in weight units: kilogrammes or tonnes. For appropriate products, these may be approximated in cubic metres using standard conversion factors.

The FAO standard for value is the United States dollar.

National currency units are converted to US dollars using current exchange rates published by the International Monetary Fund (IMF).

WHEN: THE TIME PERIOD COVERED BY A STATISTIC

The concept of time varies in different cultures. In statistics, it is an essential parameter which must always be clearly and well defined. For example, the *FAO Yearbook of Forest Products* presents statistics for the calendar year January-December. Some countries or companies maintain their statistics on fiscal or financial years, or according to different calendars. Where monthly data is available, the calendar year data can be calculated. Where countries supply data for a different time span, it may be necessary to accept this as the best estimate of calendar year data. For purposes such as marketing and trade, monthly data are important.

When we are speaking of analytical, econometric, sectorial studies, the clear time subdivision into past, present and future is a must. Often if data compilers do not observe that distinction, the resulting message is very confused, and people using the results sometimes do not recognize the difference between real observed data and projections. This leads inevitably to decisions not based on facts.

WHO: INSTITUTIONAL RESPONSIBILITIES

The responsibilities of a forestry statistical office in the production of traditional forest product statistics should be expanded also to include NWFPs. In doing this, the following should be recognized:

- main objectives of a Forestry Statistical Office;
- a Statistical Information Cycle;
- the need to build continuous understanding and support — for the statistical work;
- the demand and supply of statistical data products;
- the importance of statistics in the decision-making process;
- the role of Forestry Statistician in promoting NWFPs.

WHY: PURPOSE OF STATISTICS

We assume that facts and statistics are essential in an individual's decision-making process, to reach an effective decision. In addition, other resources and skills required include knowledge of the problems, specific experience, analysis, judgment to finally reach concrete decisions and credibility which will allow to build consensus at the local, national, regional and global levels.

With a share in the decision-making process dedicated to facts and statistics, and a well-established statistical information system, decisions can be reached and defended.

To find answers to questions of the importance of a product to a society, etc., we must recognize that **realistic information has a cost**. National institutions will only collect and contribute information if it has value to themselves.

In Figure 3 of Annex 1, the relationship between **Uncertainty** and **Cost of Statistics** over **Time** is reported. The two phenomena are reciprocal, but they are not linearly related. The cost of statistics grows linearly, but the uncertainty decreases asymptotically, never reaching zero. Each agency must identify for itself the optimal point on the curve.

INTERNATIONAL STATISTICS

FAO data is your data in the sense that the annual data published by FAO is the result of an agreement among all United Nations member countries. Everybody agrees that there is a very large number of NWFPs, and it may not be practical or feasible in the immediate future to collect formal statistics on all or even many of them at the international level.

For 17 years, from 1954 to 1971, the Forestry Department of FAO collected and published Forest Products Other Than Wood in the *Yearbook of forest products statistics*. For that period data were collected on production and export quantity and export value. The following note used to be reported for Forest Products Other Than Wood:

> Statistics on forest products other than wood are difficult to collect in all countries, and the reported figures are therefore likely to fall short on total production, and perhaps also of total trade. For this reason it is not possible at the present time to estimate regional or world totals from the statistics given.

But today, publication of inadequate information on NWFPs will not be appealing to people who use this data. Therefore, if any selected product is to be included important production and trade must be available, e.g. India and China data for bamboo.

Just to restart the publication of statistics, focus initially should be on the important products which have a long tradition at the international level e.g. cork, materials for tanning, materials for plaiting, natural gums, resins and lacs; vegetable oils; essential oils, and waxes.

For specific NWFPs important to specific groups concerned with a narrow range of products, international statistics could depend on the willingness of different groups to contribute to a collective presentation.

During the regional expert consultations on NWFPs held in Bangkok, Arusha and Santiago, and in the Seminars on Forestry Statistics held in Bangkok, Thies and Santiago, broad guidelines were suggested by the working groups as part of their recommendations for improving statistics. All participants at this meeting are invited to provide their views and suggestions.

CONCLUSION

Information is a valuable resource. The work of FAO on forestry statistics is an important contribution to the work of countries in improving their information of forests and the contribution of the forestry sector to national and rural economies. Adequate information is essential for a clear understanding of the problem, and for the formulation of sound policies and programmes in order to implement sustainable development in a way that ensures the conservation of our valuable heritage of forests and secures the benefits of their products and services for people of all countries.

ANNEX 1

AN EXAMPLE OF STATISTICS ON NON-WOOD FOREST PRODUCTS

Figure 1

Figure 2

Figure 3

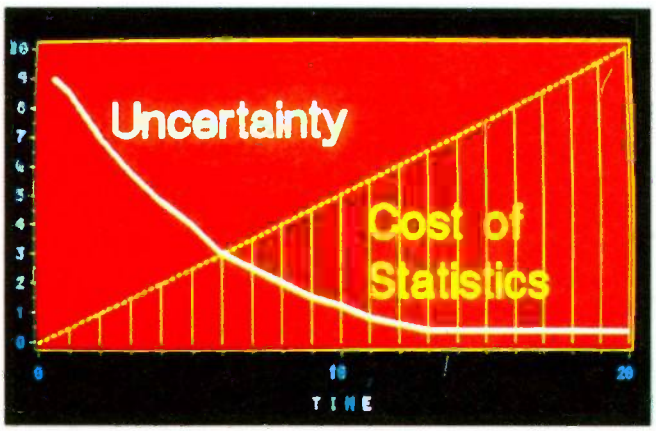

Figure 4

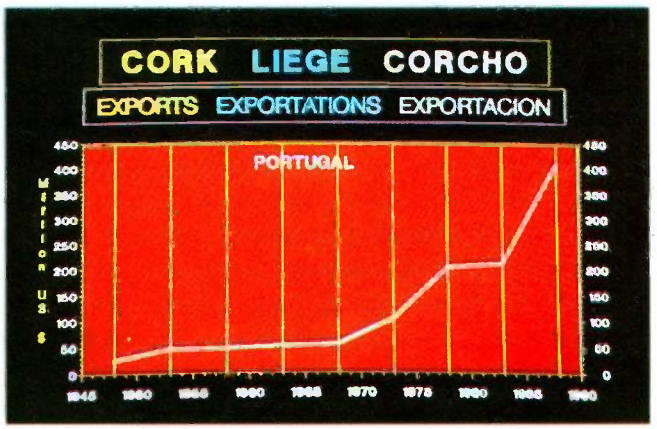

Figure 5

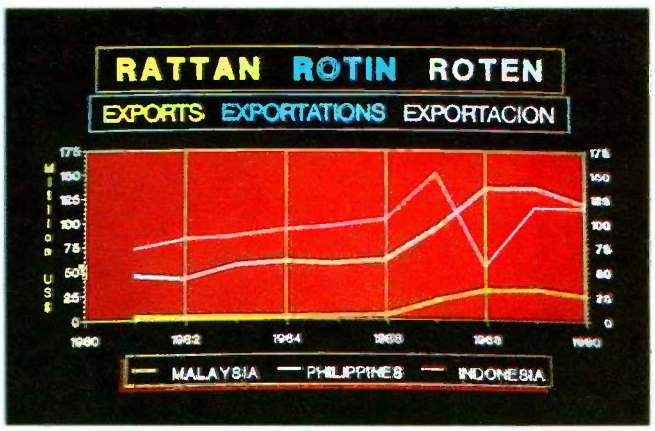

Figure 6

Note: Figures 1, 2, 4, 5 and 6 reprinted from *Statistics Today for Tomorrow, 1961-1991, 2010.* FAO, 1993.

ANNEX 2: GLOSSARY

Agricultural Land includes arable land, land under permanent crops and permanent meadows and pastures.

Arable: Land cultivated under temporary crops (double-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens (including cultivation under glass), and such land temporarily lying idle.

Permanent Crops: Land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber; it includes land under shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber.

Permanent Meadows and Pastures: Land used permanently (five years or more) for herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land).

Forest and Other Wooded Land: Land under natural or planted stands of trees, whether productive or not and exceeding 0.5 ha in extent. It includes areas occupied by roads, small cleared tracts and other small open areas within the forest which constitute an integral part of the forest.

Other Land: Includes unused but potentially productive land, built-on areas, wasteland, parks, ornamental gardens, roads, lanes, barren land, and any other land not specifically listed under: arable land, permanent meadows and pastures, land under permanent crops, forest and other wooded land.

Trees Outside the Forest includes trees on:

- Arable Land: Trees in agroforestry systems, in hedgerows and field boundaries.
- Permanent Meadows and Pastures: Scattered trees, small woodlots <0.5 ha.
- Permanent Crops: Tree crops such as rubber, coconut, fruit tree orchards, shelter trees and boundary trees.
- Other land: Trees in city parks, streets, gardens, around buildings, trees in hedgerows and in lines, along roads, canals, railways, rivers and streams, small woodlots <0.5 ha.

Source: *"Toward a common framework for world forest resources assessment".*

NON-WOOD FOREST PRODUCT RESEARCH AT CSIRO DIVISION OF FORESTRY

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INTRODUCTION

The CSIRO Division of Forestry has its headquarters in Canberra with regional groups in Hobart, Mt. Gambier and Perth. The Division has a staff of 170 and a mission to increase the economic and environmental benefit to Australia by improving the productivity and management of the nation's forests. The Division's research is organised in four programmes: Australian Tree Resources, Hardwood Plantations, Regrowth Forest Management and Softwood Plantations.

Research on non-wood forest products (NWFPs) is largely within the Australian Tree Resources programme, where the objective is to explore, sample, evaluate and distribute the genetic resources of trees of actual or potential value for planting in Australia and other countries.

NWFPs which are significant in Australia include: honey and pollen production, wild flowers and tree foliage, seed, nut and other tree crops, essential oils, sandalwood, craftwood, broombush, Christmas trees, drugs, tannins, gums and resins. Many of the existing NWFPs industries rely on exploiting natural forests, but there is increasing attention being paid to establishing man-made forests for this purpose. The human and financial resources available for work on NWFPs at CSIRO Division of Forestry are limited, dictating a high degree of selectivity in the projects undertaken and dependence on a high level of external support. Despite these constraints, a significant programme has developed within the Division, focused mainly on the Division's strengths in species selection, genetic improvement and beneficial symbionts. This paper provides a brief review of current projects on NWFPs at CSIRO's Division of Forestry.

PROJECT SUMMARIES

AUSTRALIAN *ACACIAS* FOR HUMAN FOOD

The seeds of about 50 Australian dry-zone *Acacia* species are traditional food of Australian Aboriginal people. Nutritional and toxicological analysis of seeds shows them to be quite high in protein, fat and carbohydrates, and to have low levels of known toxic and anti-nutritional factors. Recently in Australia, the seeds of several acacias have become popular ingredients of "bush tucker" (i.e. use of indigenous species of both plant and animal as food) preparations such as biscuits and coffee. Three species, *Acacia colei*, *A. cowleana* and *A. tumida,* have grown rapidly in trials in semi-arid regions of sub-Saharan Africa. In the 450-700 mm annual rainfall zone of the Sahel, wide-spaced plants can produce heavy crops of seed annually. Trials conducted at Maradi, Niger have shown that seed of *A. colei* is easily processed using local technology and can be used to prepare palatable foods (Harwood, 1994).

In August 1991, CSIRO Division of Forestry organised a workshop to discuss the merits and methods of developing the human food value of Australia's dry-zone *Acacia* species (House and Harwood, 1992). Work so far has concentrated on extending the knowledge base for species with

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human food potential, including their Aboriginal use, ecology and botany, nutritional value and performance in field trials both within Australia and outside (see Annex 1.A). Priorities for future research include feeding trials with laboratory animals, medically monitored dietary trials with human volunteers and field experiments to determine appropriate silvicultural strategies for maximum seed yields.

Cut Flowers and Foliage

Cut flowers and foliage constitute a $A 150 million industry in Australia today, with significant growth potential from expanding exports. A small project is under way at CSIRO Division of Forestry to assess the potential of eucalypts as a source of material for the cut-flower industry. A growth retardant, paclobutrazol, is being used to stimulate the formation of large numbers of flowers in potted specimens of species with colourful and decorative floral parts (see Annex 1.D.1).

Edible Fungi

The Australian Centre for International Agricultural Research (ACIAR) is currently funding a project involving CSIRO Division of Forestry in Perth, the Chinese Academy of Forestry and researchers in the Philippines to improve the performance of plantation-grown eucalypts through the introduction of beneficial mycorrhizal fungi that enhance eucalypt growth. To bolster dwindling supplies of fungi from native forests in China and the Philippines, the team is also researching the potential for introducing new species of edible fungi from Australia that are compatible with eucalypts and acceptable to the palate.

The Division is also assisting in the development of a black truffle-growing industry in Tasmania, aiming to supply truffles to the world market. Details of these projects are summarised in Annex 1.B.

Essential Oils

Essential oils are produced throughout the world. A significant proportion is produced in the United States and Europe, as well as Brazil, India, China and a number of African and Southeast Asian nations. Australia, a net importer of essential oils and oil products, has a relatively small industry with considerable scope to expand. Australian native plants used for essential oil production since early times include *Eucalyptus* , Australian tea tree (mainly *Melaleuca alternifolia*), Australian sandalwood (mainly *Santalum spicatum*), huon pine and boronia. Other essential oil crops that have been developed in Australia during the last two decades include basil, blackcurrant, caraway, citrus oils, fennel, lavender, peppermint and spearmint.

Research on essential oils at CSIRO Division of Forestry is directed at selection and improvement of yield and quality of oil in woody plant species with potential for commercial exploitation of their oils. Specific projects are briefly described below and in Annex 1.C.

Eucalyptus Oil

Commercial production of *Eucalyptus* oil in Australia began in 1852, in Victoria near Dandenong. *Eucalyptus* oils were used as medicinal products, for various industrial purposes and in perfumery and were produced from natural forests. Annual production in Australia reached a peak of about 800 tonnes in the 1950s and has since declined to less than 100 tonnes against stiff overseas competition from oils produced as a by-product of the timber industry (Boland *et al.*, 1991).

Current research in Australia is focused on the excellent solvent properties of 1,8-cineole, a major component of medicinal-grade *Eucalyptus* oils, for industrial applications like degreasing, where it may replace ozone-depleting, petrochemical-based solvents. The expectation that the demand for oil

may increase dramatically (300 times) if this new market develops has led to a resurgence of interest in production of *Eucalyptus* oil, especially in Western Australia (Barbour and Bartle, 1993).

Species included in seed collecting and selection and breeding programmes at CSIRO Division of Forestry for their oil-yielding potential are *E. camaldulensis*, *E. polybractea* and *E. radiata*. Part of the work on *E. camaldulensis* is based in Thailand, where the Division, as a component of a project funded by ACIAR, is assisting the Thai Royal Forest Department to assess the potential of producing *Eucalyptus* oil locally (Annex 1.C.4). The book, *Eucalyptus leaf oils: use, chemistry, distillation and marketing*, was prepared by Divisional staff in collaboration with University of New South Wales and private companies (Boland *et al.*, 1991). Papers highlighting the work done include Doran and Brophy (1990), Doran and Matheson (1994) and Doran and Bell (1994).

Melaleuca Oils

Several melaleuca species produce essential oils of commerce. Cayuput oil from *M. cajuputi* in Indonesia and Niaouli oil from *M. quinquenervia* in New Caledonia are among the best known. Australian tea tree oil from *M. alternifolia* has a rapidly expanding world market as a natural antiseptic. Once produced solely from natural stands in northern New South Wales, production since the 1980s has come increasingly from fast-growing, intensively managed plantations (Murtagh, 1991). Production of Australian tea tree oil is expected to reach 120 tonnes in 1994.

The Australian tea tree oil industry has recognised the need for enhanced efficiencies to maintain its position as the major world producer of this type of oil. The yields of oil from established plantations are variable; there is much scope to improve both the amount and quality of the yield through selection and breeding (Butcher *et al.*, 1994). Since May 1993, CSIRO's Division of Forestry has been assisting in a *M. alternifolia* breeding programme with the aim of increasing oil yields of new seedling plantations by 30 percent in five years.

The Division of Forestry is also involved in the screening of *Melaleuca* species and their close relatives for interesting oils with commercial potential. Part of this work is based in the Mekong Delta region of Viet Nam where, as a component of a project funded by ACIAR, one indigenous and several exotic *Melaleuca* species have been established in field trials to assess their potential for both wood and oil production.

Other Oils

A range of other Australian tree species are currently under investigation as potential essential oil crop plants (e.g. species of the genus *Backhousia*).

Honey and Pollen Production

The honey and pollen industries are important Australia-wide in all regions and climatic zones. Much of the industry is based on native species (predominantly eucalypts), but exotic and native crop plants and pasture and weed species also provide a large nectar supply for the industry. The gross value of honey production in Australia is estimated to be in the order of $A 32 million, not including the value of incidental pollination of many agricultural crops. Exports mainly to the United Kingdom, Germany and the United States earn about $A 12 million. Australia's beekeeping industry also produces 600 tonnes of beeswax annually.

Work at CSIRO Division of Forestry, as summarised in Annex 1.D, has concentrated on methods of inducing and enhancing flowering in various temperate and tropical tree species. The aims of the work are to reduce generation intervals in breeding programmes and encourage greater seed production from seed orchards of important commercial species such as *Eucalyptus nitens* (Moncur *et al.*, 1994). Research at the Division has shown that the growth retardant, paclobutrazol, previously

used in horticulture, can be used successfully in forestry. Following treatment of *E. nitens* trees with paclobutrazol at 2.5 years of age, flower buds were observed in year three, flowering occurred in year four and mature seed was harvested in year five — half the normal generation interval. A combination of additional treatments, including grafting, pot culture, temperature changes and espalier techniques, has further reduced generation time. The work of the Division on tropical tree species, such as that taking place in Indonesia with funding from ACIAR, uses similar technology to that developed for eucalypts. The Division is also assessing the potential of bees to enhance pollen flow in seed orchards, thereby improving the yield and quality of seeds in addition to providing honey as a by-product of seed orchard management.

SEEDS

The Australian woody flora is an extensive and diverse resource which has proven to be very valuable in afforestation programmes, both in Australia and in other countries. Today Australian trees are of considerable social and economic importance throughout the warm temperate and tropical regions of the world. Many species of the genus *Eucalyptus* grow quickly and can produce large quantities of wood for both industrial and community use. They are now the most widely planted hardwood trees in the world. Other widely-used genera include acacias and casuarinas: nitrogen fixing trees which are capable of tolerating harsh sites while yielding a variety of products, including timber, pulp, fuelwood, pollen in honey production and tannins. Estimates of the areas planted to species of these three genera globally are 9 million ha of eucalypts, 1.7 million ha of acacias and 1.4 million ha of casuarinas (Vercoe, 1993).

Tree seed exports from Australia are estimated to be in the order of 25-30 tonnes annually, with a commercial value of about $A 9 million (Doran and Gardiner, 1992). The Australian Tree Seed Centre (ATSC), part of CSIRO Division of Forestry, plays an important role in this industry. The Centre collects and supplies high quality seed of Australia's woody flora, with special emphasis on range-wide provenance collections and lots from widely spaced individual trees for research purposes. Currently, seed of over 1,000 species is held in store. ATSC responds to over 2,000 enquiries every year and dispatches several thousand seedlots to researchers in Australia and about 100 other countries (Vercoe and Midgley, 1993). ATSC manages the Seeds of Australian Trees Project for ACIAR. This project aims to identify and assist in the introduction and domestication of Australian tree and shrub species to meet fuelwood, agroforestry and industrial needs of developing countries. The research undertaken by the Centre generally complements the service role. Collaborative research projects cover several disciplines, including taxonomy, breeding strategies (including establishment and management of seed orchards), quantitative genetics, studies of genetic variation including use of biochemical markers, investigations of a range of physiological attributes (such as salt and waterlogging tolerance) and studies of pests and diseases of Australian trees. Several current ATSC projects are summarised in Annex 1.E.

RESINS

CSIRO Division of Forestry is presently involved in only one project concerning resins (see Annex 1.F). ACIAR is providing limited support for the gathering of baseline data on the production of benzoin resin from *Styrax tonkinensis,* which is endemic to northern Laos and Viet Nam (Pinyopusarerk, 1994).

TANNINS

Tanning greatly increases the durability, water resistance and flexibility of animal hides, which if not treated would decay rapidly. The bark of *Acacia mearnsii*, a tree native to southern Australia, is one of the most important tannin sources in the world. Australia, once the sole producer of wattlebark tannin, now imports all its supplies from other countries, including South Africa, Brazil and Kenya. Currently Australia annually imports about 7,000 tonnes (about $A 10 million) worth of wattlebark tannin. Of that, an estimated 600 tonnes is used in the leather industry while the major use

is as part of the resin component of wood-adhesives for particleboard flooring, plywood and finger-jointing (Searle, 1991).

CSIRO Division of Forestry and collaborators are presently involved in an ACIAR-funded project in China and Viet Nam to assist agencies in those countries to cultivate and improve *A. mearnsii* and other Australian acacias for wood and tannin production. In Australia, the Division is involved in similar work in Western Australia and in the Australian Capital Territory (Searle, pers. comm.). Summary details of these projects are given in Annex 1.G.

RESEARCH CONTACTS

Project leaders at CSIRO Division of Forestry for each field of NWFP research are:

Australian Acacias for Human Food	Dr C.E. Harwood
Cut Flowers and Foliage	Mr M.W. Moncur
Edible Fungi	Dr N. Malajczuk (Perth)
Essential Oils	Dr J.C. Doran
Honey and Pollen Production	Mr M.W. Moncur
Seed	Mr T.K. Vercoe
Resins	Mr K. Pinyopusarerk
Tannins	Ms S. Searle

REFERENCES

Barbour, L. and Bartle, J. 1993. Oil in the leaves. *Landscope Winter* 1993 50-53.

Boland, D.J., Brophy, J.J. and House, A.P.N. 1991. *Eucalyptus leaf oils*. Melbourne, Inkata Press.

Butcher, P.A., Doran, J.C. and Slee, M.U. 1994. Intraspecific variation in leaf oils of *Melaleuca alternifolia* (Myrtaceae). *Biochemical Systematics and Ecology* 22:419-430.

Doran, J.C. and Bell, R.E. 1994. Influence of non-genetic factors on yield of monoterpenes in leaf oils of *Eucalyptus camaldulensis*. *New Forests* 8:363-379.

Doran, J.C. and Brophy, J.J. 1990. Tropical red gums: a source of 1,8-cineole-rich *Eucalyptus* oil. *New Forests* 4:157-178.

Doran, J.C. and Gardiner, C.A. 1992. Extent, control and documentation of tree seed trade at an international level: the Australian experience. In Wolf, H., ed., *Seed procurement and legal regulations for forest reproductive material in tropical and subtropical countries*. Muguga, Kenya, GTZ-Forestry Seed Centre.

Doran, J.C. and Matheson, A.C. 1994. Genetic parameters and expected gains from selection for monoterpene yields in Petford *Eucalyptus camaldulensis*. *New Forests* 8:155-167.

Harwood, C.E. 1994. Human food potential of seeds of some Australian dry-zone *Acacia* species. *Journal of Arid Environments* 27:27-35.

House, A.P.N. and Harwood, C.E. 1992. *Australian dry-zone acacias for human food*. Melbourne, CSIRO Publications.

Moncur, M.W., Rasmussen, G.F. and Hasaw, O. 1994. Effect of paclobutrazol on flower-bud production in a *Eucalyptus nitens* espalier seed orchard. *Canadian Journal of Forestry Research* 24:46-49.

Murtagh, G.J., ed. 1991. Reports: tea tree marketing and planning conference, 31 October - 2 November 1991, Ballina New South Wales. Wollongbar, NSW Agriculture.

Pinyopusarerk, K. 1994. *Styrax tonkinensis* (Pierre) Craib ex Hartwiss: taxonomy, ecology, silviculture and uses. ACIAR Technical Report No. 31. Canberra, ACIAR.

Searle, S. 1991. The rise and demise of the black wattle bark industry in Australia. Technical Paper No. 1. Canberra, CSIRO Division of Forestry.

Vercoe, T.K. 1993. Australian trees on tour: a review of the international use of Australian forest genetic resources. Proceedings of 15th Biennial Conference of the Institute of Foresters of Australia, September 1993. Canberra, CSIRO.

Vercoe, T.K. and Midgley, S.J. 1993. Australian Tree Seed Centre: an update on current programmes and information on seed procurement for researchers. Forest Genetic Resources Information No. 21. Rome, FAO.

ANNEX 1

PROFILES OF CURRENT RESEARCH PROJECTS ON NWFPS AT CSIRO DIVISION OF FORESTRY, AUSTRALIA

A.1

1. Title:	Australian Acacias for human food.
2. Description/Objectives:	Collection and evaluation of the genetic resources of several arid zone Australian *Acacia* species.
3. Expected outputs:	1. Breeding systems and genetic diversity measurements for several acacia species. 2. Nutritional and toxicological features of these species for human food. 3. Silvicultural and production regimes for relevant species.
4. Location of research:	Northwestern and central Australia, Niger West Africa.
5. Duration:	Ongoing.
6. Partnerships:	CSIRO Division Forestry, Obajemi Awolowo University, Nigeria, Sim International Niger, several other collaborators in Australia.
7. Status:	Several field trials, most seed collections completed, human nutrition study about to commence, Ph.D. and 1 graduate student working on isozymes/DNA.

A.2

1. Title:	Provenance/progeny trials of acacia species with human food potential.
2. Description/Objectives:	1. Provenance trial of *Acacia tumida.* 2. Progeny trials of *A. colei, A. cowleana, A. holosericea, A. neurocarpa, A. oligophleba, A. thomsonii,* and *A. tropica.* The aim of these trials is to study provenance/progeny variation in growth rates, growth habit, coppicing ability and seed characteristics. It is intended to eventually thin the progeny trial into seed orchards.
3. Expected outputs:	Information regarding provenance/progeny variation, growth rate, coppicing ability and seed characteristics. Seed collected from these trials will be of value for nutritional studies.
4. Location of research:	Kununurra, Western Australia.
5. Duration:	Ongoing.
6. Partnerships:	CSIRO Division Forestry, Department of Conservation and Land Management, WA, and Department of Primary Industry, WA.
7. Status:	Ongoing.

B.1

1. Title:	Increasing productivity of *Eucalyptus* plantations in China and the Philippines by inoculation with ectomycorrhizas and nutrient application.
2. Description/Objectives:	1. Collection of ectomycorrhizal fungi for temperate and tropical eucalypts. 2. Screening ectomycorrhizal fungi that improve growth of eucalypts and that are edible. 3. Trialing inoculated eucalypts in China and the Philippines.
3. Expected outputs:	Provision of ectomycorrhizal fungal isolates that could be used in commercial inoculation programmes in China and the Philippines.
4. Location of research:	CSIRO, Div. of Forestry, Murdoch University, China and the Philippines.
5. Duration:	Ongoing.
6. Partnerships:	CSIRO, Division of Forestry, Murdoch University, Research Institute of Tropical Forestry, CAF, University of the Philippines at Los Banos.
7. Status:	Ongoing.

B.2	Development of a Truffle industry in Tasmania.
1. Title:	Consultancy to assess the development of the black truffle fungus on roots of hazel seedlings.
2. Description/Objectives:	Inoculated hazel seedlings for the production of the black truffle fungus in Tasmania.
3. Expected outputs:	Industry development.
4. Location of research:	Ongoing.
5. Duration:	Ongoing.
6. Partnerships:	Perigord Truffle Company of Tasmania
7. Status:	Ongoing.

C.1	
1. Title:	Fast growing *Eucalyptus camaldulensis* clones for foliar oil production in the tropics.
2. Description/Objectives:	Boost oil yield in combination with desirable growth characteristics by selection and cloning amongst Petford *E. camaldulensis*.
3. Expected outputs:	Fast-growing, high oil yielding clones for use in tropical countries wishing to produce *Eucalyptus* oil.
4. Location of research:	Australia.
5. Duration:	6 years.
6. Partnerships:	CSIRO Division of Forestry, Australian National University, ACIAR.
7. Status:	Nearing completion.

C.2	
1. Title:	Breeding for improved leaf oils in *Eucalyptus polybractea* and *E. radiata.*
2. Description/Objectives:	To select individuals in the field for seed collection that are superior in oil traits.
3. Expected outputs:	Seed of above-average quality for establishment of breeding programmes
4. Location of research:	New South Wales
5. Duration:	5 years
6. Partnerships:	CSIRO Division of Forestry, CALM, WA.
7. Status:	Ongoing

C.3	
1. Title:	Breeding for improved leaf oils in *Melaleuca alternifolia.*
2. Description/Objectives:	To increase the oil yields in new seedling plantations by 30 percent in five years, with a 60 percent increase at the conclusion of the first generation of breeding, about the year 2000.
3. Expected outputs:	Improved seed of progressively better quality should be available to the industry from late 1995 onwards.
4. Location of research:	New South Wales.
5. Duration:	3 years.2
6. Partnerships:	CSIRO Division of Forestry, ATTIA, NSW Agriculture, RIRDC
7. Status:	Ongoing.

C.4

1. Title:	Melaleucas and eucalypts for foliar oil production in SE Asia.
2. Description/Objectives:	1. Identify Australian *Melaleuca* species and provenances with potential for wood and /or oil production in the Mekong Delta area of Viet Nam. 2. Assess factors influencing oil yield and quality. 3. Identify *Eucalyptus* and *Melaleuca* oil markets. 4. Build a low cost oil still in Thailand.
3. Expected outputs:	1. Information on *Melaleuca* species and provenances that grow best in the difficult conditions of the Delta. 2. Seed collection and oil survey of melaleucas in northern Australia and PNG. 3. Seasonal variation in the oils of *E. camaldulensis* in Thailand. 4. Pilot oil distillations in Thailand.
4. Location of research:	Viet Nam, Australia, Thailand.
5. Duration:	18 months.
6. Partnerships:	CSIRO Division of Forestry, ACIAR, FSIV of Viet Nam, RFD Thailand.
7. Status:	Under review.

C.5

1. Title:	A study of the essential oils of tropical and sub-tropical Melaleucas and Callistemons.
2. Description/Objectives:	1. To analyze tropical and sub-tropical species of *Melaleuca* and *Callistemon* for essential oil content. 2. To use data to supplement work on temperate species relating essential oils to species taxonomy. 3. Select species for commercial essential oil production. 4. Identify and select species whose oil content and yield may be useful as a value added product in forestry and agronomy.
3. Expected outputs:	Detailed knowledge of essential oil composition of 40 species of *Melaleuca* and *Callistemon*.
4. Location of research:	Australia.
5. Duration:	12 months.
6. Partnerships:	CSIRO Division of Forestry, UNSW, ACIAR.
7. Status:	Under way.

D.1

1. Title:	Integrated seed production systems for Eucalypt breeding.
2. Description/Objectives:	To develop cultural regimes that stimulate flowering and seed production. Methods include grafting, hedging and growth retardant "Paclobutrazol".
3. Expected outputs:	Reliable source of seed, early flowering.
4. Location of research:	Canberra.
5. Duration:	2 years.
6. Partnerships:	CSIRO Division of Forestry, NSW Agriculture, University of Tasmania.
7. Status:	Ongoing.

D.2

1. Title:	Enhance seed production in tropical forest species, e.g. *A. mangium, E. urophylla,* and Dipterocarps.
2. Description/Objectives:	Using methodology developed in Australia enhance early flowering and seed production in a range of commercially important tree species.
3. Expected outputs:	Methods to increase quality and quantity of seed from plantations.
4. Location of research:	Indonesia - Java, Sumatra.
5. Duration:	Ongoing.
6. Partnerships:	CSIRO Division Forestry, Indonesian Agency for Forest Research and Development.
7. Status:	Ongoing.

D.3

1. Title:	Control of flowering in tropical forest species (e.g. *Shorea* spp.).
2. Description/Objectives:	Using methodology developed in Australia to enhance early flowering and seed production in indigenous tree species in Malaysia. These trees take a very long time to first flower (15+ years).
3. Expected outputs:	Methodology to obtain early flowering in Malaysian indigenous tree species. Assist conservation of these species.
4. Location of research:	Malaysia.
5. Duration:	Ongoing.
6. Partnerships:	CSIRO Division Forestry, FRIM.
7. Status:	Ongoing.

D.4

1. Title:	Manual "Controlled Pollination of Eucalypts".
2. Description/Objectives:	Produce a hands-on manual to help train technicians in methods of controlled pollination.
3. Expected outputs:	Completion by July 1995.
4. Location of research:	Canberra.
5. Duration:	1 year.
6. Partnerships:	CSIRO Division of Forestry, ACIAR.
7. Status:	Ongoing.

D.5

1. Title:	Reproductive biology of forest trees.
2. Description/Objectives:	Document the breeding systems of tree species. Aid to breeding programmes.
3. Expected outputs:	Methodology for controlled pollinations.
4. Location of research:	Canberra, NSW, Queensland.
5. Duration:	2 years.
6. Partnerships:	CSIRO Division of Forestry.
7. Status:	Ongoing.

E.1

1. Title:	Seeds of Australian Trees Project.
2. Description/Objectives:	1. To select appropriate species and provenances and to provide high quality seed and technical information for research projects and pilot plantations in selected countries in Asia, Africa, South Pacific and Latin America. 2. Short-term training in the fields of seed technology, design and analysis of species and provenance trials, and tree breeding. 3. Undertake advisory visits to selected countries and provide information and advice on species/provenance selection, seedling propagation and establishment techniques and pest and disease amelioration.
3. Expected outputs:	To contribute to an increase in the quality and quantity of wood and NWFPs from agroforestry, community and plantation forestry in developing countries.
4. Location of research:	Australia, Asia, Africa, South Pacific and Latin America.
5. Duration:	5 years.
6. Partnerships:	CSIRO Division Forestry, ACIAR, AIDAB, FAO and other international agencies.
7. Status:	1st year.

E.2

1. Title:	Seed orchards of tropical tree species.
2. Description/Objectives:	30 ha of seed orchards were established during 1988-1991 of *Acacia aulacocarpa, A. auriculiformis, A. crassicarpa, Eucalyptus pellita, E. urophylla* and *Casuarina junghuhniana* in northern Queensland and Melville Island, Northern Territory. The objectives are: 1. To produce a secure supply of genetically improved seed from a wide genetic base of superior provenances and provenance combinations. 2. Estimate provenance and family variation in economic traits and genetic parameters.
3. Expected outputs:	1. A secure and continuing supply of high-quality seed of superior provenances of these species. 2. Estimate provenance and family variation in economic traits and genetic parameters.
4. Location of research:	Northern Queensland, and Melville Island, Northern Territory.
5. Duration:	Ongoing.
6. Partnerships:	CSIRO Division Forestry, Conservation Commission of NT, Queensland Forest Service and Melville Forest Products Ltd.
7. Status:	Trial measurements have been recorded and seed collections made. Results have been published.

E.3

1. Title:	Improving tree productivity in South East Asia through support to FAO's Regional Project RAS/91/004. "Improved Productivity of Man-made Forests through Application of Technological Advances in Tree Breeding and Propagation" (FORTIP).
2. Description/Objectives:	FORTIP aims to significantly increase the present levels of production and use of genetically superior seed in the region to increase the potential productivity of future plantations by a minimum of 25 percent and to enhance national capabilities to develop tree improvement technologies through the development, transfer and application of appropriate tree breeding and plantation technologies.
3. Expected outputs:	1. Help ensure the long-term supply of improved tree seed of 5 priority Australian species in SE Asia. 2. Provide scientific and technical information, including biogeographic notes on two priority species and a much needed field key of the tropical acacias. 3. Provide training, through a course and field trips, to participating forest scientists to develop skills in techniques for the genetic improvement of tree species.
4. Location of research:	Australia, Indonesia, Laos, Philippines, Thailand, Viet Nam.
5. Duration:	4 years.
6. Partnerships:	CSIRO Division Forestry, FAO, AIDAB, FRDC Indonesia, Dept. of Forestry Laos, ERDB Philippines, RFD Thailand, FSIV Viet Nam.
7. Status:	1st year.

E.4

1. Title:	TREEDAT (tree performance database).
2. Description/Objectives:	Collect and selectively retrieve tree performance data related to site, species and provenance, and management factors.
3. Expected outputs:	Enhance ability to select species/provenances for various sites. Performance profiles for species across a wide range of sites.
4. Location of research:	Canberra ACT.
5. Duration:	Ongoing.
6. Partnerships:	CSIRO Division of Forestry, FAO, Australian Government Agencies, many collaborators in Asia and Africa.
7. Status:	4,000 performance records from around the world, Moderate comprehensive coverage for 6 species.

E.5

1. Title:	Variation in *Grevillea robusta*.
2. Description/Objectives:	Analysis of isozyme variability and breeding systems in natural populations. Estimation of genetic variability in exotic plantations. Establish provenance/progeny trials.
3. Expected outputs:	Obtain information on genetic variation between and within provenances as well as silvicultural and seed storage information.
4. Location of research:	Australia and Kenya.
5. Duration:	Started 1989.
6. Partnerships:	CSIRO Division of Forestry, ICRAF.
7. Status:	Ongoing.

E.6

1. Title:	Genetic diversity of *Eucalyptus urophylla* and *E. pellita*.
2. Description/Objectives:	Understand genetic variability in *E. urophylla* and E. *pellita* as an aid to provenance selection and tree improvement.
3. Expected outputs:	Understanding the nature of genetic diversity and relationships between *E. urophylla* and *E. pellita*.
4. Location of research:	Indonesia and Australia.
5. Duration:	3 years.
6. Partnerships:	CSIRO Division of Forestry, FAO and others.
7. Status:	Seed collections, isozymes, taxonomic studies complete and analysis of trial results in progress.

E.7

1.Title	Genetic improvement of multipurpose tropical trees.
2.Description/Objectives	1. Use of molecular markers to study genetic diversity, population structure and outcrossing rates in *Acacia mangium*. 2. Use of selected markers in plantation establishment and commercial breeding programmes.
3. Expected outputs	Research papers and project reports to overseas funding organisations and technology transfer to Indonesian scientists.
4. Location of research	Australia.
5. Duration	1993-1996.
6. Partnerships	CSIRO Division of Forestry, AIDAB, Forest Tree Improvement Research and Development Institute, Indonesia.
7. Status	In progress.

E.8

1. Title	Isozyme study of population genetics of *Acacia aulacocarpa*.
2. Description/Objectives	Use of isozyme markers to study genetic diversity, population structure and outcrossing rates of *Acacia aulacocarpa*.
3. Expected outputs	Research paper and honours thesis.
4. Location of research	Australia.
5. Duration	1994.
6. Partnerships	CSIRO Division of Forestry, ANU.
7. Status	In progress.

E.9

1. Title	Genetics of rainforest species.
2. Description/Objectives	1. Investigate reproductive biology of rainforest plants and relate this to mating systems and genetic structure of the species. 2. Examine genetic variation of cabinet timber species and reforestation species to assist with provenance trials and provide a sound biological basis for selection of sites for the collection of seed for reforestation. 3. Examination of fragmentation and utilisation effects on the evolutionary processes and population viability of species. The use of rapidly reproducing species, such as annuals, may provide a unique opportunity to study the effects of fragmentation on plant genetic structure.
3. Expected outputs	1. Scientific journal articles. 2. Contribution to "Atlas of Genetic Diversity" for study area in QLD.
4. Location of research	Australia.
5. Duration	Proposed.
6. Partnerships	CSIRO Division of Forestry, TREM-CRC Townsville.
7. Status	Proposed.

F.1

1. Title:	Variation in *Styrax tonkinensis*.
2. Description/Objectives:	Research on *Styrax tonkinensis,* including preparation of a species monograph, seed and resin collections and establishment of a provenance trial to study variation in economic traits.
3. Expected outputs:	Assessment of species biogeography, silviculture, resin extraction methods, assembly of germplasm, field trials.
4. Location of research:	Laos, Australia, Viet Nam.
5. Duration:	3 years.
6. Partnerships:	CSIRO Division of Forestry, ACIAR, QFRI, Laos Dept. Forestry, FSIV.
7. Status:	Approaching project review.

G.1

1. Title;	Australian acacias for sustainable development in China, Viet Nam and Australia. ACIAR Project 9227
2. Description/Objectives:	This project will explore the potential of 30 Australian acacia species for their potential under cultivation for multipurpose uses in China, Viet Nam and Australia. Biological and economic surveys of insect pest damage will be conducted. Rhizobia associated with these species will be collected and screened for effectiveness and persistence.
3. Expected outputs:	A wider choice for successful tree-form legume species for land rehabilitation and economic return in cool subtropical areas, together with effective and persistent rhizobia strains that will be more appropriate for insect prone areas.
4. Location of research:	Australia (NSW, Vic, ACT), China (Guangdong, Guangxi), Viet Nam.
5. Duration:	3.5 years
6. Partnerships:	CSIRO Division of Forestry, Plant Industry and Entomology, ACIAR, Chinese Academy of Forestry, Research Institute of Tropical and Subtropical Forestry and Forest Science Institute of Viet Nam.
7. Status:	Ongoing.

REFERENCE MATERIALS DISTRIBUTED AT THE CONSULTATION

In addition to the seven theme papers and 11 satellite papers included in the proceedings, the following documents were distributed at the Consultation.

General Reading

The major significance of "minor" forest products: the local use and value of forests in the West African humid forest zone (Julia Falconer, Community Forestry Note 6, FAO, 1990).

Non-wood forest products: the way ahead (Forestry Paper 97, FAO, 1991).

More than wood: special options on multiple use of forests (FAO Forestry Topics Report, 1994).

Development of non-wood forest products in Latin America and the Caribbean (Voluntary paper for the Consultation prepared by C. Chandrasekharan and T. Frisk).

Non-wood forest products in Asia (eds: Durst, Ulrich and Kashio). RAPA publication No. 28, FAO, Bangkok, 1994.

Non-wood forest products: proceedings of a Regional Expert Consultation for English-Speaking African Countries held in Arusha, Tanzania, 17-22 October 1993 (CSC London and FAO Rome).

Memoria: Consulta de expertos sobre productos forestales no madereros para América Latina y el Caribe, Santiago, Chile, 4 al 8 de julio de 1994. Serie forestal No. 1, FAO Santiago.

Socio-Economic Benefits

Case studies of forest-based small-scale enterprises in Asia: rattan, matchmaking and handicrafts (ed. J. Campbell, Community Forestry Case Study No. 4, Bangkok, FAO-RAPA, 1991).

Assessing multiple values of forests (J.E.M. Arnold in Network Paper 13e, ODI/RDFN, 1992, pp 13-18).

Household food security and forestry: an analysis of socio-economic issues (Community Forestry Note 1, FAO, 1991).

The socio-economic role of non-wood forest products in a logging concession in East Kalimantan, Indonesia: a research concept (Voluntary paper for the Consultation prepared by Carol Grossmann).

Summary report of FAO regional expert consultation on NWFPs in Asia-Pacific, held in Bangkok, 28 November - 2 December 1994: social, economic and cultural dimensions (Voluntary paper for the Consultation prepared by Patrick Durst).

Processing and Marketing

Market-related constraints to non-timber forest product development in Central America: experiences from the CATIE/Olafo Project (Voluntary paper for the Consultation prepared by Justine Ken and Luis Bianco).

Non-wood forest products in Nepal (Voluntary paper for the Consultation prepared by Bijay Kumar Singh).

Modern medicines from primitive forests. Paper presented at the Global Forest Conference, Bandung, Indonesia, February 1993, by James A. Duke.

Eucalyptus oils: a review of production and markets (J.J.W. Coppen and A. Hone, NRI Bulletin No. 56, 1992).

Marketing of Brazil nuts: a case study (FAO, Rome, 1992).

Chemical processing and utilisation of *Acacia catechu* (RAPA publication No. 19, FAO, Bangkok, 1992).

International trade in non-wood forest products (FO:MISC/93/11, FAO, Rome 1993).

Design options for a polyvalent pilot plant unit for the distillation and extraction of medicinal and aromatic plants (UNIDO, 1991).

Jatropha curcas: a multipurpose species for problematic sites (World Bank, 1992).

Draft NTFP manual (Prepared for circulation to the participants by Appropriate Technology International).

Summary report of the Workshop on non-timber tree products market research held in Annapolis, USA, 12-14 December 1994 (Voluntary paper for the Consultation prepared by Ruiz-Perez, CIFOR).

The present situation of non-timber forest products in Costa Rica. CATIE Working Paper No. 7/1994 (Rafael Ocampo).

Resource Management and Environment

Domestication of high-value trees for agroforestry: an alternative to slash and burn agriculture (R.F. Leakey and J.A. Maghembe, ICRAF Position Paper, 1994).

The development potential of selected Amazonian non-wood forest products: an appraisal of opportunities and constraints. Presented at the Expert Consultation on Non-Wood Forest Products for Latin America and the Caribbean, Santiago, Chile, 4-8 July 1994 (J.J.W. Coppen, A. Gordon and C.L. Green).

Sustainable Use of Non-wood Forest Resources in the Province of Peten, Guatemala, as a Strategy for Conservation and Development (Voluntary paper for the Consultation provided by Palacios Mendez).

African medicinal plants (People and Plants Working Paper 1, WWF/Unesco, 1993).

Non-wood forest products of Papua New Guinea (FORSPA, 1994).

Non-wood forest products of Himachal Pradesh, India (FORSPA, 1994).

Sustainable utilization of medicinal plant and animal diversity in Indonesian Tropical forests (Ervizal A.M. Zuhud, Indonesian Tropical Forest Institute, 1994).

Institutional Considerations

Tree and Land Tenure in the Eastern Terai, Nepal (FAO Community Forestry case study series No. 9, 1993).

NTFPs: 3 Views from Africa. ODI Rural Development Forestry Network. Network Paper 15c, Summer 1993.

Non-wood forest products in forestry education. Paper presented at the 17th session of the FAO Advisory Committee on Forestry Education, Bangkok, Thailand, December 1993 (C. Chandrasekharan).

Study on beedi leaf collection and utilization in India (FORSPA, 1994).

REGIONAL GROUP REPORTS

AFRICA

SOCIO-ECONOMIC BENEFITS

Many socio-economic problems relate to the use, development, and management of non-wood forest products (NWFPs). The theme paper clearly examines these and helps to ensure that NWFPs and their development are firmly placed in the context of livelihood systems, rather than viewing their development as merely a process of identifying products, developing markets, and improving processing technologies. The following group report starts from the discussion section of Arnold's paper, which highlights "four sets of issues that appear to be of particular importance", and examines these from an African perspective. Many of the following suggestions represent merely a shift in emphasis.

In identifying key issues for Africa, the following are key factors:

- Communal land ownership and widespread common property regimes are the norm.
- Colonial and post-independence governments have undermined traditional and social structures. There have been great changes in decision-making structures, making strategies for local and community management of forest resources difficult.
- A larger proportion of Africa's population lives in rural areas compared to other regions. Subsistence uses of NWFPs remain very important. Declines in agricultural productivity have led to the increased importance of other activities, including those based on NWFPs.
- Poverty is endemic, and the related issues highlighted in Arnold's paper are particularly important. There is also the need to examine the macro-economic framework related to poverty.
- Insecurity and risk, both economic and environmental, are perennial problems. NWFPs play important roles in people's strategies to cope with these risks.
- Much of Africa has woodlands and savannas under sub-humid and semi-arid conditions; thus we must beware of generalising findings from more humid regions.
- Africa possesses widespread and important systems based on grazing/pastoral and wildlife systems, which hold unique opportunities and constraints related to NWFPs.
- Africa faces widespread weaknesses in institutions and infrastructure.

ISSUES THAT REQUIRE ATTENTION

Recognition of the Full Range of Benefits and Values of Forests and Trees, and not Exclusive Focus on Income Generation Potential

Addressing this would require documentation and valuation of subsistence use (including use of NWFPs for risk aversion), cultural and spiritual values, and ecotourism/recreation values. We need to understand the processes involved in the despiritualisation and deculturalisation of people. An analysis of related downstream economic activities (e.g. leather, meat, and bone industries ultimately derived from forage) and their attributable linkage to resource base should be incorporated in any valuation.

Current analyses of value of NWFPs still tend to view people as mere links in a technological process. We should increasingly empower local communities through participatory methodologies.

More attention needs to be focused on the methodological and conceptual framework for valuation, and ways to develop inventories of NWFP resources.

Equitable Access to NWFP resources

Arnold's paper (Appendix 4.1.1) discusses the need to identify the beneficiaries of commercialisation, stressing the need to identify differences based on wealth status and gender. The Group further recognised the need to identify inequities that arise due to ethnic and rural-urban divisions. For example, development of NWFPs in Botswana could benefit the Bakalagadi, to the disadvantage of the San!; many other examples of conflicts exist between pastoralists and settled farmers.

Diminishing Access to Supplies

We should not only recognise logging and agricultural expansion as driving forces determining NWFP supply, but be aware that in Africa, droughts cause cyclical patterns of supply.

In the face of diminishing resource supplies, increasing amounts of NWFPs are derived from on-farm sources. While this is also true in sub-humid and semi-arid systems, it occurs to a lesser extent than in humid systems.

Tenure and Control

Due to the predominance of common property regimes in much of Africa, this set of issues contains some of the most important ones to be considered in developing NWFPs. The relationship between commercialisation and its potential negative impacts needs to be explored, as the breakdown may often lead to uncontrolled extraction, and an emerging conflict between extraction and conservation.

The theme paper generalises that breakdown of common property regimes often leads to privatisation of the resource, with much of NWFP production then taking place on-farm or in bush-fallow. While the privatisation trend may occur, the sustainable level of supply from on-farm sources is probably lower in semi-arid and sub-humid systems. Furthermore, the trend to privatise is not universal: several cases document a renewed interest in community management. For example, communities in Ghana have attempted to reassert their control over forest patches outside government forests; likewise, communities in some wildlife areas have developed strong institutional arrangements to control wildlife resource.

Regulation and Support

Much of Arnold's paper looks at regulation and support mechanisms to improve the income-generating capacity of NWFPs. The Group agreed that such mechanisms have to be considered to ensure the sustainability of NWFPs for subsistence and risk aversion.

At a broader level, it is necessary to understand the macro-economic framework within which NWFPs are utilised and commercialised, including:

- land policies and their relationship to tenure regimes;
- economic policies, such as Structural Adjustment, which can result in rapid changes in the utilisation of NWFPs due to, for example, removal of subsidies and trade barriers, or changing exchange rates;

- international policies that influence trade (e.g. CITES ban on trade in ivory, and EU beef policy resulting in changes in West African cattle systems) and commodity pricing.

PROCESSING AND MARKETING

A number of elements that need stressing in the African context include, among others, the following:

- NWFPs play a very important role in the subsistence economy, so when discussing the development of NWFPs we should not concentrate on income-generating activities.

- NWFPs are largely traded in the informal sector, so our discussion and recommendations should not be focused on national and international trade in the formal sector.

- African governments have dominated the national and international markets, but this situation is changing rapidly, creating new opportunities and constraints.

- Markets are very changeable (e.g. in relation to international pressures and problems of supply during droughts). Risk-aversion strategies for markets are required.

- Wildlife is a major sub-sector in Africa; wildlife could provide substantial benefits to local people and forestry institutions.

In general, we should beware of a product focus or bias; there is need to ensure that the discussion and recommendation take into account the socio-economic context.

Information Needs

- Information on harvesting and processing techniques that ensure high-quality products and cost-effectiveness must reach producers.

- Marketing information needs to reach producers, so they can integrate their activities into the marketing chain and gain leverage with other links in the marketing chain. It is especially important to have this information to take full advantage of "green consumerism". It is important that marketing efforts are not confined to existing products but that these efforts are coupled with a continuous product and market exploration process. Market information should reflect local business aims, and not only the interests of third-party institutions.

- The statistical base on NWFP trade at all levels (including international standards and the effect of international trade agreements and fluctuations) and production needs to be improved and communicated to producer groups.

- There is an urgent requirement to document indigenous technical practices (e.g. the many fermentation techniques that are largely unknown by technocrats).

- Intellectual property rights (IPR) with regards to traditional uses of plants and traditional processing techniques need to be protected.

Financial and Infrastructural Requirements

- Simple tools can have major positive effects on efficiency of harvesting and processing, and thus can relieve labour bottlenecks, especially for women.

- The availability of credit is a major constraint to small-scale producers, traders, and processors. Governments need to review policies so as to provide financial support to this sectors.

POLICY

- NWFPs must be recognized as a sub-sector in its own right. And, economic instruments, for example, should be placed on the same level as those for other agricultural commodities.

- Policy development needs to take place within the sub-sectors of wildlife and tourism, so as to ensure that benefit reach the local people.

RESEARCH

- Techniques and tools for post-harvesting and processing need to be developed to ensure high-quality products, and to capture value at the local level. The latter is of greater priority.

- Storage techniques require more attention as a risk-averting strategy.

- Our knowledge of the informal sector needs to be expanded so that we can identify support mechanisms.

- We need to establish criteria for assessing the performance of the marketing system. Three sets of criteria are suggested, those related to: i) efficiency (the ability of markets to match supply and demand); ii) equity (the need to ensure a symmetric distribution of information among market participants); and iii) progressiveness (i.e. Are market participants changing marketing practices?).

ADDING VALUE LOCALLY

In addition to the relevant points above, the Group noted:

- The need to ensure continuity of supply;

- The need for an organisation to be identified that can facilitate value addition;

- The need to establish pilot-scale processing facilities (e.g. through national institutions and UNIDO) and to encourage local entrepreneurship.

RESOURCE MANAGEMENT AND ENVIRONMENT

The African continent has seen a steady decline of its forest cover. An estimated 4.1 million ha of forest (about 0.7 percent of the land area) disappeared just in the period 1981-90. This rapid decline of all forest types will have serious implications on strategies for sustainable management and development of NWFPs.

ENVIRONMENTAL ASPECTS

Key Problems and Recommendations

- The environmental role of NWFPs in the forest ecosystem has been largely ignored by foresters and researchers.

  Recommendation: Formal forestry training should recognize the considerable traditional knowledge about the multiple functions of NWFPs within the forest environment. Likewise,

research on the environmental impact of NWFP harvesting should proceed in cooperation with the harvesters and processors themselves.

Recommendation: Techniques for measuring the environmental impact of NWFP harvesting (for example, the "willingness to pay approach") need to be refined and applied to improve the African countries' existing environmental impact assessment procedures.

- Methodologies for natural resource accounting are poorly developed and problematic, but they are still important tools to assist decision-makers in the natural resource sector. The valuation of NWFPs is particularly important as it more closely reflects the value of forests to communities and the national economies.

- Where particularly important habitats for rare or heavily exploited NWFPs share international boundaries, regional cooperation in their management and protection is needed.

RESOURCE MANAGEMENT AND DEVELOPMENT

- Tenure and usufruct rights are necessary ingredients for local people's sustainable management of the NWFP resource. Governments need to demonstrate greater commitment to tenure reforms which encourage people's participation in NWFP management.

- A comprehensive national strategy for the management and development of NWFPs appropriately covering resource inventory, harvesting and processing, utilization and marketing, research and extension support, training and institutional arrangements is an urgent need. This is an issue to be raised by FAO at the Rome Ministerial Meeting and to the Commission on Sustainable Development.

- Local communities must be fully involved in planning and implementing strategies to manage their NWFP resources on a sustainable basis.

- Existing conventional forest management systems should draw lessons from indigenous management experiences in developing management systems to sustain NWFPs.

- NWFP inventories are a critical tool for sustainable management. These inventories should be designed to meet specific management objectives.

- Forest inventories to monitor growth and conditions of the NWFP resource are needed. While this may involve national survey teams, it also must involve local NWFP users.

- Because of the fragility of arid ecosystems, regular ecosystem monitoring should be an essential part of NWFP management practice in these areas.

- Forest user communities should be supported to inventory and assess the NWFP resources which they use and manage. Experience in Ghana has shown that communities can survey their resources and this process engenders a strong sense of stewardship.

- Communities should be encouraged to share the costs and benefits of managing NWFP resources, alongside government or other management agencies. Experience in Morocco has demonstrated that this can be a successful way of sustaining NWFPs.

- NWFP supplies have to be understood in terms of the interface between agriculture and forestry. In West Africa, for example, the bush fallow has been the major source of most commonly exploited NWFPs. Degradation of fallow land as a result of fire, reduced fallow length, and new weed species are all having major impacts on NWFP supplies, and causing forests to be more heavily exploited for subsistence uses of NWFPs.

- There is urgent need for research to develop new harvesting technologies, especially where the whole plant is destroyed to extract a particular product.

- Research should document the ethno-pharmacology of African plants at national and regional levels.

- The Group suggests that a manual be prepared on NWFPs of the countries of Africa. This manual should contain data on species distribution, bio-data, domestication potentials, traditional and commercial values, processing technologies, markets and management of the resource. A special section should include methodologies for motivating communities to develop their own strategies to utilize and manage their forest resources on a sustainable basis.

- Medicinal plants should be screened for their active ingredients and to verify their pharmacological properties.

- Domestication strategies for locally-important NWFPs should build from the existing experiments and initiatives of farmers.

- Low-cost innovative domestication strategies should be encouraged. For example, in Botswana, a nation-wide search for superior varieties of indigenous fruit trees was carried out through a school competition programme.

- Methods need to be developed for increasing and sustaining widely exploited NWFP resources through enrichment of secondary forests and timber plantations. This offers an intermediate strategy between management of NWFPs in natural forests and domestication in farming systems.

- Local NGOs should play a critical role in advocating government policy reforms to promote sustainable NWFP management and development. International NGOs should support this process.

- National industrialization policies and programmes should include development of NWFP-based industries.

- Some widely exploited NWFPs are of regional importance (e.g. cork). Domestication and semi-domestication can be encouraged to maintain the source species throughout its range.

INSTITUTIONAL CONSIDERATIONS

It is essential that African institutions involved in R&D be strong and can act flexibly in response to changes in international markets, natural disasters, dramatic developments in the macro-economic environment and changing needs of local communities.

The Group also notes that progress in NWFP development has been slow and uneven. Very poor linkages exist between researchers, policy-makers, managers and communities.

POLICY AND LEGISLATION

- Policies are fragmented, sometime contradictory, not enabling and often inflexible. The Group recognized that some of the objectives in the promotion of NWFPs are difficult to conciliate: objectives such as promoting community participation, ensuring conservation objectives and encouraging entrepreneurship.

  The Group stressed again the importance and fundamental role of policy, legislation and regulations. These should be inspired by local practices, cultures and needs; their formulation

should benefit from the inputs of various sections of the society. National and regional level review exercises of existing policies to assess their support to local community participation, equity in participation, land tenure aspects, etc., are needed; these reviews should be conducted with grassroots participation, and with due sensitivity to African cultural and spiritual heritage (e.g. using customary rules as a basis for policy), and giving adequate emphasis for environmental considerations in policies (e.g. ensuring environmental impact measurement of activities).

- There is a need to look forward, with the benefits gained from hindsight and lessons learned from successful experiences as well as failures. For example, there has been spectacular progress with certain resource management schemes and products (e.g. wildlife in Southern Africa). But it is found that too little analysis is made of their past successes and failures. Greater attention to policy analysis and research is needed.

- There has been international interference in national policies (e.g. CITES policies and global research policies). It is recommended that greater attention be given to the development of national policies (e.g. Science policies, Forestry policies), well focused to national needs and not to suit the agenda of donors.

Research and Development

The nations of Africa need strong research organisations, but instead they are characterized by understaffing, unmotivated personnel and high turnover. The fundamental problem is poor salaries and low research budgets. National governments and donors need to come up with creative mechanisms to ensure that good scientists remain within national research institutions and can devote themselves fully to their work. The Group recommended that research budgets be derived partly from export earnings of forest products, fixed on a percentage basis; also a percentage of the budgets of development projects could be earmarked for applied and adaptive research to directly support development activities.

Training

Regarding training, the Group recommended that national training policies be developed, to ensure an appropriate mix of skills. Wherever possible this training should be done in-country or within the region.

Cultural and Spiritual Heritage

There has been a despiritualisation of African culture. Africa now has a new cadre of scientists with little links to realities in rural areas and to African heritage. The number of African anthropologists are limited, to be able to impregnate social valves in the scientific and technical realm. A number of reorientations and adjustments are needed which are relevant to the development of local resources, products and benefits responding to real needs of societies. Hence, i) researchers should maintain strong linkages with real life and conditions at field level; ii) local knowledge, craft/skills and values should be incorporated in science and development.

Political Will

The Group noted a general lack of political will to implement policies that are widely accepted as socially just and environmentally friendly. The Group recommended that i) scientists provide more easily-accessible information materials to politicians; ii) that all aspects of development and research be depoliticised; iii) scientists, especially those heading research institutions endeavour to better reach politicians to promote their support to research agendas and programmes; and iv) donor agencies devise mechanisms to ensure that their activities are politically correct, and well focused on the real needs of societies.

Institutional Frameworks

- The Group recommended that more attention be given to supporting the activities of NGOs, as they may be well placed to ensure communication at grassroots level and liaison with all sections of society.

- Research centres should be "deconcentrated" so that scientists are in closer contact with rural realities.

- The Group recommended that some institutions experienced in selected domains be identified and co-opted as regional resource centres (e.g. Veld Products Research in Botswana). Also it recommended that learned societies, such as the African Academy of Sciences, be given greater support. Such regional institutions could assist in providing information on regional issues such as development opportunities and markets; networking; providing resource persons; conducting research and acting as a conduit for funding. The present efforts to support forestry research and related networking in Africa should be accelerated.

- Governments need to be supported in key areas, *viz.* improved information dissemination, effective trade negotiation and the development of key policy options to promote NWFPs.

ASIA - CONTINENTAL

SOCIO-ECONOMIC BENEFITS

An adequate database does not exist on socio-economic benefits of non-wood forest products (NWFPs) in the region. There is a need to develop a system of collecting information on resource extent, quality, uses, and values.

Government policy needs to be reoriented towards sustainable management of NWFP resources by:

- properly accounting for the contribution of NWFPs in national economies (GDP);
- enhancing the budgetary, investment, and pricing mechanisms in the area of NWFPs;
- granting local organisations (e.g. user groups, cooperatives) a greater say in management of the resource.

A systems approach should be adopted in the analysis of issues and approaches to NWFPs development.

EQUITY

This issue needs to be addressed at four levels:

- collectors/producers;
- intermediaries;
- processors;
- end-users including related institutions.

At each level the specific issues identified and possible initiatives recommended to deal with the issues are as follows:

Producers/Collectors

Key Issues

- Primary collectors are not getting due share of the total benefits accruing from the NWFPs.
- Government initiatives are inadequate or counterproductive.

Proposed Initiatives

- Organise communities in user groups and/or cooperatives through active government agency or NGO support.
- Revise policies to assure access rights to the poor and marginalized groups through user groups or cooperatives.
- Provide information on resource inventory, management alternatives, market facilities, and price information to the producers/collectors.

- Facilitate development of appropriate post-harvest technologies.
- Organise/develop primary processing and packaging near the production/harvesting areas, especially in inaccessible mountain areas.
- Develop information systems for biological monitoring and ecological sustainability of NWFP resources.
- Protect the rights and interest of women and disadvantaged groups in managing the NWFPs.

Intermediaries

Key Issue

- Middlemen and other agents are taking disproportionate share of benefits and there is a perception that they exploit the collectors.

Proposed Initiatives

- Identify types of intermediaries and their roles at different levels.
- Create transparency in their dealings.
- Weaken/restrict trade monopolies through actions by government and NGOs.

Processors

Key Issue

- Availability and choice of technology is poorly understood.

Proposed Initiatives

- Emphasise employment generation and achieving livelihood security.
- Use cost-effectiveness criteria in selecting appropriate technologies.
- Encourage final processors to invest in R&D support in field-level resource development.
- Develop mechanisms for re-investing part of the revenue earned from NWFP-based enterprises in biodiversity/resource conservation.

End-Users and Related Agencies

Key Issue

- Unstable market prices and inadequate information.

Proposed Initiatives

- Develop inter- and intra-state coordination to develop NWFP market and share information.
- Encourage national and international donor agencies to transfer appropriate technology for NWFP processing.

- Provide adequate market and price information to capture the real cost and values of NWFPs.

SUSTAINABILITY

Key Issues

- The major issue is that the current NWFP management approach is product-oriented rather than resource-oriented.
- Biological criteria of sustainable management of NWFPs for multiple use values need to be adopted.
- Socio-economic basis of sustainable use of resources needs analysis and better understanding.

Proposed Initiative

- *Ex situ* conservation and domestication should be promoted wherever needed to achieve biodiversity conservation and sustainable management.

TENURIAL ISSUES

Key Issues

- Tenurial rights and access to resources are not well defined and ownership rights are not available to the forest based communities.
- Benefit from biodiversity prospecting by interest groups does not flow equitably.

Proposed Initiative

- Review existing tenurial, access, use, and biodiversity prospecting rights and modify them as appropriate to benefit the communities and lead to sustainable use of resources.

GOVERNMENT REGULATIONS

Key Issue

- Generally current regulations including movement of NWFPs are complicated and do not support community-initiated NWFPs development.

Proposed Initiative

- Government policies need to be reviewed and improved to address this issue.

PROCESSING AND MARKETING

Primary production, processing, marketing and trade are interlinked activities. There are variations in methods of processing and approaches to marketing and trade in the region. There are also large inter- and intra-regional markets for NWFPs.

In general, processing and marketing activities are not very organised. Primary producers are not receiving due benefits.

Information and technology flow among the three stages — gathering/collection, processing, and end use — are not adequately developed.

Inadequate policy environment affects the processing, marketing, and trade of NWFPs.

Key issues identified and initiatives proposed are the following:

PROCESSING

Key Issues

- Lack of effective organisations of collectors to gain access to knowledge about resource stocks, processes, and markets with which they could enhance their bargaining power.
- Lack of quality control and certification for NWFPs at the primary producer level.
- Lack of investment capital, financial support and incentives.
- Inadequate processing technologies for multiple products.

Proposed Initiatives

- Develop mechanisms/agencies/institutions at appropriate levels for:
  - adaptation of simple technologies;
  - organisation of information systems and dissemination of knowledge at all levels;
  - quality control and certification in accordance with types of markets;
  - appropriate environmental guidelines to promote environmentally suitable processing and monitoring activities;
  - organised supply of raw materials at the local level through balancing of government policies concerning *in situ* and *ex situ* production/conservation systems.
- Processing facilities to be developed near raw material sources.

MARKETS AND TRADE

Key Issues

- Inadequate product promotion and marketing practices.
- Fluctuations in national and international markets, and risks and uncertainties associated with NWFPs marketing at those levels.
- Lack of an early warning system on threats of synthetic substitutes entering markets.
- Inadequate marketing skills and lack of strategies for human resource development.

Proposed Initiatives

- Create database on markets and disseminate the information appropriately.
- Action by government agencies, NGOs and others to increase awareness of product values, uses, quality standards, and environmental implications through national and international trade fairs, publicity and other means.

- Strengthen R&D infrastructure to face the possible developments in synthetics and NWFP substitutes.

- Facilitate maintenance of raw material sources in order to ensure sustainable and stable supply, depending on types of NWFPs.

- Promote product diversification.

- Strengthen appropriate organisations to support capacity-development at all levels.

RESOURCE MANAGEMENT AND ENVIRONMENT

Almost all forests in continental Asia are being utilised at varying levels of intensity. Changes in forest management will therefore have implications on community welfare and sustainability.

Resource management for NWFPs should first be oriented toward meeting local needs; once these are met, commercial prospects can be explored. For large-scale commercial use, the focus needs to be *ex situ* cultivation.

The objective of NWFP resource management should be sustained multiple use; and management systems should be geared toward this objective.

Wildlife-based NWFPs are relatively less important in this region. However wilderness-based services such as ecotourism and biodiversity prospecting remain important and have considerable development potential.

Unprecedented pressures on forest resources, caused due to growing population, often lead to over-harvesting and unsustainable uses. Experience has shown that resource management through participatory approaches can greatly help integrated and sustainable management of NWFP resources.

Key issues identified and proposed initiative are given below:

RESOURCE ASSESSMENT

Key Issues

- Methodologies for assessing NWFP resources are not fully developed and have been applied to only a few commercially important species.

- Assessment methods are expensive and time-consuming, and trained human resources and financial resources are lacking.

- There are gaps between assessments of resources at different spatial and temporal levels and scales.

Proposed Initiatives

- Prioritize NWFP resources for assessment based on community perceptions, biological potentials, and market demand.

- Develop, standardize and disseminate methodologies/techniques in appropriate packages for rapid assessment.

- Develop cost-effective assessment methods, suitable curricula and training capabilities for human resource development.

- Encourage coordination among researchers/institutions working on different spatial and temporal scales through the use of modern techniques such as geographic information system (GIS).

RESOURCE MANAGEMENT

Key Issues

- Management of NWFP resources is not incorporated in existing resource management systems, which are biased toward timber. As a result, management know-how for sustainable utilisation of NWFPs has not been adequately developed.
- Existing management systems do not adequately incorporate indigenous resource management knowledge and skills.
- Research in the fields of natural regeneration, management, and harvesting of NWFPs is inadequate.
- Suitable training materials, courses, and out-reach mechanisms are lacking.
- There are no mechanisms for resolving conflicts between competing users of NWFPs.
- There is not enough *ex situ* cultivation to meet growing demands for NWFPs in cases where demand outstrips forest-based supply.
- Risks in investment on *ex situ* production and export of NWFPs due to changing government policies and risks associated with monoculture plantations
- Lack of regional coordination in prioritization and utilisation of NWFP species

Proposed Initiatives

- Incorporate NWFP management in existing management plans and make use of the indigenous knowledge-base in future plans.
- Develop and strengthen participatory approaches for resource management through involvement of stakeholders.
- Commit financial resources for upgrading research and training facilities in existing institutions.
- Incorporate NWFP species in current and future forest plantations with a view to support local needs.
- Review government policies and make them responsive to the risks associated with *ex situ* cultivation with appropriate incentives.
- Facilitate networking, information dissemination, and technology transfer through international agencies such as FAO, and bilateral arrangements.

ENVIRONMENTAL DIMENSIONS

Key Issues

- Depletion of natural stocks, and degradation of eco-systems due to over-exploitation of NWFPs.

- Lack of understanding of social and economic variables that lead to judicious and injudicious use of NWFPs.

- Lack of government policy initiatives and funding for sustainable development of NWFPs.

- Lack or inadequacy of indicators to assess environmental impact of NWFP harvesting.

Proposed Initiatives

- Facilitate provision of extension support through government organisations and NGOs to raise awareness of environmental and economic benefits of sustainable use of NWFPs.

- Provide training on improved methods of pre- and post-harvest technologies for NWFPs.

- Facilitate micro-level planning through forest resource managers with active participation of stakeholders.

- Initiate comprehensive case studies for improved understanding of the social, cultural and economic variables *vis-à-vis* use of NWFPs.

- Re-orient government policies and programmes to support environmentally sound NWFP resource management.

- Encourage research institutions to develop indicators for environmental monitoring and strategies for impact assessment of NWFP harvesting.

- Designate core protected areas and buffer zones for conservation of biodiversity in all ecological regions.

INSTITUTIONAL CONSIDERATIONS

In most of Continental Asia, policies, instruments for their implementation, and related institutions are not conducive to sustainable utilisation of NWFPs. A fundamental re-orientation in policies, strategies, instruments, and institutions from the highest to the lowest level is needed to address the many issues raised.

Legal and socio-economic dimensions of NWFP development need to be incorporated in this re-orientation.

Research, education, training and extension need to be integrated in formulating policies and building institutions at operational levels. Action-oriented research needs special emphasis.

NWFPs need to be recognized as one element of an overall strategy for rural community development. Spatial priorities need to be set for NWFP development, emphasising marginalized regions (e.g. mountains and areas inhabited by ethnic minorities).

Key issues identified and initiatives proposed are as follows:

INSTITUTIONAL ASPECTS

Key Issues

- Lack of clear national policies on utilisation, conservation and management of NWFPs.

- Existing legislation and regulations are not conducive to NWFP development.

- Lack of response in existing institutions to current needs in NWFP development related to research, training and extension.

- Lack of coordination among agencies involved with NWFP development.

- Lack of region- and area-specific strategies and guidelines for field implementation of favourable NWFP development policies.

- Lack of complementary policies to strengthen human resource development in NWFP activities.

- Lack of clear policies regarding devolution of authority, and tenurial and usufruct rights of indigenous groups regarding management and utilisation of NWFP resources.

Proposed Initiatives

Initiatives proposed to be taken by different institutions/organisations are given below:

Government

- Clear national policies need to be formulated through broader participation of relevant professionals, NGOs and other interest groups.

- Enact/evolve support legislation, regulations, strategies, and mechanisms for ensuring devolution of tenurial and usufruct rights to indigenous groups and local communities.

- Enhance planning/programming capability at different levels, with adequate budgetary support for NWFP development.

- Develop mechanisms for coordinating different sectoral agencies and their policies through establishment of an appropriate nodal agency, which will also ensure coordination at regional and international levels.

- Government-run institutions related to NWFP development must encourage a multidisciplinary approach.

- The capability of facilitating institutions (e.g. financial, credit, extension, training, and marketing) needs to be enhanced.

- Government policies and strategies should clearly stipulate an enhanced role for NGOs and local community groups in NWFP development, and provide a conducive policy and legal framework to facilitate this.

Private sector

- Make it mandatory for the private sector to contribute a portion of revenue from NWFP processing and marketing to sustainable management of NWFP resources.

- Encourage the private sector to develop NWFP-related research and development.

- Encourage the private sector to provide information regarding production and marketing of NWFPs.

- Encourage the private sector to undertake *ex situ* cultivation of high-demand NWFPs through provision of economic incentives.

Local organisations and community groups

- Institutionalize participation of community groups through formation of user groups in the harvesting/collecting process of NWFPs.

- Encourage local-level cooperative arrangements in collection, primary processing, and marketing, in a manner that makes their operations transparent.

- Government and NGOs should educate and train community groups to practice restraint in resource use to conserve NWFP resources.

NGOs

- Provide NGOs with capability to better support communities in NWFP development through:

  - training in micro-level planning, technology transfer, and extension support;
  - training in conflict resolution.

DEFINING NON-WOOD FOREST PRODUCTS

Recognizing the urgent need to incorporate NWFPs in the System of National Accounts, and that no definition can be complete and perfect in a dynamic and diverse context, the Group proposes the following definition:

> Non-wood forest products are primarily non-wood goods and services of biological origin derived from forest and allied land uses.

Regardless of the definition that may be adopted, the Group feels that periodic refinement of the definition will be needed to address the changing context.

Interest groups and agencies may adopt other definitions as appropriate to their context and requirements.

Regarding a classification system, the Group suggests that the framework proposed in the related theme paper by Chandrasekharan may be adopted with provision for periodic revisions.

ASIA - INSULAR AND THE PACIFIC

SOCIO-ECONOMIC BENEFITS

The Group recognised that the non-wood forest products (NWFPs) sector is comprised of two major sub-sectors:

- subsistence;
- commercial exploitation and trade.

It is not uncommon to have a combination of both subsistence and commercial exploitation for a particular product.

Two major issues of concern for these sub-sectors are resource sustainability for both subsistence and commercial exploitation and, equitable sharing of returns from commercial activities associated with NWFPs production and trade.

The overriding issue underlying many of the equity distribution and resource-related problems associated with the NWFPs sector is the low involvement of households and local communities in decision-making about resource utilisation.

While some of the identified issues discussed below may appear superficially to be outside the socio-economic aspects of NWFPs, the Group felt that these issues affected the socio-economic environment of the communities involved.

Key Issues

- **Equitable distribution of returns**. Local communities are not being adequately compensated for their efforts. In the chain, resource collectors and primary processors were the most disadvantaged groups in any commercial dealing and were being grossly underpaid for their products. Profits accruing to NWFP industries were not being shared adequately with resource gatherers or local communities.

- **Resource sustainability**. Local communities are experiencing an increasing scarcity of their natural resources. Resource availability for both subsistence and commercial exploitation is being jeopardised due to shortcomings in resource management.

- **Community involvement in decision-making**. While it is extremely important to involve farmers and grassroots groups in any decision-making process concerning the management and utilisation of the forest resource and in benefits sharing, such involvement hardly exists.

- **Tenure**. Controls imposed by governments as resource owners are often too restrictive and do not adequately ensure the livelihood of communities. Often there is confusion about tenure. Local communities assume they own the land while the government claims legal ownership.

- **Government regulations**. Existing legislation regarding resource utilisation is too restrictive on households and local communities. There are notable omissions in legislation with regard to protection of communities in trade.

- **Forest harvesting and management**. There are often conflicts between local communities and governments over product harvesting and prioritisation of the product mix. For example, the

government objective may be to optimise wood harvests, while communities may depend heavily on NWFPs for survival and their livelihood.

- **Rationalising exploitation**. In most situations there is lack of rationalisation of NWFP exploitation for subsistence vs. commercial purposes. It is important that only surpluses be traded.

- **Market orientation**. Development efforts for NWFPs must take cognisance of marketability. Too often, communities are faced with excess supply because NWFP programmes have been production oriented. In such cases, the communities' energy would have been better invested in other activities.

  There is inadequate appreciation of the commercial and cultural values of NWFPs, due to inadequate data. The inability of local communities to realise a better share of proceeds for some of their products may be due to a lack of price information. It is not uncommon for government personnel to be unaware of prevailing prices for these products.

- **Inter-sectoral collaboration**. There is insufficient coordination and cooperation among all parties that have decision-making powers over land use, resource utilisation, processing and trade. Local communities often suffer as a result, and are mostly inadequately consulted.

Proposed Initiatives

- **Equitable distribution of returns**. Gain a better appreciation of what is to be more equitably distributed. Enhance the knowledge base on quality grades, prices, processing, and trading structures for particular products. Educate collectors/producers on product value and processing options.

- **Resource sustainability**. Sustainably manage the resource base. Domesticate the important NWFP plant species. Pursue enrichment planting.

  It should be ensured that local communities are not displaced as a result of larger and more powerful plantation activities.

- **Community involvement in decision-making**. Increase empowerment to local communities in resource use decisions. Participatory development of curricula and training materials for NWFP activities.

- **Tenure**. Governments should recognise and reconcile customary tenure rights over all NWFP resources.

- **Government regulations**. Review and revise legislation to enable local communities to realise improved earnings. Undertake education programmes on legislation.

- **Forest harvesting and management**. Determine/design an optimum combination of wood and non-wood utilisation from ecological and local community perspectives.

- **Rationalising exploitation**. Develop long-term management plans for NWFPs together with local communities.

- **Market orientation**. Provide market orientation to initiatives for developing NWFPs. Provide access to market knowledge and information.

- **Inter-sectoral collaboration**. Enhance coordination, consultation and networking in the management and utilisation of NWFP resources.

PROCESSING AND MARKETING

Most NWFP activities occur in the rural communities sub-sector, and are generally confined to collecting or harvesting. There is now a desire and willingness to involve these local communities increasingly in processing, wherever appropriate. Obstacles to this are that producers are often widely scattered, and most do not have marketing skills. Local communities are generally price takers and have little influence in the marketing of their products.

Often there is a lack of clear policy, strategies and guidelines for developing NWFP processing industries.

PROCESSING

Key Issues

- **Information**. Information about appropriate processing technologies is difficult to obtain.
- **Policy**. There are often no policies, strategies or guidelines governing the processing of NWFPs. Maximum value adding should be carried out locally, both at rural and country level, wherever appropriate.
- **Investment environment**. It is important that a conducive environment is created at both the rural and country levels in order to promote investments in local processing.

Proposed Initiatives

- **Information**. Promote exchange and transfer of appropriate technology. Provide primary producers with relevant information and appropriate technology.
- **Policy**. Promote local downstream processing.
- **Investment environment**. Create a conducive investment environment to promote local processing. Provide appropriate financing mechanisms locally. Incorporate NWFP initiatives as part of regional development planning exercises.

MARKETING AND TRADE

The Group considered several inter-related aspects.

Key Issues

- **Policy**. There is a general lack of clear policy, strategies and guidelines for NWFPs marketing.
- **Information**. Information about the extent, volume and prices is almost non-existent or difficult to obtain. It is especially important to have this marketing information to take full advantage of emerging "green consumerism". Marketing efforts should not be confined to existing products but should be coupled with a continuous process of product development and market exploration.
- **Marketing structures**. Collective or cooperative marketing institutions are poorly developed.
- **Infrastructure**. The infrastructure for marketing and trade needs to be upgraded in order to support marketing and trade initiatives. This is critical to increase development of NWFP

service industry components, e.g. eco-tourism. In marketing of perishable products, access to appropriate storage and freighting is important.

- **Trade**:

  - Clear guidelines in trade of NWFPs are lacking. It is also important to note that the development of NWFP trade does not normally affect resource sustainability, adversely.

  - There are no agreements between producing countries for regulating supplies and prices in existence at present. These agreements might ensure that producers are not totally vulnerable to the dictates of external markets.

Proposed Initiatives

- **Policy**. Formulate and implement marketing policies and strategies that promote development of NWFPs.

- **Information**. Establish databases, trade and market intelligence networks at local, national and international levels. Initiate market research programmes for both informal and formal sectors. Disseminate marketing information at all levels. Initiate a continual programme of market exploration for existing products that are currently being traded and for other products that have trade potential.

- **Marketing structures**. Explore options for establishing institutions that could assume collective marketing responsibilities. Promote cooperative marketing efforts to cater to needs of rural communities. Shorten the market chain to bypass middlemen as much as possible.

- **Infrastructure**. Increase investment in infrastructure development to promote marketing and trade initiatives.

- **Trade**. Promote national, international and regional cooperation on trade and sustainable management on a single-product basis. NWFP trade should be promoted by regional institutions such as ASEAN, which should enhance activities to promote trade by and among its member countries. The procedure for including any species in the CITES list of endangered species should be reviewed to consider the positions of affected countries. Develop clear definitions for products and ensure that producers understand the products.

RESOURCE MANAGEMENT AND ENVIRONMENT

Key Issues

- Weak coverage of NWFPs in curricula.

- Increased migration of rural people into forest areas places added pressure on NWFPs, and creates unsustainable practices.

- Research results (including meeting/consultation outcomes) are not translated into applicable languages and formats (e.g. practical field manuals and inventory).

- Existing research does not accommodate documentation of existing local knowledge of NWFPs. There is a need to incorporate more traditional knowledge into management planning, and to empower and assist local people to use their existing knowledge in developing local management plans.

- Need for government's orientation towards participatory planning to be strengthened and implemented.

- Tenure issues need clarification in many areas.

- Certain NWFP species face depletion or extinction.

- Traditional knowledge related to NWFPs is being lost.

- Need to undertake Environmental Impact Assessments, to ensure scientific management. Unsustainable logging practices in some areas threaten social, environmental and economic sustainability of NWFPs.

Proposed Initiatives

- Increase the emphasis on NWFPs in curricula at all levels of forestry education and training, and develop training/information materials for teaching aspects related to NWFPs.

- Enhance livelihood opportunities in settlement areas and intensify family planning in rural areas. Ensure that transmigration programmes include programmes to protect and sustainably manage NWFPs.

- Each country should: develop a plan for preparing field manuals on sustainable management of selected NWFPs, for extension in local languages; encourage regional cooperation in the dissemination of field manuals; and improve dissemination of abstracts/bibliographies of existing publications, updated on a regular basis (by FAO and other international organisations).

- Improve documentation of existing knowledge and research. Establish and strengthen networks to share the knowledge/information on NWFPs. Expand inventories and research on the biology and ecology of NWFPs to include plants, animals and their habitats. Involve local people in NWFP resource management planning and implementation. Increase the number and skills of forestry extension staff in participatory planning and decision making.

- Increase training of all resource managers to improve awareness of participatory methods.

- Develop and implement conflict resolution and consensus mechanisms to resolve and clarify tenure/access/collection rights.

- Employ conservation measures including enrichment planting and protection of wildlife and introduce techniques suitable for local conditions.

- Facilitate transfer of traditional knowledge from older generations before it is lost; enrich information on traditional knowledge at the local level through strengthened extension efforts; and provide intellectual property rights to acknowledge and compensate local knowledge related to NWFPs.

- Internalize procedures for environmental impact assessment in developing management plans. Initiate country programmes on management and sustainable development of NWFP and mobilize funding agencies and expertise (e.g. FAO and other UN agencies) to assist in this.

INSTITUTIONAL CONSIDERATIONS

Key Issues

- Unclear identification of responsibilities for NWFPs (including management support, research, regulation), and inadequate attention and focus given to NWFPs by forestry organisations.
- Poor coordination among organisations working on NWFPs, leading to reduced benefits to local producers.
- Inadequate legal framework concerning NWFP development and management.
- Inadequate finances for management and research and development of NWFPs.
- Inadequate technical support for NWFP development.
- Inadequate involvement of local people and NGOs in NWFP research.
- Inadequate institutional support for technology transfer to local producers.
- Lack of a centralized database on NWFPs and lack of access to data.
- Lack of policy-makers' awareness of and commitment to NWFP activities.
- Inadequate numbers and skills of researchers and resource managers with NWFP orientation.
- Lack of strong of community-based organisations (CBOs) in forest communities.
- Lack of recognition of ownership/rights (access, use, etc.) and tenure issues.
- Inadequate definition and classification of NWFPs.

Proposed Initiatives

- Government agencies should clearly identify organisational unit(s) responsible for NWFPs and provide adequate supports to empower them.
- Establish a national council or committee to promote coordination. Establish producer associations at product level, as appropriate.
- Review and amend legislation and policy pertaining to NWFP development.
- Create mechanisms to re-invest a portion of revenue generated from NWFP activities back into financing NWFP development.
- Develop and conduct education and training programmes for relevant aspects of NWFP development at all levels.
- Involve local people in participatory research (e.g. data collection and problem identification). Ensure local people and NGOs have access to research findings.
- Strengthen extension activities to provide technical assistance to primary producers.
- Establish database centres at appropriate levels and disseminate information periodically.

- Convince policy-makers of the importance of NWFPs through workshops, seminars and electronic mass media.

- Incorporate NWFPs in curricula (at all levels), including relevant continuing education for resource managers, researchers, and extension workers.

- Support CBO's activities, especially among forest dwellers.

- Clarify the status of existing customary laws in relation to overall national legal system and develop mechanism to inform the local people concerned.

- Develop a universally applicable definition and classification of NWFPs.

LATIN AMERICA

SOCIO-ECONOMIC BENEFITS

The socio-economic importance of non-wood forest products (NWFPs) lies in the actual and potential values of these products in satisfying the livelihood needs of the people, in particular, of local and indigenous communities.

Key Issues

- NWFPs and their economic, biological, social, and cultural values are neglected by policy-makers and development planners. These products rarely figure in official national statistics, and do not appear at all in national land-use policies. National institutions lack capacity for generating knowledge on NWFPs and their socio-economic benefits. The rural community that extract and process NWFPs are not effectively organised.

- There is only limited knowledge about the biology, ecology and management of NWFPs, as well as on the interactions between the people and these products. There are no established mechanisms for strengthening exchange of information and experiences at the regional and inter-regional levels.

- Though many people are involved in the collection and processing of NWFPs, few of them improve their standard of living from this activity. This is because collectors receive only a small share of the final value. In most cases the principle of equity is not achieved. The value added locally to NWFPs, as well as efficiency in processing, is very low. This limits the income rural people can get from these resources.

- Limited and imprecise land tenure systems and legal rights and restricted access to information, particularly by the poorest segment of the rural population are major impediments. Official authorities lack capacity to provide technical assistance and extension services to support sustainable management of NWFP resources.

- South-South and North-South cooperation and technology transfer related to NWFPs are weak. International donor support for the promotion of NWFPs is insufficient.

Proposed Initiatives

- Raise awareness at the national level of the importance and constraints on NWFP development through, among other activities, workshops and seminars. Participation should include policy-makers, officials and community leaders.

- Establish alliances between community-based organisations and policy- and decision-makers to manage and develop NWFPs sustainably.

- Promote establishment and strengthening of community-based organisations and provide necessary services, mainly access to credits and markets.

- Facilitate access to NWFP resources by means of appropriate legislation and government agreements with the private sector.

- Develop methods for participatory research on socio-economic aspects of NWFPs, their assessment and inventory.

- Promote establishment of community reserves for NWFP conservation and equal access to community members.

- Improve local value addition by developing and disseminating appropriate technology for harvesting and processing.

- Promote policy reforms to improve land tenure and use in order to achieve sustainable management of NWFPs.

- Promote South-South and North-South cooperation on diverse aspects of NWFPs.

PROCESSING AND MARKETING

The key to the success of NWFPs as an important contributor to increased standards of living for rural communities, as well as to national economies, lies in increasing the potential for adding value to these products through good processing technologies and marketing channels, while keeping sustainable management as a priority for resource conservation.

Local NWFP markets are generally characterized by the prominence of food products, medicinal plants and cultural and spiritual products that do not require further processing. These are the markets that require more support.

PROCESSING

Key Issues

- Added value and efficiency in processing NWFPs is low, preventing appropriate income generation from NWFPs.

- In general, the processing of NWFPs at the local level is rudimentary with low quality and yields, due to lack of technology and training. This hinders local value addition and acceptance of the products in markets.

- Only limited information is available regarding products which have expanded market potential based on improved processing.

Proposed Initiatives

- Improve value addition by disseminating appropriate harvesting and processing technologies. This can be achieved by reinforcing local initiatives and through collaboration with other developing countries that have greater efficiency in NWFP processing (e.g. India has assisted other countries on medicinal plants processing).

- Strengthen research on appropriate technologies for extraction and processing of NWFPs in order to disseminate those which are more appropriate. In particular, special attention should be given to those processing technologies which can be implemented/used close to the source of raw material and which conform to specifications of actual and potential markets.

- Promote national strategies to add value to selected NWFPs, based on a stable supply of products and an analysis of economic and market factors. This will require financial support and incentives.

- Facilitate acquisition and/or development of technology on the basis of the following criteria: small-scale production systems should emphasise on improving harvesting techniques through community organisation, and aim distribution and processing techniques for maximum use. Technology for large-scale production should emphasise primary and downstream processing, energy use, pollution standards, productivity, inter-industry linkage and quality control.

MARKETING

Key Issues

- The great variability of NWFPs, from fruits and food to aromatic chemical products and phytopharmaceuticals, corresponds to the variability of markets for these products at the subsistence, local, and international levels. Some products meet a global demand (edible nuts), others reach specific markets (special types of honey, aromatic chemical products), while some NWFPs are collected and consumed locally. Business development and strategic planning should be formulated accordingly.

- Assessments of wild populations of NWFPs are showing depletion of resources caused by the effect of international markets.

- The dispersed production base of NWFPs, as well as poor infrastructure and information compared to that for agricultural commodities, has direct effects on enterprise survival rates, market symmetries (especially causing unbalanced relations between producers and buyers), marketing channels, prices, and selling expenses.

- Emphasis on commodity production, especially in the context of good market opportunities, can induce over-exploitation. On the other hand, market scarcities can also encourage technological improvement, higher investment, and better chances for long-term sustainable management.

- The lack of internationally accepted definition, classification and uniform measurement for NWFPs hinders the compilation of statistics for national marketing studies and for comparable market studies at the international level.

- Income generation from many NWFPs is low due to the lack of identification and characterization of market opportunities and negotiation skills. This is closely linked to the lack of statistical information on the volume and value of NWFP trade.

- The rural communities usually are only extractors and have little access to markets to increase their income. They are highly dependent on middlemen, who can be exploitative.

- The lack of information on trade barriers, commercialization channels, quality specifications, sanitary regulations, packaging norms and consumer preferences hinders access to international markets.

- Little understanding of the market and marketing systems for NWFPs, produces failures in establishing healthy supply and demand systems.

- Poor knowledge of the impact of markets on sustainable forest management.

- Different and uncoordinated incentive schemes, taxation systems and quality standards affect NWFP market practices.

- NWFPs, being nature based, can never be totally uniform in their characteristics, nor can their supply be regular and fully reliable.

Proposed Initiatives

- Each country should designate an institution responsible for the collection, processing and dissemination of statistics on NWFPs on both the resource-processing end-users sides.

- National and international institutions involved in promoting NWFPs should give more attention to establishing appropriate markets for NWFPs, mainly at the local level. This will improve income generation and stimulate improved processing.

- Appropriate technologies for quality control and classification, packaging and preservation of NWFPs should be developed and disseminated in order to meet national and international market standards.

- Systems for promotion of markets at all levels should be developed and implemented.

- There is an urgent need for an international effort to establish harmonised definition, classification and common unit measurement systems. This will facilitate collection of statistics on NWFPs and improve marketing studies at the national and international levels.

- Gradually and by stages, those NWFPs that show greater potential for generating improved income for rural communities and that can be managed in a sustainable manner should be promoted with appropriate market outlets.

- Research at the level of resource base and potential use should study linking mechanisms for more productive market systems.

- Honest brokers, international agencies, private consultants or corporations could bridge gaps between both ends of the market process (the resource and end uses).

- Marketing of edible NWFPs, in regular size, form, and quality, and free from insecticides and fertilizers should be promoted and encouraged.

- Marketing channels based on cultural traditions and the capacities of local communities should be established.

- The large number of middlemen in the marketing chain should be reduced wherever possible. The extractive reserves in Latin America offer relevant examples of this.

- Appropriate mechanisms should be introduced by which local NWFP extractors of important products could benefit directly and in a timely manner (e.g. the case of the extraction of medicinal plants), without affecting biodiversity.

RESOURCE MANAGEMENT AND ENVIRONMENT

There is an urgent need to sustainably manage forests for multiple uses, and to reverse the deforestation process that has reached a yearly average of 7.3 million ha in the region, with serious loss of biodiversity.

Key Issues

- There are few successful examples of integrated and sustainable resource management for joint production of wood and NWFPs on a commercial basis.

- Indiscriminate harvesting of wood and NWFPs results in significant alteration of the forest eco-systems and their biodiversity, preventing sustainable use of these products.

- Regulations for formulation and implementation of management plans for NWFPs are usually prepared for administrative and bureaucratic purposes, and are rarely conducive to actual application in the field.

- In the region, local and indigenous communities have developed new and innovative management plans and these should be taken seriously. These plans are based mainly on traditional systems of forest management; such as the Campa and Witoto systems. For example, the Confederation of Indigenous Peoples of the Amazon Basin (COICA), which involves more than 400 indigenous organisations representing some four million indigenous people, has prepared a Plan for Amazon Conservation and Development. This plan considers NWFPs as a main element of sustainable development.

- Lack of knowledge and research on sustainable management of NWFPs prevents their full contribution to development and conservation of biodiversity.

- At present, natural forests are evaluated in terms of commercial wood volume, with no attention to NWFPs even if these are important to the rural community.

- University curricula and research institutions still have a strong bias towards wood products. In general the multipurpose services of forests and the management and utilization of NWFPs receive little or no attention.

- Only in very few cases, have in-depth studies on domestication of NWFPs been undertaken.

Proposed Initiatives

- Promote regional ethno-biological studies with participation of indigenous communities and national institutions.

- Promote implementation of *in situ* conservation of NWFP resources by local communities, by providing fair compensation to their work in maintaining biodiversity.

- Promote in-depth studies and actions that lead to domestication of NWFPs through enrichment planting or other systems. This is particularly important where over-harvesting is causing depletion. Attention should be given to rural communities that can benefit from species domestication.

- Promote joint management of forest resources in community-based reserves.

- Increase participatory research on NWFPs to benefit from traditional knowledge and technologies in combination with other sources of knowledge.

- Effectively involve communities in formulating and implementing management plans that integrate wood and NWFPs.

- In formulating guidelines for integrated forest management, give attention to systems developed and applied by indigenous communities.

- In order to support conservation of genetic wealth and variability of NWFP resources, establish conservation areas based on social and ecological criteria.

- Undertake systematic and scientific efforts to conserve genetic resources and avoid endangering wild forms of NWFP species.

- Identify and conserve forest ecosystems of special importance to local communities that provide NWFPs (e.g. the *aguajales*) as well as sacred forests, which are of major cultural and spiritual importance.

INSTITUTIONAL CONSIDERATIONS

Appropriate policies, planning, legislation, human resource development at all levels, and administrative support are fundamental for development of NWFP activities. These are achieved basically through good institutions and guidance.

Combining local value addition, rational resource use, and initiatives for conservation is extremely complex. It requires the cooperation among governments, intermediary institutions, communities, private enterprise, and academia, as well as incorporation of various sectors of society from both developing and industrialized countries.

Key Issues

- Institutions for developing and promoting NWFPs are generally weak, including forestry administrations, educational entities, and research centres. In recent years, a number of innovative policies, legislation and institutional arrangements related to NWFPs and forest populations have emerged in Latin America. These initiatives and the overall shift of forest policies toward development of local communities have generally come as government responses to people's demands at grassroots level. This encouraging progress, however, has still not been enough to obtain more than marginal attention to NWFPs and forest communities.

- Lack of explicit usufruct and tenure rights makes harvesting from certain areas risky, since conflicts can arise as to who has authority to grant access to NWFP resources, and under what conditions.

- In contrast to many governments, non-governmental organisations have been very active in promoting NWFPs.

- There is a lack of inter-institutional and interdisciplinary approaches for developing NWFPs. Sometimes policy and legislation are inconsistent.

- Only one country in the region has initiated systematic prospecting and analysis of forest plants, insects and micro-organisms in protected areas for biologically active compounds.

- Existing legislation on NWFPs is normally regulatory and usually only refers to harvesting. Important aspects like land tenure, access to the resource and ownership rights to biodiversity are not considered.

- Concerted efforts in all research fields necessary for promoting NWFPs generally do not exist.

- There are no appropriate regional mechanisms for disseminating research results in the countries of the region.

- NWFPs have not received recognition at the higher and intermediate levels of forestry education and other disciplines.

- Extension services for promoting NWFPs are incipient due to the lack of coherent policies.

Proposed Initiatives

- For attracting strong and continued political commitment at all national and local levels, raise awareness of the importance of NWFPs among policy-makers, development planners, government authorities and community leaders, as well as among foresters, ecologists and biologists. This can be achieved through national and local workshops, among other means.

- Organise broad-based participation, encompassing local groups, women, indigenous communities and NGOs.

- Forest policies should pay attention to integrated forest use, re-evaluating their socio-economic and environmental potential. In this context, NWFPs should receive special importance.

- Through National Biodiversity Commissions, national institutions should promote inventories and conservation strategies for NWFPs. Inter-institutional coordination and harmonization of existing laws should be promoted.

- There should be a shift in philosophy from custodial to sustainable utilization, according to different types and intensities of protection required; also from centralized to decentralized management, with community participation and empowerment.

- Intellectual property rights regimes should be reviewed to protect valuable knowledge developed by communities and scientists. Contract negotiation for bioprospecting should consider three basic sets of issues: (1) science; (2) business; (3) legal issues and frameworks.

- The government should normalize and promote rational harvesting, conservation and management of NWFPs, with a view toward substituting imports with these products where possible.

- Research on NWFPs should be strengthened and undertaken in a general framework that fosters translation of findings into policies and programmes.

- Research should be oriented towards better assessment of forest resources and their products. Particular importance should be given to management systems, harvesting technologies, regeneration techniques, domestication, improved processing technologies, and market studies.

- Perspective of the forestry profession at the vocational, technical and professional levels should be rationalised, to foster appropriate awareness and knowledge about non-wood forest resources and products.

- Extension capabilities should be strengthened at the local level in order to promote improved harvesting, processing and management of NWFPs.

DONORS/DEVELOPMENT ASSISTANCE AGENCIES

SOCIO-ECONOMIC BENEFITS

The following are the recommendations of the Group relating to socio-economic benefits:

- Non-wood forest product (NWFP) use and development is complex and forms part of overall resource use through subsistence, timber, and other activities for generating cash income. NWFP development policies must therefore be multidisciplinary and integrated with other development policies.

- Development of NWFPs should take account of the overall resource use and economic situation in rural areas.

- NWFP development should include all forest types (perhaps) in all countries.

- Donors and development assistance agencies need a greater understanding of NWFPs' market mechanisms in order to promote effective and appropriate development of these products.

- NWFP programme developers (government, international agencies, NGOs) should address the following four issues when developing NWFP policies: conservation and biodiversity, sustainable management, appropriate commercialisation, and community welfare. Inappropriate commercialisation of NWFPs can conflict with forest community welfare

- Development of NWFPs should build upon — not replace — subsistence/traditional uses of the forests.

- Until suitable official data and statistics on NWFPs in developing nations becomes available, donors should base their decisions on case studies, and develop methodologies for studying economics and resource use of NWFPs.

- NWFPs should be included in the discussions defining the criteria and indicators of sustainable forest management. Governments and NGOs dealing with forest policy issues and certifying/accrediting bodies such as the Forest Stewardship Council have responsibility in this regard.

PROCESSING AND MARKETING

The objective of developing NWFPs is to commercialise new products, promote the sustainable management of forest resources (including conservation of biodiversity), and/or maintain and improve the welfare of communities living in or near forests. There are different stakeholders and therefore we cannot define a single set of objectives; one stakeholder's goal may conflict with that of another.

Processing has the potential to increase rural income by enhancing the unit value of products and therefore make producers less dependent on subsistence. It can also decrease the pressure to over-harvest primary resources. Resource exploitation through processing and marketing has the potential to benefit or damage people and/or the environment.

Unregulated marketing alone may not guarantee sustainable forest management and the equitable distribution of income from NWFPs. Other mechanisms may be needed to address these multiple objectives.

In many countries existing trade and environmental policies give priority to forest conservation. These may intervene to restrict current and future access to production and marketing of NWFPs. Governments may not, therefore, recognize the need for marketing since they may run counter to conservation objectives.

PROCESSING

The following are important requirements for development of NWFP industries.

- Need for training for collectors. There is a lack of information available to collectors on: what happens to the product; skills and training needed for workers; and options for processing that can allow the local people to conserve and harvest resources sustainability. Education is needed on what market requires.

- Strengthen producer networks. Donors should help strengthen and develop NWFP networks for producers to support improved processing and marketing, with an emphasis on extension and dissemination efforts targeted at the primary producers.

- Improve existing systems via grading/prices. Improve existing production and processing methods, ensuring that producers receive the full benefit from the improved technology. This can be done through grading systems, higher prices, and/or time savings through improved technology, etc.

- Donors to facilitate increased information to all levels of production. Donors should provide more information on profit levels for each of the actors along the value-added chain and ensure greater transparency.

- Scale-neutral policies. Rural economies are comprised of informal and formal sectors. Government policies often discriminate against informal sectors. Policies and support programmes need to be scale-neutral and directed separately towards the two sectors.

- Government role in coordination. Governments (in particular Departments of Trade and Industry) should help coordinate individual businesses processing NWFPs so that as a group they can better serve markets.

- Feasibility studies of all factors. Feasibility studies that consider all the factors simultaneously must be done before value adding can be attempted.

- Increased risk and externalities. There is need to consider all externalities when considering value-adding opportunities; it may be profitable for the business but not for the country as a whole. When one moves up the value-added chain one is also increasing risks. There is also need to make sure that processing is in the proper locations.

- Government control/direction/licensing. Donors should help develop (and governments should require as part of the licensing process) appropriate feasibility studies. It is necessary to checklist what is needed in a feasibility study, such as environmental impact, impact on local populations, processing facilities, marketing possibilities, resource sustainability, economic sustainability, etc. There is also need to develop codes of conduct for NWFP industries and to disseminate related information.

- Links among existing institutions. Efforts to strengthen links between research institutions and NWFP industries, for example, could draw on the model of Australian CRC (Collaborative Research Centre), which brings together existing institutions working on shared issues.

MARKETING

Issues related to marketing can be dealt with separately for local markets and international markets, even though they have several commonalities. Following are some of the considerations to improve local markets for NWFPs.

- Non-marketed local products. Many NWFPs are not marketable, some are not marketed at all, some are only used locally. How do we value these and account for them? These non-marketable products are the link to socio-economic benefits/issues. We need economic instruments to value these and if we could value them we could give them more importance.

- Effect of valuation on local use. Some studies show that if you create a market or put a value on a product it changes the local use of the product drastically, for example from subsistence to specialization.

- Raise policy-makers' awareness of local market importance. More attention should be given to improving local markets. To do this we need to raise the level of awareness of policy-makers.

- Government policy and monetary values. We may tend to overstate the need to have monetary values of NWFPs in order to persuade governments to make policy changes. This needs to be avoided.

- Overemphasis on marketing vs. local use. If there is too much attention given to marketing we may not be able to achieve other objectives of social-economic importance. Promotion of NWFPs for markets may disrupt local and subsistence use. Proper balance is to be sought.

Some of the considerations relating to international markets for NWFPs are the following:

- Consumer awareness of variability of NWFPs. International markets, even the so called "green" niche markets, (and domestic urban markets) increasingly demand standardised products. By definition, natural NWFPs are rarely uniform. There is, therefore, a need to increase awareness amongst consumers of the natural variability of NWFPs.

- Marketing needs to be product specific. Marketing needs are product specific and cannot be applied on a general basis for all NWFPs. Markets exist and can be defined for individual NWFPs; but not for NWFPs as a whole.

- Market monitoring is required to increase awareness of NWFPs and to improve coordination between producing communities and government, as well as coordination within government ministries themselves.

- Chain of commercialisation. The chain or path of commercialization is important in the marketing of NWFPs. Producing communities often do not know how to market new products and require information on all aspects of the market.

- Prioritise funding. Funding for product development should be prioritised, favouring those products with high marketing potential.

RESOURCE MANAGEMENT AND ENVIRONMENT

In general, environmental conservation is a matter of maintaining the characteristics and functions of the ecosystem. We have to be aware of the existing balance when moving to commercialization. Collecting of NWFPs may add value to the forests, thereby contributing to conservation and protection of forests from impacts of shifting cultivation, since farmers can draw on NWFPs and reduce the need to clear more forest for farming. Over-collection of NWFPs may disrupt ecological systems but collection may be less disruptive than activities which it forestalls. We should consider the seasonality and year-to-year variations in harvesting of NWFPs as well as what happens to the forest environment and the people when there are natural calamities (e.g. crop failures).

In discussing the environmental dimension of NWFPs, the Group noted that resource accounting is a very difficult topic, and the benefits obtained may not always justify the costs. Accounting of natural resources is very important in influencing policy-makers and should not be underestimated, but one must consider who will use the data and how it will be used. It is important to develop and agree on standard methodologies that include environmental benefits, water supply issues, opportunity costs for recreation, etc. Choice of production systems for NWFPs can influence water, soil, plant nutrients, and other environmental impact conditions. While methodologies for resource accounting exist, getting reliable data is very difficult. Research on methodologies should focus on cost-effective ways to obtain data.

There is a need to make inventories of resources and determine what levels can be harvested. This will vary from one setting to another, so it is impossible to generalize.

The Group made several recommendations, to ensure sustainable utilisation of NWFPs consistent with environmental considerations:

- Develop low-cost, rapid monitoring and evaluation systems.
- Conduct baseline surveys to gain an understanding of population dynamics. The roles of animals, birds, and insects — not just plants — need attention.
- Understand first the use of traditional mechanisms by local communities for species and ecosystems monitoring. Recognize that monitoring of ecosystems is more difficult. One way to look at the impact on the ecosystem is by comparing undisturbed forest to areas where intensive collecting is taking place.
- Identify and use indicator species to estimate impact on ecosystem when complete inventories cannot be conducted. Again, find out first what local populations consider to be indicator species and build upon this knowledge.
- Investigate if resource accounting can build upon timber inventories. Look at what has already been done, for instance, by UNEP, IUCN, World Resources Institute, and the World Bank. Build upon this.
- Pay attention also to non-tropical forests; they are equally important in biodiversity terms.
- Establish guidelines for environmental impact assessment.
- Provide priority to degraded forest lands, looking not only at habitat but also their productive capability.

From the point of view of resource management and development the Group noted that different actors are involved in resource management. It is necessary to have a clear idea as to who are the resource managers.

Accordingly, objectives will vary ranging from conservation to economic gains. The classifications based on products blur this distinction. When it comes to conservation, a Brazil nut grown in the forest is different from a Brazil nut grown in plantations, even though as a product one is not distinct from the other.

Buffer zones are an essential way of maintaining peoples' links to the forest. There are not many positive experiences with buffer zones and the lessons tend to be bleak in cases of great population pressure, or where people previously held tenure to the "buffer" land. But experience remains limited. All systems have flaws; in some cases buffer zones work, but in others, they have contributed to resource depletion. Also if too much emphasis is placed on NWFPs without attention to timber, communities may not benefit.

In India, the development of joint forest management has proved a very good model. The state retains ownership of the forest resource, but local communities receive 25-30 percent of the wood harvested, and 100 percent of NWFP harvests. In view of increasing forest scarcity, this programme shows a policy shift away from revenue emphasis towards a priority of forest maintenance through community involvement.

Some of the recommendations of the Group, related to resource management and development are the following.

- Work with the forest communities, to come up with resource management and development strategies. This should be the basis for resource management.
- Make people living in or near the forest responsible for those forests.
- Recognize that integrated management for wood and non-wood products should not be the objective *per se*. Depending on the situation, preference could be given to one or the other or both.
- Emphasize policy frameworks, awareness building and training.
- Recognize there is a continuum of NWFP extraction and cultivation practices (see the following indicative chart).

	Population Pressures	Conservation Biodiversity	Production Cost	Benefit to community
Extraction from natural forests (low management)				
Extraction from modified forests (fallow)				
Extraction from heavily managed agroforest				
Extraction from cultivated systems				
Extraction from monocrop cultivated systems				

The dichotomy of objectives (production vs. conservation) causes confusion. In viewing the interactions along the continuum of NWFP extraction and cultivation practices, we need to consider both conservation and human economic needs. Developing NWFPs as plantation crops does not necessarily reduce pressure on natural forests.

INSTITUTIONAL CONSIDERATIONS

While discussing definitions, the Group noted that the definition of NWFPs proposed in the theme paper by Chandrasekharan and discussed by this Consultation is primarily for trade classification purposes, targeted at the system of national accounts. The use of the term NWFPs does not preclude the use of other terms. However when using other terms, such as non-timber forest products (NTFPs), appropriate definitions need to be attached.

The Group recognized that the definition of forest does not explicitly incorporate the term ecosystem. It should incorporate not only plants but also animals, insects, micro-organisms and other biological components of the forest.

The Group further considered specific institutional aspects influencing the management and utilisation on NWFP resources.

RESEARCH

The major research issues considered by the Group were:

- Need for increased interdisciplinary efforts, noting that this is difficult and mechanisms have to be devised that provide incentives and infrastructures for interdisciplinary work to happen.
- Need to make research more results oriented with a vision of how the results will be used and who can use the results.
- Need to manage scarce financial resource more effectively, stressing the need to avoid duplication of efforts and the need for more coordination and collaboration. Research should be needs-based and directed by local interests.
- Need to deal with a wider range of research areas including those that are less recognized (such as economics, social sciences, and marketing). By the same token more emphasis needs to be placed on local, in-country research that builds local capabilities. This includes efforts to direct research to local priority issues.
- Need to get beyond the "publish or perish" incentive system.

The Group made the following recommendations to address the issues:

- Mechanisms should be devised and encouraged for more interdisciplinary research. Most research is still influenced by disciplinary approaches, but NWFPs need inter-disciplinary approaches. Much work is needed to promote and develop this including methodologies and training. This approach needs to recognize the varying gestation periods. Emphasis should be to supporting research programmes rather than research institutions. But this may not be applicable in countries where research facilities are still developing. Interdisciplinary work also should include sectors outside traditional research facilities, such as the private sector.
- Research should be more results oriented. Donors and development assistance agencies should require that research proposals indicate the applicability and dissemination of the research results for eventual applications in the field.
- Research work should better avoid duplication of efforts and rather bridge research gaps. It is necessary to provide incentives for universities to work in inter-disciplinary teams and to combine talents; also to determine where the capacity for research is located: in country, outside countries, international groups, etc. To address this issue FAO is publishing a

document that has looked at relevant databases and has identified the ones relevant to NWFPs (600 exist). Communities also need to play an appropriate role in the research.

- Research should include currently under-represented disciplines, e.g. economic and social sciences and marketing. While there has been some amount of research to address community needs, these may not adequately highlight NWFPs use. NWFP research needs to review and look at anthropological research and identify where NWFPs are covered, and also make links to private sector trade associations that deal with NWFPs. More research and planning on biodiversity and services needs to be undertaken, since most research is product specific.

- Suitable incentives need to be created to get away from the publish or perish culture.

- Donors and development assistance agencies should take into account the applicability of research results and how to utilise them effectively.

INFORMATION

With regard to the information needs for developing NWFPs, the Group made the following observations:

- Research findings need to be organised (e.g. in a database) and their compilation/documentation and accessibility need to be improved, with an emphasis on information dissemination.

- Dissemination of information to decentralised levels requires that it is applicable at the field level. Researchers need incentives to provide field-applicable information (e.g. publications in local languages).

- Part of research funds should be allocated for interaction with and between social science departments and to help researchers to publish results for use at the field level.

- Cooperation should be strengthened regionally and internationally for sharing information. Also information sharing between sectors is needed. Those involved in the information exchange process are just as important as the researchers themselves.

- Information and extension roles need to be clearly identified. Generation of information, dissemination and extension efforts are all equally important.

- Information use and dissemination has to consider different target groups. For example: rural workers/extension workers are community facilitators and they should know what is going on in research circles, so they can put it into practice.

HUMAN RESOURCE DEVELOPMENT

In the area of human resource development for NWFPs, the Group highlighted the following considerations:

- Forestry schools should make it easier for students to take a selection of multi-disciplinary courses.

- It is important for national educational institutions to have the capability to do research.

- More market researchers are needed who can take into account the relevant aspects of marketing and can utilize the existing and available market information.

- Training venue is an important issue. Training should take place where the problems are. There is also need for on the job training.

- It is necessary to plan the different levels of training (academic to grassroots levels); also about how to impart the training. Multidisciplinary training programmes within universities are to be set up; core curriculum of forestry schools should require at least one course in NWFPs.

- Short-term training courses are important and should be based on needs expressed.

POLICY

The objective of activities related to NWFPs is conservation of forests and generation of socio-economic benefits. This needs to be stressed in policy statements.

There is need to distinguish between internal policies, that can be changed among sectors involved in NWFP/forestry and, external policies that influence the NWFP/forestry sector (e.g. land use planning, etc.) and to look at how macro policies (not specific to forests and NWFPs) are affecting NWFPs; also to consider what is relevant and possible.

Policy is based on information and knowledge. Therefore, who makes policy and who provides information to the policy-makers, are important considerations. It is necessary to raise awareness of foresters on the need to influence politicians and to raise their understanding of NWFP issues. This calls for strategic alliances.

Policy development is an important issue; consultations with all parties to be affected by the policy is essential.

More resources are to be devoted to understanding the linkages among policies and policy implementation instruments, inside and outside the forestry sector, and their impact on issues relating to NWFPs.

THE ROLE OF AGENCIES AND DONORS

The Group considered that donors and development assistance agencies should avoid duplication of efforts and cooperate more. More coordination is needed among organisations in order to maximize the availability and use of donor funds. Also more up front work is needed to make sure that project activities do not duplicate previous work or other ongoing work by other donors or in-country programmes. Very little donor support or loans are now available for NWFP development and related capital investment. There is need for special arrangements with regards to loans for developing NWFPs and for more support from donors.

In these regards the Group made the following recommendations:

- A compendium should document existing programmes of organisations active in NWFPs. By the same token, donors should use existing structures to execute programme and not create new ones.

- NGOs need to be involved in discussions related to, and in spreading the message of, NWFPs to influence policies.

- It is necessary to understand the mechanisms that influence decision-makers, and to make strategic plans, such that NWFP activities are proposed to donors and in turn make NWFP programmes attractive to donor communities. Donors' decisions are based on what is received from countries, even though donors may give guidelines regarding priority areas. Authorities

in the recipient countries have therefore to be convinced about the importance of NWFPs, before they can propose projects to donors.

- Donors need to be more flexible in funding. Donors are to be persuaded to programme longer funding cycle commitments, at least a 10-year commitment. Also, donors should provide for flexibility once the funding of a programme has started, so that new partnerships and ideas can be added.

- Another important need is for developing policy on intellectual property rights. Many countries do not have legislation on this, and it is needed to protect their natural heritage and resources. Even though it has been mentioned in the biodiversity convention, there is still much work needed to get this implemented, country by country.

This volume contains the proceedings of the International Expert Consultation on Non-Wood Forest Products, held in Yogyakarta, Indonesia from 17 to 27 January 1995. It includes a summary of discussions, recommendations and background papers. The report is organized according to the four thematic areas considered by the consultation: socio-economic benefits; processing and marketing; resource management and environment; and institutional considerations. The 18 background papers give a comprehensive overview of the situation and prospects of non-wood forest products.

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