

Non-wood forest products

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Importance of non-wood forest products (NWFPs) and strategies for sustainable development

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SUMMARY

For millennia, the rural people and the forest dwellers have derived sustenance from forests mainly through harvesting and use of the non-wood forest products (NWFPs). The paper highlights the current crucial role of NWFPs in rural economy of the developing countries. However, as only few NWFPs were used for commercial trade, these products did not get due emphasis in the National Forest Policies or attention of Forest Managers and Policy Makers.

Since the Rio Earth Summit and launching of the Bio-Diversity Convention, most of the nations have realized the need to take steps for sustainable management, development and use of NWFPs. However, considerable effort is still needed at local, national, regional and international level for policy development for undertaking proper assessment of the NWFP wealth in each country, development of technology and tools for sustainable harvesting, research for optimal use of such products as well as in-situ and ex-situ propagation, marketing, etc.

The paper recommends adoption of a sustainable management strategy covering needs for a new silvicultural system, better tenurial rights, micro level management, marketing as well as conservation measures. It should be developed in collaboration with local people and by ensuring equitable distribution of benefits upto the primary collectors level.

It suggests a way forward based on creation of regional institutes of excellence supported by UN agencies, donor countries and banks for ensuring development of international cooperation for sustainable management, research, marketing and equitable profit sharing with local people. The FAO should serve as the nodal coordinating agency.

Keywords: Non-Timber Forest Products, Importance in Rural Economy, National Accounting & Policy Initiative, Resource Assessment, Research & Marketing Strategy and International Cooperation.

INTRODUCTION

The use of non-wood forest products (NWFPs) is as old as human civilization and was the main source of food, fodder, fibre, medicine, cosmetics, etc. The present day agricultural and horticultural plants were also derived from these wild stocks from forest areas. During the course of history, some 12,000 plants have been used for food but only about 2,000 have been domesticated and only about 150 commercially cultivated. Presently about 30 species provide 90 % world's food supply.

The tropical and sub-tropical forests, mostly located in Africa, Asia and Latin America, have great floral and faunal wealth. As such, these areas are the main storehouse of wide varieties of non-wood forest products, which are valuable beyond measure specially for the economy of the

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developing countries. For millennia, the rural people and forest resident communities have derived sustenance from forests mainly through harvesting and use of the NWFPs. Many important products are now commercially exploited for use all over the world.

It will be appropriate to categorize the important NWFPs under following use-based groups:

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|----------------------|-------------------------------------------------------------------------------------------------------------------------------|
| a) Fibre: | Bamboo, Cane, Rattan, Grasses, Hemp, etc. |
| b) Medicinal Plants: | A very large group of plant parts used in traditional and modern medicine (35,000 to 70,000 species used all over the world). |
| c) Edible Products: | Flowers, Nuts, Fruits, Roots, Rizonus, Spices, Gums, Oils, Honey, Mushrooms, Animal Products, etc. |
| d) Exudates: | Gums, Resins, Copal, Damar, Rubber, Latexes, etc. |
| e) Industrial Oils: | Neem Oil, Tung Oil, Shorea Seed Oil, Jajoba Oil, Shea-butter, etc. |
| f) Essential Oils: | Anise, Cedarwood, Citronella, Sandalwood, Vetiver Oil, etc. |
| g) Tans and Dyes: | Katha/Cutch, Wattle, Annatto, Kamala, Henna, etc. |
| h) Miscellaneous: | Bidi Leaves, Soap Nuts, Agar Woods, Pyrethrum (pesticide), flowering plants, orchids, etc. |

NWFPS ROLE IN THE NATIONAL ECONOMY

Household Needs of Rural Communities

In the developing countries, vast number of rural population specially the forest dwellers depend on NWFPs for various levels of use.

- **Subsistence**
NeedsNWFPs supplement household agricultural production through essential nutritional inputs, medicine, fodder, mulch, etc. Seasonality of forest food also help to reduce the shortages suffered during "hunger periods" of specially the marginal and shifting cultivators and forest dwellers. NWFP related activities provide employment during slack period of agricultural cycle as well as buffer against risk and household emergencies.
- **Income & Employment Generation**
For industrial use, commercial harvesting of some of the NWFPs like oleroesins, gums, bamboos, rattan, fibre grasses, medicinal plant parts, leaves, etc., have opened up new areas and opportunities for full or part-time employment of both men and women from rural communities. Further, opportunities will arise when investment is made for in-situ and ex-situ propagation/production of such products for meeting growing market demands.
- **Commercialization and Sustainable Use**
Bulk of the trade and use of NWFP is local, but due to its increasing use in urban areas, the demand for commercial use is growing much faster than the relatively stable local demand. With this growth in urban market, the range of products tends to narrow and products which develop giant scale industrial demands, the commercial forces tend to either over exploit the natural source or take the product towards domestic cultivation or substitution by synthetics. This explains the "boom and burst" cycle of many NWFPs in the unpredictable international markets.

- Cultural/Spiritual

The rural people and the forest dwellers of this region have venerated the forests as the abode of God and sacred spirits of their ancestors. Their cultural ethos is closely linked to the realization that forest as a benefactor provides sustenance to their life support system as well as spiritual and cultural needs as manifested through their songs, dances and nature worship rituals. This ensures preservation of NWFP wealth and its sustainable use by rural communities.

- Distribution of Benefits

The relatively poor households depend more on the NWFPs both for sustenance and earning supplementary income. As local markets grow, the NWFPs shift from supply - driven situation of labour intensive, low return and easy individual access, to demand-driven situation of competitive harvesting, more per capita income and higher return activities where cooperative or small local enterprises offer better opportunities.

As NWFPs resource becomes scarce, access of poorer sections declines due to competition from outside, other collectors and middlemen as well as new restrictive government regulations for earning royalty. Such a situation calls for a reorientation of the government policies to prevent over exploitation of natural resources as well for ensuring equity in distribution of benefits to the local gatherers and primary processors.

The National Needs

NWFPs play a significant role in rural economy through supply of goods and services for food security, health care, employment opportunities, etc. to a very large number of people. Moreover, in recent times, many medium and large scale industries have come up in developing countries which formulate medicines and cosmetics on traditional lines from plant parts, but by using modern technology and quality control. Similarly, the large international pharmaceutical companies are extracting alkaloids from plant parts for preparation of medicines. This new demand is generating considerable income at local and national levels.

However, no proper accounting for such a large contribution of NWFPs has been made in the national economics. Moreover, finished products from NWFPs such as medicines, pulp, construction material, edible and essential oils, tans and dyes, fibre resins, gums, etc., are not classified as NWFPs in the national or international product and economic systems for trade and exports. This has resulted in neglect and low budgetary support for development of this vital sector, specially of rural economy.

DEMAND-SUPPLY SCENARIO

At present, most of the countries do not have a well-defined policy dealing specifically with NWFPs management, sustainable harvesting and development. However, some of the commercially important NWFPs like Oleopine resin in China, India, Brazil and Indonesia, Annatto Seed in Peru and Kenya, Gum arabic in Sudan, Nigeria and Chad, Rattan in Indonesia, Malaysia, China and Vietnam, Bamboo in China, India, Malaysia, Bangladesh and Philippines, Lac in India, China and Thailand, Copal in Indonesia and Philippines, Forest Honey in Bangladesh, Vietnam and Laos, Sandalwood Oil in India and Indonesia as well as some essential oils and medicinal plants found in this region have received attention for proper management, of the forest managers and policy makers mainly for revenue generation.

The medicinal plants are the most important internationally traded products. Around 35,000 - 70,000 of the 2,50,000 known species of higher plants have been used for medicinal purposes. In the developing countries, nearly 80 % of people continue to rely chiefly on traditional, predominantly herbal medicines for health care. The growing population and emerging demands for botanical

products in the medicine and cosmetic industry is leading to enhanced gathering of such material from forest areas even to an unsustainable level in many cases like Taxaus leaves, Dioscorea tubers, wild orchids and bulbs, etc. It is reported that in United States, 25 % of all prescriptions have extracts from plants.

There is thus an urgent need for taking up conservation measures along with ex-situ propagation of plants to meet industrial demands. As such, for sustainable harvesting, it is essential to ensure that a reasonable part of the benefits derived from processing and marketing of botanical resources goes to the forest dwellers and gatherers who have preserved and have indicated through traditional knowledge the possible commercial use of such natural resources.

There is also an urgent need for policy initiative and development of regional cooperation by the Governments of user and producer countries in sharing of information on research and methods of sustainable use, preservation of the resources, propagation as well as development of legal framework for ensuring regional/national ownership on endemic species and chemicals derived from the same.

NATIONAL POLICIES ON MANAGEMENT OF NWFPs

As only few important NWFPs were used for trade, these products did not get due emphasis from forest managers and policy-makers who concentrated on timber and wood products. Despite this lack of attention and policy thrust, collection, processing and trade of NWFPs continued to thrive due to social and traditional use and growing economic value in local, national and in recent times, international markets.

Since the Rio Earth Summit and launching of the Biodiversity Conventions, most of the national Governments have realized the need to take steps for development of policy guidelines for management and sustainable harvesting of NWFP. Considerable effort is still required, both at national and international levels in policy development, analysis and proper implementation, in close collaboration with the actual gatherers and primary users in the

rural communities, researchers, managers and Non-Government Organisations (NGOs).

Moreover, considerable efforts are needed for undertaking ethnobotanical studies for recording the local use of various plant species for which very little data is available. This should help to identify the indigenous plants used in local remedies followed by phytochemical screening for recording the available active chemicals. This will lead to better development of traditional medicines as well as give lead to discoveries for new pharmaceutical products like diosgenin, quinine, taxol, etc.

Gaining support of policy planners for appropriate NWFP development will require considerable awareness-raising effort by resource managers, research agencies and NGOs. Much more intensive efforts are needed to evaluate and quantify all benefits of NWFP use such as meeting of subsistence needs, employment and income generation in rural areas, environmental, cultural and biodiversity values, eco-tourism and harvesting for growing commercial use. These increased efforts are required to place decisions regarding sustainable NWFPs use in context that recognizes values and consequences that currently go unrecorded.

SUSTAINABLE MANAGEMENT STRATEGY

Fortunately now, awareness is growing of the diverse values and services of forests other than revenue, of forest products (NWFPs) other than timber and of meeting of local needs and not only commercial gains. For achieving these objectives, following steps are suggested:

Needs for New Silvicultural Systems

Silviculture is the keystone of sustainable forest management and a new orientation is necessary from the current system focused on a single product i.e. timber, to production and regeneration of multiple products i.e. NWFPs as well as timber. Innovative silvicultural practices will have to be developed based on mixed species management techniques including enrichment planting, introduction of improved varieties and multi-tier plantations, pruning, lopping, pollarding and other cultural practices to allow multiple product yield.

Tenurial Rights

Tenurial rights of local people and forest dwellers is the central issue for sustainable development of NWFPs and its commercial harvesting. In developing countries, most of the forest is owned by national or state governments. The local people have only the right of collection of some NWFPs for personal consumption either free of cost or on payment of a small token fee. However, trade in most of the commercially important products like oleopine resin, bamboo, rattan, sal seed, lac, etc., have been either nationalized or is done only through designated traders. As such, there is urgent need to clarify these tenurial arrangements and codify the layers of traditional rights, use pattern, settlements, concessions and privileges of the local community and forest dwellers. This will ensure involvement of the stakeholders in preservation and sustainable management of forest.

Micro-Level Management

The local people get only wages for collection and generally do not get any share of the profits from commercial harvesting of NWFPs. As a result, they do not take interest in protection and sustainable management of NWFPs. As NWFPs provide short term gains and quick returns grant of tenurial rights of access to resources as well a share in the profits from commercial harvesting to the local people will create a sense of ownership and a stake of the community in sustainable management of the forests.

Conservation Measures

Development of technique for sustainable harvesting may take lot of time in study and research and as such, it is essential that NWFPs found in various ecological zones should be preserved in the chain of protective area network being developed as sanctuaries and National Parks.

Resource Assessment

For ensuring success of this approach, there will be need for proper resource assessment and research as well as improved collection, processing and marketing.

NEED FOR RESOURCE ASSESSMENT

Assessment of NWFP Resources

The NWFPs are widely used as food, fodder, fibre, herbal medicine, construction material, cosmetic products, etc. Most of the present day agricultural and horticultural plants were derived from the parent stocks in forest wilderness. However, with the beginning of the industrial revolution, wood from forest trees gained much more importance and NWFPs except for a few flagship products of commercial use, remained of only local importance.

NWFPs have recently re-emerged as an important resource for natural products for urban markets and its role in rural economy is now being recognized. However, no country, including the developed has carried out complete assessment of the status of NWFP resources. Inventory of NWFP resources

involves extensive field work of counting and measuring of plants. This is required to assess what types of economically important plants are available in a given management area. How abundant they are, can they regenerate to ensure sustainable harvesting, distribution of various forest types, which parts give what products, etc. Such an inventory/assessment data is essential for developing management options.

Researchers have developed a wide variety of inventory techniques for NWFP resource through selection of an appropriate sampling scheme of fixed area plots or transects. Unlike timber trees, where volume of wood log is the critical factor, the height and girth of the plant is not essential for NWFP inventory except may be in case of bamboo and rattan. For the species providing multiple products, the information should cover all parts of the resource (fruits as food; bark as tannin; flower as medicine; seeds for oil; etc.). This is a very costly and specialized job, but is essential to serve as baseline criteria for selecting the specific resources for sustainable management and harvesting.

Moreover, the quantification of the contribution of NWFPs in national economy is essential specially in the informal sector of meeting the subsistence needs, employment generation, health care, food security, etc., of the rural people as well as its true commercial value in local, regional, national and international trade. Such assessment of NWFP resources as well as quantification and valuation of benefits will ensure a better focus of policy makers on the need for investment and development of this vital sector of rural and national economy.

As such, assessment may be undertaken for products which have current and emerging market demand. This is an area where for developing inventory and yield models for field surveys of different NWFP Resources, specialized training of field staff is required urgently. The international organisation like FAO, CIFOR, ITTO, UNEP, etc., should come forward and help the countries of this region in assessment of NWFP resource.

RESEARCH NEEDS FOR SUSTAINABLE MANAGEMENT

Research is a critical area of concern as NWFPs potential and role have remained neglected till recently. However, in last two decades increasing amount of research, mostly following a "catalogue" approach of listing of plant and animal species found in various forest types or case studies on a few flagship species, have been carried out. Most of the research has been done at local level covering three main perspectives. (Perez 1995)

- Commodity/Income/Market-driven focus
- People's perceptions/traditional knowledge/household need focus
- Biological properties/sustainable management focus

As such, there is an urgent need for each country to undertake research work on following core areas for development of sustainable management package of practices for various NWFPs.

- Codification and evaluation of all local knowledge about occurrence, harvesting technique and use of various NWFPs both for subsistence and sale.
- Collection of quantification data covering the entire year, to better assess seasonal influence, on growth and yield of NWFPs from different plant parts like leaves, flowers, fruits, rhizome, bark shoot, etc., in a representative unit area.
- Development of improved technology for natural propagation, non-destructive harvesting, post-harvest treatment for increasing shelf life, local primary processing and storage to reduce wastage and over-harvesting.
- Prospecting, screening, evaluating chemical and pharmacological NWFPs, and identifying candidate species for development of new products and uses.

- Developing silvicultural systems for ensuring multiple use of forest to enhance desired NWFP production along with timber yield.
- Developing technique for domestication through biotechnology for cultivation in agro-forestry systems of species which have developed industrial demand to prevent unsustainable exploitation in natural forest areas and for ensuring a regular supply to the industry.
- Development of processing and product diversification technology and market information system for improved product availability and market scope as well to reduce chances of replacement by synthetics.

The need for strengthening research at national level for solving these problems cannot be over emphasized. Cooperation in such activities among countries through collaborative programmes can help avoid duplication and quicken the process of NWFP development. There is lack of linkage between different institutions as well as amongst the supportive international organisations like FAO, FORSPA, CIFOR, APAN, IDRC, WHO, UNESCO, etc. It is felt that FAO should play a lead role in coordinating the national and international research efforts in this region.

DEVELOPMENT OF COLLECTION AND PROCESSING TECHNOLOGY

Local and National Level

Sustainable harvesting should be first oriented towards meeting local needs and then only commercial prospects can be explored. For large scale commercial exploitation, the focus needs to be ex- situ cultivation to conserve the natural resources and ensure regular supply.

The local people have fairly good knowledge as to where and when to harvest and which product to derive maximum benefit. However, the assumption that local harvesting is being done on sustainable basis is unfounded as it is mostly market driven and latest technologies and tools for collection, post-harvest processing and storage have not percolated to grassroot level leading to low quality yield and lot of wastage.

Large part of most of the products like fruits, nuts, medicinal plants, etc., are consumed locally by trade and barter and only the surplus is sold for national and international level marketing. Primary production, processing and marketing are very much interlinked activities.

As such, there is urgent need for organising, through appropriate agencies, the training of local stake holders in modern methods of harvesting for sustainable production as well as technology for storage and post-harvest treatment, primary processing and quality control. This will ensure value addition and ready acceptance of the products at attractive prices in the markets. Moreover, the village level organisations like cooperative societies will be in a better position to implement the approaches in this field.

Similarly, such village level organisations can also raise funds, get necessary technology and set up post harvesting and even primary processing units for value addition and local job creation. Such units have come up in Malaysia and Indonesia for rattan furniture, in India for beedi making, oleoresin processing, honey processing, etc., for bamboo basket making and hand made paper in Bangladesh, Nepal, Vietnam, Philippines, etc.

Medium and large scale production units which involve complicated processing methods like oleoresin processing, making of traditional and pharmaceutical medicines, essential oils, cosmetics, etc., it will be necessary to develop linkages among the major players i.e. gatherers, primary processors, final product makers and the major buyers.

International Cooperation

Moreover, where genetic variety plays an important role in marketability (e.g. essential oil, medicinal plants, etc.), the processing research findings need to be better communicated up the production chain. Likewise information on consumer preferences needs to be fed back to the production chain so that producers have a simple message about the selection criteria for their products.

FAO should set up a few regional research centres to take up the coordination role that individual national governments lack the resources for. It could conduct research on product development, and training on processing methods in areas of shared interests where tendencies toward market secrecy and competition are relatively low.

STRATEGY FOR MARKET INFORMATION & TRADE

Trade in NWFPs has been going on for centuries and currently billions of dollar worth of such products are traded in international markets. However, in marked contrast to wood products, the market information regarding demand, supply and price trend are very much lacking. The problem of the non-availability of basic information on the actual production, local consumption, surplus available for incountry and international trade is very acute. At national level, except for a handful of very important NWFPs like rattan, bamboo, oleoresin, etc., very

little knowledge exists and most NWFPs are rarely covered in national statistics. Only some export data is available through custom realization records.

The possible strategy for market development is suggested as under:

- There is need to harmonized NWFP classification, definitions and collection of systematic product information at National and regional level regarding resource base, harvesting, processing, trade and end use. Some steps in this direction is being taken by FAO, ITTO, ITC, UNEP, etc.
- The individual gatherer or forest dweller who does not have market information is not in a position to get proper price from the middleman or direct industrial buyer. As such, it would be advisable to organise the gatherers and collectors into cooperative or as primary producers association which can get market information from government NGOs or trading agencies and develop better bargaining power.
- Creation of a national level organisation for assessment of demand outlook, identification of market opportunities and end use at national and international level as well as price trend and possible threat from substitutes at national and regional level.
- Arranging of comprehensive training for gatherers, intermediaries, traders regarding market practices and demand scenario through government institutions or NGOs.
- Governments should develop organisations at the operational level through institutional support like formation of cooperatives of producers, product quality control, research support for production, processing, etc., human resource development by training of all stake holders, etc.
- Provision of policy and financial support for sustainable production and marketing of NWFPs and equitable distribution of benefits, specially to the primary producers by the National Governments in the region.
- The developing countries produce lot of common products like rattan, bamboo, oleoresin, essential oils, medicinal plants and naturally compete with each other for a larger share of the world market. As such, there is an imperative need for development of regional cooperation in exchange of market information, process technology, production and price situation and

international demand to counter monopolistic market control by cartels of multinational traders and industry.

- International organisation like FAO, CIFOR, ADB can initiate the process of setting up of such a regional organisation with help of nations in this region where NWFPs play a very vital role in the socio-economic development, specially in the rural areas.

CONCLUSIONS - THE WAY FORWARD

The use of NWFPs is as old as human existence. The role of NWFPs in rural economy of developing countries is crucial for meeting subsistence and cultural needs as well as for providing gainful employment and supplementary income from sale of such products. The urgent need for extensive study and research in the sphere of resource assessment, technical and silvicultural needs, innovative management, marketing, etc., have been discussed in detail in the foregoing chapters. Some macro issues requiring action at national and international level are summarized as under:

FAO in collaboration with other international agencies should develop a clear definition and system of classification for NWFPs (within the overall system for forest products) suitably harmonized with existing international systems and take suitable action to incorporate NWFPs into these systems particularly as an annex to International Standard Industrial Classification.

In many countries policy related to NWFPs does not exist, or at best, its component elements, are scattered under many sectors. There is urgent need to develop holistic policies that consider the need to protect the forest resources to benefit local communities and to meet their cultural and spiritual needs. It should also promote the development of primary industries, and enterprises for processing and marketing of goods and services, such as eco-tourism in collaboration with local stake holders.

FAO should prepare a draft framework policy to facilitate formulation of national policies, in collaboration with other ongoing initiatives of IUCN, ITTO, UNEP, etc.

All the countries in this region should establish the identity of NWFPs by: suitably incorporating it in the policy and forest administration system, and specify its mission related to NWFPs. There is need for decentralization of decision making powers, promoting involvement/participation of private sector, local organisation, community groups, cooperatives and financial institutions for sustainable use of NWFPs.

The Governments should facilitate the establishment/strengthening of research facilities to ensure adequate functional flexibility, trained researchers, support facilities and the mechanisms for involving the users. Adequate funding for these activities is essential.

FAO in collaboration with other international agencies like FORSPA, CIFOR, UNEP, etc., and national governments, should facilitate the establishment/strengthening of appropriate regional mechanisms to enable collaborative research efforts, technology transfer and market information exchange to help development of better methods of assessment of the NWFP resources, sustainable harvesting, processing and marketing of products. For this purpose, centres of excellence in the nations of various regions be identified and further strengthened to make these capable of accepting technology transfer.

Support of developed/donor countries and agencies may be sought to provide financial and technical support in the area of NWFPs development. International agencies and development banks should incorporate NWFPs as an important component in their policies and programmes for aid and soft loans to the developing countries.

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Forest exploitation operations for non-timber purposes resin

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SUMMARY

Among forest exploitation operations for non-timber purposes we focused our attention on the exploitation of resin (pine turpentine) in species of the genus *Pinus* within countries of the European Union in the belief that the socio-economic importance which these operations have had, and still have as far as resin-production areas are concerned, needs to be known; all of them are generally areas of low income and, in the case of many of them, represent their only source of wealth and labour; in the near future these will be the only ones able to guarantee the supply of raw material for the European Union's resin product processing industry.

On account of the foregoing, there ought to be a priority interest in recovering and boosting these sources of raw material; far from destroying the natural environment, such action guarantees its permanent existence and conservation.

Keywords: Resin, pine turpentine, gum rosin, wood rosin, tall oil (CTO), turpentine.

INTRODUCTION

Currently there are three sources of resin products (rosin and turpentine): PINE TURPENTINE, CONIFER WOOD AND TALL OIL.

Pine turpentine is the oldest source and until 1910, when the United States began obtaining resin products by means of solvents from conifer wood, it was the only one; it is obtained by tapping living trees of the genus *Pinus* for resin.

Tall oil (CTO - Crude tall oil) is the most recently used source and is a by-product of the process using sulphate to obtain cellulose pulp from conifer wood.

Crude sulphate turpentine (CSF) was successfully obtained for the first time in Sweden in 1910, although it was in the United States in 1936 that large-scale production began, this country being the first to obtain tall oil rosin.

World production of resin products of all origins is estimated at around 1 200 000 tonnes of rosin and 269 800 tonnes of turpentine.

Despite the manifold changes which have taken place in the world in general and in the resin industry in particular, production has remained almost constant since 1961. Resin products derived from pine turpentine have been produced at a constant rate, originating simply from a geographical displacement of the areas of production, from the most developed countries to those with a lower standard of living. In the extraction process, the labour cost factor is decisive and will be an essential point considered in this paper.

Conifer wood resin products will disappear in the short term - before the year 2000.

Finally, conifer wood pulp production has stagnated and even declined in the last two years and,

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accordingly, so has the availability of tall oil. However, tall oil rosin has increased by 2% or so as a result of a greater recovery of tall oil and an increase in yield in the fractionation process. Despite everything, the peak has been reached and a major downturn in production is anticipated in the near future.

In the light of the foregoing, pine turpentine resin products from are the only ones with substantial growth potential, both on account of new stands for resin tapping being established or abandoned stands being tapped again, in order to compensate for the losses by way of the other two sources which will take place in the near future.

Production of resin products in Western Europe

GUMROSIN	1990	1991	1992	1993	1994
Portugal	63.9	71.2	59.5	32.9	31.8
Spain	9.5	7.0	2.0	1.8	2.1
Greece	4.1	3.0	2.9	3.1	2.4
TOTAL	77.8	81.2	64.4	37.8	36.3
TALL OIL ROSIN					
France	6.8	6.0	6.4	6.3	7.9
United Kingdom	16.3	18.0	18.1	16.5	15.6
Austria	2.9	2.6	2.7	1.9	3.6
Finland	26.2	24.1	22.3	29.3	26.0
Norway	11.6	10.0	10.5	11.4	11.7
Sweden	27.0	24.0	24.9	22.8	27.1
TOTAL	90.8	84.7	84.9	88.2	91.9
PRODUCTION	168.6	165.9	149.3	126.2	128.2
IMPORTS	95.3	103.0	119.4	159.6	120.0
EXPORTS	9.8	6.2	7.6	6.8	6.8
CONSUMPTION	254.1	262.7	261.1	279.0	241.5

Estimated production data for Western Europe (EC, Austria, Finland, Norway and Sweden) in recent years ('000 tonnes).

Turpentine production has remained, with slight variations, at the following levels:

Pine turpentine:	21 000 tonnes
Crude sulphate turpentine:	20 000 tonnes

The deficit is made up for by petroleum-based solvents, particularly white spirit.

As may be seen, the only countries in Western Europe producing pine turpentine are Portugal, Spain and Greece.

France, which has large potential stands for resin production at the present time, does not carry out resin tapping.

The resin potential of these countries, should the appropriate conditions be set up, could cover Europe's raw material deficit (which will increase by the end of the century) with the added advantage that resin products from these countries are regarded as the best in the world in the case of both turpentine and rosin.

The European rosin deficit of 128 000 tonnes or so is made up for by means of imports, predominantly from China (although the quality is not of the best).

FUTURE OF WORLD ROSIN PRODUCTION BY THE YEAR 2000

In the last five years, rosin production from all sources has stood at between 1.1 and 1.5 million tonnes.

However, gum rosin is the main source of supply in the world, accounting for 60% of the total. Tall oil rosin (Tor), which was insignificant in the Fifties, currently accounts for 35%.

Wood rosin represents between 3 and 4% of production.

Below we examine the present situation and the trends up to the end of the century in the case of these three sources of rosin supply.

Gum rosin

At the present time, world production may be put at 723 000 tonnes.

This figure may be broken down into the following production percentages:

Indonesia 9%, Latin America 14%, former USSR 10%, China 60% and others (Spain, Portugal, Greece, France, USA), 7%.

Tall oil rosin

Current production is estimated at 409 000 tonnes, the main producer (with 257 000 tonnes) being the United States, followed by Western Europe.

Wood rosin

The United States is the sole producer of refined wood rosin at the present time.

In Russia, small unrefined quantities were produced, although it is at present doubtful whether production will continue.

In the United States, there is only one factory; this is owned by Hercules and located in Georgia. The productive lifetime of its installations, according to the company itself, will end in the year 2000 when they close.

Before reaching final conclusions, it is interesting to look at the production peaks of rosins of all types by country on a comparative basis in the case of 1995 production.

	YEAR MAXIMUM PRODUCTION	MAXIMA '000 tonnes	1995 '000 tonnes
CHINA	1993	435	375
USA	1950	512	295
INDONESIA	1994	72	72
INDIA	1975	240	70
FORMER USSR	1989	47	40
BRAZIL	1989	47	40
PORTUGAL	1973	109	18
MEXICO	1974	45	14
FRANCE	1936	71	6
SPAIN	1962	42	3

To sum up, our forecasts lead us to believe, having studied production levels in the last 10 years, the development of own consumption and imports/exports, that the trend in world rosin production up to the end of this century will be as follows:

There will be a reduction in world rosin production according to the following forecasts:

- a slow increase in tall oil rosin production in the USA and a decline in Europe;
- a growth in gum rosin production in South-East Asia, although there will be a reduction in the rest of the world;

- China will be the key source of supply of gum rosin, with a production which may be estimated at 420 000 tonnes;
- however, its availability of products for export will decrease towards the year 2000 and will not exceed 62 000 tonnes; this will be accompanied by a rise in prices.
- since Europe is the main consumer of Chinese rosin, it will have supply difficulties if it does not recover the resin potential of Mediterranean countries.

CONCLUSIONS

Bearing in mind that the total installed production capacity of rosin-derived products in Western Europe is approximately 290 000 tonnes, with a tendency to increase, between 125 000 and 140 000 tonnes of resin will need to be imported; in view of the forecasts for the next few years, there will be difficulties in making good that deficit in raw materials and even if it achieved it will be at a high price which could make its production of resin products non-viable.

Bearing in mind the fact that the resin production potential in Portugal, Greece, Spain and France is sufficient to cover this deficit, this would be sufficient reason for the European Union to provide the necessary support to recover and maintain resin production operations in these countries, given the European Community's needs for such products and the positive results to be gained as far as the resin sector is concerned, specifically the creation of jobs, the conservation of resin-producing stands and an economic boost for these depressed areas, so that its inhabitants do not move out. To achieve this, willingness and imagination are needed to eliminate the causes which led to the crisis in the resin sector, namely:

- the cost of labour in the pine turpentine extraction process making resin production non-viable under current conditions;
- new technologies in resin production systems not having been introduced in time on account of opposition from resin producers and neglect by the Government;
- the inflexible labour and structural regulations in the resin sector;
- the high rate of taxation, which is an excessive burden on forest property;
- the lack of carefully considered action and judgment on the part of industrialists on many occasions.

Despite there being resin production operations which are about to be phased out, this may be the right time to break away from all the rules which govern the sector and relaunch them with new ideas which allow these operations to become profitable. The utmost effort must be focused on raising the productivity of resin workers in order to lower production costs and break away from the excessive inflexibility characterizing the sector.

To achieve this, we propose the following solutions:

- applying the latest technologies in the pine turpentine extraction process; we recommend the bark pick with prolonged stimulation carried out on a descending basis;
- establishing a new schedule for the resin production year adjusted to the characteristics of the area, eliminating those periods in which (on account of climatic conditions) there is virtually no pine production, with a minimal effect on final production although a major one on the work of resin workers;
- the lower height of incisions will allow an increase in resin production years on a face and this will have an effect on the scheme for the exploitation of the stand;
- anything which impedes the implementation of resin production operations must be eliminated from the regulations by which they are governed and these regulations need to be given the

necessary flexibility to introduce the modifications indicated by research results as needing to be changed in the pine turpentine extraction process;

- discontinuing the allocation of thickets to resin producers and organizing work in teams;
- increasing the future production of stands used for resin production by stepping up efforts in genetic improvement, breeding seeds of Plus trees - which are prolific producers of pine turpentine - in our stands or by means of grafts with the implantation of buds from these Plus trees.
- aids and interest from governments in order to foster the research whereby new and improved technologies can be developed.

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“Kekik” in trade in Turkey

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ABSTRACT

Kekik is vernacular name of some members of the family *Labiatae* in Turkey. Examples include *Thymus*, *Origanum*, *Satureja*, *Thymbra* and *Coridothymus*. *Origanum* species are the principle crop exported as Kekik from Turkey and exportation has been on the increase both in value and volume in recent years, reaching to 6.000 tonnes in 1995. The scientific names of exported material named as Kekik have been determined using the specimens obtained from natural habitats, collectors and traders. Some species are thought to be seriously threatened by the trade.

Keywords: Kekik (thyme), trade, wild species, *Labiatae*, Flora of Turkey.

INTRODUCTION

In Turkey an extremely large trade exists in wild medicinal plants usually collected from forest areas. Each year many thousands of tonnes of roots, leaves, flowers and seeds of a very wide range of native plant species are collected for local use and trade both for export and for use within Turkey.

Reports of annual harvests of 500 tonnes of roots of *Gypsophila* and the related genus *Ankropetalum* and 90 tonnes of seed of *Colchicum speciosum* indicate that the trade is large. Furthermore, it is known that a number of rare and endemic species are collected. At the present time, we do not know the impacts of such collection on wild populations. This project was carried out through the cooperation of three organisations {Istanbul & Ankara Universities, Faculty of Pharmacies, Pharmaceutical Botany Departments and DHKD} between August 1996 and Mart 1997. The project was supported by World Wide Fund for Nature-UK and Fauna and Flora International (Cambridge, UK). The project aims to promote the long-term conservation of wild medicinal plants in Turkey, by (i) determining the level of internal and external trade, (ii) assessing the relative vulnerability of individual species to collection; and (iii) making recommendations for a programme of conservation action.

Field studies, meetings with trades and collectors, and published records/state statistics show us that Kekik is the main secondary product from forest areas, and comprises the major portion of exported material of medicinal plants from Turkey. The scope of our presentation will include information based on literature and data collected during field studies.

RESULTS

Kekik is a collective vernacular name given to species which smell of thyme and contain thymol and carvacrol in their essential oils. A range of genera of *Labiatae* have this scent, notably *Origanum*, *Thymus*, *Thymbra*, *Satureja* and *Coridothymus* (Baper 1995). They are used as a general remedy for gastrointestinal disorder. Kekik is locally used as a herbal tea in the regions where they grow and other main uses of them are as condiments/culinary herbs.

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Kekik is a main export commodity of considerable economic importance for Turkey. Each year its exportation has increased: (Table 1).

Table 1. 1990-1995 years exportain of Kekik from (General Directorate of Forestry, Forest byproducts)

Year	Kg	\$
1990	3.812.520	6.290.112
1991	3.976.377	8.077.998
1992	4.744.120	10.786.478
1993	4.744.120	10.766.479
1994	6.335.386	16.103.623
1995	5.600.731	13.686.112

The principle genus of Kekik exported from Turkey is *Origanum*. *Origanum* is represented by 22 species and 4 subspecies in Turkey. They are grouped into 8 sections and 14 species are endemic to Turkey.

The list of the *Origanum* species in Turkey (°= endemic to Turkey).

1. *O.boissieri* Ietswaart°
2. *O.saccatum* P.H.Davis°
3. *O.solymicum* P.H.Davis
4. *O.hypericifolium* O.Schwarz & P.H.Davis°
5. *O.sipyleum* L.°
6. *O.rotundifolium* Boiss.
7. *O.acutidens* (Hand.-Mazz.) Ietswaart°
8. *O.haussknechtii* Boiss. °
9. *O.bargyli* Mouterde
10. *O.brevidens* (Bornm.) Dinsm.°
11. *O.husnucan-baserii* H.Duman, Z.Aytaç & A.Duran°
12. *O.leptocladum* Boiss.°
13. *O.munzurensis* Kit Tan & Sorger°
14. *O.amanum* Post°
15. *O.bilgeri* P.H.Davis°
16. *O.micranthum* Vogel°
17. *O.minutiflorum* O.Schwarz & P.H.Davis°
18. *O.majorana* L.
19. *O.onites* L.
20. *O.syriacum* L. var.*bevanii* (Holmes) Ietswaart
21. *O.vulgare* L.
subsp.*hirtum* (Link) Ietswaarts
subsp.*gracile* (C.Koch) Ietswaart
subsp.*vulgare*
subsp.*viride* (Boiss.) Hayek
22. *O.laevigatum* Boiss.

Turkey is considered as the gene centre of the genus *Origanum*. Five oil-rich and carvacrol rich species are *Origanum onites*, *O.vulgare subsp.hirtum*, *O.majorana*, *O.minutiflorum* and *O.syriacum var.bevanii* comprise the major portion of *Origanum* exported from Turkey (Tümen et al.).

Commercial *Origanum* species are good sources of essential oil rich in carvacrol. Some endemic *Origanum* species (*O.bilgeri*, *O.acutidens*, *O.hypericifolium*, *O.sipyleum*) are used as herbal tea in the regions where they grow (Tümen et al. 1995).

Although *Origanum* species are generally known as “Kekik”; however it has different names in different regions such as Mercanköşk, Merzengüş, Anık, Anzer çayı, Cantır, Eşek kekiği, Togo kekiği, Yayla kekiği, Bilyalı kekik, İzmir kekiği, Taş kekiği, Çanakkale kekiği, Güvey otu, İstanbul kekiği, Kara ot, Keklik otu (Baytop 1994).

Other economically-important genera locally termed “Kekik” are:

Thymbra: with 2 species and 2 subspecies. *Thymbra spicata* L. commercially known as “karakekik” and with other vernacular names are zater, kaya kekiği, ayaklı kekik and karabaş kekik. *Thymbra* species are used as a condiment and herbal tea and exported from Turkey.

Coridothymus: only one species: *Coridothymus capitatus* (L.) Reichb., locally called “beyaz kekik”, This is used instead of thyme and as herbal tea in west and south of Turkey.

Satureja: 14 species, of which four are endemic to Turkey (28.6 % endemism). *Satureja hortensis* L. is sold in the spice market and called sater, zahter and çibriska: it is used for salads as a condiment. Other *Satureja* species used for teas and condiments:

- ◆ *Satureja hortensis* L.
- ◆ *S.thymbra* L.
- ◆ *S.cuneifolia* Ten.
- ◆ *S.parnassica* Heldr. & Sart. ex Boiss. subsp.sipylea P.H.Davis^e
- ◆ *S.spicigera* (C.Koch) Boiss.

Thymus is represented 38 species with 40 subspecies and varieties in Turkey. 20 species are endemic to Turkey (52.6 % endemism). *Thymus* species are mainly used as herbal teas but some species can be used as condiment due to good percentage of essential oil rich in thymol: such species listed below (Başer 1995 & Baytop 1994).

- ◆ *T.longicaulis* C.Presl.
subsp.*chaubardii* (Boiss. & Heldr. ex Reichb. fil.) Jalas var. *Chaubardii*
var.*alternatus* Jalas
- ◆ *T.kotschyanus* Boiss. & Hohen var.*glabrescens* Boiss.
var *kotschyanus*
- ◆ *T.eigii* (M.Zohary & P.H.Davis) Jalas
- ◆ *T.sipyleus* Boiss. subsp. *rosulans* (Borbás) Jalas
- ◆ *T.sibthorpii* Bentham
- ◆ *T.bornmuelleri* Velen.
- ◆ *T.praecox* Opiz
- ◆ *T.pseudopulegioides* Klokov & Des.-Shost.
- ◆ *T.zygioides* Griseb. var.*lycaonicus* (Celak.) Ronniger^e

CONCLUDING REMARKS

In this paper, we have tried to give an insight into little known facts about some species known as kekik in trade in Turkey. It has shown that some rare and endemic *Labiatae* species collected from natural habitats either for local use or export. The following species are thought to be seriously threatened by over collection:

- I) *Origanum minutiflorum*, is endemic species as known “Çingilli kekik, Tota kekiği” around Sütçüler (Isparta). -an important item for exportation-
- II) *O. onites* (syn: *O.smyrnaeum* L.) as known İzmir Kekiği, Bilyalı kekik. -over collection for export-
- III) *Satureja parnassica* subsp.*sipylea*, is an endemic taxon.

IV) *Thymus zygoides* var. *lycaonicus* is an endemic taxon, not rare but locally used where it grows.

A report has been prepared which identified possible solutions which include:

- i) the establishment of cultivation areas where species can be artificially propagated
- ii) the introduction of tighter legislation (eg. species listing on Appendix II CITES, national export regulatory mechanisms etc.)
- iii) the monitoring of wild populations deemed to be vulnerable to the effects of collection
- iv) the establishment of a network of gene management zones/protected areas for habitats exhibiting outstanding assemblages of rare 'kekik' species
- v) undertaking an education/public awareness programme, detailing safe and sustainable means of harvesting wild plant material

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Summaries of voluntary papers

(Also published in Spanish, French and Turkish)

SOME ASPECTS OF FOREST POLICY AND NON-TIMBER FOREST PRODUCT MANAGEMENT IN BOTSWANA

Frank W. Taylor and Tabitha J. Mason¹

This paper investigates the present status of Botswana's natural resources, many of which are forest based. Government is changing its policy and this paper outlines one non-governmental organisation's (NGO) innovative attempt to take advantage of the new situation for the benefit of both biodiversity and the rural population.

Botswana is a semi-arid landlocked country, 85% of which may be classified as woodland savannah. It is currently experiencing problems of deforestation, overgrazing, soil degradation and diminishing land productivity. These problems are rooted in the evolution from nomadic pastoralism to sedentary pastoralism and arable agriculture which occurred this century due to increasing population.

The problems have been exacerbated by inadequate government policy limited in scope to forest reserves and national parks. Management of villages' natural resources has been virtually non-existent.

Since 1994, the Government has been developing one of the most enlightened policies in Africa with regard to natural resources. In particular, it has been trying to improve the quality of life of rural people whilst countering the loss of biodiversity. This is mainly done by encouraging rural communities to develop their own strategies for the sustainable utilisation and management of their natural resources. Government has also highlighted the need for farmers to diversify away from pastoralism and traditional arable agriculture.

Veld Products Research (VPR), a local NGO, has recognised the potential of non-timber forest products (NTFPs) to improve food security and provide alternative sustainable sources of income for Botswana's rural population. The organisation is currently researching all aspects of NTFP development such as agroforestry, sustainable harvesting, production, processing and marketing. It has recently established a Community Based Natural Resource Development Project.

Keywords: Agroforestry, community, domestication, NTFPs, sustainable management.

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THE ROLE OF NON-WOOD FOREST PRODUCT IN NIGERIA

P.M. Papka and O. Omiyale¹

Nigeria, a tropical country is well endowed with abundant flora and fauna some of which are classified as Non Wood Forest Products (NWFPS). Some of these NWFPS are edible, medicinal, structural materials, household equipment and for energy . Others assist in livestock production while some have industrial uses.

The rural communities derive substantial revenue from the collection and processing of these NWFPS which improve their economic status through the alleviation of poverty. Unfortunately the contributions of these NWFPS are yet to be properly reflected in their contribution to GDP of the country.

Programmes and projects are proposed for sustainable development and management of these products for international support so that the full potential of these products are released to alleviate the poverty of our people as well as contributing to environmental conservation.

Keywords: Economy, Conservation , Management, Poverty, Assistance.

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ECONOMIC FEASIBILITY ANALYSIS OF TAPPING IN *PINUS ELLIOTTII* VAR. *ELLIOTTII* IN BRAZIL

Vitor Afonso Hoeflich¹, Ernst Christian Lamster² and Eliseu de Souza Baena³

The main objective of this paper was to evaluate the economic feasibility of tapping *Pinus elliottii* Engelm. var. *elliottii* in South Brazil. The resin is a product from the exsudation of pine trees and is prime material for colophony and turpentine production, used for a series of chemical and pharmaceutical industries. Tapping is an important activity, socially and economically providing thousands direct and indirect jobs, stabilizing populations in rural regions and generating resources to the country through exports. Using IRR (Internal Rate of Return) on cash-flow for a non tapped forest, tapped one, and tapped in genetically improved forest for resin exsudation gain, the advantage of tapping was evident for improved trees. Respectively, the IRR was 8,60%/year, 13,20%/year, and 16,60%/year. Some recommendations are presented: a) there is a need to research the "extraction" method, used in Southern USA and other new techniques in order to minimise the cost of tapping; b) government authorities should provide incentives such as loans.

Keywords:- slash pine - tapping - genetic - economics - reforestation

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CHILEAN PALM: AN ECONOMIC ALTERNATIVE FOR SMALL PEASANT PROPERTY ON DRY LAND

L. Alberto González¹

Up until a few years ago, it was believed in Chile that the Chilean palm (*Juabaea chilensis*), one of the species of national flora of great scientific value, was endangered on account of its indiscriminate exploitation for the production of palm honey. Although it was certain that there had been a decrease in palm populations, the true causes of its decline and, in some cases, its disappearance, were quite different - namely indiscriminate harvesting and the virtually entire consumption of its fruits.

In the light of current knowledge, the palm is a species whose propagation is achieved without difficulty. In addition to its scientific and ornamental value, which is undisputed, it is one of the native species of sclerophyllous forest with the greatest prospects and highest economic value in the country. In fact, despite still featuring in the list of vulnerable species in Chile, this is a plant whose cultivation offers great possibilities on account of its economic, ecological and ornamental potential. The Chilean palm may be a species of vital importance for the economic development of the country, particularly the central area, on the granitic soils on the coast and in unirrigated areas inland.

Alternatives need to be sought, via more intensive cultivation, which accelerate germination and the development of the species to convert it to an attractive alternative for owners of marginal soils with low or zero productivity. In fact, this can be a resource of great interest for small and medium-sized peasant property on land with no alternative use, since plantations of this species require no grubbing and this can make extensive stockfarming possible; nor does it require large tracts of land, since even a low level of production represents a food of great calorific value.

Chilean forests can no longer continue supporting exclusively exotic, fast-growing plantations. The focus of promotion needs to be the sustainable management of native forests and at the same time the diversification of species to be afforested. It is precisely under this policy that the development of the Chilean palm is to take place.

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SUSTAINABLE FOREST MANAGEMENT BY LOCAL COMMUNITIES: THE ROLE OF NON-TIMBER FOREST PRODUCTS

J.K. Hibberd¹

In Papua New Guinea, local communities are being assisted in the development of NTFPs as part of a programme to manage primary forest to conserve the remaining populations of the world's largest butterfly, the Queen Alexandra Birdwing Butterfly (QABB), *Ornithoptera Alexandrae* Rothschild. All QABB forest areas are under customary land tenure. These forests are utilised extensively by local communities and most rural families practice a relatively subsistence level of lifestyle supplemented by occasional cash crops. Villagers' lifestyles depend upon a supply of land for family gardens which, together with hunting, provide most of a communities' food, shelter and religious needs. The paper details how the Oro Conservation Project is working to empower local communities to take a more active role in the management of their forests since clearing of primary forest for new village gardens has the potential to destroy the core habitat for QABB. A range of approaches are examined. Local people have been encouraged to participate in the Project in a variety of activities.

The paper investigates utilisation of the primary rainforest and finds twelve major categories of items being collected. Wild food resources are shown to provide a substantial supplement to community diets while hunting tends to be opportunistic rather than highly organised, with fifteen species of wild fauna being regularly hunted. Information is presented on the importance of forest products for community medicine, building materials, and direct cash income.

A number of strategies to improve forest management are examined. The key to improved management of customary owned forests is shown to be collaborative management, which is being implemented through participatory rural appraisal. It is suggested that sustainable NTFP forest management strategies also need to address economic and social aspects besides just those of ecological, silvicultural and ecosystem processes.

The encouragement of local communities to take a more positive role in actively managing their forests for sustainable income is explored in the paper. The role of forest management is examined and it is suggested that the forests need to 'belong' to each local community in order to be effective and sustainable. A range of techniques to facilitate participation by those classes of people who traditionally are excluded is under trial. The paper concludes by detailing the role of Village Conservation Committees whereby a cadre of local language speaking advocates for change are trained.

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SUSTAINABLE DEVELOPMENT OF NON-WOOD FOREST PRODUCTS OF THE SUNDARBAN RESERVED FOREST: AN INTEGRATED APPROACH

Laskar Muqsudur Rahman¹

The Sundarban Forests of Bangladesh is the largest single tract of mangrove forest in the world having an area of 577,000 ha that has the distinction of being the first mangrove forest in the world to be brought under scientific management. Until recently the Sundarbans had been seen primarily as a wood-producing unit and other products were usually referred to minor forest products. Now time has come to set objectives for strategies aimed at improving production of not only timber but also non-timber products in a sustainable manner. Nypa palm, fish and honey have been given substantial attention but more from the point of view of revenue earning potential than in terms of improving sustainable production for the benefit of underprivileged local people. Existing management systems do not make sufficient provision for such management and at present there is a serious imbalance in institutional arrangements, structures, research, monitoring, staff training and control mechanisms. The collection and processing arrangements are primarily done by two sectors, viz. The Government primarily through the Forestry Department (FD) and small scale private entrepreneurs. The Forest Department has no specialized section for handling non-wood forest products. It is done as an additional responsibility. Some steps have been taken by private sector entrepreneurs on a very small scale and on a necessary purely commercial basis. Attention by responsible authorities is now necessary.

Keywords: Mangroves, Tourism, Management, Sustainable

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PLANTATION BAMBOO FOR SUSTAINABLE PRODUCTIVITY

P. Shanmughavel¹

Over-exploitation and shrinkage of their natural habitat is depleting the bamboo resources at an alarming rate. Sustained availability can be ensured only by plantations. This paper describes the results from a trial plantation of *Bambusa bambos*. This proved to be an ideal species for large-scale plantations. Productivity, pulp characteristics and economic aspects are discussed.

Keywords: Natural bamboo, depletion, sustained availability, plantation bamboo.

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PROSPECTS FOR DEVELOPMENT OF NON-WOOD FOREST PRODUCTS IN INDONESIA

Rufi'ie¹

Non Wood Forest Products (NWFPs) in Indonesia are playing an increasingly important role in the social and economic aspects of the country. They provide many useful commodities for people, especially the ones living near forests. Some of them are traded, locally or internationally. Among them, rattan is the most important.

Development of NWFPs is expected to improve people's prosperity by involving them in forest utilization activities, such as tumpang sari (taung-ya) in Java and Village Development Scheme of Concessionaire (HPH Bina Desa) in outer Java.

There is a need for improvement of propagation methods, management, harvesting, storage and utilization; promotion of women's participation; improvement of quality of processing facilities and development of facilities and local experts.

Keywords: Non-wood forest products, NWFP, Indonesia

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THE PROCESSING AND APPLICATION OF ALMACIGA (*AGATHIS PHILIPPINENSIS* WARB.) RESIN FOR PAINTS

Elvira C. Fernandez¹

Almaciga resin was purified and modified by the thermal process to convert it to a form suitable as a component for paint manufacture. In the purification process, the highest yield obtained for resin was 88.98% and the lowest was 79.9%. The average solvent recovery for the three grades of resin was 72.1%. A large decrease in percentage yield of modified resin was observed at higher temperature and longer heating time.

Modified almaciga resin is soluble in drying oils in an acid number of 18. The conditions for modified almaciga resin soluble in linseed oil were 330°C for four hours; 340°C for two hours and 350°C for 0.75 hour.

Using Friedman's two-way analysis of variance by ranks, the formulation with 70% modified almaciga resin and 30% alkyd resin was found comparable in properties to that of the commercial paint.

Keywords: Agathis, resin, Manila copal, paint

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NON-WOODY FOREST PRODUCTS FROM REMOVAL TO INITIAL MARKETING

Alain Pénelon¹ and Mendouga Mebenga²

The humid forest of the equatorial zone is characterized by considerable biological diversity. Some resources have been exploited since ancient times while in the case of others exploitation has been recent and intensive. This paper considers how non-woody resources, long held in low regard on account of the priority accorded to commercial timber, are viewed by forest populations.

The timber industry has triggered many social conflicts by exploiting the timber of several species used for their bark, their fruit or the caterpillars they carry. Beyond these conflicts, it is the economy of households which has been changed by a reduction in own consumption to the benefit of sales, with the modification also - and especially - of the rules governing the removal of, access to and control of resources.

The study is taking place in the Province of East Cameroon, a feature of which is an imposing stand of 7.5 million ha of semi-deciduous, sempervirent forest in its southern two-thirds and grassier formations with gallery forests in its northern part. The study, conducted among 40 households from 4 villages, is intended to ascertain the socio-economic importance of non-woody forest products in the local economy. To achieve the lasting management of this combination of resources, intensifying the present system of barter based on harvesting cannot be envisaged. In fact, it would be liable to cause certain species, particularly the rarest, to disappear. Yet others are still greatly under-utilized on a commercial basis.

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SUSTAINABLE AND COMMERCIAL EXTRACTION OF NON-TIMBER FOREST PRODUCTS – A POLICY AND MANAGEMENT ORIENTED RESEARCH STRATEGY

Mirjam Ros-Tonen, Wim Dijkman and Erik Lammerts van Bueren¹

The present paper outlines an interdisciplinary research strategy for research on non-timber forest products. The strategy is aimed at developing a checklist of attributes and requirements for successful and sustainable commercial extraction and of a methodology to apply this checklist in land-use planning. The results should enable the identification of areas which are suitable for the implementation or expansion of commercial extraction of non-timber forest products as a strategy for the conservation of tropical rain forests. The text summarizes the main attributes of sustainable extraction and successful commercialization which underlie the formulation of the checklist. The presented strategy forms the analytical framework for studies on non-timber forest products, carried out under the umbrella of the Tropenbos programme in the Netherlands.

The Tropenbos Foundation is an internationally oriented organization conducting interdisciplinary research and training programmes in support of biodiversity conservation and wise use of tropical rain forests. Tropenbos has five permanent research sites in Colombia, Guyana, Cameroon, Côte d'Ivoire and Indonesia.

Keywords: (1) Non-timber forest products (2) Tropical rain forests (3) Sustainable forest use (4) Land evaluation (5) Interdisciplinary research programmes

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BASIL (*OCIMUM BASILICUM* L.) AND IT'S CULTIVATION PROCEDURES AS NON-WOOD FOREST PRODUCTS

S. Tansı¹, S. Nacar and A. A. Çulcu²

Sweet basil (*O. Basilicum* L.) is an annual plant of the genus *Ocimum* which belong to the *Labiatae* family. *O. Basilicum* is an erect, almost glabrous and annual herb reaching a height of 30-90 cm. It is called as Reyhan or Feslegen in Turkey.

In this research the yield and quality of basils of different origins (French, Greek and German basil) were assessed. Basil was harvested three times during the vegetation period of six months. Maximum height has been observed for French basil i.e. 77.73 cm in the third harvest time followed by Greek basil and German basil. The highest fresh weight was obtained in French basil (3564 kg/da). French basil also had the highest total yield performance. The stem of basil did not contain essential oil. The highest essential oil content was found in the second harvest.

In German basil the maximum level of essential oil were reached in the third harvest. In Greece and French basil the maximum level of essential oil was reached in the second harvest.

As a result, it is concluded that the three basil species originating from different regions are well adapted to Çukurova conditions as no serious pests or diseases occurred during the growing period.

Keywords: basil, essential oil, non-wood forest products.

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Summaries of voluntary papers

(The following summaries are only published in original language)

EGGS INCUBATION PERIOD AND HATCHING SUCCESS OF AFRICAN GIANT LAND SNAIL (*ARCHACHATINA MARGINATA*) SWAINSON IN DIFFERENT INCUBATION MEDIA

E.A. Agbelusi, Adeparusi, E. Oluwayemisi¹

A study of incubation period and hatching success was investigated in the African giant land snail - *Archachatina marginata*. Four different media with varying moisture content were used for egg incubation.

The result revealed that too much or too little moisture content in the incubation media either prolonged the incubation period or prevented hatching.

Two media with 25% or 30% moisture content, i.e. dry soil and sawdust, had 0% hatchability. Egg hatchability on the damp soil was 30% while it was highest in moist soil at 82% success. Eggs incubated in both the dry soil and the sawdust became crystallised. This shows that high ambient temperature coupled with little moisture content in the incubation media prevented the development of the embryo to maturity. Unhatched eggs then contained liquid with the undeveloped yoke or were devoid of content.

Incubation period ranged between 32 to 42 days in the damp soil while it was between 23 to 30 days in the moist soil.

These results indicate that soil with optimum moisture contents should be chosen for snail rearing in order to ensure good snail yield and productivity.

Keywords: Egg hatching success, giant African land snail, incubation period, hatching spread

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EFFECT OF SOME PLANT-FOOD MATERIALS ON THE GROWTH RATE OF THE AFRICAN GIANT LAND SNAIL (*ARCHACHATINA MARGINATA*)

Adeparusi, E. Oluwayemisi and E.A. Agbelusi¹

There has been an increase in the quest for the optimal production of the African giant land snail (*Archachatina marginata*) under culture. In this study we assessed the growth response of this snail to locally available food materials: *Talinum triangulare* leaves, *Carica papaya* leaves, *Boerhavia diffusa* leaves and *Colocasia esculenta* leaves.

Three growth parameters were measured: weight, body length and aperture length. Data on these growth parameters were collected biweekly. The rate of growth in body weight was found to be affected by the type of diet while the body length and aperture length were found to be independent of type of diets. The highest growth rate of 0.30 gm per day was recorded in snails fed with pawpaw leaves, this differed significantly ($P < 0.01$) from the growth rate on *Talinum* leaves which had a lower growth rate of 0.10 gm per day.

Keywords: Plant-food, Body length, Aperture length.

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THE ECONOMIC VALUES OF NON-WOOD FOREST PRODUCTS IN NIGERIA

Joseph A. Fuwape and Jonathan C. Onyekwelu¹

Non-Wood Forest Products (NWFP) are important for the economic, social and cultural well being of the communities in low-income rural areas of Nigeria. This paper reviews the importance of NWFP in the provisional of food, medicine, handicraft, tannin and dyes. The paper also highlights some of the problems that impede the development of NWFP in Nigeria. These include: prejudice against the use of wild resources, lack of adequate information on NWFP, restrictive forest legislation, underdeveloped markets, poor knowledge transfer and training and a poor understanding of the roles of NWFP.

Keywords: Non-wood products, tannin, mushrooms, fibres, dyes, medicinal; plant, rattan;.

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BAMBOO RESOURCE UTILIZATION AND INDUSTRIAL PROCESS IN CHINA

Yang Yuming and Wang Kanglin¹

A review is made of the historical and present use of bamboo species in China of which there are more than 500 species representing 40 genera.

The case is made to place utilization of the species on a sustained basis and to conserve the genetic diversity of this great national resource.

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GAS CHROMATOGRAPHY OF RESIDUE FROM FRACTIONAL DISTILLATION OF *EUCALYPTUS GLOBULUS* LEAF OIL

Z. Zhendong¹, S. Zhen,¹ L. Zhiqin,¹ Wang Yan¹

More than 70 components in the residues of *Eucalyptus globulus* were detected, and among them 48 components were identified with GC and GC-MS. The main components were identified as α -terpineol (Sample A: 27.9%; Sample B: 5.5%), aromadendrene (Sample A: 17.3%; Sample B: 26.8%), alloaromadendrene, guaienes, gurjunenes, epiglobulol, ledol, diepialustrol and others.

Keywords: Residue, *Eucalyptus globulus* leaf oil, component.

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UTILIZATION POTENTIAL OF *ACACIA SENEGAL* IN ARID AND SEM-ARID REGION OF INDIA

Hamid A. Khan and L.N. Harsh¹

Acacia Senegal occurs widely in the arid and semi-arid region of Gujarat and Rajasthan in India. The tree is a source of fodder and fuel and the seeds are used as vegetable.. Besides, being a leguminous tree, it fixes atmospheric nitrogen and improves soil fertility and has a typical soil stabilising property as the tap root extends deep down in search of water and the lateral roots extend about 20-30 m in length, stabilising the soil and arresting soil erosion. Recent discovery of occurrence of triacontanol, an effective plant growth regulator, in the leaves of this tree has increased its importance as an important component of agroforestry system as the leaf-litter is a source of triacontanol rich humus to the soil. *A. Senegal* is a well known source of highly valuable gum arabic in Sudan. However, in India, the tree produces little or no gum as such. A systematic study has been initiated to tap the gum from this tree by ethephon treatment. The development of a technique for tapping *A senegal* without affecting the performance of the trees would go a long way in saving foreign exchange, generating employment, creating a source of income to the inhabitants of arid and semi-arid region of India and promoting sense of responsibility for propagating and conserving this multipurpose tree among the people.

Keywords: *Acacia senegal* , triacontanol, gum-arabic, ethephon, utilization.

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TRIACONTANOL AND TRITERPENES FROM *TECOMELLA UNDULATA*

M. Mohibb E. Azam¹, Pushpa Singh¹ and A. Ghanim¹

Tecomella undulata (Smith), a member of the family *Bignoniaceae*, is one of the co-dominant species in the desert of western Rajasthan and adjoining plains of Haryana. The plant is very hardy and drought resistant, is used for afforestation and landscaping of dry tracts and is prized for its high-quality timber and medicinal value. The plant parts are used for the cure of syphilis and eczema and the bark possesses mild relaxant, cardiotoxic and chloretic activities.

Chemical investigations of leaves of *T. undulata* led to the isolation of triacontanol, betulinic acid, oleanolic acid and ursolic acid. Triacontanol is an effective plant growth regulator while both betulinic acid and ursolic acid are potent anti-human immunodeficiency virus (HIV). The leaves of *T. undulata* could be a rich source of ursolic acid for further clinical studies.

Keywords: *Tecomella undulata*, triacontanol, betulinic acid, ursolic acid, anti-HIV.

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REHABILITATION OF SANDAL, TREE (*SANTALUM ALBUM* L.) THROUGH PEOPLES PARTICIPATION

R.S. Vinaya Rai and G. Kumaravelu¹

Santalum album L., endemic to the States of Tamil Nadu and Karnataka in India, occupies a prime position in the country's forestry, earning valuable foreign exchange. Its heartwood yields the renowned sandalwood oil used extensively in perfumery trade. In view of their intrinsic worth, all trees whether grown on private or public land, belong, by statutory provision, to the State and its management is governed by stringent regulations. Yet sandal has become a vanishing species due to wanton, illicit cutting by smugglers who employ ingenious methods to hoodwink the law-enforcers. Owing to the dysgenic selection practised by the smugglers even the existing population comprises mostly genetically inferior trees. A sandal estate project mandated to rehabilitate the sandal tree in an area of 13,968 ha through the active participation of tribals in the adjoining villages has been implemented in five major sandal growing districts in the State. The project has a strong component designed to enhance the socio-economic conditions of the tribals, so that they do not fall a prey to the inducements of the smugglers. In the short period of its implementation, the project has considerably defused smuggling activity by severing the tribal-smuggler nexus and has thus helped rapid proliferation of the sandal population.

Keywords: *Santalum albul* L., endangered species, rehabilitation, people's participation

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SOCIAL AND ECONOMIC ASPECTS OF RATTAN IN INDONESIA A CASE STUDY IN INDUSTRY AND RESOURCE IN JAVA

Hariyatno Dwiprabowo, Rahayu Supriyadi, and Setiasih Irawanti¹

This study is aimed at employment in rattan industry , the socio-economic condition of the worker and the general condition of the industry in Java. Data were collected through a survey of the industry (rattan products manufacturers) in Cirebon and Surabaya regions which represent the main industrial centres. Financial analysis is conducted to determine profitability of rattan manufacturing.

The study shows that labor absorption in rattan product manufacturers and in the industry as a whole are quite impressive in comparison with wood products industries. Worker's socio-economic condition in general is good. Financial profitability of manufacturing firms in general is good except for home manufacturers. The export earnings is steadily increasing. There is cooperation among manufacturers of different scales to produce rattan furniture through subcontracting mechanism which is beneficial particularly when demand is high. The supply of rattan is reasonably good although there is a need to do an reinventory. Worker's wage in rattan collecting activity is above the regional minimum wages, although it is still below those received by workers in the industry.

Keywords: Rattan,industry, socioeconomic, Java, Indonesia

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CONSERVATION AND UTILIZATION OF RAINFOREST MEDICINAL PLANT IN MERU BETIRI NATIONAL PARK, INDONESIA

Ervizal AM. Zuhud¹, Arif Aliadi² and Indra Arinal³

Conservation and utilization of rainforest medicinal plants are the principal of The Indonesian Tropical Forest Medicinal Plant (ITFMP) Program. The program is based on the World Conservation Strategy (WCS) released in 1980. Principles contained in the WCS are very important and if applied would contribute to sustainable development. However, this strategy will stay a concept on paper if not followed by appropriate programs in the field.

The ITFMP Program implemented by the Consortium of Faculty of Forestry, Bogor Agricultural University and the Indonesian Tropical Institute since 1992 endorsed by the MacArthur Foundation-USA aims to apply the WCS by developing medicinal plants. The medicinal plants are chosen since they have an important economic potential. In addition, they can assist in promoting conservation values among people particularly those living near the forests.

Keywords: conservation, medicinal plants, community development, agroforestry

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ECONOMIC ASPECTS OF AQUILARIA MALACCENSIS AND ITS CONSERVATION IN MALAYSIA

Azizol Abdul Kadir, Ng Lean Teik and Abdul Razak Mohd Ali¹

In the past few years the prices of gaharu, a fragrant wood produced by the *Aquilaria* species of the family *Thymeleaceae*, have increased tremendously. Three species of *Aquilaria*, namely *A. malaccensis* Lam., *A. hirta* Ridl. and *A. rostrata* Ridl. Are found in Malaysia, although, only *A. malaccensis* is economically important. Recently, its survival in natural habitats has been endangered as the demand for gaharu continues to rise.

Realizing the consequence caused by uncontrolled harvesting, indiscriminate felling, and pressure from high market demand, scientists in Malaysia especially at FRIM have initiated several programmes to conserve this species. At the same time, research is also being conducted to investigate the mechanism of gaharu formation. In choosing conservation strategies, both ex situ and in situ techniques are being applied.

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HARVESTING TECHNIQUES IN TAPPING PHILIPPINE RESINS WITH EMPHASIS ON ALMACIGA (*AGATHIS PHILIPPINENSIS* WARB)

Arsenio B. Ella¹

The tapping practices on five resin producing species in the Philippines, namely, *Dipterocarpus* spp. for balau resin, Palosapis (*Anisoptera thurifera* ssp. *thurifera*) for oil of palosapis, *Canarium* spp. for Manila elemi resin, Benguet Pine (*Pinus insularis* Endl.) for oleoresin, and almaciga (*Agathis philippinensis* Warb.) for Manila copal resin, are discussed, including the potential of the resins as an export winner for the country.

Because of economic importance, demand and availability of suitable trees for tapping purposes, emphasis is put on almaciga. The biological considerations in tapping to promote sustained resin production, the traditional method of tapping in the Philippines, and the improved tapping techniques developed by FPRDI for almaciga are explained.

Keywords: Almaciga tapping, almaciga resin, Manila copal

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WATER REPELLENT EFFICIENCY OF ORGANIC SOLVENT EXTRACTIVES FROM PINE LEAVES AND BARK APPLIED TO WOOD

Costas Passialis¹ and Elias Voulgaridis²

Natural wax-like materials were extracted from leaves and bark of Aleppo pine (*Pinus halepensis* Mill.) by using toluene as organic solvent. Experimental water repellent formulations (WRFs) were prepared by using 10% gum rosin as resin constituent and 0%, 1% and 2% paraffin wax, pine needle/bark extracts or a mixture of paraffin wax and needle/bark extracts in proportion 1:1 as hydrophobic substance. All experimental WRFs applied to small, cross-sectional wood specimens of Scots pine (*Pinus silvestris*) and beech (*Fagus sylvatica*). Wood specimens were impregnated by a simple immersion technique and the water repellent effectiveness (WRE) was assessed by using tangential swelling data. Toluene soluble extracts from needles and bark applied to wood provided hydrophobic properties to pine and beech wood specimens but to a lesser degree when compared to paraffin wax. Bark extracts appeared to be stronger hydrophobic materials than needle extracts. Both needle and bark extracts can be successful substitutes for paraffin wax in WRFs up to 50%. The degree of protection provided by WRFs and the differences between treatments were smaller in pine heartwood and beech sapwood than in pine sapwood.

Keywords: Aleppo pine, needle/bark extracts, gum rosin, water repellency

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COMPARISON OF COMPOSITION ELEMENTS ON DIFFERENT SUBSTRATES OF OYSTER MUSHROOMS (*PLEUROTUS* SPP.) GROWING UNDER PLASTIC SHEET

M. Güler¹ and Y. S. Ağaoğlu²

The paper describes changes in the yield, dry matter percentage, crude protein percentage, pileus diameter, stipe diameter and stipe length of *Pleurotus pulmonarius* (PP), *P. sajor-caju* (PSC), *P. sp. cfr. Florida* (PF), *P. columbinus* (PC), *P. ostretus* (Origin of England-POE) and *P. ostretus* (Origin of Anatolia-POA) inoculated and grown in different substrates composed of mixtures of wheat straw (W), paddy straw (P), corn straw (C), wheat+paddy straw (WP), wheat+corn straw (WC) and wheat+paddy+corn straw (WPC). During the experiment it was also found that substrates of WPC (437.90 g), WP (377.90 g) and WC (375.90 g) have proven to be the best growing media, providing highest yields. Yield of the P (249.90 g) are lower than the others. According to the comparison of quality factors at different media, the levels of dry matter in C (8.32 %), crude protein in W (25.32 %), pileus diameter in P (70.77 mm) stipe diameter in WC (15.06 mm) and stipe length in WPC (30.96 mm) were found to be important.

Keywords: *Pleurotus*, waste matters, plastic sheet, composition elements.

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PRODUCTION AND EXPORT OF BASIC SECONDARY FOREST PRODUCTS OF TURKEY

E. Gavcar¹, M.K. Yalınkılıç² and A. Aytekin³

Turkey is very rich country in terms of secondary forest products. Many of these plant species are present in the forest areas and are named as secondary forest products (SFPs). The paper outlines the production and export of these products. These products are mainly the balsamic secretions of the living trees, parts of trees excluding timber and some woody or herbaceous plants having medical and industrial importance or consumed as food. Such products of Türkiye are composed of styrax oil, naval stores, root of licorice plant and their pure extract, valonia acron, pine nut, carob fruit, lavrel leaves and oil, linden flowers, thyme, sage, etc.

Keywords: Turkey, Secondary Products, Styrax oil, naval stores, licorice, valonia acron, pine nut, carob fruit, lavrel, linden, thyme, sage.

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WOOD AND BARK EXTRACTS OF TURKISH CONIFEROUS WOOD SPECIES AS RAW MATERIAL FOR CHEMICALS

Harzemşah Hafızoğlu¹

Most of Turkish coniferous wood species, *Pinus sylvestris*, *Pinus nigra*, *Pinus brutia*, *Pinus pinea*, *Cedrus libani*, *Abies nordmanniana* and *Picea orientalis*, were investigated for wood and bark extractives. The bark contains higher amounts of lipophilic extractives than the wood. Fatty acids, resin acids and sterols are the main groups of lipophilic constituents. The pine species contain higher amounts of lipophilic extractives than those of the other conifers. Cedar is distinguished with its unique composition of lipophilic fraction consisting mainly of sesquiterpene constituents. Also hydrophilic constituents, lignans and monosaccharides, occur both in the wood and in the bark. The bark is very rich in phenolic constituents, mostly of a complex nature. Barks of fir and spruce were investigated for their solubility values, phenolic character and suberin composition. Possible uses of the extractives as chemical raw material are given.

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EFFECT OF HEIGHT OF CUTTINGS ON HERB AND LEAF YIELD AND ESSENTIAL OIL CONTENT OF *ROSMARINUS OFFICINALIS* L.

Saliha Kırıcı and Çetin Şafak¹

Treatments consisted of five height cuttings (5,10,15,20 and 25 cm from the ground surface) and were tested in a randomized block design with three replications. The 10 cm. cutting height proved the most productive in fresh and dry herbage and essential oil as well as subsequent vigour of regrowth.

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A STUDY THE EFFECTS OF UNSUITABLE CONDITIONS ON YIELD PERFORMANCE OF CULTIVATED MUSHROOMS (*Agaricus bisporus*) GROWN IN BEYKAVADI VILLAGE, IN KONYA

M. Güler¹

This research was carried out to determine the effects of unsuitable conditions on yield of *Agaricus bisporus* grown in Konya. The paper describes, changes in the values of daily yield average, per bag yield average, total yield average and biological efficiency of used *Agaricus bisporus*. According to the results 956.20 kg mushroom were obtained in one season. The highest total yield (225.20 kg) was obtained in first week of August. However, It has been determined that the highest daily average yield value (26.80 kg), the highest average yield per a bag (0.563 kg/bag) and biological efficiency (14.07 %), were obtained in fourth week of August.

Keywords: *Agaricus bisporus*, yield performance.

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IMPORTANCE OF CAPER (*CAPPARIS SPINOSA* L.) UNDER FOREST ECOSYSTEM AND ITS CULTIVATION

S. TansÚ and F. Kocaba• a¹

Capparis spinosa is called Caper and is widespread as a native plant in the Mediterranean area. Caper can be propagated by seeds or cuttings. Recently there has been some interest in growing caper as a commercial crop, but problems have arisen regarding the poor germinability of the seed. When seeds are used, germination problems can arise due to dormancy caused by hard seeds.

In this research methods of breaking seed dormancy by mechanical and chemical means (H₂SO₄, KNO₃, GA and CH₃COOH), were studied. Propagation of caper by using stem cuttings was also assessed. The highest germination percentage (53%) was determined in seeds which were soaked in 400 ppm GA for 120 min. after treatment with sulphuric acid for 20 min. The stem cuttings sprouted but did not root. Propagation of caper by using stem cuttings is non an economic method and root stocks should be used.

Keywords: Caper, non-wood forest products

¹ Çukurova University

SOME WILD MEDICINAL, SPICE, AROMATIC AND DYE PLANTS AS NON-WOOD FOREST PRODUCTS FOUND IN DIYARBAKIR REGION

Sezen Tansı¹, Dođan Őakar² and Őzlem Gl Toncer³

This paper provides a list of some wild medicinal, spice, aromatic and dye plants, spreading family and medicinal uses in the GAP region of Turkey. Most of the major food crops and some medicinal, spice, aromatic and dye originated in drylands like the Diyarbakır region. These species have evolved under harsh conditions of temperature and drought. For this reason when these Non-Wood Forest Products (NWFPs) are brought under cultivation, it is possible to provide additional income to people living in the rural areas and to reduce erosion prevailing in these areas threatened by desertification. Just as the sustainability of NWFPs depends on the sustainability of forests, sustainability of forest production, including NWFPs, requires management.

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REHABILITATION OF WALNUT TREES , PRODUCTION OF SEEDLING AND FORESTATION STUDIES IN TURKEY

Necati Uyara, Nazif Gl and Ramazan Topak¹

Walnut is an important resource in Turkey but has been over-exploited and its gene resources endangered. It is estimated that a single walnut tree in terms of nut production is worth 165 US dollars per year and 1234 US dollars when finally felled for timber production. The species is now being submitted to a programme of improvement and endangered sources are selected and grafted for both public and private institutions.

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UTILIZATION OS SOME LIGNOCELLULOSIC WASTES AS RAW MATERIAL FOR *PLEUROTUS OSTREATUS* CULTIVATION IN NORTHERN KARADENIZ REGION

S. Yıldız, Z. Demirci, K. Yalınkılıç and U.C. Yıldız¹

The cultivation of *Pleurotus ostreatus* on some lignocellulosic wastes found in Northern Karadeniz Region was studied.

This research involved 7 trials, of which three are considered in this paper. Each trial approximately was completed within a period of 2-2,5 months. Diameters and numbers of individual fruit bodies of mushrooms were measured and the effects of different substrates on productivity were investigated.

In conclusion, it is proved that the materials such as leaf of hazelnut, wheat straw, sawdust and corn cob which are plentiful in the Northern Karadeniz Region have suitable properties for mushroom cultivation.

Keywords: *Pleurotus ostreatus*, culture mushroom, leaf of hazelnut, wheat straw, corn cob.

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THE ZERO EMISSIONS RESEARCH INITIATIVE SEPARATING NON-WOOD FOREST PRODUCTS INTO VALUE ADDED MATERIALS

Pauli G., Gravitis J., Vedernikovs N., Zandersons J., Kokorevics A., Kruma I., Bikovens O. and Andersons B.¹

This work has been done on the bases of the Zero Emissions Research Initiative (ZERI) undertaken in 1995 at the United Nations University. Main interest was concentrated on combination fiber materials, biobased products, creating jobs and integrating into new industrial clusters. Steam explosion treatment (SET) demonstrated the value of non-wood forest products (NWF-s) such as: baggase, bamboo, corn cob, kenaf, oil palm, seaweed and others for processing. SET in combination with furfural technology is likely to remain effective in the use of plantation biomass. .

Keywords: zero emissions, steam explosion, NWF-s.

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EXPLOITATION POTENTIALS OF NATIVE MEDICINAL PLANTS IN SERBIA

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Unplanned exploitation of medicinal plants often leads to depletion of natural resources, reduction of diversity and degradation of ecosystems. Rational exploitation of medicinal plants must be based on the research of their representation, degree of presence, abundance and sociability. Based on these parameters, conclusions can be made on their potential exploitation. The research by the above methodology has been applied at three localities in Serbia, and the results have been presented in this paper.

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POTENTIAL OF ESSENTIAL OILS PRODUCTION FROM FOREST RESIDUES IN STATE CONIFER FORESTS OF SERBIA

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Volatile needle oil production is one of the alternatives available in green forest biomass utilization. Conifer forest residues such as twigs and foliage (needles) represent an important potential raw-material for this type chemical processing. Potential of conifer forest residues based on the pine species from forests managed by Serbiaforests: *Pinus nigra* and *Pinus sylvestris*, spruce *Picea abies*, fir *Abies alba* and *Juniperus communis* is investigated. Mobile distillery application is recommended for production of volatile oils from foliage available in state forests of Serbia.

Keywords: technical foliage, native conifers of Serbia, anatomical properties, volatile oils production, steam distillation, terpene composition

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