



PROCEEDINGS

EXPERT CONSULTATION ON ENHANCING THE CONTRIBUTION OF TREES OUTSIDE FORESTS TO SUSTAINABLE LIVELIHOODS

Rome, 26–28 November 2001



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Rome, 26–28 November 2001

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 2002

FOREWORD

Awareness of trees outside Forests has considerably increased in the last ten years. It has been realised/realized far more than ever before, that they substantially/substantially contribute in many ways to sustainable livelihoods. Indeed, trees provide essential environmental services through their capabilities to restore degraded lands and eventually ecosystems, ecosystems heighten soil fertility and help set profitable farming systems. Besides they provide goods generating income. These facilitate steps towards food security and poverty alleviation for rural families. The above is being more and more recognized and documented by decision and policy-makers. Research and development institutions are further studying and understanding tree based systems in rural and urban environments.

In many countries, particularly those with low forest cover (LFCCs); trees outside forests are the main source of forest products and are at the heart of natural resource conservation and poverty alleviation strategies for rural areas. Even in areas, with suitable forest cover, people may be closer to the tree resources out of the forests as these readily respond to and are more accessible for the satisfaction of, their daily needs..

However, the recognition of the concept of TOF notwithstanding/notwithstanding, several country case studies show that the many and valuable benefits and services they offer has still to be fully understood by decision and policy-makers. It has been also recognised that some substantive work needs to be invested to address the complex issue of definition of TOF resources, their assessment management and ownership issues relating/relating to them. Reckoning with with economic benefits accruing from TOF in the national economies likewise has not been adequately addressed as yet.

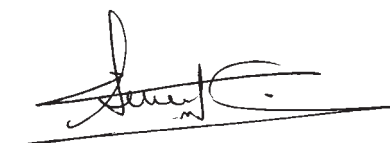
To give more visibility to TOF, specific efforts have been made in the last five years to collect information on them at national and international level, to raise awareness and promote dialogue around them through national and sub-regional international meetings and workshops. The FAO/IRD (ex-ORSTOM) workshop in Orleans, France (21-23 September 1998) and the ICRAF/Sokoine University “Off-Forest Tree Resources of Africa” workshop held in Arusha, Tanzania (12-16 July 1999) confirmed the need to find more practical definition and harmonize assessment methodologies and approaches to TOF in order to improve understanding of TOF and highlight their contribution to sustainable livelihoods. Many other works and initiatives, as those undertaken by FAO (FRA 2000, Africover and the EC projects on forest data collection), CATIE, FSI, etc. these These are a rich sources of information on various issues related to TOF. The material thus produced, including the Conservation Guide No.35 prepared by the Forest Resources Division of FAO Forestry Department has contributed to document and heighten awareness of trees outside forests and their relevance in sustainable development.

This first international Expert Consultation on “ **Enhancing the contribution of Trees outside Forests to sustainable livelihoods**”, further expanded on the achievements referred to above . It aimed at fostering discussion on the concept, definition and assessment methodology. It also had the objective to establish a shared vision between experts and practitioners. . It clarified a number of issues including the participation of stakeholders in the decision-making processes related to forest product supply, land and ecosystem management, and poverty alleviation. It also showed that economically viable and environmentally sound TOF systems could definitely increase availability of wood and non-wood

product, improve land productivity, reduce pressure on forests, contribute to ecosystem conservation and improve urban environmental conditions.

The TOF concept has come a long way and has still a long way to go. The importance currently gained by TOF will lead to further consideration of the related technical issues, and strengthen dialogue between stakeholders. They will certainly be further resorted to in activities to control desertification and land degradation processes.. The Forestry Department is braced to assist countries to further use and increase the potential of TOF in environmental protection and the improvement of livelihoods. In this, special attention will be given to tree management and property rights on farmlands and to putting in evidence the socio-economic benefits provided by trees outside forests..

The present proceedings report on the discussions and results of the Expert Consultation and recommends follow-up actions. TheyIt also includes the papers presented at the meeting. I hope that the papers contributed and, the conclusions and recommendations of the workshop will further promote interest, understanding and best practices in the conservation, dsevelopment and use of tree resources outside forests and the production systems they are part of. Readers are kindly requested to provide any comments to the Forest Resources Division for furthurer considerations.



El Hadji Sène
Director
Forest Resources Division

ACKNOWLEDGEMENTS

FAO wish to thank the Experts and all participants for their participation at the consultation.

The preparation of this proceedings was carried forward by Forest Resources Division under the overall coordination of Tage Michaelson, Chief of FORC and the technical leadership of Syaka Sadio, Agroforestry and Land Use Officer.

Christoph Kleinn, co-editor compiled the papers presented at the consultation and draft the first draft proceedings. Many thanks to him

The authors wish to acknowledge the valuable contribution from Ms. Patricia Negreros-Castillo for reviewing the first draft proceedings.

The Expert Consultation was initiated by Ms. Michelle Gauthier, before her secondment to the Secretariat of the Convention on Biological Diversity in Montreal, Canada. We seize this opportunity to express our sincere thanks to her.

Mr. Tage Michelson, Chief of the Forest Conservation, Research and Education Service of FAO's Forest Resources Division played a key role in coordinating and supervising the preparation of the Expert Consultation and the editing of the proceedings. Sincere thanks to him.

Many thanks to Christel Palmberg, Chief of Forest Resources Management of FAO's Forest Resources Division for her advice and contribution to the success of the consultation.

Without the interest and the valuable commitment of El-Hadji Sène, Director of the Forest Resources Division who gives special attention to this delicate topic that's TOF, the consultation wouldn't have taken place. I wish to acknowledge him for trusting us.

This paper is the consecration of a fruitful collaboration among several FAO services and many experts, scientists and people from FAO's Forestry Department and others, and also from outside, who believe on the urgent need to find another way to address issues related to sustainable forest management and livelihoods

ACCRONYMS

CATIE	Centro Agronómico de Investigación y Enseñanza /Tropical Agricultural Research and Training Centre (Costa Rica)
CBD	Convention on Biological Diversity
CIRAD	International Cooperation Centre on Agrarian Research for Development (France)
COFO	Committee on Forestry
FAO	Food and Agriculture Organization of the United Nations
FRA 2000	Forest Resources Assessment 2000
FSI	Forest Survey of India
ICRAF	International Council for Research in Agroforestry
IFF	Intergovernmental Forum on Forests
IRD	Institute for Research and Development
IUCN	International Union for the Conservation of Nature
IUFRO	International Union of Forestry Research Organizations
LFCCs	Low Forest Cover Countries
NFP	National Forestry Programme
NGOs	Non Governmental Organizations
TOF	Trees Outside Forests
TROF	Tree Resources Outside Forests
UNCCD	United Nations Convention on the Control of Desertification
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on the forest

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OPENING STATEMENT

by

M. Hosny El-Lakany
FAO, Assistant Director-general
Forestry Department

Distinguished participants,

Colleagues, Friends,

Ladies and Gentlemen,

It is a great pleasure to welcome you, on behalf of the Director-General of FAO and on behalf of the Forestry Department, to this important Expert Consultation on “Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”.

The Forestry Department is indeed honoured by the presence of many recognized scientists and professionals with expertise covering key aspects of forestry development.

We in FAO, as well as others, believe that TOF will constitute a key element of strategies to reduce pressure on forests and to improve livelihoods. TOF already play an increasing role in providing goods and services, particularly to the rural poor. In countries with low forest cover (LFCCs), Trees Outside Forests of different types and compositions, constitute the main source of tree products and services, and are at the heart of land resources conservation strategies. Even in countries with extensive forest cover, TOF are generally more accessible, and often contribute to household livelihood.

During the last 5 years, the recognition of the importance of TOF in the forestry sector development and livelihoods improvement has captured the attention of all institutions involved in natural resource planning, management and monitoring, as well as by those concerned with forestry, agriculture and livestock. Nonetheless, TOF are generally not taken into account in forest and tree resources assessments and are not systematically integrated in decision making concerning land use management, including forests.

In collaboration with other institutions, FAO has made specific attempts to collect information on TOF at national and international levels and to promote dialogue addressing them. Among our collaborators are IRD (ex-ORSTOM), ICRAF/Sokoine University, EC, CATIE, FSI and many other institutions. They constitute a rich source of information and expertise in the process to develop standardised, efficient and cost-effective methods for planning, monitoring and assessing TOF. An example of our recent joint efforts is the FAO Conservation Guide No.35 (in print) which highlights TOF issues through 8 case studies based on an extended review of bibliography, studies and discussions.

Distinguished participants,

This consultation is taking place here in Rome, as a contribution to the global commitment to eliminate

hunger and poverty and to achieve sustainable food security. Since Trees Outside Forests are mainly on agricultural land and in urban and peri-urban areas, issues related to agricultural production and food security must be analyzed in the context of integrated production systems and planned urbanisation.

I am convinced that the analytical framework and your discussions will furnish sound methodological tools for studying TOF, and identify key areas for future cooperation . It is expected that you will eventually recommend strategic components for national programmes (e.g. national forest programmes) and for international processes, including harmonization of cross-sectoral approaches.

The need for continued collaboration, and strengthened dialogue among foresters and other sectors and the public at large has never been so vital.

I wish to conclude by thanking all experts and resource persons who have taken time out of their busy schedules to contribute to this important event. We look forward to working with you during the next few days.

Thank you.

EXECUTIVE SUMMARY

1. Organiser

Forest Resources Division of the Forestry Department

2. Person Responsible

Tage Michaelsen, Chief, Forest Conservation, Research and Education; Forest Resources Division (D-484, Ext 56548)

3. Participants

6 invited Experts and 9 invited Resource Persons, including two resource persons from CIRAD and ICRAF, and one student from Italy.

4. Objectives

i) To define a shared conceptual framework (concepts, terminology, resource assessment methodologies) on TOF and identify the key issues, needs and constraints; ii) to harmonize cross-sectoral approaches; iii) To recommend specific strategies and priorities for action; iv) to raise awareness and define respective role and responsibility sharing among major partners.

5. Organization of the workshop

The Consultation took place at FAO Headquarters, from 26 to 28 November 2001 and was chaired by Ms. Jenny Wong (UK) and Mr. Fredua Agyeman (Ghana), Vice-Chair.

The consultation included five sessions composed of plenary sessions and Working Group sessions. Several papers were presented and discussed, addressing the main specific issues of TOF and regional case studies (Africa, Asia, Europe and Latin America), including Agroforestry and Urban forestry issues and FAO's on-going initiatives.

The discussions of the 8 working groups were summarized in minutes, as was the final discussion of the afternoon of the third meeting's day. The working groups treated the following topics:

Working Group 1: Definition and Classification.

Working Group 2: TOF assessment: inventory, methodology and data acquisition.

Working Group 3: Sustainable land use, forest resources management, agricultural production.

Working Group G 4: Policy issues.

Working Group 5: Economic, environmental, social valuation.

Working Group 6: Research, education, extension.

Working Group 7: Review of institutional capacities; TOF studies, assessment of resources, programme formulation, monitoring and evaluation.

Working Group 8: TOF information system

6. Conclusion and Recommendations

Conclusion

The Expert Consultation:

- i) Considered TOF are currently gaining importance and the need will grow to further consider the technical issues related to TOF, strengthen dialogue between stakeholders, specifically address desertification and land degradation processes, including the improvement of livelihoods;
- ii) In general, agreed with the broad outlines of the present FAO definition of TOF and recommended to revise certain characteristics (minimal surface area, crown cover, height of the trees, tree species, etc.);
- iii) Noted that there was little systematic information on the size of TOF resources in relation to their production and service values. These values should be fully recognized and integrated into national and international policies;
- iv) Noted that other issues to tackle were lack of well defined TOF related policies, inadequate incentives for TOF, extreme of diversity in land-use situations and the inadequacy of existing forestry codes;
- v) Welcomed FAO's initiative to organise and host the event. It further commented on FAO work on the subject, including the event and the inter-departmental activities as well as relevant PAIAs which recognise the role of TOF.

Recommendations

The Expert Consultation formulated a number of recommendations stressing, in particular, the need to move forward on the following aspects:

- i) Dedicated studies should be undertaken to obviate the lack of systematic information on TOF (status and changes of the resource, multiple functions), through, i.e. country case studies
- ii) FAO should take the lead in raising awareness among stakeholders, UN Agencies, donors, policy-makers, member countries and encourage and support organising regional/sub-regional workshops and meetings, to analyse existing policies on TOF. Follow-up mechanisms and networking linking FAO and other international agencies and institutes to ensure cross-sectoral approaches will be necessary.
- iii) FAO should continue promoting TOF through its relevant programme of work and encourage and support countries to review TOF status, promote management, policy formulation and further inclusion of TOF issues in national forest and agricultural programmes.
- iv) It further recommended to base the definition of TOF on: i) the functions of trees; ii) geographical situations; iii) cultural considerations; iv) economic considerations; and v) social considerations;
- v) The consultation reviewed the progress made in resource assessment methodology and proposed to consider land use and functions as attributes of the trees, including crown cover; geometric arrangement, etc;
- vi) The Expert consultation recommended that more attention be given to various tree tenure systems, in formal and informal sector, for more efficient use of TOF. The full environmental and socio-economic values of TOF should be recognised in national policies and international conventions and agreements including for biodiversity conservation, carbon fixation, soil and water conservation, combating desertification and for urban greening;

- vii) Trees should be considered as playing an important role in human well-being, in rural as well as urban livelihoods;
- viii) Urban forestry could address the needs in urban areas. The work of renowned institutes, such as the Danish Forest and Landscape Research Institute (FSL) should be made known so as to promote Urban Forestry.

RESOLUTION

Trees contribute in many ways to sustainable livelihoods, human welfare and environment. The respective role of forests is well recognized in national policies and international conventions, and much data is available. However, trees outside forests (“TOF”) are not fully appreciated in this context, and, although present on many lands, not much systematic information is available.

FAO has recognized this situation and convened an expert consultation “Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”, which took place Nov. 26-28, 2001, in FAO headquarters in Rome, Italy. Proceedings of this meeting will be published by March 2002.

Trees outside forests include those associated with agricultural lands, in urban and peri-urban areas, or along roads, canals, creeks, in home gardens and parks, and in natural lands where tree cover is low. These trees fulfill a broad range of ecological, economic and socio-cultural functions. In many countries, including the low forest cover countries (LFCC), they constitute a major source of tree products and contribute in many different ways significantly to people’s livelihood and welfare.

The consultation discovered that there was little systematic information on the size of the TOF resource in relation to its production and service values. These values should be fully recognized and integrated into national and international policies. It was also stated that information sharing with local stakeholders is necessary to enhance and sustainably develop this resource.

To further this, the consultation found and recommended the following major points:

- Awareness among politicians, administrators, researchers and local stakeholders should be raised. FAO continues with its corresponding program of work.
- Dedicated studies are required to improve the unsatisfactory situation of lack of systematic information on TOF, both with respect to state and changes of the resource, and with respect to its manifold functions. These studies should be carried out inter-disciplinary and inter-nationally.
- Of particular relevance are comparative studies (between countries) on options how to integrate TOF into the legislation related to good management of landscape and natural resources.
- TOF as a resource should be taken into account in national strategies and programmes to promote best management practices of renewable natural resources, including fields like forestry, agriculture, conservation, rural and urban development and landscape planning. In particular, in national forest and agricultural programs, the role and potential of all TOF should be reviewed.
- The role and potential of TOF should be evaluated and considered in the great international conventions and processes (including CCD, CBD, FCCC).

It requires cross-sectoral efforts to develop the diverse resource TOF in a sustainable manner and to propose realistic mechanisms of management options and incentives.

SECTION I: MAJOR RESULTS

Compiled by: Dr Christoph Kleinn,

Dr Syaka Sadio

The consultation reviewed the concept and definition of TOF, and its role in sustainable livelihoods, food security, environmental protection and biological diversity conservation. The Consultation also took stock of previous activities (regional workshops, national consultations, case studies) which had taken place in Africa (Tanzania), Asia (India), Europe (France) and Latin America (Venezuela) with assistance from FAO and other Institutions and partners involved in TOF studies.

What follows is a summary of the major points addressed in the discussions. Not all statements do necessarily reflect the points of view of all participants. Before working out the major discussion issues under specific headers, some overarching issues are listed that came up in practically all discussions.

OVERARCHING ISSUES

- TOF is a *highly diverse resource*, from the biophysical and socio-economic viewpoint. They occur in varying composition and spatial arrangement on many different lands, and fulfill a series of important economic and ecological functions.
- *Regional differences*, and above all those between continents are obvious and can be big. Despite many commonalities, the participants from Asia, Africa and Latin America identified clear differences, particularly with respect to user rights and land tenure issues, but also with respect to the prevailing TOF types.
- As is in general true for renewable natural resources, TOF issues and discussions do also have different character according to scale. Local, national and global concerns are different.
- It was found that, when talking about TOF, the agroforestry systems are frequently in the center of discussions, referring mainly to their role in rural livelihoods. However, emphasis should be that TOF is a much wider concept than agroforestry only, embracing *all* tree resources found outside forests. Urban trees, fruit tree orchards and trees along infrastructure (roads, canals, etc.) are examples. It is this general view that makes up the particularity of the TOF initiative.
- *Different groups with possible interest in TOF* were identified, that can also be considered key actors and target groups for the implementation of the recommendations. These groups include in particular: (1) policy and decision makers, professionals in (2) research stations and universities and at (3) technical and administrative level, (4) direct TOF beneficiaries, including farmers, owners of lands, home gardens, etc.
- The *multisectoral character of TOF* and its management was emphasized, and identified as one of the major challenges in dealing with TOF. Fields like forestry, agriculture,

agroforestry, urban planning, landscape planning, rural development, nature conservation and environmental protection are touched. Therefore, it is considered essential that TOF studies follow in general a multi-disciplinary approach.

- The diversity of the resource lead repeatedly to the proposal to treat different classes of TOF in a different way. While it is certainly necessary to differentiate, it was also stated that the novel part of the TOF initiative is that all different classes are simultaneously contemplated under one umbrella – though accepting the differences. Breaking it down into single “classes” would likely lead above all to the classical fields of agroforestry and urban forestry – leaving out several important but less “formalized” TOF like gallery trees, trees along streets, canals and other infrastructure, urban parks, home gardens, fruit tree orchards, and others.
- The problem of definition and classification was identified as one that affects all fields in which TOF are discussed (information, economics and use, ecological functions, policy). Though this topic arose repeatedly and was central subject of one Working Group, it was decided not to lengthen this particular discussion or allow it to supercede the other discussions.
- *Awareness building* was identified as one of the most relevant issues, awareness building on all levels of concerned actors. The formal non-recognition of TOF has probably much to do with the lack of awareness and possibly also with the complexity of the issue. TOF should be recognized as a resource that has the potential to be managed for the benefit of the land owners and the whole society.
- In the same context of awareness building it was considered helpful to foster the integration of the discussion of TOF into academic curricula of different careers (forestry, agriculture, agroforestry, landscape planning, biology, urban planning, ecology), and into the corresponding programs of training courses.
- *Lack of systematic information* in all fields (resource, ecological functions, production, markets, etc.) was addressed as another impediment for the immediate development of management options. However, it was also acknowledged that there exists information, though scattered and not systematic. Also, due to the novel, intersectoral and diverse character of TOF, it was acknowledged that there might be more information than the present experts are aware of.
- It was stated that one should avoid seeing or propagating TOF as a resource that can replace forest or some of its functions. That would clearly be a wrong signal and counterproductive. TOF are a resource of its own right and do exist outside forest; they can never replace the unique eco- and production system forest. However, forest and TOF share many common products and functions.
- TOF, though to be seen as a resource of its own right, should be an integrative concept rather than a separating one: the aim of the TOF initiative should be that TOF are taken into consideration by all those interest groups who touch upon TOF directly or indirectly, and not to single it out as something completely “new”.

TOF DEFINITION AND CLASSIFICATION

Issues

- TOF land is defined in the framework of the land definitions used in FAO FRA (Forest Resources Assessment Programme). The Consultation agreed in principle with the broad outline given in that definition.
- A clear terminological distinction must be made between the resource TOF and the land where TOF is found (TOF land).
- A unique and best classification system will be difficult to design; too big is the biophysical and geographical variety, and too big are the differences of their socio-economic role. Some classification criteria were addressed including associated land use (for example: human settlements, perennial crops, pastures), geometry (for example: groups of trees, dispersed trees, trees in lines), or functions (for example: shadow, fruit production, wind protection, cultural/religious function). The classification to be used will depend heavily on the purpose of the specific exercise, and on the geographical focus.
- It was agreed that the definition and classification question, though of utmost relevance, *will continue to be discussed* in the scientific and implementation community, as is the case with the everlasting and partially controversial discussion about forest definitions. The Consultation acknowledged this situation, yet did not wish to concentrate too much on this topic.

Recommendations:

- The Consultation recommends revising some specific points in the FAO definition, particularly regarding quantitative criteria (minimum area, crown cover, tree height).
- Similar to what is discussed for a general global land use (and forest) definition and classification, it might be recommendable to devise a hierarchical classification system with a general and rough classification on a global and a more detailed system according to the national requirements. Then, national classifications should be such that they easily fit into the higher international level of the classification hierarchy.

TOF ROLE, FUNCTIONS, PRODUCTS

Issues

- TOF role and functions are manifold and diverse. Many non tangible products are involved, and a big share of the tangible ones is for local use (subsistence), and do not enter the market. Therefore, in the context of “roles, functions and products” it is impossible to talk about TOF in general, but one must rather refer to specific types of TOF.
- Many TOF products and functions, particularly in rural areas, resemble or are identical to those of forest. As the origin is usually not registered, it is difficult to differentiate between products coming from TOF and from forest.

- With respect to TOF products, the separation of land tenure, tree tenure and product's usufruct plays an important role in many countries. This was particularly mentioned for African countries.
- The whole range of actual and potential functions of TOF are not entirely acknowledged, not in national nor in international policies.

Recommendations:

- Elaborate on the diversity of functions of different types of TOF for livelihoods, for farm production systems, for conservation, scenic beauty, etc. in order to promote the management of TOF from a utility point of view.
- For some specific TOF products, market analysis and market development would be useful.

POLICIES FOR TOF

Issues

- It was agreed that a dedicated policy is key, recognizing TOF as renewable natural resource that needs to be managed.
- It was also acknowledged that these policies must take carefully into consideration the specific circumstances (role and functions) of the different classes of TOF in different geographical, socio-economic and land-tenure contexts.
- A dedicated policy should also be seen in relation to the commitment to reduce poverty, where applicable.
- The full environmental values of TOF should be recognised in national policies for biodiversity conservation, carbon fixation, soil and water conservation, combating desertification and for urban development and renewal.
- Comprehensive national policies regarding TOF are the exception. There are some examples of specific TOF policies, but a general overview does not exist. Participants of the Consultation presented detail information about specific TOF policies in Ghana and in the UK. However, there might be other examples not known in detail to the participants, though it is not expected that those are many.
- It was found that existing forestry codes are usually not adequate nor sufficient to serve as a basis for TOF management. Sustainable management of some types of TOF will possibly have elements of the management of perennial crops.
- The consensus was that TOF policy should focus on fostering the sharing of knowledge, and the promotion of the benefits that can be gained by managing and developing TOF actively and sustainably. That approach is more promising than simple restrictive legal regulation.
- A system of incentives is considered appropriate, such as proper information on services and market value of TOF to stakeholders, technical assistance and training. Inclusion of TOF into a national system of payment for environmental services has been discussed.

- TOF should be considered for inclusion in national sustainable development agendas, where the “where”, “who” and “how” still needs to be further defined.

Recommendations:

- To commission detailed comparative country case studies of TOF policy, regulation and effectiveness, to close the information gap in this field.
- Organise regional/subregional workshops and meetings, bringing together national representatives of sectoral ministries to analyse existing policies on TOF and discuss their history and their contribution to a sustainable management of the resource. It was noted that the Dutch TF initiative is undertaking two regional workshops on forestry policy in LFCC which will include TOF.
- The FAO NFP initiative (National Forest Programs) should review TOF status, management and policies.

INCREASING STAKEHOLDER'S INTEREST IN TOF

Issues

- Local knowledge on TOF is very important and needs, where it exists, to be incorporated into management. This is particularly true for TOF in rural areas and on smaller farm properties.
- Stakeholder interest will be increased if the values of TOF (market and non-market) are quantified and disseminated, and technical assistance offered.
- Identification and promotion of new products may help smallholders developing their TOF into a source of income. As an example, renewable energy was mentioned (biofuels), which might open the possibility of incentives related to the CDM.
- TOF should be seen as a means of enhancing livelihoods and reducing poverty, where applicable.
- In some regions, the situation of user rights towards trees and/or their products is unclear. In many countries the system of land tenure is an obstacle and disincentive for longer-term management and commitment, particularly where land and trees are not in the same ownership.
- TOF have a relevance that goes beyond ecological and economic functions. Social, cultural, spiritual and religious values – wherever relevant - should not be forgotten when discussing TOF.

Recommendations:

- Commission case studies to compile and analyse local knowledge of use and management of TOF, for different types of TOF and for different geographical regions.
- Design technical assistance programs for those who want to enhance the tree resource on their lands.

TECHNICAL ASPECTS OF TOF

While much of the discussion dealt with the political and socio-economic role of TOF, it became also clear that there are a number of important technical issues.

Issues

- There is still some confusion on terminology, definition and classification. TOF as a general concept is difficult to plant into the heads of resource planners, as it embraces so different resources such as trees along roads, shadow trees in coffee fields, trees in urban areas, fruit tree plantations, trees in parks and home gardens.
- There is not much experience in specific TOF assessments. Many experiences from forest assessments may be used; but still there remain some particularities. TOF assessments have been carried out for example in the UK, in India, in Ghana and in Costa Rica.
- As TOF is a resource integrated to specific land use, mapping is a difficult exercise - and maps are central components in all planning of natural resources.
- Obviously, for a number of detail questions specific research is required. Research needs are in technical issues (such as establishment and protection of tree regeneration, management of TOF, inventory and information procurement), and in socio-economic and economic issues (such as a comprehensive TOF valuation, TOF product utilization, generation of a system of incentives, integration of TOF into the discussion of conservation and protection of renewable natural resources). TOF related research should be particularly focused on people and their livelihoods.

Recommendations:

- Definition and classification questions should be clarified, particularly for international use, and a key document be written.
- For planners it would be helpful to have the TOF status of a particular region documented in maps and in an information system. Some research and development is needed in that respect, including the following two points:
 - o efficient and illustrative mapping options should be developed, and
 - o the integration of TOF into information systems should be fostered (possibly using the IUFRO's GFIS task force as a first platform)
- A compilation of experiences of TOF assessments should be made (cases like India, Ghana, Costa Rica, UK, France).
- A number of research issues arise that are recommended to be tackled, including
 - o Comprehensive valuation of TOF,
 - o Ecological functions of TOF,
 - o Biomass and Carbon estimation in TOF.

TOF DIALOGUE – HOW TO FOLLOW UP

Issues

- While the forestry sector has brought up the issue, it is acknowledged that TOF management and development must be a multi-sectoral approach. Collaboration of other fields than forestry must be actively sought (agriculture; conservation; rural, urban and regional planners; landscape ecologists).
- TOF as resource and general concept should be reviewed in all fields that deal with the renewable natural resource, on a local, national, regional and international basis.
- FAO FRA2000 did contemplate TOF in a Special Study. Similar initiatives should be encouraged.
- While TOF should be reviewed or considered in an integrative manner in all fields relevant to sustainable development, it should always be kept in mind that TOF constitutes a resource of “its own right”.

Recommendations:

- Some key document should be there dealing with the definition and classification question, making transparent the particular scope and objectives of the TOF initiative.
- FAO should take a lead in providing information and encouraging the inter-sectoral dialogue.

SPONSORSHIP

- In general, donors should be interested in the topic if a high priority request comes from a country, linking the relevance of TOF with food security, poverty alleviation and improvement of livelihood and welfare.
- FAO should foster the integration of TOF in donor’s programmes that deal in general with the development of renewable natural resources.
- The multifunctional and cross-sectoral character of TOF initiatives should be emphasized.

SECTION II: PAPERS PRESENTED



Photo: FAO-Media Archive, Photo Nr.14090 (Ch. Errath)

TOF: Measuring the biomass of conifers in Cape Verde

Land rehabilitation to combat desertification, restore the ecological environment by reconstituting a vegetative cover, provide fuelwood and forage for grazing and create a forestry service in the national economy.

SECTION 2.1: KEYNOTE PAPER

Enhancing The Contribution Of Trees Outside Forests To Sustainable Livelihoods

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INTRODUCTION

Trees Outside Forests have been for centuries recognised to play an important role in rural and urban development. They have been well integrated into the agricultural production systems and urban settlements.

For instance, in arid and Semi-arid zones of Africa and Asia, TOF constitute the main source of firewood and non-wood forest products. In Savannah areas, farmers may often conserve on their lands high percentage of trees to control soil erosion, improve the soil fertility and for domestic uses (fruit, firewood, medicines, forages, etc.). In countries with low forest cover (LFCCs), Trees Outside Forests constitute the main source of tree products and are at the heart of land resources conservation strategies. In places with extensive forest areas, TOF as they are generally more accessible, may still offer major contribution to household livelihood. In fragile ecosystems (drylands, mountains, watersheds and densely populated areas) TOF contribution deserve special attention, because only trees can effectively protect them.

The importance of the Trees Outside Forest (TOF) in providing goods and services is being increasingly recognised by institutions involved in natural resource planning, management and monitoring, as by those concerned with forestry, agriculture and livestock. However, TOF development is affected by several constraints: i) its heterogeneity, ii) lack of general awareness among managers, policy and decision makers about the role and potential of TOF in supplying social and economic products; ii) the non-competitive economic return and the low economic incentive for the husbandry of tree-based systems compared to other land use (annual crops), iii) the unfavourable policy and inadequate institutional support (land tenure and legislation) to tree based systems. In addition, TOF have not been systematically taken into account in forest resource assessments and management processes. The use of trees in conjunction with other land uses is often faced with land tenure systems.

Several countries have been assessing in various ways TOF among the resources contributing to wood and non wood “forest” products supply, land and ecosystem conservation and poverty alleviation. Studies have shown that economically and environmentally-sound Tree-based systems can increase wood and non wood product supply, improve land productivity, reduce pressure on forests, contribute to ecosystem conservation and improve urban environmental conditions. It is also expected that efficient use of TOF information will improve the economic and ecological valuation of these resources and help to eliminate policy and economic constraints to their sustainable use and conservation.

During the last 2 years, a specific attempt has been made to collect information on TOF at national and international level and promote dialogue around them. The FAO/IRD (ex-ORSTOM) workshop in Orléans, France (21-23 September 1998) and the ICRAF/Sokoine University “Off-Forest Tree Resources of Africa” workshop held in Arusha, Tanzania (12-16 July 1999) confirmed the importance of harmonizing concepts

and activities at national and international level. Other works as those undertaken by FAO (FRA 2000, Africover and the EC projects on forest data collection), CATIE, FSI and many other institutions constitute a rich source of information and expertise in the process to develop standardised, efficient, cost-effective methods for planning, monitoring and assessing TOF. Countries and institutions have accumulated sparse knowledge on the status of TOF resources and on the methodologies of assessment, in line with national and institutional perspectives. The FAO Conservation Guide No.35 (in printing) highlights TOF issues through 8 case studies based on an extended review of bibliography, studies and discussions, shows the extent of this knowledge.

One conclusion arising from all these recent developments is that issues related to TOF must be analysed in the context of environmental protection and sustainable forest management, as well as sustainable agriculture and planned urbanisation. The Forest Resources Division within the Forestry Department is interested in facilitating the identification of roles and responsibilities among all major actors concerned by TOF and promote collaboration among them. Such collaboration offers potential for common approach to outstanding issues related to definition, policy design and programme development including legal aspects to enhance TOF contribution. In this, special attention will certainly be given to a) the environmental contribution of trees on farmlands; b) the productivity and economic return of trees outside forest, and; c) the general contribution of trees to rural and urban livelihoods.

We are convinced enabling dialogue between researchers, trainers, professionals and practitioners from various sectors to discuss and share common vision could be a good opportunity to agree on the concept and definition, discuss key issues and elaborate on elements of an action programme to move forward towards sustainable livelihoods. During these three days, we will have to discuss analytical framework and methodological tools for studying TOF, identify key areas for future cooperation and eventually recommend strategic components in national programmes (e.g. national forest and agricultural programmes) and international processes and agreements (e.g. Teheran process, CCD, CBD and UNFCCC). The Consultation builds on the results of previous meetings as referred above and will probably lead to an other Expert Consultation on policy issues towards end 2003.

OBJECTIVES OF THE EXPERT CONSULTATION

The major objectives of these consultation is to harmonize cross-sectoral approaches and identify constraints to the contribution of Trees Outside Forests to sustainable development in general, and in particular to food security and sustainable livelihoods.

The Specific objectives are to: i) exchange information on the status, related issues and knowledge on TOF resources; ii) define a shared conceptual framework (concepts, terminology, resources); iii) identify the key issues, needs, constraints and priorities; iv) propose strategies, action and partnership for the promotion of TOF and development of methodologies for resource assessment in the framework of on-going mechanisms; and v) enhance TOF contribution to sustainable livelihoods by (i) improving national policy framework, (ii) strengthening information and knowledge systems and (iii) fostering the participation of concerned actors in the decision-making processes related to forest product supply, land and ecosystem management, and poverty alleviation.

To this extent it is understood that we will have to establish a common language and approach of work, look at the institutional capacities, raise awareness and propose priority action plan in order to respond to local needs, national priorities and to global norms, agreements and international conventions.

CONCEPT OF TREE OUTSIDE FOREST

In the early seventies some authors have pointed out the importance of trees in agricultural land and production systems. However, only during this last decade, the concept of TOF has been given much importance. TOF concept has yet to be clearly defined.

Many attempts have been made to reach a consensual definition. According to FAO definition, “Trees Outside Forest” are the *trees, shrubs and their systems* on land not defined as forest and other wooded land¹. Trees Outside Forests are essentially located on agricultural lands (including croplands and rangelands) and on built-on and settlement areas, both in rural and urban areas. A large number of these systems, but not exclusively, consist of man-made or domesticated shrubs and trees. Some of the land use systems include alley cropping and shifting cultivation, permanent tree cover crops (e.g. café, cacao), scattered trees in meadows and pastures, wind breaks, hedgerows, home gardens, fruit tree plantations (e.g. coconut, olive trees, chestnut trees, mango, citrus), road and street plantations, urban parks and line plantations along streams and ponds. *They must cover an area of less than 0.5 Ha with less than 5 percent cover if the height is more than 5m at mature stage, or with less than 10 percent of cover if the height is less than 5m at mature stage. In linear scheme, the width of the plantation must be less than 20 m.*

For better understanding, one should ask the following: What is the basis of this definition? On what basis it corresponds to the livelihoods? How does it fit into the agricultural production systems?

Depending on various national or institutional perceptions, they may be under the responsibility (resource use and management, decision, policy, economic) of several institutions, including private or individual owners.

On the basis of its role and the wide range of the resource types, to enable sustainable development and to improve TOF contribution to the livelihoods, TOF definition should be seen within a development system rather than simple resource. Furthermore, issues related to TOF must be analysed in the context of environment protection and sustainable agricultural development, and planned urbanisation.

Some specific attempts, i.g. FAO/IRD (ex-ORSTOM) workshop in Orléans, France (21-23 September 1998) and the ICRAF/Sokoine University “Off-Tree Resource of Africa” workshop held in Arusha, Tanzania (12-16 July 1999) have been made to collect information on TOF at national and international level and promote dialogue. They all confirmed the importance to harmonize concepts and actions at national and international level. However, further discussion is still needed to (1) clarify the definition of the concept and related terminology; (2) analyse its perceptions and objectives at national level in relation with food security, social, economic and environmental functions; and (3) identify opportunities and constraints as to the best uses of Trees outside forests. In addition, the progress in the development of capacity building and assessment methods need to be highlighted.

This Expert Consultation aims at clarifying these issues. We will also identify some key activities to be strengthened at local, national, regional and global levels and work on the prospects.

¹ Trees outside the forest: “Trees outside the forest” are the trees, shrubs and their systems on land not defined as forest and other wooded land. They are on the other lands, which comprise: farmlands (including meadows and pastures), built-up areas (human settlements and infrastructures) and bare lands. They include a variety of trees and shrubs of all functions (e.g. protection, production, amenity, ornamental, landscape) and all domains (e.g. agricultural, forestry and urban development).

The SESSION 1: General issues, needs and trends will address above issues in order to have clear understanding on the concept, resource assessment and data collecting methodologies, socio-economic role of TOF.

Two Key papers are proposed for discussion:

Paper 1: The world of information: Trees Outside the Forest: What do we know and why are we possibly interested? Christoph Kleinn. This paper is dealing with what we consider the major problems in discussions on TOF information, including questions that are seemingly basic such as terminology (definition, classification, conceptualization) or functions (economic, ecological, socio-cultural relevance), and others like the missing technical visions and management options for a large area development of that resource, and the missing legal framework in most countries.

Paper 2: Trees outside of the forest: Definition and for a better recognition (D. Louppe). This paper based on the Conservation Guide 35 – FAO/CIRAD, gives an overview of the TOF issues: definition, recognition and diversity, national politics, consultation and international agreements, social, economic and environmental benefits, better knowledge, and extension and basic training, including resource assessment.

TOF RESOURCES (TOFR) ASSESSMENT

During the last three years, a specific attempt has been made to collect information on TOF at national and international levels and promote institutional dialogue. FAO has assisted country members in looking at these questions and collecting and analysing relevant information from various regions of the world. Some work undertaken by FAO (FRA 2000, Africover and the EC projects on forest data collection), CATIE, FSI and so many other constitute a rich source of information and expertise in the process to develop standardised, efficient, cost-effective methods for planning, monitoring and assessing TOF.

Numerous thematic and national case studies, workshops and networking activities involving experts and national and international institutions contributed to support this process. For instance, in Costa Rica, CATIE, in collaboration with Freiburg University (Germany), is developing a regional methodology for Central America to assess tree resources outside forest. A mix of satellite remote sensing, aerial photos and ground sampling is used to address the complexity of the resource (number of species, distribution and structure) and to allow dynamic monitoring of resources at the national and regional levels (Kleinn *et al.*, 1999).

The objectives were to take stock of the conceptual, methodological, technical, informational and institutional issues related to the resource and to develop methodologies and tools to collect and analyse relevant information.

However, in spite of the limits of the data, the case studies present quite a bit of useful information. The main findings of these case studies can be summarised as follows:

- Much information do, in fact, exist but it is scattered among different institutions and sectors and serves a wide range of purposes;
- The data collection method is rarely reported and this makes interpretation difficult;
- When information exists, it is almost always site-specific and does not always relate products to resources.

- An important part of trees outside forests belongs to the informal sector, making them a “hidden” resource in statistics.
- The economic value of their products is often underestimated and the economic value of their environmental benefits often completely overlooked.
- The information related to trees in settlements and cities is almost non-existent;

One key paper prepared by C.S. Rathore “TOF Resource Study and Management: Assessment Methodologies and Institutional Approaches in India” will address these issues. This paper presents an overview of some of the important approaches used in India for TOF assessment. Assessment approaches have been categorized as ground based enumeration approaches or remote sensing aided approaches and discussed in the context of their methodological details, merits and demerits. The potential use of remote sensing data has been highlighted as it can add accuracy and speed to certain TOF assessment tasks. A brief discussion on TOF management in India has also been presented focussing on legal issues impacting TOF conservation. The overview suggests that there is inadequate data on TOF resources in the country and there is a need to evolve standard methods and institutional partnerships to collect data. The need to adopt enabling legislation in order to encourage private landowners and local communities to plant and conserve more trees has been highlighted.

ROLE OF TOF

In general terms, the results of these studies indicate that TOF are taking an increasing importance for their environmental services, for sustainable agriculture and for their contribution to the supply of wood and non wood forest products.

Assessments results show that in many areas and countries, trees outside forests are important and sometimes the main source of wood and non-wood forest products. Their wise management improves agricultural soil fertility and combats agricultural land degradation, helps secure water production and conservation in mountains and watersheds, regulates micro-climate and aids air and water cleansing in cities, improves temperature and forage conditions for livestock and wildlife and, finally, contributes to the liveability of cities. Indeed, floods, landslides and water shortages in cities and rural areas are often the consequence of the degradation of tree-based systems.

One key paper (A. P. Castro) and several case study papers (Asia, Africa, Europe and Latin Amrica) will address the socio-economic issues and their relationship with agricultural and food production, and livelihoods.

Agro-forestry systems

In France, several laws, incentives and farmer associations promote the establishment of hedgerows in the rural landscape. However, the mechanisation of agriculture and the politics of reallocation of lands (*remembrement*) have caused degradation of hedgerows over the last several decades, a significant factor in soil, watershed drainage and floods problems (IFN, 2000). In fact, the comparison between two watersheds in Brittany, respectively wooded (*bocagé*) and not, put in evidence the role of the hedgerows in regulating the annual run-off, in decreasing the peak flow velocity (Mérot et al., 1976) by facilitating water infiltration into the soil.

Tree Crop Farming System in rainfed system occupies 73 million ha in a belt that stretches through the humid forest zone of West Africa from Ivory Coast, Sierra Leone and Liberia, to Ghana, Nigeria, Cameroon and Gabon, and in the eastern part of Madagascar (Dixon et al., 2001). It accounts for 6 percent of the cultivated area in the region (10 million ha). The backbone of the system is smallholder industrial tree crop production (cocoa, coffee, oilpalm and rubber). Food crops are interplanted between tree crops and are grown mainly for subsistence.

In traditional agro-silvicultural system crops have been always associated with exploitation of the natural vegetation of trees and shrubs. It involves inter-cropping (mainly millet and sorghum). Tree planting is not a significant activity but the people protect trees, shrubs, and bushes to meet their various needs including fruit, browse, building materials, fuelwood, nutrient cycling, gum, honey, and medicines. Agro-forestry techniques seem to hold in arid and semi-arid areas the most promise, because it addresses both the soil fertility problem and environmental protection. The use of woody nitrogen fixing species such as *Acacia albida*, *Glyricidia spp.*, *Leucenna spp.*, have the benefit to improve soil properties and protect soil against erosion. These techniques allow alley cropping which superiority over conventional continuous cultivation systems has been demonstrated in on-station and on-farm trials.

The paper presented by Tony Simons highlights in detail the role of TOF in agroforestry systems.

Fuelwood

In Kerala, the most densely inhabited State of India, a study estimated that of the total annual production of 14.6 million m³ of wood in the State, about 83% was from homesteads, 10% from estates² and only about 7% from forest areas (26.6% of the State area is under forest cover [FSI, 1998]). Trees outside forests met about 90% of the fuelwood requirements of the State. Fuel from coconut trees alone, including both wood and non-wood materials (pruned and fallen), constituted about 70% of the total fuelwood supply (Krishnakutty, 1990).

A study in Haryana State in India, an intensively cultivated state with about 3.8% of its area under forest land and only about 2% under actual forest cover (FSI, 1998, showed that farm forestry (trees along farm boundaries and in small patches up to 0.1 ha) accounted for 41.2% of the total growing stock of wood, multiple tree rows along roads and canals for respectively 13% and 9.6%, village woodlots for 24% and block plantations of less than 0.1 ha for 10.6% (FSI, 2000).

This role is highlighted by the presentation delivered by Tara Bhatarai, focused on Asia cases studies.

Environmental Protection

The rapid growth of the cities, mainly in developing countries, is worsening the living conditions of poor people. The population in urban and peri-urban areas suffer from harshness of bad environmental quality due to air pollution, and lack of fuelwood and other wood and non-woods products. The issue is how to fulfil the increasing needs of the population while maintaining or improving the urban environment. Urban and peri-

² Estate: Kerala Forest Research Institute (KFRI) while conducting survey of trees outside forests in Kerala used two terms 'homesteads' and 'estates'. Homesteads include house compounds and farm lands whereas estates include plantations of rubber, cardamom, coffee and tea (Krishnakutty 1990).

urban forestry could offer various potential benefits, including provisioning the urban poor with some forestry products, mitigating the ecological effects of urban sprawl, and improving the living environment in urban areas.

A case study paper focused on Europe urbanization issues will be presented by T. Randrup.

Farmers' income improvement

In Morocco, where forests are less than 5% of the land cover and other wooded lands only 7%, nearly 20% of the land may be occupied by trees outside forest, namely as wooded pasture (84%) and fruit tree plantations (12%) (rosaceae, citrus, olives trees, palm trees, walnut trees, fig trees, almond trees). Fruit production has an important place in the national economy (MADRPM, 2000). It is noted that even when a forest is largely destroyed, the carob (*Ceratonia siliqua* L.) is one of the few species traditionally conserved, as it is highly appreciated by the farmers for multiple purposes, providing both fodder and income from the sale of its fruit for export.

Some clear figures are highlighted by the presentation of Omar Mhirit in North Africa cases studies.

Non-wood forest products

In Sudan, the National Forest Inventory has undertaken a national land use inventory in order to provide area and volume statistics for planning at the sub-national (regional) and national levels (FAO, 1995). The inventory was designed to provide preliminary estimates of products other than the traditional fuelwood and timber, such as the amount of gum, fruit or nuts that can be collected and the distribution of non-timber species of interest (Glen, 2000).

All these products which are not often taken into account by the formal assessment methodologies of forest resources play great role on poverty alleviation, particularly in rural areas, in Africa, Latin America and Asia.

Some useful aspects will be presented by Peter Bailey.

PROSPECTS OF TOF

A case study carried out in Kenya, showed a useful policy measures to promote TOF in rural area. To promote TOF development by 1980s, Land tenure security has been used as a major pre-condition to enable extensive tree planting on farmlands. Today, empirical field evidence shows that there is an increasing trend of tree cover and species diversification on privately owned farms (Kiyiapi, 2000). Based on the present rate of increase in tree planting farms will produce about 9.4 million m³ of wood in 2000 and about 17.8 million m³ in 2020. Their share of the total wood produced in the medium- and high-potential districts is projected to increase to 80% in 2020 (Forest Department of Kenya, 1994). A study conducted by Njenga *et al.* (1999) indicates that tree crops contributed 51%, 40% and 18% of the total household income at the farm level respectively in 3 areas representing different agro-ecological zones: Nyeri (high potential), Mwingi (medium potential) and Ngalange (low potential). The net result is that while natural stands of trees have declined there has been a corresponding increase in tree planting in much of the densely populated highlands of Kenya. As natural forests are completely destroyed, greatly reduced or become inaccessible, the use of trees within agroforestry systems will help people to diversify production and their income and to protect themselves from shortages of fuel and wood. (KFMP 1994).

As pointed out by the key paper prepared by Karsenty, some emerging instruments linked to environmental conventions, especially the UNFCCC – climate convention, Clean Development Mechanism, could be good opportunities to promote (theoretically) TOF development by providing incentives, through small-scale and community targeted projects. One could be optimistic that TOF consideration will be evolving, slowly but surely in near future.

THE WAY FORWARD

Moving forward requires that following questions be addressed:

- How to assess TOFR and what is the status and dynamics of these resources ?
- What are the role of TOF towards combating desertification, agricultural production, biodiversity conservation and livelihoods improvement?
- What are the factors influencing TOFR conservation and development ?
- What is the relationship between TOF and forests?
- To which extent can trees outside forests contribute to decrease the pressure on the remaining forests and to improve their restoration and extension?
- How to built an effective information system and provide information on on-going institutional and policy approaches ?
- To which extent can trees outside forests contribute to decrease the pressure on the remaining forests and to improve their restoration and extension ?
- Which strategies can be put in place in order to promote TOF and their optimum use?

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SECTION 2.2: THE CONTEXT



Photo15490 FAO-Media Archive (F. Paladini, 1989):

Woman watering fruit tree in cooperative orchard, Keita, Niger

Project GCP/NER/028/ITA: The immediate objectives of the project were to improve agricultural techniques and increase soil productivity; to increase the availability of water; to fight erosion; and to strengthen roads and infrastructure. Women have been especially active in land reclamation, soil and water conservation, reforestation, crop production, rural engineering, training, and setting up credit and alternative incomes.

HOW FORESTS OF TREES CAN REDUCE POVERTY

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ABSTRACT

The international community is committed to eliminating poverty by half the number of people who are food insecure living in extreme poverty by the year 2015.

The Forestry Department of the Food and Agriculture Organization of the United Nations (FAO), with the support of the UK's Department for International Development (DFID), held an interagency Forum on the Role of Forestry in Poverty Alleviation in September 2001. Analysts from developing countries, representatives of multi- and bilateral agencies, international research organizations and NGOs came together to share their experiences.

This work is the result of the joint efforts of the 60 participants in the forum, with a significant contribution by the international institute for environment and development (iied). It highlights the findings of the forum to help further the understanding of the ways in which trees, forests and forestry can contribute towards increasing food security and reducing poverty.

INTRODUCTION

The international community is committed to eliminating poverty. International development targets include a reduction by half of the number of people who are food insecure and a reduction in the proportion of the people living in extreme poverty by the year 2015.

Action is needed now to take advantage of the ways that forestry can help reduce poverty. Without action – without investment in people-centred forestry – other measures to tackle poverty and improve poor people's livelihoods will be undermined.

Forests and trees can help. Forest resources contribute to food security. They can provide commercial opportunities and employment for the poor. They are often central to the development of good local governance.

A people-centered approach can further increase the impact of trees in reducing poverty. What is needed is the removal of barriers that prevent forests and trees from contributing to the livelihoods of the poor as well as support for emerging opportunities. As priority actions to implement are the followings:

- Strengthening rights, capabilities and governance;
- Reducing vulnerability;
- Capturing emerging opportunities;
- Working in Partnership.

WHAT DO POOR PEOPLE GET FROM TREES AND FORESTS?

Forests and Trees outside Forests provide:

- Subsistence goods such as fuelwood, medicines, wood for building, rope, bushmeat, fodder, mushrooms, honey, edible leaves, roots, fruits
- Goods for sale all of the above goods, arts and crafts, timber and other wood products
- Indirect benefits such as land for other uses, social and spiritual sites, environmental services, including watershed protection and biodiversity conservation

Forest and tree resources contribute directly to livelihoods, and can complement other key components of poverty reduction through food production, education and primary health care.

Box1: Benefits to local livelihoods from people-centred forestry

- More say in decisions over use and management of forest resources
- Reduced vulnerability, not only through secure forest resources but political empowerment
- Income from forest products and services
- Direct benefits from environmental services
- Increased powers of negotiation

OPPORTUNITIES IN A FAST CHANGING WORLD

As the world's population grows, trade, technology and information systems, and even human aspirations become more global. The world's forest resources are declining because of increase population pressure. Global climate changes are expected to continue with drastic impacts on forests and tree resources as well agricultural production systems. This will have major implications for strategies aimed at poverty alleviation.

Box 2: Dependence on forest resources

- 60 million indigenous people living in the rainforests of Latin America, Southeast Asia and West Africa depend heavily on forests.
- 350 million people living in, or next to, dense forests rely on them for subsistence or income.
- 1.2 billion people in developing countries use trees on farms to generate food and cash.¹

With economic inequity increasing, the poor need safeguards more than ever. Demands on forests and trees are increasing, with about 1.6 billion people relying on forest resources for their livelihoods. The world's rapid pace of change means increased challenges for the poor, but also can provide new opportunities for improved livelihoods based on sustainable use of natural resources. If key actions are taken, even the poorest tree products producers, traders and workers can participate in local initiatives that offer commercial prospects.

The challenge is to support specific changes that will lead to a greater role for forest and tree resources in the livelihoods of poor people. This challenge requires immediate action.

AN AGENDA FOR ACTION

Strengthening rights, capabilities and governance

Support the poor's own decision-making power

As with other resources, forests and trees contribute to reducing poverty when local people are able to make their own decisions concerning forest management. The best participatory forest initiatives provide for capacity-building, and for strengthening group organizations and local institutions. Strengthened communities can take action to improve local livelihoods by improving access to infrastructure, education and health services, as illustrated by community forestry initiatives in Nepal.

Strengthen forest rights of the poor and the means to claim them

Many people stay poor because they have insufficient rights to manage their resources, including forests. Evidence increasingly shows that transferring or returning ownership of forest assets to the poor, or securing long-term access and control rights, are politically feasible and cost-effective strategies for poverty reduction.

Clear tenure rights allow local people to protect forests from outside encroachment, to increase their local food and forest security, and to enter into business contracts. Proven new mechanisms for devolving forest rights to poor communities include: joint forest management agreements (India, Tanzania), ownership or control of village forest reserves by indigenous and rural communities (Ghana, Nicaragua, Tanzania), long-term concessions (Bolivia, Indonesia), household forest allocations (China, Viet Nam), conditional handover of forest resources consonant with government policy (Nepal, Philippines), and complete transfer of forest resources (Mexico, The Gambia). These vary in the security they offer the poor, but all are valid under different circumstances and all are stepping-stones to poverty reduction.

Rights on their own are not enough: they must be supported by the capability to claim and defend them against more powerful actors; they must have clear constitutional guarantees, as well as specific supportive legislation and regulations. The poor need to be aware of their rights and know how to access effective routes to recourse. Management of budgets, costs and benefits should be devolved along with responsibilities. Local institutions need sufficient autonomy to act, modify, and enforce local rules. In addition, national laws should define rules by which communities interact with outsiders, provide basic protection for individuals against the abuse of local power, and set guidelines for the protection of wider societal interests.

Recognize links between forestry and local governance

Initiatives aimed at improving poor people's use and control of forest resources provide entry points to elements of good governance such as representation, transparency, accountability, equitable taxation and increased civil society roles. The forestry sector has a good record in public sector reform, capacity-building, improvement of rights to natural resources, and elimination of corruption and illegal trade. The forestry sector is becoming increasingly effective in generating lessons for other sectors, learning from other sectors, and providing a springboard to broader action on governance.

Improved access to, and transparency of, information on forest resources is central to people-centred development and requires appropriate information technologies and communication channels to assist local decision-making. The inclusion of information in local planning improves freedom of choice for the poor.

Box 3: Advantages to governments of people-centred forestry

- Reduced central government costs
- Environmental benefits
- Local conflict resolution
- Natural resources for local development
- Effective management through partnership

Reducing vulnerability

Make safety nets not poverty traps

In situations of persistent poverty, forest products can help people cope with hard times. For the very poor, access to forest resources provides a vital buffer – absorbing agricultural risk and reducing vulnerability. The very poor have less access to market opportunities or participatory forestry initiatives. They need, above all, measures that protect their access to resources in the face of privatization and trade liberalization, measures that do not lock them into forest dependence.

Support tree planting outside forest lands

Planting trees in and around agricultural lands can provide a significant opportunity for the poor to satisfy subsistence needs and earn additional income. The magnitude and effects of India's farm forestry programme provide ample evidence of the importance of tree planting for poverty alleviation.

Cut the regulatory burden on the poor and make regulation affordable

The regulations that govern poor people's use of forests are excessive and often inconsistent – for example, imposing timber felling bans on community forests but not on commercial forests. Access of the poor to forest resources is over-regulated while the more powerful interests can defy control, which undermines the rule and legitimacy of law. When the poor have enough say in defining regulations, they will usually adapt these regulations effectively and support their enforcement.

Box 4: Regulations benefit livelihoods and forests when poor people have rights and control:

In Niger, where rural fuelwood markets were established, villagers gained control of fuelwood harvesting and trading through a set of regulations developed with their involvement. These provide a fairer balance of rights, responsibilities and revenues to poor people and the government, and extra revenues to both through higher prices

Regulations need to focus more on curbing the excesses of the powerful than on limiting use by the poor.

Reduce unfair obligations in forest management

The demand for overly detailed forest and trees management plans creates barriers for communities trying to acquire commercial rights to forest lands. States should simplify planning and monitoring requirements for small-scale forest and Trees outside forests managers.

As shown in countries such as The Gambia, effective planning, utilization, and monitoring can be based on clear guidelines and do not require elaborate management plans.

Capturing emerging opportunities

Remove the barriers to market entry

Small-scale producers of timber and other forest products are frequently subjected to costly controls when harvesting, transporting and selling wood and other forest products, while state and large corporate producers are sometimes subsidized. States should provide enabling conditions for the poor in those markets where small producers would have a comparative advantage. A next step is to remove constraints to poor people's access to the more profitable and dynamic opportunities in forestry, such as secondary processing and forest support services.

Access to information on the value of forest and trees products in the market place is crucial. Emerging small-scale producers need support to analyse their markets and establish a competitive position, and to learn the financial and organizational viability of different business models and how to manage market risks.

Base land use decisions on true value of forests

In the predominating system of state and corporate tenure over forest lands, forest and trees resources remain undervalued. Current valuation methods for forest goods and services do not reflect real costs and benefits. In particular, they do not take into account the opportunity costs of renewing forest resources, or the role of rural people in producing and providing forest goods and services. Greater control over resources and more secure tenure rights for the poor would ensure that these real values of forest and trees resources are reflected in the market. In addition, policy-makers need to recognize and include them in their decisions.

Ensure that markets for environmental services benefit the poor

Markets that pay for environmental services, such as watershed protection, carbon storage and biodiversity conservation, already exist or look feasible in many countries. The central rationale is that those who benefit from the services that forests and trees outside forests provide should pay those – often the rural poor – who maintain them. At the same time, these payments must benefit the poor in a cost effective and equitable way.

For environmental service markets to benefit the poor, their rights must be secured; payments should be treated as a supplement to, rather than substitute for, sustainable forest use; and systems for market transactions and compliance must be equitable, transparent and efficient.

Support associations and financing for local forest businesses

Increased support is needed to improve the capacity of local forest businesses to access markets and match

supply to demand. Strengthened producer organizations, cooperatives, alliances and federations can reduce transaction costs, negotiate with buyers and provide economies of scale. Support measures are also needed to protect the rights of employees, particularly in contracted and outsourced sectors.

Financing local forest businesses requires innovation. Credit tends to benefit wealthier people who have individual land titles. The poor will continue to rely on savings as the primary source to make investments. Many individual and group savings schemes have proven effective in forestry. Traders of forest products and conservation agencies need to support more local forest businesses, and venture capitalists may find that helping local enterprises scale up their operations is a sound investment.

Working in partnership

Simplify policies and support participatory processes

National forest policies that have proliferated over the last few years have created layer upon layer of new directives, while the capacity of over-structured and under-resourced forestry departments to implement them has decreased. This needs to be turned around. Policies must be simplified and more widely shared. Poor local forest producers must actively participate in policy negotiation and prioritization.

Promote multi-sectoral learning and action

Single-sector solutions will not reduce poverty. An improved understanding of the various elements and dynamics of poverty suggests that multiple agencies need to be engaged. At national and international levels, insufficient intersectoral coordination and unnecessary duplication result in poorly targeted action, sometimes at the expense of the priorities of the poor. Interagency collaboration requires much interchange, recognition of comparative advantage, negotiation and a steady focus on knowledge-generation with poverty reduction priorities.

CONCLUSION

The message is clear – forests and trees outside forests have considerable advantages and an important role to play in the struggle to reduce poverty. Initiatives based on sustainable local forest and trees outside forests management, as part of rural development and sustainable livelihood strategies, can support good governance and increase benefits to the poor. The challenge now is to turn this potential into a reality.

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VULNERABILITY, LIVELIHOODS AND TREES OUTSIDE FORESTS

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ABSTRACT.

The importance of trees outside forests (TOF), including the range, volume, and value of the products and services they provide, continues to be underestimated. A more systematic approach to the definition and measurement of such trees and their contributions is needed. One challenge to developing such approaches is taking into account the heterogeneity and dynamism of TOF, their users and their uses. Another challenge is incorporating local perspectives into ongoing research and policy discourses concerning TOF.

Seeking to enhance the role of TOF in livelihoods will also be a challenge. Without local participation, forestry policies and interventions can pose major risks for the communities that they are meant to help. For example, tree growing projects can become an anti-social task, putting unwanted trees in places where no one needs them.

Sustainable livelihoods analysis (SLA) has much to offer to those interested in enhancing the contribution of trees outside forests to poverty alleviation. It provides a framework for research and policy that takes into the complex and multidimensional relationships between the social and physical environments, as well as time-scales moving from past to future. SLA also links analytical levels spanning from the intra-household to the global. TOF can be seen in relationship to different types of livelihood assets, to transforming structures and processes (the market, the state, culture) that give these assets their meaning and value and to the vulnerability context in which decisions about livelihood strategies take place.

The paper concludes with a brief case study of vulnerability and livelihood strategies in South Wello, Ethiopia.

THE CHALLENGE OF UNDERSTANDING TOF AND LIVELIHOODS

Trying to enhance the contribution of trees outside forests (TOF) to sustainable livelihoods calls for a more systematic approach to the definition and measures of such trees, their products and services. Despite the explosion of research on forestry and trees over the past two decades, TOF continue to be underreported or ignored in many natural resource assessments (Kleinn, 2000). The range, volume and value of products and services obtained from TOF also remain poorly documented in official statistics (Wollenberg and Ingles, 1998; Warner, 2000). Many aspects of TOF remain statistically “invisible” and poorly comprehended by policy makers and researchers. At the same time such trees are known to play critical roles in the lives of rural and urban people, helping to meet basic material needs and ensure environmental stability. These trees also often possess cultural significance, tied to local identities, religious activities and other facets of life (for example, see Castro, 1995).

Those trying to impose a more systematic approach to the study of TOF face several challenges. A major factor is the heterogeneity and dynamism of such resources, of their users and their uses. One must deal with ever-shifting physical and social landscapes. Analysts sometimes work with two handicaps regarding to TOF: possessing too little data, especially regarding land use changes through time; and holding too many delicatated assumptions about environmental-societal interactions. Concepts such as equilibrium or forest degradation are often stipulated rather than demonstrated. James Fairhead and Melissa Leach’s (1996) recent historical study of ecology and society in Guinea’s forest-savanna mosaic underscores the problem of “misreading” changes in landscape. The dominant interpretation among researchers and policy makers has emphasized human activities as a source of degradation for Kissidougou’s remnant forests. In contrast,

drawing on a wide array of evidence, Fairhead and Leach conclude that the region's forests were neither declining nor being degraded by people. Indeed, their research shows that people encourage forest growth, identifying the socioeconomic and cultural factors behind their management patterns. The authors carefully examine why this 'misreading' of the landscape has persisted among researchers and policy makers. Overall, Fairhead and Leach call for a more pluralistic approach to ecology that draws upon social and historical analysis, as well as on local views and knowledge.

Another challenge concerns the need for improved communication between the managers/users of TOF and researchers, policy makers and concerned others. Outsiders usually perceive this as a matter of allowing 'local people' or 'stakeholders' to 'participate.' Given the nature of TOF, the situation is reversed: We depend on the willingness of people to share their knowledge, their perspectives and their priorities. Obtaining such knowledge should not be another extractive industry, with the raw material removed and processed elsewhere with little lasting benefit to the source of origin. Outside investigators need to consider how their activities can be conducted in a way to build local research capacity and to support locally identified priorities. Involving local people as partners in research (including in the setting of research design issues) and providing communities and local authorities with information about findings are among the ways of addressing these concerns. Fairhead and Leach (1996) point out the importance of including local knowledge, views and priorities as voices within the discourse among researchers and policy makers on natural resource management.

Greater recognition of trees outside forests, including a more precise definition and means of measurement of them in inventories, is likely to come about in the near future. I say this with the confidence of someone who has worked on issues related to TOF for two decades. Although significant gaps still exist in our knowledge, and improvement is needed in theory, method and practice, the situation today is light-years away from that prevailing in the early 1980s. I was fortunate to contribute to an early FAO initiative to promote a more systematic understanding of TOF: the report *Tree Growing by Rural People*, issued in 1985. Spearheaded by Mike Arnold³, then the Chief of Policy and Planning, this publication was one of the first to review the efforts of communities and households to maintain or increase their local tree resources. It documented the capabilities of rural people to plant and manage trees, while uncovering emergent patterns in terms of intensification, incentives, extension and institutional arrangements. At that time very little was known about trees on farmland, in pastures, within household compounds, and in small copses or woodlots. Since that time we have gained a greater understanding and sophistication of the TOF (see the collection of papers in Arnold and Dewees, 1995, which update the issues introduced in *Tree Growing by Rural People*). The vibrancy of the study of TOF is also evident in publications such as *Agroforestry Systems*, *Unasylva* and the Rural Development Forestry Network papers series.

The extent to which policies and interventions aimed at enhancing the contribution of TOF to sustainable livelihoods will actually accomplish that goal is less certain. This lack of confidence, or skepticism, is based on several concerns. There is the danger that TOF can evolve into something studied or promoted for its own sake (or the sake of science), with little connection to the pressing realities of the people who depend on such trees. Forestry policies and interventions can pose major risks for the communities they are meant to help.

³ Mike Arnold has been the single most influential individual in promoting the understanding of trees outside the forest, as well as other aspects of community forestry. His publications, including those on tree management and intensification, common property management, non-timber forest products, forestry and food security, community forestry and related topics are must reads for those interested in TOF.

Meaningful participation that takes into account the range of local interests is required in the process of planning, managing, monitoring and evaluating interventions. Widespread involvement can be difficult to achieve given the heterogeneity of communities (division by sex, age, class, caste, ethnicity, religion, livelihood strategies and so on) and their power dynamics. Yet, without adequate local input, interventions can undermine or overwhelm local livelihoods, particularly for the most vulnerable and marginalized groups. Tree propagation schemes can be an anti-social task, putting unwanted trees in places where no one needs them. For example, Bangladesh's Social Forestry Project met resistance from villagers angry about the forced conversion of their farmland into woodlots (Castro, 1997). People in South Wello, Ethiopia, similarly objected to the replacing of their hillside pastures with woodlots (Pankhurst, 2001). While the planners and technical experts only perceive 'barren' or 'waste' land, local people may see heavily utilized (and much needed) commons. Market incentives related to TOF can similarly threaten livelihoods. As forest products become commercially attractive, the rural elite such as traders can gain control over supplies, marginalizing the poor who lack the resources and bargaining power to protect their interests (Dove, 1995). Such conflicts are not an aberration, but a common feature of policies, interventions and natural resource management in general (see Castro and Nielson, 2001).

This meeting offers us an opportunity not only to reexamine issues about the conceptualization, definition and measure of TOF, but also of the notion of livelihoods and its significance. Placing TOF within this broader context means that the success of policies and interventions will not only be measured by the number of trees, the amount of products harvested or the revenue generated, but their contributions to the alleviation of poverty, the reduction of vulnerability and the strengthening of food security (Warner, 2000; Sène, 2000). Basic questions need to be asked: What exactly is a livelihood? How do TOF fit into livelihoods? When is it sustainable? Are there concepts and frameworks that allow for cross-national analysis, as well as programmatic action? Fortunately, sustainable livelihoods analysis offers us a framework with much potential for analysis and practice.

SUSTAINABLE LIVELIHOODS ANALYSIS: AN INTRODUCTION

Many social scientists have always been uncomfortable with the term 'development' and its explicit meanings and implicit assumptions. The concept has lost much of its currency, as it is nowadays seen as too value laden, too fuzzy and too easily disconnected from the concept and goal of poverty alleviation. Similarly, the concepts of poverty and poverty alleviation have undergone considerable reexamination in recent years. Greater attention now is given to the complex, diverse and dynamic nature of poverty. Income, expenditure or consumption thresholds are no longer regarded as the only definitions and measurements that matter in poverty analysis. Instead, a number of qualitative and quantitative approaches, including participatory ones, now document the multidimensional characteristics of poverty, including its relationship to notions of well-being and ill-being. Analysts increasingly seek to understand what the poor have, rather than what they lack, examining the nature of tangible and intangible assets. More research is focusing on how and why people move into and out of poverty, reflecting new questions about vulnerability, capabilities and social capital. Policies and interventions aimed at alleviating poverty seek (and still often struggle) to take into account these new insights and knowledge.

Sustainable livelihoods analysis (SLA) has emerged in recent years as an alternative way of conceptualizing poverty alleviation, including its context, objectives and priorities. As is evident in its title, SLA focuses on one of the most fundamental aspects of life: the ability of people to support themselves, both now and into the future. It does so in a manner that views livelihoods within both micro- and macro-contexts, spanning

both physical and social environments at the local to the global levels. The approach, with its roots in research on agro-ecology and natural resource management, has much to offer for forestry (Warner, 2000). It is beyond the scope of this paper to set out in detail the principles of sustainable livelihoods analysis. Rather, my intent is to provide a quick overview of SLA, trying to identify some of its implications for understanding the socio-economic and policy dimensions related to TOFs. My account draws heavily on the Department for International Development's *Sustainable Livelihoods Guidance Sheets*, which provide in a clear, concise and comprehensive manner concepts for comparative purposes.⁴

A livelihood is the set of capabilities, assets, and activities that furnish the means for people to meet their basic needs and support their well-being. The building of livelihoods reflects and seeks to fulfill both material and experiential needs. Livelihoods are not simply a localized phenomenon, but connected by environmental, economic, political and cultural processes to wider national, regional and global arenas. The sustainability of a livelihood is ascertained by its sensitivity, hardiness and resiliency in the face of short- and long-term challenges. Chambers and Conway point out that: "A livelihood is sustainable when it can cope with, and recover from, shocks and stresses and maintain or enhance its capabilities and assets both now and into the future, while not undermining the natural resource base" (quoted in DFID, 1999). Although the question of a livelihood's capacity for sustainability involves evaluating current circumstances and assessing future trends, it also requires some understanding of the past, of prior conditions and patterns. Analyzing livelihoods requires a framework that takes into the complex and multidimensional relationships between the social and physical environments, as well as time-scales moving from past to future. It also calls for a framework that can link analytical levels spanning from the intra-household to the global.

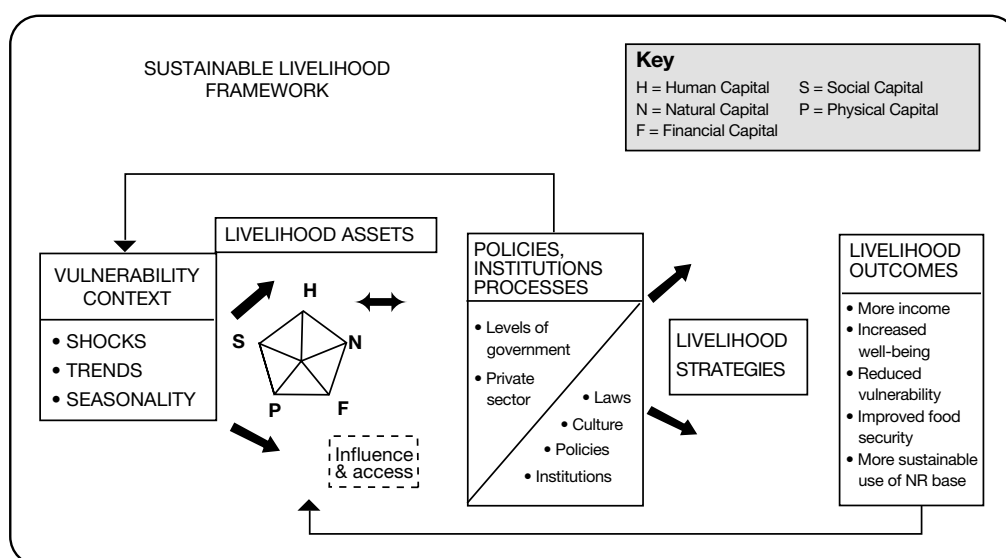
SUSTAINABLE LIVELIHOODS FRAMEWORK

Figure 1, taken from DFID's presents in schematic form the key aspects of SLA. People are shown as pursuing their livelihoods in a *context of vulnerability*, including *shocks* (sudden onset of natural disasters, conflicts, economic traumas, health problems and crop or livestock distress), *trends* (in population, resources, health problems, the economy or governance) and *seasonality* (cyclic fluctuations in prices, production, health and employment). This complex of influences has direct and indirect impacts on people's livelihoods, including the options available to them. The vulnerability context is far from static. Recent research on ecology, natural resource management and rural economy have converged in finding that rural physical and social environments are characterized by greater degrees of variability and unpredictability than previously assumed (see Leach et al., 1999). Vulnerability in urban areas also appears to be diverse and highly complex (see Moser 1998). Development policies and interventions often underestimate the role and significance of the vulnerability context, usually with very serious consequences. The importance of the vulnerability context will be explored further in the South Wello, Ethiopia, example discussed below.

Within this context, people draw upon their portfolio of *livelihood assets* to make a living. SLA takes into account the range of tangible and intangible assets necessary to build a livelihood, identifying five types of 'capital' or core assets. It bears noting that building a livelihood requires to some extent inclusion of all five. *Human capital* denotes skills, knowledge, good health and ability to work. Knowledge about the properties, use or location of trees, for example, would fall under this category. *Social capital* refers to formal and

⁴ There is a sizable and ever growing literature on sustainable livelihoods, with analysts sometimes differing in the definitions and frameworks. DFID (1999) contains a detailed thematic bibliography.

informal social relationships, including their degree of trust, reliability and adaptability. *Natural capital* consists of natural resources, including their flows and services. *Physical capital* refers to producer goods and physical infrastructure. *Financial capital* includes financial resources. As might be expected, those with larger asset portfolios have more livelihood options, as well less vulnerability, than those with fewer assets. The distribution of livelihood assets in any population – rural or urban – is always uneven. Gradations of poverty exist even in the poorest communities. Gender, age and other social differences may significantly affect access to livelihood assets within the household and other groups. For example, while a tree may be regarded as a household’s assets, women’s rights to it may not be the same as men’s.⁵ People’s control over core assets is also dynamic. The “stocks” of both tangible and intangible assets fluctuate seasonally and through time in response to the contingencies of life. The South Wello case will address differentiation and fluctuation in assets.



Source: Department of International Development, *Sustainable Livelihoods Guidance Sheets*

Figure 1. Sustainable livelihoods framework

Policies, institutions and related *processes* give meaning and value to livelihood assets. DFID’s approach to sustainable livelihood analysis calls them *transforming structures and processes*. Structures refer to the key roles of all *levels of government* and the *private sector* in shaping livelihoods. Processes determine the way in which structures – and individuals – operate and interact. *Policies, laws, institutions* and *culture* furnish the everyday framework, rules and relations for human interaction. Together, structures and processes effectively determine access to public and private resources and the terms of trade between different types of livelihood assets. They also influence the returns (economic or otherwise) to *livelihood strategies* – the ways people combine and use assets to meet their objectives. Livelihood outcomes are the results or ‘outcomes’ of the livelihood strategies. In an ideal world, livelihood incomes would generate more income, increase well-being, reduce vulnerability, improve food security, and result in more sustainable use of natural resources.

⁵ Significant shifts have taken place regarding the importance of gender differences in African household economics. The “unified” approach to household economics gave way to the “bargaining” approach that highlighted gender inequalities and the conflicting interests of women and men. A recent livelihoods analysis by Whitehead and Kabeer (2001) calls for examining households as arenas of both joint, as well as conflicting, interests.

Katherine Warner (2000) reviews the contributions of forest resources to sustainable livelihoods and food security, while identifying substantial gaps in knowledge that still exist. She observes that many past efforts in forestry have focused on increasing natural capital without giving adequate attention to how these assets, such as forests and farmland trees, combine with other assets to build livelihoods. Warner states that forest resource will continue to play a significant role in livelihoods, but emphasizes that reliance on them is dynamic. People's dependence on forest resources, including TOF, may increase or decrease in the future, or they may rely on them in different ways than in the past. She also stresses the important role of policy, of the market, and related processes in influencing livelihoods.

RESPONSES TO VULNERABILITY: AN ETHIOPIAN EXAMPLE

Social scientists and ecologists are increasingly recognizing the dynamic nature of both the physical and social environments. Earlier models based on notions of equilibrium and balance are giving way to ones that incorporate spatial and temporal variability, nonequilibrium processes and histories of disturbance events (Leach et al., 1999). One of the virtues of sustainable livelihoods analysis is the emphasis it gives to vulnerability, including the range of factors involved in its context (shocks, trends and seasonal fluctuations).

Some indication of the nature of shocks, including their differential impacts on asset-poor and asset-rich households, is indicated in Figure 2, which is based on research in rural Ethiopia. Since 1999, I have been involved in an interdisciplinary study on food security in South Wello, Ethiopia, carried out by the BASIS Horn of Africa Collaborative Research Support Program in collaboration with Addis Ababa University. South Wello is a drought-prone region of rugged mountains, plateaus and valleys in the central part of the country. It has been the site of famines in the early 1970s and 1984-85, and chronic hunger is prevalent. The research project addresses theoretical and policy debates about the causes and consequences of food insecurity, examining livelihood strategies, entitlements, market linkages and agro-ecological variation. The methods used by the project include market inventories, community assessments, household surveys, case studies and key informant interviews. Outputs from the project, which is ongoing, are available from the BASIS web site at:

Figure 2 is based on rapid community assessments conducted at 21 sites in South Wello (see Castro et al., 1999; Yared et al., 2000). These assessments were not aimed at investigating a particular food insecurity event, but providing general information. Their implementation, however, coincided with a severe food crisis in the area, which was the outcome of both short-term (drought, market fluctuations) as well as long-term factors (including trends in resource access and farm productivity). Michael Roth (in Roth et al., 1999) synthesized the findings and placed them within a theoretical framework of resource 'deaccumulation' and 'reaccumulation'. The figure shows that not only the stocks of natural, financial, human, and physical capital decline in severe food shortages, but also stocks of social capital as well. Ongoing research will determine the extent to which this interpretation requires modification.

The figure reveals the significance of forest resources in relationship to other aspects of the vulnerability context and livelihood strategies. Trees on farmland and around homesteads were a major source of the wood sold by households. Interviews and observations indicated that tree planting has increased in recent years in response to urban demand for wood, despite constraints due to land scarcity and other factors. Ironically, the effectiveness of trees as a buffer during the 1999 food crisis was reduced by glutted wood markets. Figure 2 highlights the role of livestock as a key asset in local livelihood strategies. Households view livestock, particularly oxen used for draft power but other animals as well, as essential for their survival. This perception has had important ramifications for forestry efforts. As mentioned earlier, attempts to convert pastures into woodlots for conservation and economic purposes have generated conflict in South Wello (Pankhurst, 2001).

	Gradual Asset Deaccumulation	Accelerated Deaccumulation	Massive Deaccumulation	Reaccumulation
Accumulation (+)				
Deaccumulation (-)				
Livelihood Strategies	<ul style="list-style-type: none"> • Sell livestock • Grain stocks decline • Food expenditures increase • Search for off-farm employ't • Conserve cash • Sell wood • Borrow from merchants and family • Grain loans 	<ul style="list-style-type: none"> • Livestock distress sales and • Livestock consumed by h'hold • Consume wild roots/leaves • ↑ search for off-farm employ't • Out-migration • Go to live with relatives • Sell h'hold items+implements • Increased sharecropping 	<ul style="list-style-type: none"> • Extreme livestock mortality • Grain stocks dry up • Homes deconstructed to sell wood and corrugated iron • Outmigration if health allows 	Unknown
Market Characteristics	<ul style="list-style-type: none"> • Land rental rates increase • Borrowing costs increase • Wage rate declines slightly • Grain prices rise slightly • Livestock prices begin to decline • Diets and labor productivity maintained 	<ul style="list-style-type: none"> • Wage rates fall; land rental rates rise • Labor demand declines • Grain prices spike in thin mkts • Livestock prices plummet • ↑ giving from the well-off to poor w/in community • Purchasing power erodes • Protein/calorie ratio rises 	<ul style="list-style-type: none"> • Borrowing costs spike • Land rental rates fall • Wood/livestock prices collapse • Cereal prices uncertain due to food aid • Community network collapses • Malnutrition and disease • Physical exhaustion • Human suicide and death 	Unknown

Figure 2. Anatomy and Chronology of Famine, South Wollo Source: Roth et al., 1999, adapted from Castro et al., 1999

CONCLUSION

Sustainable livelihoods analysis has much to offer to those interested in enhancing the contribution of trees outside forests to poverty alleviation. TOF need to be seen in relationship to the different types of livelihood assets, to the transforming structures and processes (the market, the state, culture) that give these assets their meaning and value, and the vulnerability context in which decisions about livelihood strategies take place.

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TREES OUTSIDE FORESTS: WHAT INCENTIVES AND WHAT OUTLOOK STUDIES

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ABSTRACT

The role of trees outside forest, under the current trend of forest conservation, is very likely to become more relevant in rural development and a very valuable option for wood industry, energy policy makers, and conservation of biodiversity. Several issues however need to be taken into consideration to fully development of TOF. Among them are: Land-tenure and tree property rights, structure of incentive and tax system, & Demand and market access. Most environmental alleviation projects include tree planting, thus TOF will also be expanded as result of Climate change mitigation initiatives like UNFCC, CDM. TOF increase can bring many positive benefits, however a good incentive system is needed to fully achieve TOF potential.

INTRODUCTION

Are Trees Outside Forests the future of the forests? Hopefully not, but in many places the room of TOF is likely to raise as natural forests area will decline. TOF use, planting and management have become a critical issue in rural development and it is also considered as an option for wood industry and energy policy makers.

THE TREES OUTSIDE FORESTS AND THE LAW

TOF management has been hampered by land-tenure legislation, in many of which right on the land was the one that took over rights on other resources linked to the land itself.

It has been also hampered forestry codes, in which any tree outside fields and garden areas in the landscape was potentially subject to specific regulations.

Historically, rural societies were used to have different use or property rights on various resources, and one individual would had enjoyed yields rights, another one grazing rights and a third gathering rights on trees on the same area. With the recognition of so-called “modern ownership”, the variety of property rights has been turned down into a single and “absolute” right given to a single juridical entity (individual, company, local council, the State...).

In actual rural societies, trees outside forests have an ambiguous position. On one hand, they are land ownership markers, a testimony of a long an peaceful occupancy; on the other hand, any endeavour to plant some trees could be felt as a threat by “traditional owners” lending temporary the land to migrant under customary rules. Trees are, thus, vectors of land tenure conflicts as it is the case in several West-African countries (Benin, Côte d'Ivoire...).

TOF are also means of “boserupian intensification path”: used as fences to keep animals away from permanent crops, they are both limits markers (Madagascar, Comoros, Western Cameroon...) and tools for intensification process. In several ways, TOF have to do with land property but often not in a straight way.

IS LAND TITLING THE SOLUTION?

In many parts of the world, uncertainty about ultimate land rights hampered tree plantations and management. Is there only one way to address such a problem?

Secure land rights through land titling or through use right registrations is sometime possible and relevant. But in many conflicting situations, that type of solution is unworkable as the conflict is not matter of area boundaries, but of the legitimacy of land occupancy itself. The problem, in this way, is the same with land rights registration, a potentially useful tool, used in Western Africa, but implemented too closely as a mere substitute for formal land titling

Is there a room for innovative solutions, mixing negotiation processes, rural contracts and division of property rights on land and associated resources in order to give a relative security to both original land owner and actual occupant? Then very recent Congo Law includes provisions allowing such a scheme. A challenge for the future would be to explore the scope for new legal arrangements entitling stakeholders with use rights on different resources which uses are embedded within the same areas. This is the only way if one want to avoid a very likely consequence of land titling generalisation: the exclusion of poorest people from rights and benefits they can have only through access maintaining, not from land titling.

INFLUENCE OF FORESTRY CODES

But planted wood are not the only TOF. When agriculture expand in forest areas, some farmers leave trees on the field, but other do not. On one hand there is the possibility to sold a valuable tree to a logger, on the other hand there is the risk to be subject to forestry code with, potentially, eviction of the newly created field, or distribution of logging rights to operators without financial compensation. How to change incentives structure in such a case? There is no mere and straightforward answer, but in each situation some arrangements are possible. In areas bordering the forests, granting (or recognition) of trees property might encourage conservation of the most valuable trees. Obviously, it might give legitimacy to slash and burn agriculture in areas where governments want to promote strict conservation or industrial use of the resource.

THE STARTING POINT IS DEMAND AND MARKET ACCESS

If security of use and transmission are critical incentives, economics is the other part of the story. TOF can be valued through products (fruits, rubber, oil, fodder, etc.) all along their lives and as wood (solid wood, pulp, firewood, energy wood) when matures or older. Multiple use trees are obviously preferred by farmers. Promoting use of tree products other than wood and allowing farmers to keep a significant rent share, provide economic incentives for plantation of such trees and their proper management. There is a significant scope of progress in the matter, where the Governments, NGOs, traders, rural projects, can play a role. But many of these products have substitutes and are subject to inherent volatility of commodities markets and, in many cases, the domination of intermediaries leads to disappointing revenues for farmers.

The wood ought to be more considered, even if the main motivation for planting trees in fields and fallow will remain “flux” products, for households needs satisfaction. Trees are incidentally planted for the wood, and sometimes for solidwood. Time matters also for farmers, and economic incentives would have to address short term revenues alongside middle and long term financial promises.

Subsidising farm tree planting seems not to be the best solution. Public subsidies, through specific projects

for instance, is by nature unlikely to be sustainable. The real incentive will be given by market prices, that should be high enough to pay all the “opportunity costs” associated with tree planting, a time and land consuming activity. Government and projects focus should be on market access obstacles removal, rather than subsidising tree planting. Such a challenging goal, include many aspects: disseminating information, promote rural market places where farmers and several carriers can meet... Another major obstacle to reach market places is the road control abuse by forest administration and authority forces, when money is extorted to carriers under the pretence of illegal logging activities control. Some promising tools have been experienced in Sahelian countries, as in Niger, where fuelwood rural market, co-managed with forest administration, are allowed to deliver legal-like document attesting the legality of wood origin. Such a formula can be implemented also with out-growing schemes, where local and private producers are supplying a specific industry and where contract documents can be shown at any stage.

If one considering that wood processing industry in Côte d'Ivoire has been actually saved from log shortage by Trees Outside Forests collected in fallow lands, fields margins and degraded areas, one should concludes that there is a scope for “win-win” arrangements for both farmers and loggers. But there are pre-requisites: recognising farmers rights on tree selling, thus clarifying, and secure, rights on lands. Economics cannot escape from land tenure and institutional arrangements.

Several industrialist, in Côte d'Ivoire and elsewhere, are looking for (and already practising) out-grower schemes with farmers and communities. That is certainly a promising way, providing communities and individuals are supported to negotiate fair contracts and the Governments commit themselves firmly to handle in a realistic way land tenure issues and local rights on resources as TOF. The Administration must be aware also that large-scale plantations funded with public subsidies might result, in some cases, in lowering the average price for wood, thus provide disincentives for individual/collective proper management and further planting within farming systems.

TAXATION ISSUES

Taxation regimes are likely to impact the incentives structure too. If trees have been planted and managed, stumpage fees or felling taxes seems to have negative effects on the incentive structure.

But if scattered, natural growth trees are concerned (as in many places in Côte d'Ivoire and Ghana), the resource used by loggers have to be paid to reflect its potential value and opportunity cost. If land royalties are in force, tax exemption for tree gardens and parks might encourage tree planting and management, providing the Administration have real capacities to monitor effectively the taxation situation.

Increasing loggers' access cost to the wooden resource is generally a sound policy, even if it is a highly sensitive issue with loggers and wood processors. Having significant levels of taxes not only provide money for public expenses and investments, but push the wood processing activity toward more efficiency, allowing it – on the medium/long term and providing it survives... – to pay higher prices for raw material. Sylviculture constraints stemmed from management plan enforcement combined with higher stumpage/area royalties tend to reduce large and easy wood availability, raise wood prices and put more interest in TOF development. However, in fiscal matter, things are not straightforward and forest taxation reforms ought to be wise, step-by-step and negotiated enough to avoid adverse effects and reach initial objectives.

TOF AND “CLIMATE INSTRUMENTS”

Would the emerging instruments linked to environmental conventions, especially the UNFCCC – climate convention, be of some help for TOF development?

The Clean Development Mechanism could provide, theoretically, incentives, through small-scale and community targeted projects, to plant trees and to develop agroforestry. But, at this stage, it seemed that the mechanism is designed for investments in large scale projects, as industrial plantations, and not for investing and supporting clusters of small-scale initiatives, with high transaction and monitoring costs. The US defection of the Kyoto protocol implementation process, the amount of “hot air” available on the market will lead to a low price of carbon credits, leading to the “low-hanging” fruits scenario in which only very cost-effective projects are undertaken. CDM, at this stage, seems not being a promising tool for TOF, unless if used in association with other existing tools (GEF, ODA, fiscal tools...) and if appropriate institutions are build-up (special investments funds targeting small-scale projects).

In that case, if trees are planted and managed in connection with climate change mitigation purposes, it would be necessary also to think about market outlets, otherwise the activity will be economically unlikely. There is, yet, a potential demand in line with UNFCCC ultimate goals: the use of biomass in modern ovens to produce (non-fossil) power supply in a decentralized way, for rural areas themselves. There is a case for such an energetic switch in developing countries and this would create a sustained demand for wood production and farming by-products. In that case, CDM can represent a powerful instrument, providing investments can reach both the electricity producer and the potential biomass producer.

CONCLUSION

In conclusion, one should say that views on TOF are evolving, slowly but surely. Forest are gradually eroded in developing countries, despite country and international community commitments. But even if forest area are diminishing, trees might remain and (other ones) be replanted. This one aspect of the Kuznet’s Curve (or Boseruperian scheme). Wood supply is not at risk, but biodiversity losses are serious within that process. Beyond incentives for TOF management and planting, one should also think about incentives to keep, to manage and also to re-create a diversified nature and landscapes.

In that respect, some Outlook studies would be of particular interest:

- In legal field, considered in a broad sense, several critical issues are to be addressed :
 - The prospect of formalizing a “right of the practices”, aiming at providing more security to resources users, especially those who use farm trees and would be likely to manage and replant them under appropriate local and legal arrangements. Potential of innovating tools such as “Rural Land Tenure Plans” (*Plans Fonciers Ruraux*, in French-speaking areas) are to be revisited and prospected in that way. New articulations between forestry codes and land tenure legislation are to be planned.
 - The prospect for private rural loans to farm planters who do not have land titles. Arrangement like collateral guarantees given by local stakeholders might work or not: under what conditions?
- On the economic side, one critical point seems to be the market access for TOF products:
 - An assessment of the various natures of obstacles/barriers to market access for TOF products would help to prepare response measures, such as wood rural markets, cooperative networks for products transportation, better maintenance of rural trails, etc.

- O The indirect effects of forest policies on TOF products prices and market access are to be better known. What is the price effect on wood of public/subsidized plantations in various structures of markets? What is the effect of hardening resource access for loggers in natural forests, both stemmed from silviculture constraints and different taxation policies?
- O Out grower schemes, in one hand, tree by tree negotiation in the other hand, are 2 raising modes of interaction between farmers and private/industrial sector. Assessing the existing arrangements and foresee what improvements in terms of institutional mechanisms are possible (insurance system provided to contracting farmers by the private sector to minimize risks on the long range, for instance) would be one way to pay attention to local empowerment, fairness/equity issues and enhancement of the incentives structure.
- O Forest policies and international community-funded projects too often overlooked the small-scale/informal sector issue, even though this last have impressively grown in several countries where formal industries are focused on exportations not domestic consumption. Formalization and efficiency enhancement of such activities is likely to have in many places a significant influence on TOF through ability to pay higher prices, better market access through the legalization of a hidden activity, etc. Design policies in that matter is very challenging but very necessary.
- O Economic instruments related to global environment have not been designed for supporting small-scale activities. However, all the rules governing their implementation are not set yet, and there is a room for proposals. Innovative tools such as Clean Development Mechanism might be used, in combination with other instruments, to provide direct incentives for TOF plantations (out-grower scheme would be an indirect incentive). Outlook studies for designing the appropriate combination and use of mixes of economic & institutional instruments, existing or under construction, for TOF development appears worthwhile.

SECTION III: SPECIFIC TECHNICAL ISSUES



Photo No: 17774-FAO media (P. Conti, 1994): Project GOM/UNDP/FAO: Assisting the smallholders in participatory way to establish village woodlot and to improve management of natural resources which increases productivity and income generation in an environmentally sound manner.

Photo 14081 FAO media (Ch. Errath, 1985): Man preparing bundles of firewood in prosopis plantation, Santiago & Maio Islands, Cape Verde.

The objectives of this large FAO forestry project financed by Belgium, which started in January 1978, are to combat desertification, restore the ecological environment by reconstituting a vegetative cover, provide fuelwood and forage for grazing and create a forestry service in the national economy.

TREES OUTSIDE FORESTS: THE WOODFUEL PRODUCTION CONTEXT

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ABSTRACT

In an assessment conducted by FAO in 1997 it was stated that developing countries in Asia are home to approximately three quarters of the world's woodfuel users, but have only one quarter of the forest cover in the South. Thus the prediction was mass fuel scarcity by the year 2000. Despite this prediction more people today depend on traditional fuels than back in 1980s. And their demands of traditional fuels are being met one way or other over the past two decades. This is particularly interesting with regard to those users in the zones previously classified as being in *Acute Scarcity Situations* and *Deficit Situations*. There must be other unaccounted sources of either forestry and/or agricultural origin, which allow the people to meet their domestic fuel needs. In addition, people might also use inferior biomass to supplement their fuel shortages. The universal cause of deforestation in tropical Asia has been the clearing of forests for agricultural expansion and other developments, not fuelwood collection. Nevertheless forest conversion also produces incremental fuelwood for local consumption. Such conversion has taken place and is taking place with the approval of national governments and donor agencies. Unfortunately, the blame for accelerated deforestation is shifted to the poor who collect the fuelwood for free. Also statistics projects on fuelwood supply do not take into account the biomass that can be harvested from trees and shrubs under certain minimum diameter at breast height (DBH) or top diameter (i.e. 10-20 cm). Therefore the contribution of non-inventoried biomass which contributes to the domestic fuel supply to the poor remains still unknown. Households are depending less and less on forest for fuelwood collection. Therefore, a proper assessment of micro-level, not macro-level, situation of woodfuel supply-demand would be necessary, not only to understand the prevailing system of production and flow but also to promote sustainable bioenergy utilization policy for the future.

CONTEXT

The Regional Study on Wood Energy Today and Tomorrow in Asia (RWEDP, 1997c) categorically states in its Foreword that “developing countries in Asia are home to approximately three quarters of the world's woodfuel users, but have only one quarter of the forest cover in the South.” With their ever-increasing populations and the associated growth in woodfuel demand in absolute terms, one wonders how the growing woodfuel demands in the household, traditional industry and commercial sectors of RWEDP member countries have been met over the years.

Indeed, if one refers to the FAO study of the early 1980s (FAO, 1983) that was conducted exclusively to draw attention to the problem of fuelwood (often referred to as ‘the other energy crisis in the Third World’) prior to the United Nations Conference on New and Renewable Sources of Energy, Nairobi, August 1981, it becomes difficult to imagine how the people in WEDP member countries have managed to meet their needs for fuelwood over the past 20 years. Similar may be the situation in other Asia countries, as well as in Africa. The conclusion then was that without a radical change in the present (i.e. in 1980) fuelwood demand-supply situation, over 2 thousand million people, or double the number in 1980, would be affected by fuel scarcity

by the year 2000. FAO's assessment of fuelwood scarcity was based on both high population growth rates and associated fuelwood demands *vis-à-vis* accelerated rates of deforestation (shrinking supply sources) and limited possibilities for fuelwood replacement by other energy sources in the developing countries. The most important achievement of the FAO study was the attainment of its intended goal of raising awareness of both concerned governments and international communities about the energy problem of the Third World at that time.

The FAO study showed all member countries of RWEDP in South Asia and the heavily populated forest deficit zones of the countries in Southeast Asia facing fuelwood scarcities of different magnitudes. It was reported that people in the scarcity zones of South Asia were meeting their fuelwood needs by over-cutting the existing resources (or harvesting beyond their sustainable supply potentials), contributing to further deforestation and/or forest degradation. All types of fuelwood resources that existed at the time in developing countries were included in this assessment. This included natural woody vegetation (i.e. formations with over 10 percent of the ground covered by woody species), plantations (i.e. forest stands established through afforestation and reforestation), and other types of natural woody resources (e.g. linear tree plantations alongside roads, railways and canals; scattered trees on farms, homesteads and hedges; woodlots, orchards and block plantations). Even the fuelwood production potentials of industrial plantations, from thinning and logging residues, as well as from the residues and byproducts of agricultural and industrial activities were taken into account for assessing the demand-supply situation.

Despite the bleak fuelwood demand-supply projections of FAO, more people today depend on traditional fuels than back in 1980s. And their demands of traditional fuels are being met one way or other over the past two decades. But most national statistics provide misleading information about the trends in energy consumption. They clearly show a decreasing share of traditional fuel in their annual energy balances. As their use was considered to phase-out over the years their development was never considered to be a priority. In reality, rather than decline, the use of traditional fuels in most developing countries has increased in absolute terms over the past two decades. In the 16 member countries of RWEDP the annual average growth rate in woodfuel consumption alone is about 1.6 percent (RWEDP, 1997c). How this incremental demand for woodfuel is being met remains an open question (or a mystery). This is particularly interesting with regard to those users in the zones previously classified as being in *Acute Scarcity Situations* and *Deficit Situations* in the FAO study of 1980. These zones include the sub-desert zones of Pakistan, the populated zones in the Himalayas, the Indian Sub-continent, Sri Lanka and Bangladesh, Central Thailand and Central Philippines, and the coastal plains and deltas of Vietnam. It appears that the people in these zones have managed to meet their energy needs without substantial official efforts to overcome the perceived problems in these zones, except for the promotion of activities like improved cook stove development, community woodlot establishment, and limited trials of other renewable sources of energy at national levels. One therefore wonders whether the authors of the 1980 FAO report missed some important supply sources, or if the productivity figure used for assessing the fuelwood supply potentials of different production systems were grossly underestimated.

DEFORESTATION AND WOODFUEL SUPPLY SOURCES

Different studies conducted in the region underline that the universal cause of deforestation in tropical Asia has been the clearing of forests for agricultural expansion and other developments, not fuelwood collection.

Nevertheless it has been observed that forest conversion also produces incremental fuelwood for local consumption, which would not have been available under the sustainable management regime of forests. In this way, a substantial amount of fuelwood is being produced currently and provides the cushion for absorbing the pressure of additional fuelwood demand particularly from industries and from urban centers. Such activities have taken place and are taking place with the approval of national governments and donor agencies. Unfortunately, the blame for accelerated deforestation is shifted to the poor who collect the fuelwood for free. It should be noted that the biomass fuels collected by the poor for self-consumption comprise mostly dead branches, twigs, leaves, and even pine needles and empty cones, or the products derived during the full-cycle of tree and shrub growth - products are not included in fuelwood supply-demand statistics. Most forestry statistics projects the sustainable fuelwood supply potentials in member countries do not take into account the biomass that can be harvested from trees and shrubs under certain minimum diameter at breast height (DBH) or top diameter (i.e. 10-20 cm). Therefore the contribution of non-inventoried biomass which contributes to the domestic fuel supply to the poor remains still unknown. It will be also difficult to quantify these products in cubic meter or metric ton terms - the commonly used units for roundwood or fuelwood measurement.

One should be careful while using the national aggregate figures for making local, area specific, woodfuel supply-demand projections. Even in within the zone of supply surplus there could also be localized scarcities due to the uneven distribution of fuelwood resources, and limited or no access to the existing resources. No matter how rich a geographical area may be in terms of forest cover, it is only those resources which are located within a radius of 20 km that are accessible to the local woodfuel users/collectors for free (100 km for commercial traders), provided no physical or legal barriers exists to restrict the woodfuel flows.

Among RWEDP member countries that have faced acute fuelwood scarcities, China, India, Indonesia, Myanmar, Pakistan, Thailand and Vietnam have initiated large-scale fast-growing fuelwood plantation programmes. Nevertheless, one may have doubts about the ultimate use of the additional wood produced under these labor- and cost-intensive fuelwood plantations. Given the growing competition for wood in the local market, for industrial raw material and other uses, whatever incremental wood is produced from these plantations will most probably be delivered to the highest price bidders, industries and/or open markets, rather than as free woodfuel for the poor. Observation in some of these countries endorses that only small branches, twigs, stumps, roots, and leaves, or the residues and by-products of these plantations are supplied to the poor for fuel from these plantations.

In other member countries, tree planting and forest protection campaigns under the banner of social, community, private, and/or leasehold forestry development have been on-going for some years. These schemes have contributed substantially to expanding tree and forest covered areas, as well as woodfuel production. But to what extent? The data provided in Forestry Sector Master Plans of many South Asian countries show their total annual woodfuel demands far beyond the sustainable production potential of their existing supply sources, primarily natural forests and plantations. In most cases an increasing gap in the supply and demand in the future is projected.

The question arises: how have people succeeded in meeting their fuelwood needs over the years given the diminishing/shrinking resources? In most cases the unavailability of reliable data hinders attempts to answer such a question or even to make acceptable projections. In other cases, misinterpretation of available data, often to justify the sectoral biases of concerned agencies, has contributed to misleading (or even wrong) projections. There must be other unaccounted sources of either forestry and/or agricultural origin, which allow the people to meet their domestic fuel needs. In addition, people might also use inferior biomass to

supplement their fuel shortages. Or else, the share of non-forest lands in fuelwood supply might have increased significantly. RWEDP's estimate already shows the average share of non-forest land in woodfuel supply as much as two-thirds of total consumption and the forest for only one-third in its 16 member countries (RWEDP, 1997c). The situation in Bangladesh, Pakistan, Sri Lanka and the Indonesian island of Java show the crucial role of non-forest lands in meeting the woodfuel demand in these countries.

If this were not the case, then all existing fuelwood resources in severe scarcity areas would have completely disappeared over the past 2 decades, as predicted earlier. But this has not been the case anywhere. Still the traditional woodfuel users in rural areas have not switched-over to alternative commercial fuels (although some urban centers have started showing this trend for social, economic and technical reasons). Similarly, stove improvement programmes, promoted as an additional strategy to manage the fuelwood demand, have not achieved the expected success. Of course the progress under social or community forestry schemes has been tremendous in some countries, but no country has succeeded in establishing large-scale fast-growing tree plantations at low cost exclusively for woodfuel production to the poor.

WOODFUEL FROM NON-FOREST LANDS

Many countries in the Asia-Pacific region are reducing their reliance on natural forests for industrial wood as well as firewood and developing new supply sources (i.e. plantations, agroforestry systems, farm forests). The achievements of China, India, Indonesia and Vietnam with the establishment of large-scale tree plantations are well known. Many others have promoted participatory forest management programmes, including community woodlots, farm and private forestry development, and tree planting in non-forest land. Others, at least in specific locations, have been integrating multipurpose trees into different models of traditional land and tree based production systems. Therefore, recently the role of trees outside the forests in wood and fuelwood production has been gaining increasing importance. And further integration of trees into farming systems is expected to continue, which is expected to contribute significantly to industrial roundwood and fuelwood production in RWEDP member countries in the coming years. Swaminathan & Balaji (1998) report that as much as 71 percent of the private land of 150 sample charcoal producing households previously used for raising Dry Millets, was used for raising *Proposis juliflora* plantation in the Tamil Nadu State of India.

In India, Saxena (in RWEDP, 1997a) citing Natarajan (1996) reports that only 17 percent of the firewood-collecting households depended on forests to meet their demand in 1992-93. Over 78 percent of the households collected woodfuel from non-forest lands (i.e. 48.5 percent from their own farms, and 29.8 percent from roadside bushes and trees) bushes and tree. The share of households who depended on forest for fuelwood collection in 1978-79 was about 35 percent. In the Philippines, about 58 percent of the households depended on gathered or self-collected fuelwood and another 28 percent on purchased fuelwood. Among self-collecting households 45 percent collected fuelwood from their own land or the private land of others (Rebugio *et al.*, 1999). Aggregate national data explaining the share of forest and non-forest supplied woodfuels are not yet available, except for Pakistan (GOP/WB/UNDP, 1991), but a number of RWEDP-sponsored area-based studies and other studies (by UNDP/World Bank under various ESMAP projects in the region) suggest an increasing role for non-forest lands in meeting the fuelwood needs of the people in member countries (Table 1).

CONCLUSIONS

Numerous country and area-based case studies (sponsored by FAO-RWEDP, World Bank, UNDP, etc. in the 1990s) suggest that in most cases there is no “gap” in the supply-demand of traditional fuels. In many places people did not rely solely on natural forests and plantations to meet their domestic fuel needs. It was commonly found that people who lived in areas with limited access to, or devoid of existing forests and plantations, developed either alternative woodfuel supply sources on non-forest lands, or switch-over to other locally available inferior biomass for substituting their domestic fuel requirements. None of these studies categorically identify woodfuel collection by the poor as the main cause of deforestation. Of course, in specific locations of high population and low forest cover, unsustainable woodfuel collection did contribute to forest depletion locally. The findings of many area-based woodfuel flow studies suggest simplifying the legislation in forestry and related sectors, to encourage non-forest area based woodfuel production, flow and utilization in member countries.

Forest or non-forest source, which plays an important role in the supply-demand of woodfuel could be area-specific. The role may change significantly between sources from one place to another, depending upon the local supply-demand situations of woodfuels. It may change between places within an administrative district of a single country. One could observe in areas close to fuelwood resources (i.e. natural forests and plantations), local people – including the populations of small towns – tend to rely more on these public sources to meet their domestic fuel requirements. However, rural households at a considerable distance from the natural supply sources have either managed alternative fuelwood supply sources on non-forest lands or supplemented their fuel requirement with other inferior traditional fuels. Most people in larger urban centers, on the other hand, seem to opt for alternative commercial fuels wherever available and affordable. Some traded woodfuels used in many large urban centers, industries and commercial establishments could also be produced from non-forest lands. Therefore, which of the two supply sources are more important from the point of view of meeting the local energy needs is very much location-specific. Either or both could be of paramount importance in a given area depending upon local physical, social, economic and environmental conditions. The use of woodfuel, other biomass (crop and/or animal residues) or commercial fuels depends on the access to and/or availability of alternative sources to meet the energy needs of the traditional users, including their fuel choice and mix. But the extent of this dependency remains unclear.

Therefore, a proper assessment of micro-level, not macro-level, situation of woodfuel supply-demand would be necessary, not only to understand the prevailing system of production and flow but also to promote sustainable bioenergy utilization policy for the future. Generation of area-specific data would be necessary also for planning and implementation of decentralized rural energy program in rural areas. Increasing availability of modern bioenergy technology in commercial markets, for application in the household, industry and commercial sectors, recently, some farmers and private investors have been motivated to raise tree and energy crops on non-forest lands, even by replacing some important food crops in farms. Such new trends are slowly emerging in both developed as well as developing countries.

With the growing concerns for health, gender and global climate, future prospect of this carbon neutral, renewable source of energy is expected to gain in importance globally. This trend has already become more visible in many developed countries. It is expected to expand commercial tree planting and energy crop production in private farms and other non-forest lands, both productive as well as marginal lands. However, sustainable bioenergy development calls for reforms in legal and institutional fronts, as well as in extension methods and support services in the forestry, agriculture and energy sectors. Further, the land and tree tenure issues; production, transportation and trade in woodfuels; subsidies and cross subsidies on commercial fuels;

technology transfer and dissemination; incentives and credit facilities; human resources, call for adequate consideration and concerted action, to promote sustainable woodfuel production, flow and utilization from non-forest lands in the future.

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Country	Fuelwood Production (%)		
	Forest ¹	Non-Forest Land ²	Unknown
Bangladesh ⁶ Bangla	13/ 75/ -	87/ 25/ 82	--
Bangladesh ³	84	16	--
Bhutan ⁴	NA	NA	--
Cambodia ⁵	NA	26	--
China ⁶	51 / 17	49 / 83	--
India ⁷	6	65	29
Indonesia ⁸	>90	<10	--
Laos ⁹	NA	NA	NA
Malaysia ¹⁰	NA	NA	NA
Maldives ¹¹	60	40	--
Myanmar ¹²	82.5/73	17.5/2	--
Nepal ¹³	12.6	84.1	3.3
Pakistan ¹⁴	13.7	86.3	--
Philippines ¹⁵	11 / 12	75 / 69	14 / 20
Sri Lanka ¹⁶	--	93	7
Thailand ¹⁷	80	20	--
Vietnam ¹⁸			

Data Sources:

¹ Includes forest plantations

² Includes private farms, homesteads, community managed lands, shrub, scrub and waste lands, linear & scattered tree plantations, etc.

³ GOB (in RWEDP 1997c) reports a 13% and 87% share of forest and non-forest; Ahmed (in RWEDP 1998a) shows a 75% share of forest in *Hathazari Thana* of forest reach Chittagong District; Hashem (in RWEDP 1998a) cites the Statistical Pocket Book of 1995 and presents a 82% share of homestead trees in 1991-92.

⁴ Sharma (in RWEDP 2000b) shows 70- 90% share of forest in local fuelwood supply in areas adjoining to the Black Mountain National Park in Bhutan, average share 84%.

⁵ RWEDP (1998) states that all firewood and charcoal traded in Phnom Penh market come from nearby natural forests, most locally consumed fuelwood in rural areas were collected from agricultural lands.

⁶ Yongqi Zheng (in RWEDP, 2000c) states a 26% share of non-forest land in local fuelwood supply in the Northwestern Provinces of China.

⁷ Forest Survey of India (FSI) shows the average share of forest and non-forest at the national level as 51% and 49% respectively (in *Fuelwood, Timber and Fodder from Forests of India*, 1996). Saxena (in RWEDP 1997a) cites Natarajan (1996) and presents 17% share of forests and 83% for non-forest areas (includes trees in farms and roadsides). Prasad (in RWEDP, 2000c) shows in the forest-rich North-Eastern West Bengal 80% of the locally consumed fuelwood came from forests, but in forest deficit Punjab its share was only 1%, in Rajasthan <5%, in Kerala 20%, in Southern West Bengal 11%. Alam et al (1984) shows only 6% share of government forests and 94% for private forests and farms.

⁸ Indonesia Urban Household Energy Strategy Study, World Bank/ESMAP, 1990.

⁹Sawathvong (in RWEDP 1999) cites the information from Luang Prabang Province, Laos.

¹⁰ Poh (in RWEDP 2000c) identifies the wood residues generated in industries and energy plantation in waste lands as the two important non-forest fuelwood sources.

¹¹the Country Paper of Maldives, 1995 states all fuelwood come from natural forests, no data given.

¹² Myint (in RWEDP 1997) shows a 40% share of non-forest land even in heavily populated Dry Zone of Myanmar. Hlaing (RWEDP 2000c) gives an average 24% share of non-forest lands in total fuelwood supply. Sein (in: *Non-Forest Area Based Woodfuel Production and Its Contribution in Rural Socio-Economy in Ayeyawady Division*, 1999, unpublished) states that the supply from non-forest area meets the present and projected fuelwood demand in all 5 Districts of Ayeyawady Division.

¹³ Shrestha (in RWEDP 2000a) shows 82.5% and 17.5% share of forest and non-forest supplied fuelwood; Water and Energy Commission Secretariat (WECS) Bulletin of 1997 shows the share of forest as 73%.

¹⁴ Pakistan Household Energy Strategy Study: Household Energy Demand Handbook, 1991, World Bank/UNDP/ESMAP: Siddiqui and Amjad (in RWEDP 1993) state the adjoining forests as the main fuelwood supply source to the city but private farms to the rural households.

¹⁵, World Bank/UNDP/ESMAP, 1991 The Philippines Household Energy Strategy; Espiritu (1999) states a mere 7% share of forests at the national level.

¹⁶ FSMP (1995) shows the share of forest and non-forest area as 11% and 75% respectively. Bhandartillake (in RWEDP 1998b) cites the National Consumer Survey report of 1990 and present the share of state forests, non-forests and other sources (includes farms and purchased) as 12%, 69% and 20%, respectively. Wickramasinghe (in RWEDP 1998b) show a 40% share of forest in 2 out of 5 villages and no share at all in the other 3 villages studied.

¹⁷ Thai Forestry Sector Master Plan: Sub-sectoral Plan for Production and Utilization, Vol. 6, Royal Forest Department, 1993.

¹⁸ Tin (in RWEDP, 1996) states that 80% fuelwood is supplied from natural forests (47%) and forest plantations (33%), and scattered trees in farms meet another 20%.

Table 1: Fuelwood Production from Forest and Non-Forest Land

URBANISATION AND TREES OUTSIDE FORESTS ISSUES

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ABSTRACT

The World Resource Institute (WRI) has estimated that by the year 2025 more than 85% of the population in Europe, North- and South America will be living in urban areas. In Africa, Asia and Central America the urban population will be 52%, 52% and 75% respectively. To address the changing needs arising from a significant increase in the urban population, sustainable management of trees outside forests has to be enacted – either out of self-interest, market considerations or altruistic concerns for future generations. Urban forests are considered important because of their geographic extent, their impact on local economies, and their proximity to people. Urban forestry can be defined as “the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic and aesthetic benefits trees provide. Urban forestry research focuses on the three major issues and benefits from urban forests and trees: environmental services, recreation and quality of life. Thus, increasingly urban forestry will find root in any country where cities and the urban population are growing. As such, urban forestry is a potential for growth, as the increase in urban forestry networks seem to indicate. It has to be seen as a supplement to conventional forestry and as part of a sustainable development in the urban sector

INTRODUCTION

The World Resource Institute (WRI) has estimated that by the year 2025 more than 85% of the population in Europe, North- and South America will be living in urban areas. In Africa, Asia and Central America the urban population will be 52%, 52% and 75% respectively (WRI 2001).

If the world is divided into categories of ‘urban’ / ‘rural’ and ‘developing’ / ‘developed’, then the main increase in population is estimated to be in urban developing, and urban developed areas (WRI 2001). Thus, there is little doubt that urban aspects of trees outside forests will be of major relevance in the years to come.

Existing focus on urban forestry, even in developing countries, has primarily focused on amenities and environmental benefits. In developing countries urban forestry should primarily fulfil basic necessities, which may best be achieved by multiple resource management (Kuchelmeister 2000). Urban forestry is in general a new approach. In the US, research has presumably not been formally carried out for more than 40 years, and in Europe the research experience is even shorter (Konijnendijk et al. 2000).

This paper will focus on urban forestry seen from an urban, developed perspective, and should be regarded as an input to future discussions of urban and peri-urban forestry in developing countries.

URBAN FORESTRY SERVICES TO THE URBAN POPULATION

Three types of urban forest services offer examples of how the higher degree of urbanisation has led to a new focus when prioritising tree goods and services: environmental or protection services, recreation, and

enhancement of the quality of life.

The manifold environmental services trees provide have taken central stage, most recently because of the role trees can play in reducing atmospheric carbon dioxide levels and thus global warming. Decreasing labour hours, ageing of the Western population, changes in lifestyles, and a daily life more remote from nature have all led to a demand for a wide range of ways to spend leisure time. Moreover, the urban population has increased dramatically within the past hundred years and consequently the need for high quality and healthy urban environments to live and work has become more pressing.

The need to cater for the new and multiple demands of an urbanising society calls for an appropriate response of forestry and other natural resource professions. Not only do different demands have to be met; this also has to be done with resources that are increasingly threatened by urban pressures such as air pollution, intensive use, construction and infrastructure development. Dealing with the specific demands and problems related to forests and other tree-based resources in and near urban areas calls for an innovative, specialised approach. Foresters traditionally are no experts in, for example, communication, public participation and conflict management, while working in urban environments requires a wider range of social skills (e.g. Kennedy et al. 1998).

As an answer to the new demands, the multidisciplinary approach of urban forestry has been developed, with its roots in North America (Miller 1997). Urban forestry can be defined as “the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic and aesthetic benefits trees provide” (Helms 1998). In Europe, this definition has been further elaborated into the, so-called, Urban Forestry Matrix (see Figure 1). The matrix is useful to explore what urban forestry actually entails. Thus, urban forestry does not only incorporate the planning and management of urban woodlands, but is an integrated approach towards all urban tree resources,

Approach	Type of sites		
	Street trees	Park trees	Urban woodlands
Form, design, functions and policies			
Selection and establishment			
Management			

incorporating also trees in park settings, including cemeteries, private yard trees and street trees.

Figure 1. The Urban Forestry Matrix

The distinction between the three types of sites included in the urban forestry matrix arises from three

different levels of stress, establishment techniques, average life time and cost in relation to establishment and management (Nilsson et al. 2001). For example, street trees are usually single trees, with a low average lifetime due to a relatively high stress level. Moreover, street trees in general generate high costs for management. Park trees too, are in general individual trees, with a medium or high average lifetime, medium stress level, and medium costs for establishment and management. Trees in urban woodlands are usually established in stands consisting of small trees, with a high average lifetime, low establishment cost, and low management costs.

IDENTIFYING BENEFITS AND COST OF URBAN FORESTS

Urban forests are considered important because of their geographic extent, their impact on local economies, and their proximity to people. Because of their proximity to people, urban forests can provide substantial environmental, recreational as well as economic benefits to urban dwellers. Urban forestry is not a panacea for all the problems cities face, but it can make cities more liveable.

A European research survey indicated an increasing research effort within urban forestry being directed towards assessing and quantifying the multiple benefits urban forests provide to society (Forrest et al. 1999, Konijnendijk et al. 2000). Benefit-cost information seems much needed in policy making. Timber production functions of forests have been relatively easy to quantify in monetary terms. However, quantification of the benefits and costs of other goods and services is inherently more difficult, and the subject of much ongoing research (Mähler and Vincents forthcoming). This research focuses on the three issues mentioned in the previous section: environmental services, recreation and quality of life.

Firstly, *in relation to recreation*, a growing amount of surveys at local and national level has been carried out to assess the popularity of (urban) forests for recreation (e.g. Koch and Jensen 1988; Jensen and Koch 1997). Most popular and preferred are those forests and green areas closest to the home (Jensen 1999; Holm 2000; Hörnsten 2000). Traditionally, the recreational use of forests has been more or less free in most countries. Costs are, however, associated with maintaining recreational facilities although forests are inexpensive in management compared to, for example, parks and gardens (NUFU 1998). Ways are being explored to generate more income from recreation for forest managers. In some cases, local foresters charge small fees for visitor facilities such as guided tours, visitor centres and car parks. The Hoge Veluwe National Park in the Netherlands can only be entered after paying an entrance fee (Konijnendijk 1999). Despite traditional free rights of access, people often show themselves willing to pay small fees for recreational use. A study by Tyrväinen (1999) in two Finnish towns mentioned that about two thirds of the inhabitants were willing to pay a small fee for continued forest use.

Secondly, *in the context of environmental services*, more than 1 billion people worldwide live in urban areas with unhealthy air quality – although urban air quality has improved over the past two decades in most North American cities (McPherson 2000). Rising motor vehicle use, reflecting the increasingly sprawling form of many cities, poses the greatest threats to air quality. In the United Kingdom the government has estimated that more than 24 000 people die prematurely each year as a result of air pollution (NUFU 1998). Urban forests have a positive impact on air quality through deposition of pollutants to the vegetation canopy, sequestration of atmospheric CO₂ in woody biomass, and reduction of summertime air temperatures and associated ozone formation. Extensive studies in American cities have shown the significant filtering effects of trees. For the city of Modesto, California, USA, the estimated air pollution reduction effect of the city's over 91 000 trees had an implied value of almost US\$1.5 million (McPherson et al. 1999).

Trees also have a secondary effect on air pollution, as their evapotranspiration cools the air and thus reduce the production and reactivity of pollutants. The shading and cooling effect of trees can have a dramatic effect on livelihood, and in the developed part of the world reducing cost of e.g. air conditioning, while the presence of trees can also reduce heating cost because of their insulating effect. Energy reductions for individual buildings in the United States ranged between 5 and 15% for heating and between 10 and 50% for cooling (McPherson and Rowntree 1993). McPherson et al.'s (1999) full assessment of all benefits and cost associated with a typical urban forest, indicate that benefits from energy savings, pollution reduction, stormwater runoff reduction, and aesthetic and other benefits in fact exceed management costs by a factor two.

Thirdly, *concerning the quality of life*, various studies have shown that the nearby presence of forests, parks and other green spaces have a positive effect on house prices, raising prices of at least several percent (e.g. NUFU 1998; Bolitzer and Netusil 2000). Tyrväinen (1999) used hedonic pricing methods to quantify the effect of nearby urban forest on house prices in two Finnish towns. Having a forest or other green area within 1 km of the dwelling had a positive price effect of 5.9%. In the town of Salo, people were willing to pay almost 5% extra if they could obtain a forest view from their house.

So-called green environments also attract businesses. An informal survey among businesses that settled in Telford New Town, United Kingdom after town establishment showed that a majority of the businesses mentioned "green environment" as a primary reason for opting for Telford (Simson, personal communication).

The effect of green areas on the health of urban dwellers is quite significant. Although trees might have some negative health effects – such as causing allergies – they generally enhance physical and mental health. A much-cited study by Ulrich (1984) showed that hospitalised patients recover faster from surgery when they have a window view of a green area. The establishment of health walks in e.g. the United Kingdom acknowledges the positive effect of regular exercise in pleasant green settings. Other health effects include protection against solar radiation.

In developing countries, the effects on house prices may not be the most relevant estimate to conduct. Effects of shade, woodfuel, water protection, storm water runoff etc. may have a much greater potential. However, these issues still need to be dealt with in detail. Consequences of the trees in relation to each of these factors and the related values for the urban economy as well as the urban population need to be estimated.

The financial impact of urban forests' positive effect on mental and physical health has to our knowledge not been quantified yet. It could be significant in terms of avoided treatment and medication. The Danish Forest and Landscape Research Institute has initiated new studies in this field, and results are expected within the next two to three years.

INFORMATION AND EXISTING URBAN FORESTRY NETWORKS

Today, various networks of urban forestry experts exist, including the International Society of Arboriculture (ISA), the working group on urban forestry of the International Union of Forest Research Organizations (IUFRO), and COST Action E12 "Urban Forests and Trees". The latter, an EU-funded network of European urban forestry experts from 22 countries has placed urban forestry on the European research agenda (see www.fsl.dk/cost_e12/). As a spin-off of the network the European Urban Forestry Research and Information Centre (EUFORIC) was established as a thematic centre of the European Forest Institute (EFI) in January

2001. EUFORIC is hosted by *Skov & Landskab*, the Danish Centre for Forest, Landscape and Planning (see www.fsl.dk/euforic/).

CONCLUSION

To address the changing needs arising from a significant increase in the urban population, sustainable management of trees outside forests has to be enacted – either out of self-interest, market considerations or altruistic concerns for future generations.

Urban forestry seems to be a good, effective tool for cities in developing countries to deliver benefits as discussed above. Integrated planning and management of all tree and forest resources in cities is needed to be successful in a low-cost and sustainable way. Also, involvement of local communities seems very important.

In developing countries urban forestry, which to a large extent tries to address the changed values, is on the rise, but to a large extent is still based on values from the developed part of the world. However, increasingly urban forestry will find root in any country where cities and the urban population are growing. As such, urban forestry is a potential for growth, as the increase in urban forestry networks seem to indicate. It has to be seen as a supplement to conventional forestry and as part of a sustainable development in the urban sector.

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TREES OUTSIDE FORESTS: DEFINITION AND TAKING ACCOUNT

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THE ASSESSMENT OF FORESTRY RESOURCES

In order to assess the state of the world's forests every 10 years, the FAO uses precise definitions that are accepted and recognized throughout the world. Diverse inventories and statistics are established on the basis of these definitions. This universal base should make it possible to draw reliable comparisons between statistics in terms of time and space. Therefore, FAO proposes standard definitions for numerous terms, such as "soil degradation", "deforestation", "agricultural land", "wooded land", and "forests".

According to the FAO definition, a "forest" is a population of bushes, shrubby trees, and trees of over 5 m in height which covers (projection from the crown) more than 10% of a minimum surface area of 0.5 ha (FRA, 1998).

WHAT ABOUT WOODY RESOURCES OUTSIDE FORESTS?

For several decades, foresters, environmentalists, and land planners have been aware that woody resources (over and above wood from trees) are not always extracted from forests. Hence, the development of the expression "trees outside the forest" or "non-forest trees" which conjures up a multitude of images. The fact that the expression can be interpreted in many different ways means that a precise definition is called for so that this "new" resource can be evaluated and included in "forestry" or "agricultural" statistics.

The first definition of trees outside the forest was proposed at the meeting in Kotka, Finland (Nyssonen and Ahti, 1996).

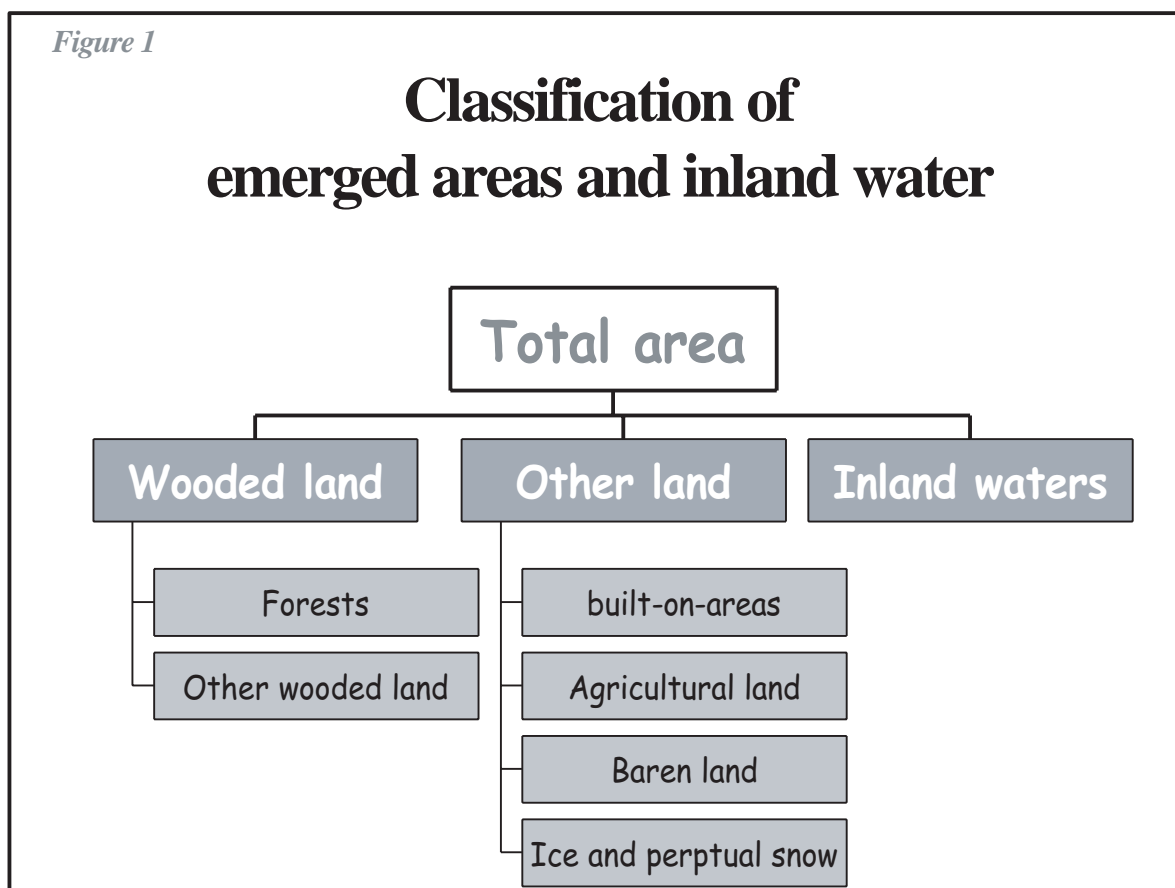
FAO organized two initiatives in order to draw this underestimated resource to the attention of decision-makers and planners throughout the world:

- A workshop from 21-23 September 1998 in Orléans (France) organized by IRD (Institut de recherche pour le développement, a French research and development institute) which brought together 40 specialists from different countries and institutions (Alexandre D.Y. *et al.* 1999);
- A report of the existing knowledge on trees outside the forest which was compiled by CIRAD-forêt: "*Les arbres hors forêt : pour une meilleure prise en compte.* (Trees outside the forest : Raising awareness)". This report was co-published by FAO and CIRAD in November 2001 and made it possible to improve the definition of the term "trees outside the forest" (Bellefontaine *et al.*, 2001).

How can "trees outside the forest" be defined?

Here are several definitions which will help provide a framework for the concept of "trees outside the forest".

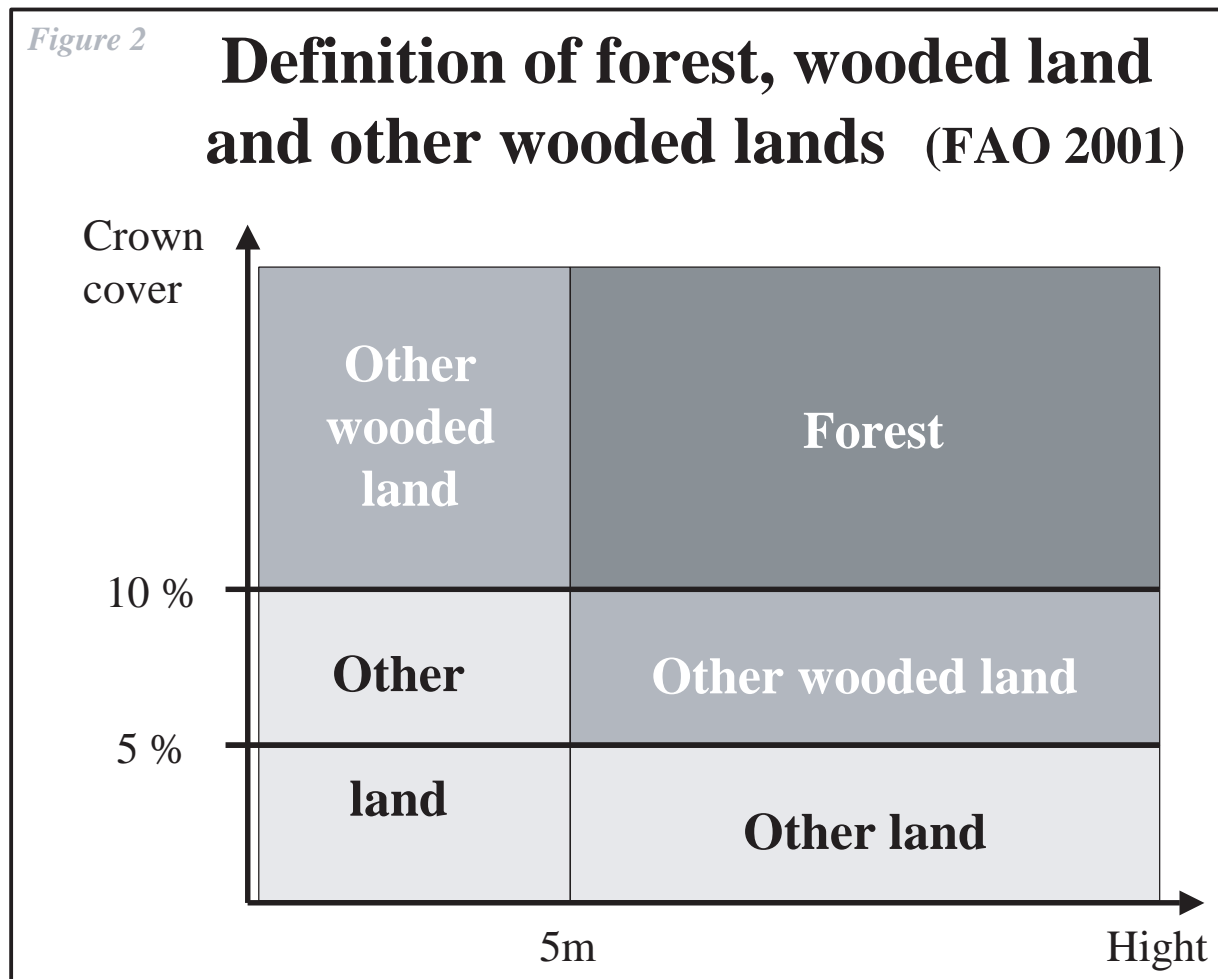
The term "emerged land" includes "wooded land", "other land", and "inland waters" (Figure 1).



"Wooded land" can be divided into "forest land" (synonymous with "forests") and "other wooded land" (Figure 2). The term "other wooded land" relates to land of more than 0.5 ha where shrubs of up to 5 m high cover more than 10% of the surface area or where shrubby trees and trees of more than 5 m high cover 5-10% of the surface area.

The term forest does not include land which is used primarily for agricultural purposes.

As a result, "trees outside the forest" fall into the category for "other land", which refers to land that is neither "forest" nor "other wooded land". In other words, they are on land where the woody crown cover is below 10% and less than 5 m high or below 5% and more than 5 m high. "Other land" also applies to all land of less than 0.5 ha where there is more than 10% woody cover, which includes linear formations such as shelter belts and riparian forests. Trees outside the forest can also be found on land that is used primarily for agriculture which is, by definition, excluded from "forests" but not necessarily from "other wooded land".



IMPROVING THE DEFINITION

The advantage of this definition is that it explains what is meant by trees outside the forest. It seems to be satisfactory when applied to natural environments where there has been little human interference. In the case of deforestation, it also includes the scattered trees left and the small groves that remain or are planted after agricultural clearing. However, it does not always correspond to our idea of trees outside the forest, particularly those found in very manmade countryside.

Thus, how should the wooded formations in the following examples be classified?

Oases and their date palms; woody species on fallow farm land which is sometimes agricultural sometimes forest; the grazing-orchards of France which primarily produce grass for livestock and not fruit or timber; linear wooded structures (windbreaks, straight plantations along water courses or roads, etc.); agroforestry parks and systems where shade trees and food crops or industrial produce (coffee, cocoa, tea, etc.) are intercropped, etc. According to the FAO definition, all these formations could be considered as forest formations. But are they really? Are they not rather trees outside the forest because of their uses?

The same question applies to agro-forests in Asia whose name would suggest that they be classified as "forests" although they produce agricultural products (which are also included in national agricultural production statistics). However, because of the very manmade nature of these "forest gardens" and the fact that they produce other products besides wood, many people do not consider them to be forests any more than fruit orchards.

In contrast, the silvo-pastoral systems in Latin America (pasture and ranching, "*espinal*" in Chile, Mexican "*matorral*", the Argentinian plains, etc.), or Europe (the more or less dense stands of oak in the Spanish "*dehesa*" and the Portuguese "*montado*", etc.) could be classified as forest because grazing in forests is a traditional practice found all over the world.

Lastly, some sparsely wooded "forests" that are relatively untouched by Man in high mountain areas or arid zones or even some sparse formations of "miombo" in East Africa are naturally classified as "forests" or as "other forest land" if they are too sparse.

These questions show that the current definition of trees outside the forest, although very clear, is not entirely satisfactory. We do not consider that trees outside the forest can be adequately defined using criteria for the amount of crown cover, tree height, and plot size.

This explains why the definition of trees outside the forest presented in the FAO-CIRAD document includes the following categories of trees found in open environments:

- Scattered trees in permanent meadows or grassland.
- Permanent tree crops, orchards, and grazing-orchards, such as industrial fruit trees, coconuts, date palms.
- Trees in wooded agroforestry systems, such as coffee, cocoa, trees in home gardens.
- Trees in urban environments and around infrastructures, such as parks and gardens, around buildings, along streets, roads, water courses, and canals.

Despite these additional details, some questions still remain. For example, the definition of "forests" includes shelterbelts and windbreaks that *are more than 20 m wide and more than 0.5 ha in size*. In the definition of "trees outside the forest", only shelterbelts of *less than 0.5 ha and less than 20 m wide* are included. If this is to be coherent with the given definition of forests, it would be better to say *less than 0.5 ha or less than 20 m wide*.

The definition of trees outside the forest still needs to be more specific. The seminar which is currently underway (26-28 November 2001) and the Comité des Forêts (COFO, a forestry committee), which meets every 2 years, could provide FAO with the opportunity to address the issue of trees outside the forest. It is these assemblies that ultimately decide whether or not to modify the current definition of "trees outside the forest".

Nevertheless, we would like to suggest that an additional criterion—which already appears in the definition of forests—be considered, namely the principal land use. The definition of "forests" *excludes land which is used primarily for agricultural purposes*. Yet, this definition does not specify the point at which land is considered to be used for agricultural or pastoral purposes. If agricultural production is extensive and temporary, for example shifting cultivation using slash and burn, should the land be considered agricultural?

We do not think so. Instead, we consider that if land is to be classified as agricultural, then the agriculture should be intensive and sedentarized to a certain extent. In these circumstances, if the trees are an integral part of the cropping system, we think that they should be considered as trees outside the forest. Even woody species grown on short-term fallow (5-7 years) should be included in this category if they are part of an intensive agricultural system where the length of cropping is longer than the fallow period. The same applies to trees in pasture if the pasture is used extensively and managed using fire. In other words, these trees should be included in the forestry category or as trees outside the forest depending on whether they cover more or less than 10% of the land.

The definition of trees outside the forest should, therefore, take into account the vegetation's evolution which is linked to how manmade and domesticated the environment is. Land clearance drastically reduces woody cover. After this phase of depletion, we have observed that people generally reconstitute the forest cover, at least in part. This new cover is often very structured spatially. The forest, as such, often appears to be like a long-term fallow, like real forestry plantations or preserved natural forest areas. Beyond this, the trees are in the middle of cropping or grazing land, in other words on manmade land where they have many and varied functions. Therefore, these trees have been tamed, indeed domesticated. Trees which are on intensive agricultural or grazing land are not usually included in forestry statistics. The same applies to trees in urban areas. Even when their cover exceeds 10%, they are still considered to be trees outside the forest.

The difficulty of finding a simple definition for a tree outside the forest stems from the importance that it represents for different human societies and the economic role that it fulfils. Therefore, the tree outside the forest can no longer be ignored by politicians and decision-makers. We make several recommendations below—which are not exhaustive—so that these trees can be taken into account on every level, particularly at the decision-making level.

RECOMMENDATIONS

Defining, accounting for and diversity

The national and world assessments of woody resources are incomplete because, in general, they only include areas qualified as forest and exclude "trees outside the forest" found in rural and urban areas. The current term "trees outside the forest" does not give a sufficiently clear illustration of the diversity of this resource which straddles different sectors, fields, and disciplines. Thus, the concept will inevitably develop as the resource is taken into account by land planning. The proposals to improve the definition, include local specificities, and facilitate comparisons between countries or ecosystems have been presented here.

For planning, we recommend that trees outside the forest are included systematically in the assessments of woody resources. A discussion is required on a national and global level so that trees outside the forest can be included in an unequivocal classification of land that is both pluridisciplinary and multi-sectorial. In this context, the definition of "forests" will undoubtedly have to be revised. It is important to ensure that the definition for trees outside the forest is the result of a broad discussion between stakeholders and users.

NATIONAL POLICY, INTERNATIONAL DISCUSSION AND AGREEMENT

In many countries, people use trees outside the forest spontaneously even though there are no national policies to encourage them to do so. The role of these trees is not officially recognized despite the fact that they have important functions. In addition, international conventions make no mention of this category although they do refer to other ecosystems.

On a national level, a clear coherent policy that acts as an incentive in terms of trees outside the forest is advisable to ensure that land planning is truly integrated. On an international level, trees outside the forest should be included among donors' major environmental concerns, conventions, and policies.

SOCIAL, ECONOMIC, AND ENVIRONMENTAL CONTRIBUTION

Trees outside the forest are characterized by their relationships with Man and society. They often provide a vital contribution to the needs and incomes of rural and urban households. The sustainability of these tree systems is ensured through diverse management practices. However, there are gaps in our knowledge on the dynamics of this resource, particularly in terms of the relationships between "trees outside the forest, Man and society, agriculture, and the environment". The economic, social, and environmental contribution made by these wooded systems is not fully recognized. Disperse, fragmentary and empirical information is already available for numerous countries. A report appraising the real contribution of trees outside the forest in terms of the global supply of services and products is often inadequate.

Programmes for food security and the well-being of people can no longer ignore the resource represented by trees outside the forest. National policies should continue to manage these trees in a flexible way. Integrated regional and land planning practices should be varied and adapted to the different local conditions and should evolve in line with social and cultural changes. New economic tools should be tested. A summary and an analysis of existing knowledge are vital for outlining a policy to encourage "trees outside the forest".

IMPROVED KNOWLEDGE, EXTENSION, AND TRAINING

We do not know enough about the role and function of trees outside the forest to be able to improve their management. This explains why existing training courses are still very specific and disciplinary (for example, preliminary pruning of fruit trees). Similarly, extension programmes only address certain—often very sectorial and thematic—issues and fall short of users' expectations.

We need to further our understanding of how trees outside the forest function within production systems. In order to do this, support is needed so that research programmes can be developed to meet national needs. Training and extension programmes should be developed by using a more systematic approach that takes into account people's needs and concerns.

EVALUATING THE RESOURCE

The available qualitative and quantitative data on trees outside the forest is very fragmentary and often only represents the situation on a local (rarely regional) level. Until now, most assessments have been carried out

on manmade and agroforestry areas. The evaluation of the extremely diverse products is not very reliable. Therefore, comparing inventories is not easy.

The methods used to conduct the inventory of forests do not seem adapted to scattered resources of this kind. The evaluation of trees outside the forest is complex because it requires a great deal of information.

It is important to define the objectives of the evaluation clearly. These should address the needs and interests of the stakeholders concerned and should be taken into account when the results are applied. New inventory methods, particularly inventory plans, should be tested on different types of trees outside the forest and on significant areas before being applied on a larger scale. This type of evaluation should also include socio-cultural and economic aspects which are essential for maintaining the resource and ensuring that it is well managed.

CONCLUSION

On a global level, trees outside the forest represent a significant source of wood production and other non-woody tree products. Neither the resource nor its productivity have been quantified. This is partly because there is not a sufficiently precise definition of what should be surveyed and, partly, because of the difficulty of conducting an inventory of such a diverse and scattered resource.

The existence of this resource, which has long been ignored, has disproved many alarmist theories about accelerated desertification and the systematic disappearance of fuelwood. It is important to recognize and raise awareness of this resource. It is also essential that policies take it into account so that environmental management can be improved for people's benefit.

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INFORMATION ON TREES OUTSIDE FORESTS: WHAT DO WE KNOW AND WHY ARE WE POSSIBLY INTERESTED?

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ABSTRACT

Trees outside the forest (TOF) constitute a resource that has received little systematic and synoptic attention, and it is only in the last about five years that managers and researchers in the field of natural resources are “discovering” it as a general concept; though the topic has been treated in different “sectors” for quite a while, like in agroforestry and urban forestry. Most experts agree that this resource yet plays an important role with respect to a wide range of ecological and economic functions, and that it will be gaining importance in the future. However, it appears that this is largely an expert guess and not much hard data and information is there. While forest inventories, also in the tropics, have a long history, and provide data on a regular basis, the tree resource outside forests appears to be largely ignored.

In this paper, we present and discuss this situation, and try to analyze the “why”. Geo-graphical focus is Latin America, particularly Central America. This leads us to dealing with what we consider the major problems in discussions on TOF information, including questions that are seemingly basic such as terminology (definition, classification, conceptualization) or functions (economic, ecological, socio-cultural relevance), and others like the missing technical visions and management options for a large area development of that resource, and the missing legal framework in most countries. As an example, some aspects of the TOF situation in Costa Rica are described.

TOF INFORMATION: THE CONTEXT

In the past decades, the renewable natural resources and their sustainable long-term management have received much attention. International conventions set the political framework for concerted actions to combat negative effects of ignorance towards natural resources, of its exploitation and mismanagement. Trees have always received particular attention in those conventions; however, most of the discussions are focused on trees in the context of forest, though it is obvious that the resource tree outside the forests (TOF) does also play a relevant role in many regions.

While there are areas that are completely tree-free, landowners tend to leave, for specific purposes or not deliberately, a certain number of trees on their land. These trees do have similar functions like trees in forest in principle, though different in extent. This comparison refers to environmental services such as carbon sequestration, erosion control, soil and water quality improvement, conservation of biodiversity etc., but also with respect to timber and non-wood-forest products. In fact, for many regions, a significant share of the future fiber supply is expected to come from non-forest trees (e.g. the study on the macro trends in fiber supply by Bull (1999)).

TOF are supposed to constitute a considerable resource, equally from an ecological, and from an economic and socio-economic point of view. It is therefore natural, that planners and managers of renewable natural resources get increasingly interested in and concerned about that resource. Figure 1 illustrates TOF with four examples.

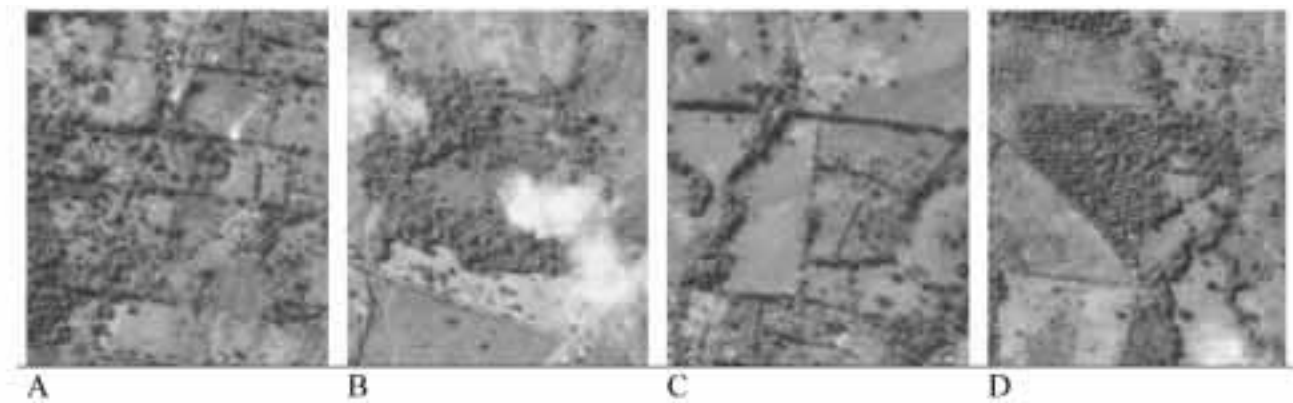


Figure 1. Four examples illustrating the tree resource outside the forest in Central America. The images are taken from air photos of scale about 1:20,000. (A) Transition from forest (left) to non-forest, intermingled with tree lines and isolated trees. (B) Examples of relatively clear (lower end border) and difficult to draw forest border (upper right border). (C) Tree lines delimiting properties or fields, and narrow, strip shaped gallery trees (left side). (D) Timber tree plantation (forest) or fruit tree orchard (non-forest)?

Most experts agree that TOF already play an important role with respect to a wide range of ecological and economical functions as described above, and that it will be gaining importance in the future. However, it appears that this is largely an expert guess. While forest inventories, also in the tropics, have a long history, and provide data on a regular basis, the tree resource outside forests appears to be mostly ignored.

Obviously, when attempting to plan and manage a resource sustainably those responsible need *information*. At the best, that information would be based on high quality, verifiable hard data. In this paper we deal with the situation of TOF information in a more general sense, analyzing the information situation, identifying and discussing some key issues, and finally making some conclusions. Given the complexity and the inherent variability of the issue, it is necessary to point out that the authors' geographical background is predominantly in Latin America (it is acknowledged that the situation varies greatly with geographical regions!), and that the authors' subject matter background is in forestry. This paper is intended to be a blend of a scientific and a discussion paper.

TOF INFORMATION: THE SITUATION

Where does up-to-date information on renewable natural resources come from? Obviously, there are several different options, including

- direct assessments (inventories using recent remotely sensed imagery and/or direct measurements in the field),
- model based propagation and extrapolation of earlier assessments,
- use of indirect information (trade and market statistics, for example),
- model based combination of geographically not complete coverage,
- expert guesses.

According to our experiences, currently none of these five options is efficiently in place in any Latin

American country that would allow producing reliable estimates of the status and composition of the resource. This perception comes mainly from comparative TOF studies carried out for FAO (Kleinn et al. 1999) and FAO/EC (Kleinn and Morales 2001). In fact, this general conclusion does not make wonder, as neither the information about the forest resource itself is satisfactory in many countries, even though forests have a much more central recognition in the international discussions.

When talking about TOF, one must make a clear distinction between *local information* (farm level, for example) and *information for larger areas* (bigger provinces, countries or regions). Local data are usually from research or technical cooperation activities and have the objective to directly improve rural livelihood by increasing efficiency, for example, of the various agroforestry production systems. Also, studies in urban forestry appear to be concentrated on few urban centers – at least this is what we know from some Latin American countries. There are actually innumerable studies on trees on farms, associated with pasture, coffee, cocoa, or annual crops. Many of those studies, but not all, provide quantitative information on the tree resource. But these studies usually take place in subjectively selected or politically prioritized areas or farms, and combining them (if that would technically be feasible) would not allow a direct extrapolation to a larger area along option (4) as mentioned above.

If it comes to *larger areas*, the situation is different: no country in Latin America could be identified where there were reported activities that TOF was systematically part of a forest inventory or of an agricultural survey. Large area information on natural resources is in general relevant for formulation corresponding politics, and the definition of a legal framework. In this paper we concentrate on large area information, which is deemed to be a key element in promoting and fostering the TOF issue in many contexts.

Examples of direct large area assessments of TOF are not many - though forest inventory experts keep on discussing about multiple resources inventories and the integration of more than only the classical forest information into the forest inventories for quite a while (Cunia 1978, Lund 1998). However, some studies are there, particularly from the past decade, and the number of activities is increasing; some of them are listed in the following. (As is the case with forest inventories one may assume that many studies and surveys are not properly published and therefore hardly accessible).

In the FRA2000 report, some example studies are listed as result of the corresponding Special Studies: some provinces in India tally TOF, and other data and examples come from Marocco, Bangladesh, Sudan. Currently, an inventory focused on TOF is also ongoing in Ghana (Affum-Baffoe 2001). In the Northern Zone of Costa Rica the assessment of trees on pastureland was integrated into a forest inventory carried out in 1992/93 (COSEFORMA 1995). For reasons of practicability and cost, however, only those pastures were included where tree density exceeded 6 trees per ha. In 2001, in Costa Rica a pilot inventory was carried out in the framework of the GFS initiative (Global Forest Survey) of FAO FRA. There, an integrated inventory approach was chosen, including not only forest into the remote sensing and field work, but all other land, thus allowing to produce estimations of the principal mensurational characteristics not only of trees in forest, but also for TOF.

To also mention non-tropical examples, the British National Inventory of Woodlands and Trees, includes some types of TOF. Actually the mandate of the Forestry commission since 1919 (!) is to determine the “extent and condition of woodlands and trees in Great Britain” (Forestry Commission 2001). Also, the Dutch national forest inventory includes alley trees that make up a considerable share of the tree resource there. In France, some classes of TOF (hedgerows, line plantations, and isolated trees) are considered in the National Forest Inventory of 1996 there.

Apart from national activities, several international initiatives have started focusing on TOF and always making strong reference to the situation of TOF information. A first conference dedicated to TOF (there denominated Off-Forest Trees) was held in Arusha Tanzania in 1999 where also assessment issues were discussed (Temu et al. 2000). TOF do appear in the list of Special Studies that the Forest Resources Assessment Programme of FAO (FRA) launched for inclusion into the 2000 assessment. In 1997, the forest assessment session at the World Forestry Congress in Antalya, Turkey, carried the title „Assessment and Monitoring of Forest and *Tree* Resources” (italics put by the authors), but still concentrating much on trees in forests. The EC funded a research project to analyze options of inventorying the tree resource outside forests (TROF Project in the framework of the INCO-DC programme of the European Commission). A joint FAO/EC project in Latin America “Information and Analysis for a Sustainable Forest Management” does include TOF as an integral component, which was then discussed on a workshop in Caracas in August 2001. And, we are sure that there are many more activities in that field in the last years.

AN EXAMPLE: COSTA RICA

Costa Rica is a small country in Central America (about 51000km²) with a very high diversity of species, and a proactive society and government in what refers to the implementation of ideas for an efficient conservation and management of the renewable natural resources. It is also a country in which the level of information on the forest resource is very good. Many forest mapping studies have been undertaken in the past years. Some published figures of forest cover are depicted in Figure 2, displaying a wide range of variation. This uncertainty affects directly the estimation of the area of TOF-land, which is one of the basic information required in TOF assessments.

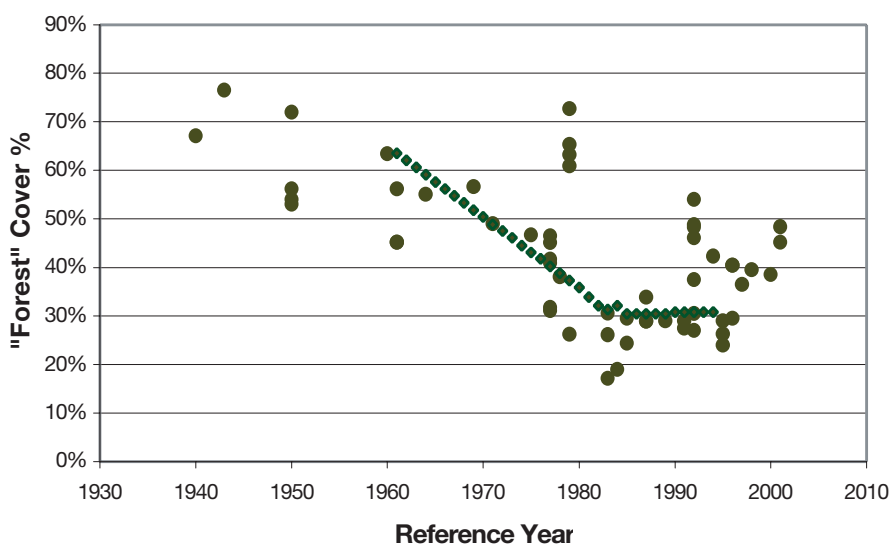


Figure 2: Published forest area *figures* (dots) for Costa Rica (modified from Kleinn et al., 2002). The dotted line represents figures taken from FAOSTAT database (up to 1994).

The resource TOF is now clearly recognized by the Government of Costa Rica as a key element in forestry and landscape development. In the new Forest Development Plan, trees on pastures (which constitute just one class of TOF) are explicitly mentioned as an important, though largely ignored resource. The corresponding chapter is titled “The sad history of pasture trees in Costa Rica”. In fact, harvesting of non-

forest trees is yet contemplated in the Costa Rican forest act, and formal permits have to be applied for. Yet contrary to forest management plans, the forest act does not stipulate a management plan for trees outside forest, it is a simple *felling* permit. It is suspected that a considerable portion of the timber harvest (the legal and illegal ones) comes from non-forest trees, and that the gap in the legislation with respect to TOF management leads to a certain level of misuse of the felling permits for trees on pastures.

Costa Rica has a good reputation for the proactive and constructive environmental policy implemented. To the knowledge of the authors it is the first country introducing a system of “Payment for Environmental Services” which entitles forest owners to receive a per-ha payment when and if they conserve the forest. TOF are not included in this system, though one could certainly find good arguments for similar payment schemes for the tree component outside forest - where forest in Costa Rica has a legally defined minimum area of 2ha, so that many “small” tree clusters under 2ha are actually considered non-forest and are outside the relatively strict regulations for forest management.

In a pilot survey for the GFS (Global Forest Survey) Initiative of FAO FRA, implemented by CATIE and SINAC, the Costa Rican National Park Administration, the classical idea of forest inventories was expanded to include trees on all types of land use, meaning that field plots were not only established in forest, but also outside forest. In addition, farmers were interviewed and asked about their ideas, plans, and expectations towards the tree resource. Some experiences are given here, the results are being published separately :

- There are very many situations in which a clear distinction between forest and non-forest can hardly be made, including cases like cacao plantations, coffee plantations with shade trees, recent secondary forest on abandoned pastures, or pastures with a relatively high tree density.
- Lacking biomass models at the moment, commercial volume (according to dimension: diameter greater 30cm) was estimated by the commonly used volume function. About 8% of the total commercial tree volume in Costa Rica is found outside forests. At a first glance, this figure appears small. Yet for a proper interpretation, one must take into account, that about 40% of the forest area was estimated to be in National Parks (not yet including other protected areas like those close to waters and on steep slopes). In forest, about 15% of the individual trees could not be identified in the course of the default fieldwork, on TOF land it was only about 5%. This may represent about an estimation of the share of non-commercial species, which is obviously greater for TOF than in forest.

These first estimations for the whole of Costa Rica indicate that the tree resource outside forests is considerable in quantitative terms, though many experts informally interviewed estimated it much higher.

A simple quantitative comparison to forest is misleading in several aspects: gallery strips along creeks, for example, in an otherwise tree-less landscape have a very small area, but an invaluable function as habitat, and as bio-corridor. The same holds for small groups of trees, and scattered isolated trees. From a production point of view, trees on cultivated land are an additional source of income for the farmers. Trees on pastures, for example, have much lower felling cost, road infrastructure for transport is usually much more favorable than in forest.

Fiirst TOF lesson learned from the GFS pilot study in Costa Rica when comparing the tree resource in and outside forest. The entire system should be taken into account and see “forest” and “TOF land” as systems with very distinct characteristics, though the basic resource, the trees, is the same.

An interesting result of the interviews with the farmers was, that one of their wishes was, that they would like had more trees, where the majority wanted to have more trees on pasture land. Probably, because they

are easier to access for later harvesting, and because the cutting permits are easier obtained than for trees in forest.

In another project in Costa Rica, options of TROF assessment (Tree Resources Outside the Forest) were explored (TROF Project), in a limited study area in North Western Costa Rica (Province of Guanacaste) where TOF land is dominated by pastures. If we look at the diameter distribution of trees on pastures (Figure 1) we see that it is actually the expected typical inversely J-shaped curve, but the small diameter classes are missing, the regeneration. For this system to be sustainable, the survival rate of small trees must be much higher than in forest. Otherwise the trees on pastures are “living deads”. Not much is known, however, about the development of the diameter distributions on pastures. In fact, one must wonder how long the timber harvest of remnant trees on pastures can go on: it is likely that soon the vast majority is cut.

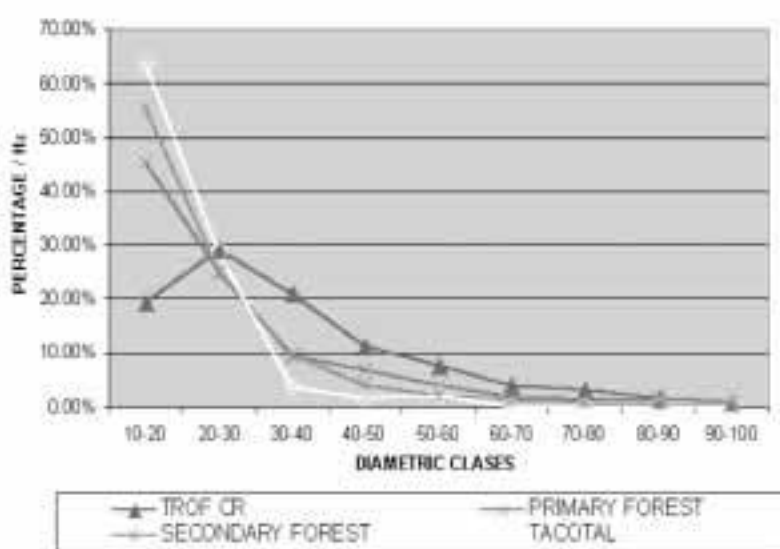


Figure 3: Diameter distribution of TOF in comparison with three different forest types (TROF Project 2000). OBS: *relative* frequencies are depicted. Absolute number of trees per class on TROF land is, of course, much lower than in forest.

TOF INFORMATION: MAJOR ISSUES

In this chapter we discuss what we identify as the major issues in discussions about TOF and TOF information, where one necessarily must include more than technical aspects only.

Terminology

Trees outside forests (TOF), sometimes also labeled tree resource outside forests (TROF), or Off-Forest Trees, is an interesting category: it is a *non-category* in that it refers to what is not forest, and - contrary to the usual definitions of forest – it refers to *the trees* and not to the *land*, (which is then to be labeled TOF-land). However, it would also be sensible to make a subdivision of non-forest land in two further categories, one in which trees can be found (“generic” TOF-land), and others like water, barren land, and land above the tree line where natural conditions are such that trees can not grow. From an operational point of view of

TOF management and development, this general breakdown in three classes (forest, TOF-land, others) appears more useful than only the distinction forest/non-forest.

In the actual TOF discussion, still much confusion is present; some see tree plantations as non-forest (actually it is non-natural-forest), some put it equal with trees agroforestry systems (certainly an important, but not the only class), some with other sub-classes of TOF.

Per definition, TOF is found outside forest. That means that all the long and still ongoing, and important discussion about *forest definitions* does directly relate to the definition of what TOF land is, and of what is to be regarded TOF. We do not go into detail, but relevant aspects include the question of *crown cover*, the one of *predominant land use*, and the clear definition of the *border of forest* – where the latter one is in many tropical regions an extremely difficult one.

Within TOF land, the classification question is relevant; the resource TOF is as diverse as the land uses outside forest are. We will not present a proposal of a “best” classification, because we believe that there is no one single best classification. The classification to be used in a concrete activity is a direct function of the particular objectives. Ecologists will be interested in other features than foresters or regional planners. We will therefore rather list some classification criteria: A useful and immediately understandable criterion is the *land use* where TOF are found (such as permanent crops, annual crops, range land, urban areas, peri-urban areas). However, many trees in lines are separating two different types of land use – and it is difficult to assign those trees to one. *Geometric arrangement* is another criterion (such as scattered trees, trees in lines, clusters of trees), or *origin* (natural, man-made), or *principal function* (like windbreak, water protection, shadow, timber, fruit production), or simply the *tree density*.

For large area or global assessments a baseline classification must be devised in some few and clearly to define categories under which, along with national priorities, more detailed local classifications can be accommodated.

Planning and management

TOF, though having trees as its constituting elements, are usually not included in forest inventories, as they are non-forest (there are some exceptions to that). Also, in usual agricultural surveys, they are not included, as they are not an agricultural crop. That means that one can, in general, not expect that there is not a sound base of data for planning and management. The fact that TOF do not explicitly belong to one specific sector may be one of the reasons of having been disregarded for a relatively long time. It is one of the major challenges to define and assign the responsibilities for this resource and its management - and also its information procurement.

Land tenure is another planning and information relevant issue. While forests in many countries are largely in public or community ownership or, if private, the properties are fairly big, most of the TOF-land, which is under human management, is in private hand, frequently of smallholders and those without legal land title. This is not only a difficulty for field work in TOF-inventories, where one has to obtain the consent of many land owners to carry out the field measurements; it is a major obstacle for the implementation of sustainable management ideas: if there are just two big trees on a smallholders property of 1ha, a sustainable management is hardly imaginable within this particular farm. Much bigger units would have to be conformed to reach a “critical mass” of trees that can be managed sustainably.

Legal framework

While for forest management there are decades of research, development and experiences, and in many countries forest acts are in place that define rigorous forest planning and forest management procedures, this is not the case for TOF. There is not yet a complete general legal framework in place in any country (to the knowledge of the authors) that would foster a systematic and sustainable development of the tree resource outside forest. As mentioned, in Costa Rica, for example, felling permits have to be applied for for forest trees and for non-forest trees. However, while for forest trees a detailed management plan must be prepared by a forest planning expert, for TOF the felling permit is the end of the story and no more planning is required.

This is probably a key issue: to grade up the recognition of the tree resource outside the forest, to foster its sustainable management, to entitle TOF for incentives usually reserved for pure plantations, and to offer at the same time technical assistance to farmers who need assistance for the implementation of tree “production” in their production systems.

As long as TOF are not integrated in the legal framework of the management of renewable natural resources, we do not see a serious chance for the implementation of its sustainable development. It would probably also help if the TOF would receive more attention, recognition and explicit mentioning in the great international conventions.

Inventory implementation

Recognizing the generally non-satisfactory situation of TOF information, it is sensible to think about TOF inventory options and their implementation options. Much can be learned from forest inventories, where there is a much experience and well-established inventory schemes and designs for practically all situations. Still, while the experiences are useful, forest inventory ideas can usually not directly be transferred to TOF inventories, some adaptations are required, on the technical and on the organizational level. TOF is a resource with much less value per ha (compared to forest), and a much bigger reference area (assuming that in most regions forest cover is clearly less than 50%), growing much more on private grounds usually used and cultivated otherwise. Obtaining permit for access and organizing field work is therefore frequently more complicated – though at a first glance the contrary appears true.

Remote sensing is an indispensable tool, where the spatial resolution is decisive. While a forest/non-forest decision can be made in many regions with reasonable accuracy, for example, with Landsat type imagery, not much more TOF information can be retrieved there; possibly a rough (and little reliable) classification into classes of different TOF density. Aerial photographs, or higher resolution satellite imagery (like IKONOS), allow single tree identification and a direct estimation of crown cover, and of different geometric TOF arrangements (tree lines, tree groups, dispersed trees, gallery trees, etc.). These images are also an extremely valuable tool for fieldwork preparation, where field work is indispensable when interest is in mensurational attributes like species, diameter, volume, etc. of trees.

From a technical and budget point of view, it is likely a good option to combine a TOF inventory with other surveys of natural resources, be it forest inventories or agricultural censuses. However, from an organizational point of view, many difficulties would have to be overcome.

CONCLUSIONS

Not much systematic and synoptic information on TOF is available today, particularly not for large areas: either TOF is simply unimportant, or it has been disregarded for other reasons, maybe because it is unpleasantly complex to deal with.

TOF comprise a great variety of categories, which differ considerably. While we see it as an excellent approach to deal with TOF as a generalized concept, one must also be aware of the heterogeneity of TOF and not try to oversimplify. As foresters would never use the same management ideas for a primary forest and for a plantation forest, we must also differentiate for TOF. Trees on pasture and their management will be very different from trees associated with annual crops, or from tree stripes along creeks (gallery trees); and fruit orchards are again a completely different issue. Therefore, it is good that agroforestry, urban forestry, horticulture, etc. are developing specific techniques, each one for the very particular situations they deal with; yet, the TOF discussion should then contribute to build a common roof under which the conceptual development of a general management vision is pushed.

In fact, having thought and discussed quite a bit about TOF in general, we wonder some times where the conceptual effects of several decades of intensive agroforestry research, of intensive extension activities and many technical cooperation projects have lead to in terms of large area concepts and visions. We do not see too many examples of countries where augmenting the tree density in agricultural fields receives incentives comparable to those for the establishment of a tree plantation, for example.

Those who care about the sustainable management of renewable resources in an ecological and economic sense, notably of the tree resource, should be happy to see TOF shifting into the zone of more general interest. To our impression, it is still mainly the foresters who take the initiative, and many foresters still have their problem to include non-forest in their world of thinking. Foresters must obviously re-shape and generalize their attitude towards the resource, thinking more in terms of *trees* rather than of *forest* – which is not a contradiction, anyway. In the same line, large area forest inventories should develop towards tree inventories, not any more restricting the geographical unit of action of the inventories to *forest* but to all the landscape. These activities would immediately also produce data that are of interest for other sectors; and probably, those should be included into the survey from the outset.

Inter-sectoral collaboration, is indispensable when dealing with TOF; and maybe the position of TOF in between different sectors makes it such a difficult issue to deal with. Agriculture, urban planning, regional planning, are affected. Many trees outside forest grow on land used primordially for other purposes than trees: conflicts are programmed. But are they really? Maybe not even as much as with forest, because no change of land use is required to increase the tree component. It is likely more a technical problem: identifying the optimal composition of a tree component on a given non-forest land, finding techniques to implement it, and create the political will to foster it – so that at the end a win-win situation is found for simultaneous agricultural (or others) and tree production.

TOF can contribute to many functions that forests fulfill. However, we should avoid provoking the impression that TOF can *replace* forest. They cannot. Forest is a unique system with a low level of human intervention, or none at all, and has a much wider role in biodiversity conservation, for example. However, TOF may help taking some pressure from natural forests, and at the same time enrich the landscape by some more “natural” elements, which also protect soil and water, increase scenic beauty, and serve as stepping stone and bio-corridor.

ACKNOWLEDGEMENTS

Our sincerest thanks go to Mrs. Michelle Gauthier (formerly FAO) and Dr. Sakya Sadio, for the long time cooperation between FAO Forestry Department and CATIE in TOF issues; and, above all, for the opportunity to present this paper, our experiences and points of view to the audience of international experts gathered in this Expert Consultation.

Some of the results come from a pilot study that was carried out and recently finished in Costa Rica for the FAO FRA Programme, in cooperation with the Costa Rican National Park Service SINAC. Our thanks for the permission to use the results for this paper go to Mr. Guido Chaves, SINAC, and Dr. Peter Holmgren and Mr. Mohamed Saket (FAO).

Some of the results discussed in this paper come from a just finished, European Union (EU) funded, research project (INCO-DC TROF Project, Project No. ERB3514PL973202). Thanks go to the EC and the research consortium.

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SECTION IV: CASE STUDIES FROM DIFFERENT REGIONS



Photo No: 17961-FAO Media (J.Y. Piel): Pine tree plantation for soil Protection, mountains and erosion control in China

GCP/CPR/009/BEL: Since 1978 China has been implementing a massive rehabilitation programme aimed at afforestation of more than 35 million h a. over a 73-year period in the arid and sub-arid belt of Northwest, North and Northeast China, the so-called Three-North Region. FAO assisted in selecting suitable trees, and in testing appropriate plantation methods and developing efficient and cost-effective forest mechanization techniques. The project objectives are: to support the environmental land and pasture reclamation and protection programme (including sand-dune fixation, wind-breaks, flood control and soil conservation) together with suitable agroforestry practices and techniques in sandy soils.

TREES OUTSIDE FORESTS IN THE NORTH AFRICA CONTEXT AND TRENDS

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ABSTRACT

North African countries show similarities in some of their biological, ecological, social and economical characteristics: limited water resources, large acreage of arid lands, high cover of rangelands, traditional livestock systems and a high human pressure. In this region trees in the forest or outside the forest have been considered, as one of the most important elements to meet human needs. However, currently, the promotion and integration of TOF in land use planning requires strategies and programs, stressing the decision makers' awareness and their willingness to pay a particular attention to the protection of natural resources as well as to a sustainable management of wooded lands.

TREES OUTSIDE FORESTS (TOF): GENERAL CONTEXT AND SYSTEMS

North African countries show similarities in some of their biological, ecological, social and economical characteristics, notably in terms of: limited water resources, large acreage of arid lands, high cover of rangelands, traditional livestock systems and a high human pressure. With the exception of desert areas, significant proportions of these countries are wooded lands; more than 14 million ha, i.e. 10% of their total territories, are forest lands, including high elevation natural forests and other good forests stands.

In this region, trees play several important roles in three major areas: ecological, social and economical. Elsewhere, during the immemorial period, trees were considered, under their various forms, as one of the most important elements to meet human needs

The land classification shows four different categories: (i) Forest lands; (ii) other wooded lands, including shrublands, Alfa steppes (*Stipa tenacissima*) and Acacia browselands; (iii) lands with TOF; and (iv) other land without TOF

In relation to their spatial, social and economical importance, TOF systems are of seven types: (i) permanent wooded grazing lands; (ii) highly dense fruit orchards; (iii) sparsely fruit tree lands, comprising some particular species such as walnuts, figs, pomegranate..., located in familiar backyards; (iv) plantations for soil conservation, comprising stands of forest species, fruit trees or fodder crops; (v) green belt and road-alignment plantations; (vi) urban and peri-urban parks; and (vii) poplar trees.

Regarding land tenure and legislation, TOF fall under three types of property status: collective, private and state-owned; the collective status is the most common in this region.

IMPORTANCE OF TOF: EVOLUTION AND EXTENT

TOF assessment reveals their high importance in regard to food security and poverty alleviation, economy and environment. Their effective contribution on rural population incomes and urban well being are not to be denied.

TOF products supply many agro-industry sectors, provide a high contribution to the agricultural products exports, of the region, and enhance job market of rural areas.

TOF biological diversity includes seven systems and a wide variety of species (palms, olives, oranges, tangerines and lemons, decorative forest species, multiple uses species, forage, etc.)

The social and cultural motivations in the use of TOF may be found in the social status provided by the existence of trees on land, appreciated by rural populations as a valuable refuge, sign of security or adhesion to a social group or location, and human being prosperity.

The TOF dynamics and extent are shown with development of the great and medium hydraulics, agricultural investment codes and technical knowledge retained by a favorable market.

INSTITUTIONAL ASPECTS AND TOF RESOURCES MANAGEMENT

The TOF introduction is made through sector development plans supported by agricultural and rural investment codes, forest regulations and urban rights. TOF management is, however, the main responsibility of the department in charge of agriculture and forests as well as that of territory management and environment.

Over a long period of time, natural resources management was based on the cultural richness and know-how of farmers as well as on the partnership and interdependent capacity of rural environment. The scientific knowledge deals particularly with the technical components and accessories: tree planting, valorization of forest products and genetic improvement. The technology transfer is carried out by national, regional and local structures of education, training and extension.

CONCLUSION AND RECOMMENDATIONS

Human pressure, soil erosion and ecosystems degradation are the major factors affecting management and dynamics of natural resources. The main constraints of such a situation are found in the complex land tenure status, dispersion of plantations, low-state financial assistance to agriculture research and weakness in the systems of communication and information. The promotion and integration of TOF in land use planning requires strategies and programs, stressing the decision makers' awareness and their willingness to pay a particular attention to the protection of natural resources as well as to a sustainable management of wooded lands. Such strategies are to be based on a global and integrated approach, in which more consideration should be done to patrimony, partnership and territory aspects, coupled with the development of exports market and agro-industries. However, a real appreciation of TOF resources still requires efforts, in terms of "sensitization" and promotion, to ensure an optimal integration and concept adoption by institutions and public.

Some actions and measures are required to ensure the TOF promotion and development. These are, notably:

- To harmonize the TOF notion in terms of terminology and typology.
- To develop specific TOF inventory methods and their crossed-sectors links as well as statistical tools, at low geographical levels (less than 5 ha), with a consistent supports of remote sensing and GIS.

- To develop institutional tools, socio-judicials and budgetary, to ensure the implementation of TOF integration policy into land use planning.
- To promote support policies oriented towards the improvement of rural incomes and the enhancement of food security.
- To put in place formal units for evaluation, extension and planning.
- To promote research, focused on the inter-institutional and inter-disciplinary aspects of TOF, in form of national and regional networks.

TREES OUTSIDE FORESTS IN GHANA: policy and legislation frameworks

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ABSTRACT

Local communities and the government derive enormous benefits from trees outside forest (TOF) with over 70% of all timber produced in the country since the 1980's consistently coming from TOF. It is estimated that timber resource within TOF are being overexploited at a rate of 2.5 times the annual allowable cut (AAC). Over 50% of exploitation of timber from TOF is illegal mainly due to the fact that the lack of involvement of forest fringe communities, farmers and resource owners in the management of TOF discourages them from supporting government TOF harvest control measures. The lack of effective participation of these stakeholders, which was a major problem prior to 1994, arose out of the following reasons:

- forest management was excessively centralised in the state
- a flawed TOF policy, which sought to encourage the systematic harvesting of TOF to make way for the conversion of the lands in these areas into agricultural use.
- local economies which were not integrated with the forest economy
- poor TOF harvesting controls
- weak public and local community institutional structures to implement effective and sustainable TOF resource management

Within the last five years, the government has adopted a more comprehensive approach to TOF management, which involves the collaborative management approach. The management strategy involves the organization of farmers and land-owning individuals and chiefs within a District Management Area (DMA) to draw up sustainable District Forest Development Plans (DFDP)⁷ for their area with the support of specialists from the Forestry Commission. To this end the government has put in place a programme aimed at building the capacity of local communities to play a full role in the management of TOF resources.

A review of the collaborative management strategy is currently being done to ensure that factors such tenure and resource use rights, social equity and efficient distribution of costs and benefits and integrated community development to alleviate poverty are effectively incorporated in the management strategy to achieve their desired impact.

This collaborative forest management framework is being undertaken together with a vigorous reforestation programme within TOF areas and farms based on the principle of compensatory planting. In this regard district felling quotas (DFQ) of TOF, which set the total number of trees to be felled within an administrative district each year, has been developed and is being implemented. These district quotas do not include trees destroyed by farmers during farm establishment. However, the compensatory plantings (equal to district quota plus trees lost during farming) takes into consideration trees lost due to human interference.

⁷ The District Forest development Plan (DFDP) is a management plan for TOF within a defined area . The DFDP will outline the broad categories of land use areas based on the goals and objectives of relevant stakeholders and the District Assembly (District Political Administrative body), indicate available TOF resources and the project demand for these resources.

GENERAL INTRODUCTION

Population

Ghana covers an area of approximately 238,540 km² and the total population was estimated to be about 18.4 million based on the 2000 Population Census, thus giving a population density of about 0.75 ha⁻¹. The population growth is between 2.6-3.0%, while the fertility rate is 6.0%. About 45% of the population is below the age of 15 years. Almost 60% of the population live in rural communities and the remaining living in urban centres. Agriculture is the most widespread occupation in Ghana with over 60% of the working class population being farmers.

Economy

Per-capita gross national product (GNP) and gross domestic product (GDP) are US\$420 and US\$452 respectively. Agriculture contributes approximately 50% of GDP (World Resources Institute 1999). Industry accounts for 15% while services contributes the remaining 35% of GDP. The forestry sector's contribution to GDP is estimated to be about 6%. The Ghana Living Standards survey (1988-92) indicates that about 31% of the Ghanaian population is poor. Rural areas, which contain about 66% of the country's population accounts for almost 75% of the population of the country which is below the poverty line (MLF 1997).

Role of the Forestry Sector

The forestry sector plays an important role in the socio-economic development of the country. For example, wood fuel consumption for domestic and industrial energy uses amount to about 16 million m³ valued at approximately US\$250 million annually. In addition, the timber industry earned \$175.24 million from the export of wood and wood products in year 2000. The forestry sector contributes about 6% to gross domestic product (GDP) and provides direct employment to over 100,000 people and indirect employment to over 2.5 million Ghanaians.

Facts on Trees Outside The Forest Reserves

Available records from the Ghana Forest Service show that about 70 percent of all timber produced in the country has consistently come from trees outside the reserved forest since the 1980's. The high level of timber exploitation and the uncontrolled agriculture expansion have resulted in rapid deforestation of trees outside the forest (TOF). This has happened because there are no legal restrictions to felling TOF during land preparation for farming.

One of the major challenges facing policy makers and forest managers in Ghana is how to evolve an effective management system for TOF to ensure a balance between the sustainable production of tree resources and the maintenance of agricultural productivity within an area with a mosaic of forests and

farmlands. Secondly, protection, biodiversity conservation, harvesting controls and husbandry decisions that are central to SFM of TOF came only under the ambit of the Forest Services Division (Government Forest Service) of the Forestry Commission, in November 1994. Previously, farmers had direct management control over all TOF, even though they did not have rights to utilise timber trees outside forests.

The Forest Services Division (FSD) have since 1994 been trying to develop a sustainable management system for TOF within the involvement of all stakeholders. One of the major constraints to the achievement of the objective, which has been of great concern for the professional foresters, is the lack of very cordial relations between some field forestry officers and the local forest users. This situation has come about because in the past FSD was regarded by the communities more as a regulator of their activities and not as a partner in the management and development of the forest resources of Ghana.

As a result of this situation, there was very little cooperation between the FSD and the populations living near the forests and this posed a serious threat to the future development of forest resources on reserves. Similarly, the major problem for the FSD currently, in the management of TOF is not how to put new areas under management, but how to stop farmers from wantonly destroying valuable timber trees on their farms and encourage them to tend them instead.

The lack of farmer's participation in the active management of TOF has been the result of their marginalisation from the management of forests and economic trees over past years. Farmers are the main custodians of the forest environment, they work among trees and decide to either preserve or clear TOF during land preparation for farming. The future of TOF depends on how farmers manage or mismanage their farmlands. The Government therefore decided to develop a collaborative management of TOF with the active participation of farmers and local communities in order to address the rapid removal of TOF and to sustain their utilisation.

Under the collaborative management of TOF programme, the potential for communities to actively manage their TOF, and the resources FSD might need to facilitate it have been intensively investigated in a number of pilot sites. Many other possibilities is being explored such as the provision of a planting grant or loan facility to enable farmers to plant and tend timber trees on their lands or farms.

NATURE AND EXTENT OF TREES OUTSIDE THE FOREST

The first national inventory covering commercial TOF, with emphasis on timber trees, was undertaken by the Forest Services Division (FSD) of the Forestry Commission between 1996 and 1997. The inventory covered plots totalling 500 ha of the four major vegetation zones of the country.

The results of the inventory indicate that most of the tree resources are found within the following areas:

- Remnants of old growth forest
- Secondary forest regenerating from fallow areas
- Riparian forest strips ranging from 5-50 m wide along most streams
- Trees on farms
- Small plots of plantation areas in the farm mosaic

The highest density and number of trees are found in pockets of small continuous closed canopy forests (Fig. 1). This is followed closely by degraded secondary forests or farm fallow areas invaded by *Chromolaena odorata* and *Theobroma cacao* (Cocoa) growing areas. However, if the tree resources of food crop farms and fallow areas are combined, it becomes clear that there are more economic trees on farms than in natural forests outside forest reserves. The TOF situation in the country indicates that there is the need for consultations of farmers in the management of trees and forests (Forestry Department 1999).

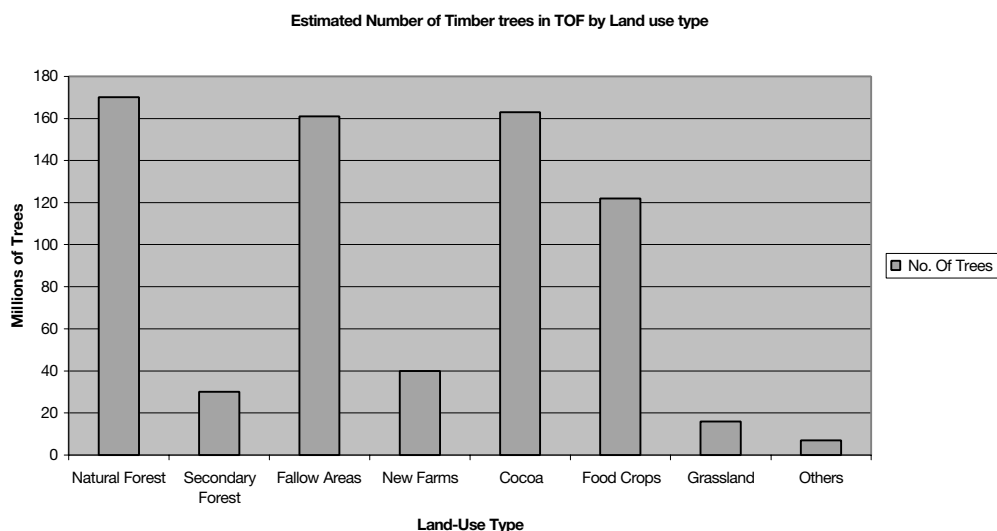


Fig. 1: Number of timber trees within different land use types based on data from National Commercial TOF inventory

Available records from the Forest Product Inspection Division (FPID) and Forest Services Division (FSD) of the Forestry Commission show that about 70 percent of timber on the average has consistently been produced from TOFs (Table 1). The present rates of exploitation of TOFs certainly cannot be sustained and since on-reserve harvesting cannot be increased in the short-term it would appear that total harvest rates would have to fall at least until the TOF harvest can be sustainably secured.

Table 1: Timber Production from On-Reserve and TOF in 1996

Source of Timber	Volume of Logs Produced	Percentage of Logs Produced
Trees Outside Forests	820,547 m ³	70.5%
Trees Within Forest Reserves	282,521 m ³	24.3%
Unknown Sources	61,244 m ³	5.2%
Total Timber Volume Felled	1,164,292 m ³	100%

POLICY AND LEGISLATION ON TREES OUTSIDE THE FOREST

The first official forest policy of Ghana which was formulated in 1908 was directed primarily to the preservation of a sufficient area of forest-covered land so distributed as to protect the water supply and to ensure the maintenance of the humid forest type of climate which was an essential factor in the growth of *Theobroma cacao* (cocoa), *Cola nitida* (kola) and other crops upon which the prosperity of the colony depended (Annual Report on the Forestry Department, 1929-1930). This policy did not emphasise the conservation and sustainable utilisation of TOF probably because forests were abundant.

Prior to independence in 1957, the Colonial Administration addressed the issue of TOF only in relation to the development of a revenue base for Chiefs and Traditional Authorities by securing their rights to hold allodial title to all economic TOF and thus the right to accrue revenue from royalty payments. However, after Independence in 1957, state control over forest resources increased and was further entrenched by the passing of the Administrator of Lands Act, 1962 (Act 123). The Act conferred to the state the management of stool lands and the grant of timber rights amongst others. All timber trees were vested in the President with the passing of the Concessions Act, 1962 (Act.124). The title of lands however still remained with the stool landowners.

The provisions of Section 16 of the Concessions Act, 1962 (Act 124) make timber or trees on any other lands also vested in the President. The forest Ordinance is made applicable *mutatis mutandis* to any land outside forest reserve for which rights relating to timber or trees have been or are expected to be granted. Generally, the management of all forests is made subject to the Forest Ordinance. For example the provisions establishing prohibitions, restrictions, impositions or concerning settlement of customary rights could apply to any forest areas. The laws make FSD the management authority of the outside reserve and the lands commission being responsible for collection of rents and revenues and the disbursements of revenue done through the Administrator of stool lands (FD undated).

Also prior to independence a new forest policy was formulated in 1948 to maximise the utilisation of TOF prior to conversion to agricultural lands. During the pre-1970 era total timber exploited were very high and the large contributions from TOF represented the clearance of land for agriculture. The general economic trends in the country from 1970 to 1980's resulted in the low rates of exploitation's from outside reserve whilst the bulk was contributed by the introduction of salvage of over-mature trees in most productive reserves. Since the 1980's the majority of trees exploited have come form off-reserve areas. This is probably because the Structural Adjustment programme initiated by the Ghana Government and supported by the International Monetary Fund (IMF) led to a revival of the timber industry resulting in an increased rate of exploitation. Incidentally, during the same period a Forest Resource Management Project (FRMP) supported by the World Bank and ODA, UK. brought production from on reserve to sustainable levels. The resulting impact of these two programmes was that following sustainable exploitation on reserve, the industry turned to off- reserve areas for the bulk of their increased wood requirements for processing for both domestic and export markets.

A new Forest and Wildlife Policy was formulated in 1994 to ensure that there was a major shift from the policy of "liquidation" to sustained management of TOF and other resources. This is highlighted by clause 5.3.2, which encourages the efficient management and utilisation of unreserved forests based on the regulation of uncontrolled harvesting, expeditious collection of relevant fees and conformity with criteria for

sustainable resource management.

Other frameworks that have been adopted by the 1994 Forest and Wildlife Policy to ensure sustainable management of TOF include:

1. On the resource, the policy advocates for :-
 - a. Inclusion of unreserved forest resources under state management even though ownership of the resource still resides in traditional owners and individuals
 - b. Promotion of agro-forestry initiatives
2. For stakeholder participation, the policy recognises or provides for:-
 - a. Encouraging communities to undertake protection initiatives
 - b. Widening of co-operation and promotion of dialogue with the private sector.
 - c. Promotion and implementation of awareness programmes
3. On institutional frameworks, the policy seeks to:-
 - a. Introduce competitive allocation and harvesting of timber resource
 - b. Review legislation and administrative arrangements for SFM

A comprehensive review of the 1994 Forest and Wildlife Policy indicates that the policy is a very good framework for the sustainable management of TOFs.

TENURIAL ARRANGEMENTS FOR TOF

Land Tenure

Land on which TOF is found is either communally or privately owned and the government has no direct ownership functions for such lands. Individuals and families acquire land with the consent of the Traditional Authority. However, the Traditional Authority cannot deny a member of the community the right of access if the land has not been occupied for some time. Land tenure systems, however varies throughout the country and depends on the customs and traditional political organisation of the community.

Generally, immigrants and tenant farmers have restricted rights to the use of acquired land. Although customary laws do not prevent immigrants and tenant farmers from planting and managing TOF, land owners do not encourage them to do so because the long production period of trees and the lack of appropriate documentation of land ownership, increases the security of land rights for immigrants and tenants when trees are planted (Agyeman 1994). They can use the farm for growing food crops but not tree or cash crops unless the landowner has specifically agreed to it.

Fragmentation of land through inheritance practices is also a major tenurial problem influencing the sustainable management of commercial TOF. Farmers with less tenuous rights to land are reluctant to manage TOF since they can lose rights to some TOF as a result of fragmentation of land through inheritance. Therefore unless inheritance and land tenure systems which lead to fragmentation of land and conflicts between tree and land tenure are addressed, individual with less tenuous rights to land in some areas, including women, tenants and strangers may not participate readily in the conservation and sustainable utilisation of TOF.

Tree Tenure

Tree tenure systems are very variable in Ghana and depend upon

- i) How economic the tree is
- ii) Status of land (communal or private)
- iii) Land availability
- iv) population density
- v) status of individuals (whether chiefs, indigenes, strangers, landlords or tenants) and length of tenure in the community.

Generally, in almost all societies in the country planted and naturally grown TOFs are not regarded as part of the land and are not covered by land sale. Trees may be purchased or inherited separately. Title to TOF, especially economic ones, vests in the holder of the paramount interest to the land on which they grow (Agyeman 1994). Naturally occurring timber trees although belonging to the landowners are vested in the President. It is from this vestiture that the regulatory powers used as the basis for off-reserve management are derived.

Tree tenure systems are different for planted trees compared to those naturally occurring and for trees on family and communal lands⁸. Individuals cannot harvest TOF and food crops that have been planted on communally owned land without the consent of the community. The communities normally do planting and maintenance of TOF on communal land. On the other hand, individual members of the family have secure rights to TOF on family land. However, the security of tenure is much stronger for planted trees than for naturally occurring commercial trees like timber, which is vested in the State.

With respect to the tenorial differences between naturally occurring trees on family and communal lands, most communities allow the collection of medicine, fruits and fuelwood for personal use from communal lands by members of the community, however these cannot be sold for profit. On the other hand TOF on family land are the exclusive property of the family members. Generally tenorial rights are affected by the use of the tree and the more economic a tree becomes, the greater the tenorial restriction on tenants and strangers (Agyeman 1994).

Tree tenorial restrictions in some parts of the country have impacted negatively on the community participation in TOF management. Other factors impacting negatively on sustainable TOF management include the failure of the government to take adequately into account the traditional tenure systems when developing forest policy. This is necessary in order to ensure the cooperation of the community. However, it is also possible that the traditional tree tenure systems may no longer be appropriate, or sufficient, to protect TOF as cultural changes occur and population pressures increase. If the tree tenure systems in force in the community were ones that facilitated sustainable management of TOF, or if the community's usufructuary rights with regard to TOF were more secure, then trees would have been better protected by local communities.

Tenorial Conflicts and their impacts on TOF Management

In several communities in the country, land and tree tenorial rights are vested in different parties. In some cases the family retains the right to economic trees even when the land in question has been given out to

⁸ Communal land is defined as land, which does not belong to any individual or family and is considered the property of the whole community.

others or sold. In these societies, all economic trees, such as cocoa, palm and citrus belong to the planter (both landlords and tenants) and are inheritable. The land on which these trees occur are also separately inherited which leads to conflicts (Agyeman 1994). The importance of land, and the fact that claims to land ownership is through often inaccurate oral history, has resulted in a high number of land cases pending before the law courts. According to Meek (1957) the separate ownership of trees and land may interfere with the cultivation rights of new landowners, or tenant farmers, when there are many trees leading to direct land use conflicts arise.

In the present system, all rights to naturally occurring timber trees are vested in the government. However, if a farmer plants commercial timber trees on his farm and they reach maturity it belongs to him. On the other hand, generally trees planted on communal land cannot be owned, harvested or inherited by individuals. They are communally owned. This has led to a situation where individuals are not willing to or are prevented from managing TOF on certain lands.

The main points to note with reference to conflicts over land and tree tenure are:

1. The right to use TOF and land can be held by two different parties, which may result in conflicting interests
2. Some indigenous laws and customs do not encourage all people (stranger and tenant farmers particularly) to plant, use and own TOF.
3. TOF on communal lands may be regarded as public property, which prevents tree planters from exercising complete control over their use.
4. Only certain TOF of low economic value are likely to be planted as individual rights appear to decline as the value of the planted tree increase.

Underlying Causes of Degradation of TOF

Wildfires

Fire is at present the most important cause of degradation of TOF in Ghana. The incidence of fire has been found to increase with forest disturbance caused by logging and thinning operations (Swaine *et. al.* 1997).

The annual loss of revenue from merchantable timber to fire is currently estimated at \$24 million. Wildfire has been estimated to cause an annual loss of 3% of GDP during the last fifteen years (Bank of Ghana 1995). Fire has severely reduced not only the productive capacity of the forests affected but has also had major impacts on the other benefits of forest cover, including water supply and quality, soil fertility and biodiversity (Hawthorne and Abu-Juam 1995). Ground fires in particular, may have serious consequences for degradation of TOF because they are more damaging to small plants near the ground surface (Orgle 1994).

Before 1983, fires were common in the savannah zone but not the high forest zone of the country. However, the severe drought and fires of 1983 and 1987 caused such damage that the affected TOF areas within the high forest zone of the country were more prone to subsequent fires and suffered greater damage. Logging in affected TOF areas also increased the susceptibility of TOF areas to fire. The combination of these factors has converted the forest from generally aggrading systems to systems of progressive degradation (Swaine *et. al.* 1997).

There is an urgent need to develop an understanding of causes and effects of wildfires in TOF areas in order to find effective means to prevent fires in the country. In this regard the Ministry of Lands and Forestry of the Government of Ghana has initiated a broad programme with the support of the Royal Netherlands Government (RNG), aimed at the prevention and control of forest fires.

Poor Agricultural Practices

Majority of Ghanaian farmers use shifting cultivation/rotation cropping system of farming. Under this system, a portion of land is cleared (using the slash-and burn method) and farmed for two to four years and then fallowed for a period for the land to regain its fertility. In time past, the fallow period was about twenty years during which time the farmer would be cultivating other areas. Increased population pressure has reduced the fallow period to one to three years, which is inadequate for soil rejuvenation. This has led to a situation in which the land does not revert to its former fertility before it is cropped again. It has resulted in soil degradation and reduced per-hectare crop yields, one of the major problems facing agricultural production and consequently an encroachment on TOF areas to attain and maintain the level of food production, which will satisfy the increasing population. A large proportion of degradation of TOF is attributed to shifting cultivation. This, coupled with other factors like the search for fuelwood and timber exploitation have reduced the total area with TOF.

High Population Growth

High human population growth and the increasing dependence of people on TOF has resulted in increasing deforestation rates. Although increased utilisation of TOF promotes socio-economic development, it is important to note that the unsustainable utilisation of TOF has in some instances led to a spiral effect. It has been observed in several places that degradation of TOF results in immediate increased benefits to local communities but in the long term leads to a high incidence of poverty. Thus corresponding appropriate sustainable TOF management strategies would have to be developed and implemented to ensure that increased harvesting of TOF does not lead to degradation of the environment.

Logging

Logging not only reduces the standing stock in TOF areas but also damages the residual stand. The incidence of the most severe form of logging damage in TOF areas increases with felling intensity (Agyeman *et. al.* 1999). It has been noted that on average about four commercial timber trees between 10-50cm dbh are completely destroyed for every 100m of skid trails constructed during the logging process. The high tree damage may be related to the large sizes of the skid trails and haulage roads, which are made during extraction.

MANAGEMENT OF TREES OUTSIDE FORESTS

Prior to 1994 there were no effective management systems for TOF. The procedures in place supported the old 1948 Forest Policy. This policy controls liquidation of commercial TOF, especially timber prior to land clearance and by this time the regulation of timber exploitation off reserve was muddled.

In order to address the problems of TOF management, “Interim Control Measures” on exploitation and

transportation of TOF was instituted in 1995. The first measure considers local community involvement in monitoring and management, to foster social responsibility, and implementation of environmental and ecological issues were in order to ensure sustainability of wood supplies from TOF (Gronow 1996). The second step under the “Interim Control Measures” was a shift from the policy of “liquidation” to sustained management of TOF. This is highlighted by clause 5.3.2 of the 1998 Forest and Wildlife policy which encourages the efficient management and utilization of TOF based on the regulation of harvesting, expeditious collection of relevant fees and conformity with criteria for sustainable resource management.

In order to consolidate the gains made by the implementation of the Interim Measures, a Timber Resources Management Act, 1997 (Act 583) and an accompanying Timber Resources Management Regulations, 1998 (L.I 1649) was enacted. Timber Utilisation Contracts (TUCs) with social responsibility agreement (SRA) to make contracts and local people responsible enough for the protection and management of TOF have been instituted in the Forest Resources Management Act of 1998 (Act 543).

Currently, the approach that has been adopted for the sustainable management of TOF is different from the one for reserved forests. Whereas timber resources can be harvested, based on the annual allowable cut (AAC), in perpetuity in reserved forest, those of TOF is based on the principle of compensatory planting, enhanced natural regeneration in forests with a high degree of cover, and protection of fragile ecosystems and rare and endangered plants. The compensatory plantings, involving the establishment of plantations and trees on agricultural lands, are similar to the carbon credits being developed in some countries. District felling quotas, which set the total number of trees to be felled within an administrative district each year, have been developed based on the results of an off-reserve timber resource inventory in 1996 (Planning Branch 1997). These district quotas do not include trees destroyed by farmers during farm establishment. However, the compensatory plantings (equal to district quota plus trees lost during farming) would take into consideration trees lost due to human interference.

Environmental control is being maintained by best practice codes through Timber Utilisation Contract (TUC) plans or Timber Operations Specifications (TOS), which are required of concessionaires for the protection of watersheds, riparian zones and hilly areas. Maintaining and enhancing the socio-economic needs of the local communities is being achieved through the implementation of a Social Responsibility Agreement (SRA) between contracts and local communities; benefits may include, employment, poverty alleviation, flow of benefits, and the degree to which social, culture and spiritual needs of the people are met.

Maintenance and enhancement of biological diversity in TOF areas is also being achieved through defining strict and protected dedicated forests, protection of endangered species and use of indigenous species in mixed plantations. Control systems cover Forestry Commission control mechanisms within TOFs. These include a range of things such as the monitoring of the TUC operation plans, felling permits and compliance with social responsibility agreements.

TOF management structures are currently heavily dependent on the support and active participation of landowners and local communities since they control the resource. The management strategy involves the organization of farmers and land-owning individuals and chiefs within a District Management Area (DMA) to draw up sustainable District Forest Development Plans (DFDP) for their area with the support of specialists from the Forestry Commission.

However, it is worth mentioning that the effectiveness of TOF management have been hampered through the use of inappropriate prevailing legislative framework in controlling illegal fellings within TOF. Currently laws are being reviewed and updated. In some cases the laws are contradictory or circumstances have

changed so much since their promulgation that they are no more relevant. These laws require immediate attention for effective managing of TOF by the Forestry Commission.

COLLABORATIVE MANAGEMENT AND DECISION-MAKING PROCESS

Local community involvement is important because in Ghana, the land and forest tenure systems are unique. Local communities represented by Chiefs or stools own all forests in the country, including the TOF. However the forests are managed by the Forestry Commission on behalf of the landowners who have customary and moral use rights of forest resources, which are known as Domestic Use Rights (DURs).

In view of the strong interest and rights of local communities in forest resource management, the Forestry Commission has modified the focal point of its management system to ensure greater consultation with stakeholders, especially local communities that are dependent on the TOF and are willing to ensure its maintenance. Thus the focus of TOF management in the country is shifting from a government-led system to a community-government collaborative management approach. The current collaborative approach involves consultation, needs assessment, investigation, synthesis and consensus building aimed at ensuring equity and the fair distribution of benefits and efficiency in the execution of forest management prescriptions. The overall objectives of the collaborative management approach are as follows:

1. To promote and sustain TOF use and value through the development of collaborative management initiatives involving the Forestry Commission and rural people. The programme was designed to examine the potential for collaborative management of forests, especially by harnessing the potentials initiatives of these communities:
2. To provide the government of Ghana with information and analysis to inform policy making on a wide range of land use and natural resource management issues of relevance to sustaining TOF.
3. To provide the Forestry Commission with the information needed to demonstrate the importance and value of TOF to rural livelihoods
4. To identify and develop local level initiatives to counter environmental problems such as fire, decreasing soil fertility and local watershed protection.
5. To identify and develop local level initiatives to sustain and improve the value of TOF.

The Collaborative Forest Management (CFM) approach adopts the learning-up process, which concentrates on devising effective strategies at the conceptual stages, reviewing the effective phase to make it more efficient and finally expanding the lessons learnt to cover the target area. The programme combines action research with local pilot initiative in collaborative management of TOF. The collaborative programme emphasizes the development of systems of information gathering and analysis on TOF use, both for the purposes of local level planning, and in order to demonstrate the value of TOF to local people. It stresses that the value of the TOF should not be seen only in terms of its contribution to the national economy through timber revenues, but also through its value to local populations as a source of income and subsistence produce, and critically as a 'buffer' resource that can be drawn on by the vulnerable in times of particular hardship and crisis.

Consultations have been done at both the strategic⁹ and operational levels¹⁰ of forest management. Workshops and educational programmes have been held in a number of communities to raise the awareness of local communities and also to secure their views on forest management. Reserve management planning sessions have also been evolved on a pilot basis through which communities in conjunction with the Forestry Commission jointly undertake reserve management planning.

The problem is that even though a comprehensive collaborative TOF management strategy has been developed, it is still largely at the pilot stage. The main problem facing the forestry authorities is how to integrate local communities into planning and management and still maintain a profitable and export-oriented forestry sector. In order to address this problem, the Ministry of Lands and Forestry (MLF) will soon establish a FOREST FORUM (multi-stakeholder group) to adopt and implement collaborative programmes to resolve the problems affecting the forestry sector. The scope for collaboration in forest management across such a broad landscape will involve a great diversity of people; groups of poor rural NTFP collectors, chainsaw operators and sawmill owners, local politicians, traditional chiefs.

OVERVIEW OF THE POTENTIAL, CONSTRAINTS AND OPPORTUNITIES FOR THE PROMOTION AND THE ECONOMIC VALORISATION OF TOF RESOURCE

I. Potential and Opportunities for TOF Management

Ghana is faced with future export and domestic demands on local timber resources far in excess of sustainable limits. If these demands were to be realized only from existing local resources, the resultant shortages in a few years would signal the demise of the industry, not to mention the punitive international market sanctions that would take effect since our timber products would not qualify as "*sourced from sustainably managed forests*". Consequently, should timber exploitation of TOF continue at the present rate (70% of total timber exploitation), over the next ten to twenty years there will be a significant reduction in the economic contribution of TOF in Ghana. Export earnings could fall to zero (or even become negative as wood is imported to meet domestic demand), tens of thousands of jobs could be lost, and the non-timber values of the forest would be eroded.

It is therefore crucial that all stakeholders, including the government, timber industry, land owners and farmers, respond favourably to the policy reforms and that the desired changes are effected in the shortest possible time. First of all, a framework of competitive allocation of commercial rights to TOF, increased royalty rates and improved industrial standards need to be enforced.

These actions need to be integrated with a re-tooling of the timber industry to improve efficiency and increase utilization of available timber supplies from TOF. At the same time, there should be greater use of logging and mill residues, which constitute about 50% of utilisable volume of timber, and significant improvement in output and quality of wood products. Secondly, there is the need for tighter fiscal measures, good investment incentives and training and greater diversification of production and marketing to help increase the volume of tertiary products for both domestic and export demand without increasing wood

The role that TOF can play as a fall-back resource for the vulnerable in times of crises currently forms part

⁹ Operational planning defines work programmes to be undertaken in order to achieve the strategic objectives. It ensures that resource requirements in terms of labour, transport, materials and funds are available at the right time.

¹⁰ Strategic planning is a mechanism for ensuring that local forest resource management is carried out in accordance with the requirements of National Forest Policy in Ghana.

of the current concerns of the Ministry of Lands and Forestry (MLF). It is quite difficult that such value cannot be quantified in terms of global contribution of forest exploitation to GDP, it must be seen in respect of the economic value, including their contribution to the significant trading of the economic value, including their contribution to the significant trading networks based on NTFP exploitation, and to local income; and also the social value, which can be seen in terms of the role they play in sustaining livelihoods in the rural poor. Linked to this is the issue of benefit flow in respect of sustainable TOF exploitation.

The Ministry of Lands and Forestry intends to pursue an essential strategy of conducting regular reviews of forest (and wildlife) fees to reflect the economic value of the resource and to recover optimum revenues for supporting the costs of sustainable management. Under the 1994 Forest and Wildlife Policy, government has also given its commitment to the principle that "a share of financial benefits from resource utilization should be retained to fund the maintenance of resource production capacity and for the benefit of local communities". An important aspect of an improved fee structure is the administrative capability to collect such fees timely and efficient manner, account for them totally and disburse the funds to the appropriate beneficiaries in a timely manner also.

II. Constraints

The main constraints to the sustainable development and management of TOF include obsolete laws and regulations, limited financial resources and inadequacy of line agencies and their working conditions. Also, the trade associations and respective public agencies have not yet developed the mutual appreciation and understanding that is necessary for fostering an enabling environment. In addition, there has been a significant lack of initiative on the part of the private sector to respond positively to policies and incentives with respect to sustainable management, development and exploitation of TOF.

Another constraint is the issue of an appropriate institutional structure and arrangement to facilitate sustainable forest management. The performance of government forestry sector institutions have in the past been severely hampered by its civil service structure, which resulted in ineffective administration and poor monitoring of forest operations.

The Forestry Commission Act, 1999 (Act 571) was therefore formulated to put in place an efficient and cost effective institutional framework for the successful implementation of forestry policies and programmes. Act 571 replaced the old Forestry Commission, within the Civil Service, with a new Corporate Forestry Commission to minimise bureaucracy, allow for the timely recruitment of competent staff with adequate remuneration and ensure better funding of programmes to ensure sustainable management of the forest resources. Under the Forestry Commission Act, 1999 (Act 571), all the forestry sector institutions were made divisions of the FC, which was given implementation autonomy under the law. Critical to successful reform is the need for adequate financing and capacity building for the FC to be effective.

CONCLUSION

Ghana's past TOF policy and management frameworks have had some failings due to excessive centralisation of forest management, the acceptance of the ultimate demise of off-reserve forests where the bulk of the country's timber resources were obtained and the lack of active participation of forest fringe communities, resource owners as well as rural communities in forest management. These could be explained as follows:

- **Forest management was excessively centralised in the state:** - There was little or no role accorded to the owners of the resource, the timber industry, farmers, and fringe communities who lived by and also depended on the resource for their very sustenance.
- **Local economies were not integrated with the forest economy:** - This tended to foster confrontation, bitterness and resentment towards the forestry sector institutions and their activities in the forests.
- **The policy for the management and or harvesting of TOF was flawed:** - It sought to encourage the systematic harvesting of TOF to make way for the conversion of the lands in these areas into agricultural use.

A review of policy, legislative and management frameworks for the sustainable utilisation and conservation of TOF in the early 1990's by the government led to the implementation of a set of complementary programmes to address these identified weaknesses and to sustainably manage TOF for the benefit of society. The programme, which is called Collaborative Forest Management (CFM), has put in place a programme of action to involve all relevant stakeholders in the management, development and efficient utilisation of TOF. Preliminary assessment of the CFM Programme suggests that Ghana is on course in the sustainable management of TOF.

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TREES OUTSIDE FORESTS ISSUES IN AFRICA, WITH AN OVERVIEW OF RESEARCH CARRIED OUT, INSTITUTIONAL EXPERIENCES AND EXISTING NETWORKS AND REGIONAL INITIATIVES ON AGROFORESTRY

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ABSTRACT

In Africa, Trees Outside Forests are disappearing for ecological, economic and socio cultural condition. Many studies on Tree Outside Forest issues have been carried out in many countries. Projects on those issues are being under taken around the world. To identify, compare and facilitate harmonization of approaches, the Food and Agricultural Organization (FAO) of the United Nations decided to organize an international expert meeting in Rome.

This paper presented in the above meeting is dealing with TOF issues in West Africa based on Senegalese experience with an overview research carried out, institutional experience and existing regional networks on Agroforestry.

TOF may be considered as natural or artificial plants growing outside forest, generally in farmed lands, Pasture lands, Fallows, along roads and littoral, in inhabited urban and rural areas, home gardens, sacred forest, etc... They are generally protected for goods (wood, food, fodder; etc ...), services (soil fertility improvement, watershed protection, river bank protection Chad and shelter, ornamentation, road protection, etc...), medicine and socio-cultural purposes. Despite these multiple roles, TOT management is facing in Africa many difficulties.

To mitigate those constrains, National Development Services, Non Governmental Organizations (NGO's) and National Research Institute shifted from conventional forestry approach that failed to take into account local knowledge and population interests, to rural/social forestry and agroforestry.

In West Africa, the International Center for Research in Agroforestry (ICRAF) through its SALWA (Semi Arid Low lands of West Africa) network is conducting in four (4) sahelian countries (Burkina Faso, Mali, Niger and Senegal) strategic research to reinforce Tree Outside Forest potentials to sustain livelihood and food security.

INTRODUCTION

Forest and tree covert are declining at an alarming rate in the developing countries, in general and particularly in the sahel where the destruction of the natural ecosystem resulted from the combination of many factors such as: the long drought of the last thirty years, the introduction of inadequate agricultural technologies to increase cash crops (Gelar 1982), an increased demand for wood energy in relation to population increase and inadequate agricultural policy that failed to integrate farming, tree products and livestock enterprises (Agroforestry today 1989). As a result, essential resources of food, fuel, shelter, fodder, medicine and many other forest products are disappearing and the soil and water base for the food production is being degraded. (Chasin and Franke, 1983 ; Freeman and Fricke, 1983)

These unfavorable ecological, economic and socio cultural conditions affected significantly Tree Outside Forest survival and sustainability. Conscious of this danger, many african countries shifted from convention forestry that failed to take into account population needs and local knowledge , to rural/social forestry and agroforestry. This new forestry approaches were highly investigated by National Agricultural Research Centers, and International Research Institutes (ICRAF) to improve the related technologies.

Many studies on Tree Outside Forest have been carried throughout the world to better understand the issues using different approaches. Most of them were funded by FAO which finally decided to organize in Rome, November 2001 an international expert meeting to identify, compare and facilitate harmonization of used approaches.

This paper deals with Tree Outside Forest in Africa, particularly in west Africa. It describes first the issue (definition, classification, localization, tenure system and constraints to sustainability), highlights institutional experiences and regional initiatives and finally gives conclusions and makes recommendations.

TREE OUTSIDE FOREST ISSUES IN AFRICA

Definition

Tree Outside Forestry can be as natural or artificial plants, and by definition growing outside forest, generally in farmed lands, pastures lands, fallows areas, along roads, in inhabited urban and rural areas, homegardens, sacred forest, mangroves etc.... They are generally protected for :

- products (wood, food, fodder, etc...);
- services (soil fertility improvement, watershed protection, shade and shelter, ornamentation, road protection, bank protection, etc...);
- medicine and
- socio - cultural purposes

Localization

In most African countries, particularly in Senegal, there are three (3) major types of land property where trees are grown : (i) National property; (ii) public property and (iii) private property.

National property

National property is subdivided into three (3) zones :

- *villages zones* are regularly cultivated or grazed;
- *pioneers zones* comprise essentially classified forests, silvo- pastoral reserves, planted areas, national parks, etc... These areas are generally protected to enhance production and biodiversity and
- *urban zones* are managed by municipalities for urban development.

Public property

Public property is represented by seas, rivers, lakes, roads, railways, public places, mangrove, etc....

Private property

Private property belongs to governments or individuals. This type of land is generally registered and has license.

Specific rules are used to manage each of these properties. In fact, urban, pioneers and classified zones are generally managed by the government. The rural zones are managed by the state agents through rural councils. Trees Outside Forest are located in the national property (except classified areas), in public property and in private property.

TREE OUTSIDE FOREST CLASSIFICATION

Tree Outside Forest can be classified according to the following criteria : (i) Field disposition; (ii) Principal function; and (iii) type of ecosystem. (DIOUF and al, 1999)

Field disposition

Isolated trees are naturally regenerated or planted within houses, fields, gardens, etc., generally for fruit production (*Adansonia digitata*, *Tamarindus indica*, citrus sp.), (AFRENA, 1990) leaves production (*Borassus aethiopum*, *Adansonia digitata*, *Moringa oleifera*, *Cordyla pinnata*), wood production (*Eucalyptus* sp., *Azadirachta indica*, *Khaya senegalensis*, *Cordyla pinnata*, etc...), shade (*Azadirachta indica*, *Adansonia digitata*, *Khaya senegalensis*) and for cultural purposes (*Adansonia digitata*, *Celtis integrifolia*, etc) (Seyler, J. R. 1993)

Scattered trees on farm lands or pasture lands. The most frequent land use system where trees are associated with crops and/or animals is known as parkland. In this ecosystem, trees are mainly selected and protected for fruit, wood and leaf production, for soil fertility improvement, etc ... The most known parklands in the Sahelian countries are : (i) *Faidherbia albida* (Senegal, Mali, Burkina and Niger); (ii) *Adansonia digitata* (Senegal, Mali Burkina Faso); (iii) *Butyrospermum paradoxum* (Mali, Burkina and Eastern part of Senegal); and (iv) *Borassus* sp (, Mali, Burkina Faso, Niger and Senegal).

Linear plantations comprise: living fence, windbreak, plantation along roads, etc....

- o *Living fence* is generally used to protect crops, vegetable, fruit trees against free grazing. *Euphorbia balsamifera*, *Euphorbia tericuli*, *Jatropha curcas* are traditionally used in this technology. Living fence is largely used in many African countries. Since 1985 Agroforestry research is testing many multipurpose thorny species to replace the traditional ones to improve the technology. Among them *Acacia laeta*, *Acacia mellifera*, *Acacia tortilis*, *Acacia nilotica*, *Zizyphus mauritiana* and *Bauhinia rufescens* are more useful.
- o *Wind break technology* is not traditionally known in the Sahelian countries. Forestry development services and National Research Institutes are implementing the technology in many land use systems. *Eucalyptus* sp., *Prosopis* sp., *Racosperma holoserica* are generally used in the irrigated systems of Senegal, Niger and Mali. In the Senegalese peanut basin, the association of fast growing trees (*Acacia tortilis*, *Acacia nilotica* with thorny shrubs (*Acacia mellifera*) is currently used as windbreak and living fence. This technology, locally called fence-windbreak, is being generalized in the peanut basin.
- o *Trees along roads*. During the colonial period, many trees have been planted in many African countries along national and departmental roads. *Khaya senegalensis* was mostly used. After the independence *Azadirachta indica* was largely propagated in the Sahelian countries. This exotic species, very adapted to drought, is becoming proliferating even in the natural forests. Its elimination is a serious problem in some areas. (Fred Weber, M. W., Hoskin, 1983).

Trees planted in houses are generally planted for shade (*Khaya senegalensis*, *Azadirachta indica*), for fruit (*Mangifera indica*, *Citrus* sp, *Carica papaya*) for leaves (*Moringa oleifera*, *Adansonia digitata*, etc...).

Trees planted in homegardens are generally used for fruit production to improve and diversify household revenues. *Mangifera indica*, *Citrus sp*, *Carica papaya*, *Musa sp* etc... are generally planted in depressions where water table is not so deep and along the Senegal river (in Senegal, Mali and Mauritania) and Niger river (in Mali and Niger). Improved *Mangifera* and *Citrus* species are now largely propagated in these areas. In Senegal, Mali, Niger, Ivory Coast, Guinea, etc., fruit commercialization is contributing significantly to national macro-economy increase (Shea, k. R. and Ned, D. Bayley. 1982).

Principal functions

Tree Outside Forest may be classified according their function (economic, ecological, socio cultural, scientific and medicinal and recreation).

- a. *Economic function.* The economic function, mostly preferred (Ndour and Gaye, 1996), encompasses :
- o Wood production (firewood, poles, matches, etc). *Eucalyptus sp.*, *Azadirachta indica*, *Borassus aethiopum*, *Cordyla pinnata*) are the main species of that category.
 - o Fodder production (*Faidherbia albida*, *Pterocarpus erinaceus*, *Pterocarpus lucens*, *Celtis integrifolia*, *Leucaena leucocephala*, *Bauhinia rufescens*, etc...).
 - o Fruit production (*Mangifera indica*, *Cordyla pinnata*, *Parkia biglobosa*, *Adansonia digitata*, *Detarium senegalensis*, *Elaeis guineensis*, *Detarium microcarpum*, *Zizyphus mauritiana*, *Borassus aethiopum*, *Butyrospermum paradoxum*, etc ...)
 - o Gum production (*Acacia senegal*, *Acacia laeta*, *Sterculia setigera*, *Acacia seyal*, etc...) (Badji, S., Ndiaye, I., Danthu, P. et Colonna, JP. 1991)
 - o Oil and wine production (*Elaeis guineensis*, *Borassus aethiopum*, *Balanites aegyptiaca*);
 - o Leave production (*Borassus aethiopum*, *Adansonia digitata*, *Moringa oleifera*).

Ecological function is becoming more and more important in the Sahelian countries where the climate is relatively harsh. Those trees contribute to soil fertility improvement (Jung, G. 1967; Louppe, D. 1989; Louppe et al. 1996), watershed protection, shelter and shade for domestic and wild animals, salinity alleviation (SADIO, S. 1991:

Socio-cultural Function. In Africa Trees outside Forest play important socio-cultural roles through sacred forests, taboo trees, totem trees, etc.... The sacred forests are protected and managed for traditional religion practices, cult and sanctuary. Biodiversity in these ecosystems is generally rich and diversified since all wood exploitation is forbidden for any purpose. *Adansonia digitata*, *Tamarindus indica*, *Celtis integrifolia*, *Bauhinia rufescens*, *Borassus aethiopum* are the most well known taboo and totem trees in West Africans particularity in Senegal. Under those venerated trees sacrifices and prayers are regularly and periodically done for God grace.

Scientific and medicinal function. In many African Universities, botanic gardens with many tree species are managed for scientific and medicinal purpose.

Recreation function. In many African cities, public places are managed for resting and recreation. Ornamental trees are mostly used for that purpose. Among them, *Cordia sp.*, *Hibiscus sp*, *Cactus* species, etc... are mainly planted and managed by communal councils.

Ecosystem type

Ecosystem type is the simplest classification criterion. It indicates the zone where TOF are located. Trees in

the field and trees outside field are the principal categories.

- b. Tree within field* comprises parklands, delimitation plantation, living fence, windbreak annual and pluriannual fallows, contour plantation, vegetation strips, alley cropping trees, etc...
- c. Tree outside field* encompasses homegardens, trees in inhabited areas, trees in public places, trees planted along roads, in village woodlots, in individual plantations, etc...

TREE OUTSIDE FOREST TENURE

In many African countries, land (natural resource support) is inherited by matriarchal or patriarchal ways, according to the customary law. For government law land and natural resources belong to the state. In so doing, TOF conservation and sustainability are a real problem. In fact, in many African countries, gathering fruit and wood from TOF is totally free whenever the resource is not protected. This not well defined property right is a source of many conflicts between land owners and forest protect gatherers. To mitigate this problem, the new Senegalese forestry law tends to responsabilise more and more land owners to manage themselves trees in their lands in order to benefit from the usufruct. For planted trees, property right has no ambiguity, nevertheless, tree owners should always have an authorization from the local forest agents before cutting and/or selling a single tree. For common properties, wood and fruit gathering are controlled by communities.

CONSTRAINTS TO TREE OUTSIDE FOREST SUSTAINABILITY

Tree Outside Forest survival faces many difficulties in most western african countries du to population growth, overgrazing, low and irregular rainfall, inadequate agricultural practices, inadequate land tenure policies, etc.

Population growth

The high population growth rate in west africa (3,2% per year in Senegal) increases regularly population needs for food, fuel and habitat. To satisfy those needs, many hectares of forest and other natural reserves are disappearing at an alarming rate (1,2% per year) (Tybirk and al, 1990). In the urban areas in Senegal, many natural reserves are disappeared for inhabitation needs.

Inadequate agricultural practices

Traditional farmers use to integrate in the same land trees with crops, and/or animals to sustain production. During the green revolution, focused on peanut and cotton production increase, farmers were advised by the agricultural development service to cut and uproot all trees in farmed land to facilitate mechanization. This so-called modern agriculture degraded tremendously soil and vegetation cover in many countries. With the decrease of rainfall, many species disappeared by lack of natural regenerate.

Rainfall decrease

The long drought of the last thirty (30) years contributed significantly to the mortality of many species in the Sahel. In fact, in the sahelian part of many west African countries, many sudanian species have completely disappeared because of low and irregular rainfall.

Overgrazing and bush fire

In the Sahelian countries, the lack of grass during the dry season du generally to bush fire, causes the pruning

and lopping of some outside forest species (*Faidherbia albida*, *Pterocarpus erinaceus*, *Adansonia digitata*, *Celtis integrifolia* etc.). This inadequate practice decrease significantly the productivity of injured trees and increases tree death rate.

Inadequate land use policies

According to the domonial law, in Senegal, many non valuated land for four (4) years may be attributed to any landless who makes the demand. In addition, all borrowed land for more than four years may be taken up by the borrower. These confusing dispositions make land owners very careful to put land in fallow or lend it to landless, for more than four years. Knowing that, after four years, borrowed land returns to the owner, borrowers are not always motivated to protect, regenerate and manage conveniently trees in farmed lands.

INSTITUTIONAL EXPERIENCES

After many years of conventional forestry approach (forestry management in classify forests, industrial plantations with fast growing species such as *Eucalyptus camaldulensis*, *Azadirachta indica*, etc.), that failed to take into account population needs and local knowledge, many government forest services are adopting a new approach (button - up) one that involve actively farmers in tree planting, conservation and management. The most significant activities on Tree Outside Forest undertaken by the senegalese forestry development service and the forestry research center are described below.

Tree Outside Foreste Development Projets

Since the 80th, most of the forestry development projects were focused, in Senegal, on rural/social forestry and agroforestry. The following table shows the different projects implemented in Senegal from 1980 to 2000, the covered geographic zones and the related main objectives.

Table 1. The main forestry development projects on Tree Outside Forest conducted in Senegal from 1980 to 2000

Project title	Localization	General objective	Duration	Funding agency
(1) Village reforestation: <i>Acacia nilotica</i> forest restoration (PROGONA)	- Podor - Matam	- Regeneration of dying trees; - Village woodlots creation.	1984- 1993	Netherlands Senegal
(2) Natural ecosystem restoration (PREMINA)	- Saint louis - Richard - Toll - Podor	- Forest product development through windbreak and woodlots; - Environment conservation	1988- 1995	EDF Senegal
(3) Sylvo pastoral management and reforestation (Zone Nord)	- Sylvo- - pastoal - zone - Linguere - Podor - Dagana	- Water reserve rehabilitation around 6 drillings; - degraded farm land regeneration	1975- 1994	Rep of Germany
(4) Community reforestation in the peanut basin(PRECOBA)	- Fatick - Thies - Koalack	- Salty soils revalorization; - Sylvo – pastoral management; - Promote agroforestry technologies; - Community and individual plantation;	1982 - 1995	USAID Senegal Scotland
(5) <i>Amacadium</i> project (PASA)	- Fatick - Kaolack	- Population revenues increase; - Agricultural technologies improvement;	1979 - 1984	Rep. Germany Senegal
(6) Diourbel Agroforestry Project (PAD)	- Diourbel	- Soil degradation process; - Population welfare improvement	1990- 2001	IFAD Senegal
(7) <i>Borassus</i> parkland regeneration (- Thies - Mbour	- Inventory, protection and management natural ressource; - Assisted regeneration	1989- 1992	BID Senegal
(8) Village reforestation (PROBOVIL)	- Louga - Bakel - Mbacke	- Village reforestation; - Natural regeneration assistance	1982- 1994	Sweden Senegal
(9) Senegal Reforestation Project (PRS)	- National	- Promote rural reforestation - Encourage private enterprise for plantation along road	1988- 1994	USAID Senegal
(10) Integrated program for conservation and natural resource management (PICOGERNA)	- Tamba - Counda - Kaffrine - Bakel	- Responsabilise rural population in natural resources management	1990- 1992	CCCE FAC BM Norway
(11) Littoral conservation (CTL sud), (CTL nord), (FDK)	- Saint Louis - Louga - Dakar - Thies - Tivaouane	- Vegetable gardening preservation - Promote population participation	1975- 1994	Canada PNUD, BNE PAM – UNSO Netherlands
(12) Forestry rural development (PDRF)	- National	- Elaboration of strategic forestry approach in Senegal	1988- 1994	PNUD Senegal Netherlands

Among the 24 forestry projects conducted in Senegal from 1980 to 2000, 12 were mainly focused on Tree Outside Forest improvement and sustainability. Those projects were implemented from the north to the south. Most of them involved actively local people in their activities by using participatory approach. Some of them are successful and others have mixed results.

Tree Outside Forest Research Activities

Since 1978, the National Senegalese Forestry Research Center (CNRF) started introducing fast growing trees (*Eucalyptus sp* and *Acacia sp*) in farmed land, in the south peanut basin. In 1986, a well structured agroforestry research project funded by France through its Cooperation Aid Fund (FAC), focusing on tree reintroduction on farms plots was implemented in the peanut basin land use system. Many other agroforestry research projects funded by ICRAF, IFAD (International Found for Agriculture Development), USAID, EDF (European Development Fund) etc... followed. Their main objectives were to develop, on station and on farm plots, agroforestry technologies to sustain production and alleviate poverty in rural areas. The following table shows the main Tree Outside Forest research project conducted in Senegal these fifteen last years.

Table 2. Agroforestry research projects conducted in Senegal the fifteen last years

Project title	Funding agencies	Period	Covered region	Tested agroforestry technologies
Tree role in agricultural exploitation	cooperation and Aid Fund	1986 - 1990	North peanut basin South peanut basin, Casamance	Living fence, parkland, soil conservation
Diourbel Agroforestry project accompanying research	IFAD	1990 - 1997	Diourbel region	Parkland, windbreak, living fence, fodder bank
SALWA project	IFAD IRDC, (through ICRAF)	1989 - 1997	Diourbel region Kaolack region	Parkland, windbreak, living fence, fodder bank, alley cropping
Fallow project	European Development Fund (EDF)	1994 - 2000	Kaolack region, Kolda region Casamance	Parkland Fallow, living fence, biodiversity
Natural Resource Based on Agricultural Research (NRBAR)	USAID	1993 - 1998	All Senegalese regions excepts Saint Louis and Louga	Parkland, windbreak, living fence, fodder bank, alley cropping

REGIONAL INITIATIVE: SALWA CASE STUDY

Introduction

The creation of the Semi Arid Low land of West Africa in 1989 was subjected to two phenomena :

- The desire of the International Center for Research in Agroforestry to improve the population welfare of african developing countries by the integration of perennial trees in the agricultural production systems and other land use systems to increase yield, diversify product and assure systems sustainability and ;

- the fact that hand, National Agricultural Research Institutes (NARS) of west african countries wish to collaborate with ICRAF and the governments of Burkina Faso, Mali, Niger and Senegal signed cooperation agreement to develop agroforestry technologies and reinforce national capacities for agroforestry research ;

The main SALWA objectives are :

- promote appropriate agroforestry technologies for the sahelian countries with the collaboration of National, Regional and International Institutes working in the area;
- reinforce national agroforestry research system capacities ;
- conduct strategic research in agroforestry.

Network Organization

SALWA has structure at national and regional level.

National level

In each country member, it was created a National Directory Committee of Agroforestry Research (NDCAR) having the following attributes :

- advise countries in defining policies and priorities related to rural development through agroforestry ;
- evaluate agroforestry projects and programs ;
- assure the linkage of all national organizations involved in agroforestry development and research and
- approve the national documents to be submitted in the regional evaluation and planification meetings.

Regional level

With the following structures :

- Regional evaluation and planification meeting ;
- Regional director committee and ;
- Regional coordination.

Covered Ecological Zone

The target ecological SALWA zone goes from Senegal to Niger through Mali and Burkina Faso on 700.000 hm². Sixty (60) to 85% of the rural population are fund in this area where the essential food from crop are produced (mape 1). In each country, the principal land use system was chosen (Central plateau system in Burkina, Parkland system in Mali, Valley system in Niger and South and North peanut basin in Senegal).

Tree Outside Forest Research made in (SALWA) Network

During his eight (8) year existence, SALWA was focused on five (5) agroforestry technologies (Parkland, Windbreak, Living fence, soil and water conservation, fodder bank). In 1995, the prioritization of the most preferred TOF was done in Burkina, Mali and Senegal.

Parklands studies

Two types of studies are done for this agroforestry technology (Parkland inventory in Burkina, Mali and Senegal and Parkland production improvement)

- d. *Parkland inventory*: This documentary study was done in 1995 in each country by a forest consultant hired by ICRAF. The following tables show the main parklands per country, their localization the food and cash crop associated, etc.;
- e. *Parkland production improvement* focused on Multi Purpose Use Trees planting within parklands, Natural regeneration assistance, etc... to increase production.

Table 3. The main agroforestry parklands in Senegal (SALL, 1996)

Parkland type	Localization	Accompanying species	Roles	Associated crops
<i>F. albida</i>	Peanut basin	<i>Guiera senegalensis</i> , <i>Balanites aegyptiaca</i> , <i>Adansonia digitata</i>	Fertilization fodder firewood	millet Peanut sorghum
<i>Acacia senegal</i>	Silvo - pastoral zone	<i>Balanites aegyptiaca</i> , <i>Combretum aculeatum</i> , <i>Acacia raddiana</i>	Economic firewood dead fence	Millet bean watermelon
<i>Adansonia digitata</i>	Center West Tamba Counda region	<i>Acacia ataxacantha</i> , <i>Combretum aculeatum</i> , <i>Tamarindus indica</i>	Food Fodder medicine	millet Peanut sorghum
<i>Borassus aethiopum</i>	Thies region Fatick Tambacounda region Casamance	<i>Pterocarpus erinaceus</i> , <i>Prosopis africana</i> , <i>Cassia sieberiana</i> <i>Combretum glutinosum</i> <i>Combretum micranthum</i>	Poles Food Craft industry	Millet sorghum peanut
<i>Cordyla pinnata</i>	Kaolack region Tambacounda region Kolda region	<i>Combretum sp.</i> <i>Pterocarpus erinaceus</i> <i>Prosopis africana</i>	Food Wood	Millet Peanut Maize Sorghum
<i>Elaeis guineensis</i>	Casamance region Kolda region	<i>Combretum sp.</i>	Food	Rice

Table 4. The main agroforestry parklands in Burkina Faso (OUEDRAOGO, 1995)

Parkland type	Localization	Accompanying species	Roles	Associated crops
<i>Butyrospermum paradoxum</i>	Sudanian zone	<i>Parkia biglobosa</i> , <i>Faidherbia albida</i> , <i>Azadirachta indica</i> , <i>Lannea microcarpum</i>	Economic Food Medicine	Millet Sorghum
<i>Acacia raddiana</i>	Sahelian zone	<i>Faidherbia. albida</i> , <i>Hyphaene thebaica</i> , <i>Combretum glutinosum</i> , <i>Acacia Senegal</i>	Fodder Firewood	Millet Sorghum
<i>Parkia biglobosa</i>	Western zone	<i>Butyrospermum paradoxum</i>	Economic Food	Millet Sorghum
<i>Faidherbia. albida</i>	Eastern zone	<i>Tectona grandis</i> , <i>Parkia biglobosa</i> , <i>Butyrospermum paradoxum</i>	Fertilization Fodder	Millet Sorghum

Table 5. The main agroforestry parklands in Mali (CISSE, 1995)

Parkland type	Localization	Accompanying species	Roles	Associated crops
<i>F. albida</i>	Secondary dry valley, recent ergs, high sandy lands	<i>Borassus aethiopum</i> , <i>Sclerocarya birrea</i> , <i>Hyphaene thebaica</i>	Fertilization Fodder	Millet sorghum maize, cotton
<i>Parkia biglobosa</i>	high sandy lands	<i>Sclerocarya birrea</i> , <i>Lannea microcarpum</i>	Economic Food Firewood	Millet sorghum
<i>Butyrospermum paradoxum</i>	Northern center zone, Western zone	<i>Parkia biglobosa</i> , <i>Sclerocarya birrea</i>	Economic Food Firewood	Millet sorghum
<i>Hyphaene thebaica</i>	Coarse sandy lands	<i>Sclerocarya birrea</i>	Craft industry Economic Food	Millet sorghum maize

Windbreaks

This technology was experimented in two countries (Niger, in the Valley system, and Senegal, in Bambey station). The target species were (*Eucalyptus sp*, *Racosperma holosericea*, *Prosopis sp*, etc.). In these experimented way, the technology was not successful.

Living fence

Live fencing is the most investigated technology in the hole countries. *Zizyphus mauritiana*, *Acacia laeta*, *Acacia mellifera*, *Acacia nilotica*, *Acacia tortilis* and *Bauhinia rufescens* are tested to protect cassava, vegetables, fruit trees, annual crops, in some extend, etc.... The technology was successful in the four countries where it is largely propagating now.

Fodder bank

Fodder bank was tested in Mali and Senegal with *Pterocarpus erinaceus*, *Pterocarpus lucens*, *Bauhinia rufescens*, *Gliricidia sepium*, (for the first country.), *Bauhinia rufescens*, *Gliricidia sepium* *Zizyphus mauritiana*, *Leucaena leucocephala*, *Hardwichia biinnata*, *Caesalpinia ferrea* and *Moringa oleifera* (for the

second). *Pterocarpus lucens* and *Gliricidia sepium* are more performant in Mali while *Zizyphus mauritiana*, *Bauhinia rufescens* and *Gliricidia* did best in Senegal. This technology is been transferred in farm plots.

Alley cropping

Alley cropping was only tested in Niore, Senegal with *Gliricidia sepium*, *Leucaena leucocephala*, *Azadirachta indica*, *Hardwickia binnata*, etc... After four (4) years of experimentation, the evaluation showed that the technology did very badly because of low rainfall and low biomasse productivity. (NDOUR and al, 1997). It was therefore recommended to take it off from the technology package.

Soil and water conservation

This technology was only tested in Burkina Faso with : *Bauhinia rufescens*, *Zizyphus mauritiana*, *Acacia nilotica*, associated with *Vetivera negrita*, *Andropogone gayanus*, etc. It was very successful and is propagating in the Burkina rural area.

Prioritization of the most preferred Tree Outside Forest species

This study was done in Burkina Faso, Mali and Senegal in 1995. Its main objective was to identify the ten (10) most preferred species in each country and the five (5) ones in the hole region for the elaboration of a tree improvement research program. The following table shows the obtained results.

Table 6. The ten most proffered Outside Forest Species in Burkina, Mali and Senegal

Rank	BURKINA FASO	MALI	SENEGAL
1	<i>Butyrospermum paradoxum</i>	<i>Butyrospermum paradoxum</i>	<i>Adansonia digitata</i>
2	<i>Parkia biglobosa</i>	<i>Adansonia digitata</i>	<i>Cordyla pinnata</i>
3	<i>Lannea microcarpa</i>	<i>Parkia biglobosa</i>	<i>Faidherbia albida</i>
4	<i>Tamarindus indica</i>	<i>Tamarindus indica</i>	<i>Tamarindus indica</i>
5	<i>Adansonia digitata</i>	<i>Lannea microcarpa</i>	<i>Balanites aegyptiaca</i>
6	<i>Bombax costatum</i>	<i>Faidherbia albida</i>	<i>Zizyphus mauritiana</i>
7	<i>Faidherbia albida</i>	<i>Sclerocarya birrea</i>	<i>Parkia biglobosa</i>
8	<i>Balanites aegyptiaca</i>	<i>Khaya senegalensis</i>	<i>Detarium microcarpum</i>
9	<i>Zizyphus mauritiana</i>	<i>Cordyla pinnata</i>	<i>Ficus icteophylla</i>
10	<i>Diospyros mespiliformis</i>	<i>Borassus aethiopum</i>	<i>Azadirachta indica</i>

This study shows that *Adansonia Digitata* is the most preferred species in the sub – region. It IS followed by *Butyrospermum paradoxum*, *Parkia biglobosa*, *Tamarindus indica*, *Faidherbia albida*, etc... On the base of this result, one can conclude that Trees Outside Forest are mostly protected and managed in the parklands for food production (NDOUR and GAYE, 1997).

CONCLUSION AND RECOMMENDATIONS

Trees Outside Forest are facing many difficulties, in Africa, and particularly in Sahelian countries due to low and irregular rainfall, inadequate agricultural practices, inadequate natural management policies (land and tree tenure), etc...

Many countries investigated to mitigate those problems and sustain productivity. Most of the related activities were very successful by using participatory approaches and working with networks. To sustain these efforts, some recommendations are done :

- better sensibilise local people to protect Trees Outside Forest to combat desertification, assure food security and mitigate poverty ;
- adopt natural resource management policies to the present ecological, economic and socio-cultural conditions;
- implement agricultural practices which conserve biodiversity and
- disseminate performant natural resource management technologies through publication, international meetings, networks, etc....

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TREES OUTSIDE FORESTS IN BRAZIL: A RENEWABLE RESOURCE WHICH CAN BE NEGLECTED?

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ABSTRACT

According to FAO trees on land not defined as forest and other wooded land, or trees outside forest (TOF). In Brazil TOF occurs mainly within agroforestry systems, also as in individual trees or in parks in urban areas, fruit tree plantations or orchards, scattered trees and forest patches in transition zones as e.g. between dense forests and open savannas or swamps. In North Brazil indigenous tribes and traditional forest dwellers utilise a variety of domesticated palms and other (indigenous) fruit trees in shifting cultivation and multistrata systems (home gardens) that can also be considered as examples of TOF. Quantification of TOF resources has not been conducted but the IBGE survey contains some relevant information. Regarding TOF in urban areas in many cities, small ones as well as metropolises, an environmental legislation process has been established in the last two decades. Maintenance of trees and parks in downtown areas is not a big problem, as it is the uncoordinated to chaotic urbanisation process in the periphery of the big cities. Information about TOF in Curitiba, the eighth largest city of Brazil is provided.

INTRODUCTION

According to FAO (Kleinn, 2000) trees on land not defined as forest and other wooded land or Trees outside forests (TOF) include:

- trees on land that fulfils the requirements of forest and other wooded land except that the area is less than 0.5 ha;
- trees able to reach a height of at least 5 m at maturity in situ where the stocking level is below 5 percent;
- trees not able to reach a height of 5 m at maturity in situ where the stocking level is below 20 percent;
- scattered trees in permanent meadows and pastures;
- permanent tree crops such as fruit trees and coconuts;
- trees in parks and gardens, around buildings and in lines along streets, roads, railways, rivers, streams and canals;
- trees in shelterbelts of less than 20 m width and 0.5 ha area.

TOF in Brazil occurs mainly within agroforestry systems, also as in individual trees or in parks in urban areas, fruit tree plantations or orchards, scattered trees and forest patches in transition zones as e.g. between dense forests and open savannas or swamps. In the following a TOF classification for Brazil is outlined. Institutions involved in the development of TOF related systems in Brazil are shown in table 5 of the appendix.

TOF CLASSIFICATION FOR BRAZIL

Trees within agroforestry systems (Clement, 1990, Dubois, 1996, Harwood, 1996)

The tree component in agroforestry systems in Brazil occurs in the form of live hedges (including windbreaks), alley cropping, (agro)silvopastoral systems, agroforests and shading elements for perennial crops. Within the sequential systems shifting cultivation and multistrata systems with perennial crops prevail.

In North Brazil indigenous tribes and traditional forest dwellers utilise a variety of domesticated palms and other (indigenous) fruit trees (so-called multipurpose trees, MPTs) in shifting cultivation and multistrata systems (home gardens). For these people gathering forest products is an important component in the agricultural cycle. E.g. babassu (*Orbignya martiana*) palm kernels are gathered during the agricultural slack period by tenant farmers with few possibilities for earning cash income. A variety of fruit tree species like the pejobaye palm (*Bactris gasipaes* H.B.K.) are domesticated (i.e. managed) by local tribes within agroforestry systems. These trees in general are planted on fallows. After rotation to other swidden plots, the Indians return to the older plots to gather the fruit. Domestication has led to new varieties and clones of *Bactris* spp., pineapple and rubber and the extension of some valuable species like the Brazil nut tree. A great number of other tree species serve as collection trees without further harvest. Other well-studied examples of agroforestry systems with native tree species are the systems of the Japanese who immigrated in the 1920s with the cultivation of black pepper together with trees. Due to phytopathological problems of pepper the systems underwent a diversification with other annuals but also trees.

Special attention must be given to the traditional system to produce cocoa in South Bahia where small landholders maintain shading trees to produce cocoa, dendee and other crops and the culture of *Acacia* spp. with annual crops in Rio Grande do Sul.

Some important systems with their regional relevance are described in Table 1:

Table 1: Agroforestry systems according to their regional occurrence.

Region (federal states)	Type of system	Tree species
South (Rio Grande do Sul, Santa Catarina, Paraná)	silvopastoral and agrosilvopastoral systems, "faxinal" (native tree species with pasture), live hedges in vineyards	<i>Acacia mearnsii</i> , <i>Mimosa scabrella</i> , <i>Ilex paraguaiensis</i> (erva-mate), <i>Araucaria angustifolia</i> (Brazilian pine) and other native tree species (e.g. <i>Euterpe edulis</i>), <i>Platanus</i> spp.
Centre-East (e.g. Minas Gerais, São Paulo)	alley cropping	<i>Eucalyptus</i> spp., <i>Pinus</i> spp.
Northeast (e.g. Bahia)	traditional cocoa system with shading trees, dendee culture	<i>Cordia alliodora</i> , <i>Prosopis</i> spp., <i>Leucaena</i> spp., palms
North (e.g. Amazônia, Pará, Acre, Rondônia)	multistrata systems, shifting cultivation, alley cropping	various native species (<i>Cordia</i> spp., <i>Tabebuia</i> spp., <i>Swietenia</i> spp., <i>Hevea brasiliensis</i>)
Centre-West (e.g. Mato Grosso)	multistrata systems, shifting cultivation, silvopastoral systems	various native species (see above), <i>Tectona grandis</i>

Trees and parks in urban areas (Veras, 1986, Milano, 1988, 1990, Kuchelmeister & Braatz, 1993, Kuchelmeister, 2000, Pastuk, 1999)

Urban forestry in Brazilian cities means the preservation and management of green areas and street arborisation. In every Brazilian city there are some parks and squares. But often a co-ordinated development ("master plan") of the green area sector is lacking and spontaneous measures prevail. Nevertheless, in many cities, small ones as well as metropolises, an environmental legislation process has been established in the last two decades. In the following cities major urban forestry activities have been documented (see References): São Paulo (São Paulo), Rio de Janeiro (Rio de Janeiro), Recife (Pernambuco), Curitiba (Paraná) [see case study], Porto Alegre and Bento Gonçalves (Rio Grande do Sul). The situation of parks and trees in urban areas has been analysed quantitatively and qualitatively in detailed case studies (Curitiba [see case study], Maringá, in Paraná or Petrolina in Pernambuco). In general the situation of green areas in Brazilian cities is crucial, because they are far away from the 12 m² of green area per inhabitant which is required by the U.N. (see positive exception of Curitiba with 52 m² or Maringá with 21 m²). The problem is less the maintenance of trees and parks in downtown areas than an uncoordinated to chaotic urbanisation process in the periphery of the big cities. This horizontal expansion is characterised by clandestine occupations of land which often is unsuitable for buildings. The absence of a sound housing policy and tenural insecurity in most of these areas lead to a strong geographical segregation of residential areas which goes along with a social stratification, too. In most cases the basic infrastructure of housing, health or waste deposition can not be guaranteed. Thus, there is just as little a concern for environmental policy.

Some documented aspects of urban forestry in Brazil are listed below (Ferreira, 1992, Moraes de Jesus, 1984, Pereira Lima, 1990, Sanchotene, 1990): tree planting and environmental education (project "Um milhão de árvores", São Paulo), establishment and maintenance of alleys and parks (Curitiba, Porto Alegre), establishment of urban orchards (Recife), rearrangement or structuring of parking areas with trees (Porto Alegre), establishment of green belts around industrial areas to contain pollution effects (port of Tubarão, Vitória). A well-documented case study of urban forestry is the Community Forestation Project (Projeto Mutirão Reflorestamento) in the city of Rio de Janeiro (Pastuk, 1999). On the hillsides of Rio many favelas were established uncoordinatedly due to population growth (rural migration) and an absence of housing policy. These vulnerable agglomerations frequently suffer from landslides due to exposed soils and a high surface run-off. Reforestation programmes on the slopes above those favela towns helped to diminish their vulnerability against soil erosion and landslides and to reduce the pressure against native forest remnants. In this project, which was supported by the Parks and Garden Foundation (Fundação de Parques e Jardins), a special consideration was given to active community participation within the forestation activities.

Fruit tree plantations or orchards (Mesquita, 1986, Fachinello et al., 1996, Manica, 1997)

Due to its extension from the tropics to temperate climates Brazil has privileged conditions for all kinds of fruit production, especially tropical fruits. In 1994 Brazil had 2.5 million ha of fruit tree plantations: 55 % of them were located in the tropics, 40 % in the subtropics and 5 % in the temperate zones of the south. An emphasis is laid on the cultivation of citrus fruits (São Paulo), apple (Santa Catarina, highlands) but also on many tropical fruits (valley of San Francisco, valleys of smaller rivers in South Brazil and the coastal region). Fruit bearing trees play an important role in the Amazonian region where forest dwellers and indigenous people domesticated a lot of MPTs. Moreover, fruit trees are a very important component within the arborisation of urban areas (see example of urban orchard in the city of Recife).

The types of stands where fruit trees occur are multistrata and multispecies home gardens, monospecific

industrial orchards, urban orchards or street trees and experimental stands (plots).

Scattered trees and forest patches in transition zones (examples) (Furley et al., 1992, Schelhas & Greenberg, 1996)

A large transition zone between dense forest formations and savannas has to be considered as a considerable area of TOF in Brazil, which has yet not been assessed systematically. Investigations on trees and forest fragments have been done in the following transition zones:

- transition zone between close semi-deciduous forests (cerradão) and

Cerrado (open savanna with sparse trees or scrubs) on the entire border between the seasonal and humid tropics in Brazil [Mato Grosso, Goiás, DF, Tocantins, Pará, Maranhão, Piauí]. As a general rule one can say that the less fertile the soils are the poorer the conditions are for closed forests of the cerradão type. An important multiple-use tree species in the Brazilian Cerrado is *Caryocar brasiliense*;

wetland (wet flooded savanna in the Pantanal, Mato Grosso) with forest patches (islands) on elevated ground like termite mounds (e.g. forests with *Tabebuia impetiginosa*, *Attalea* palms);

Chaco (Argentine and Paraguayan thorn savanna) with *Shinopsis balansae* parklands (quebrachal) and other more or less chaqueni scrub formations.

- transition zone between (close) Amazonian forests and

Amazonian hydrologic savannas as e.g. in Roraima (Maracá Island);

agricultural areas such as in Rondônia. The colonisation of Rondônia led to a strong fragmentation of forests. These forest patches and trees are retained by the farmers for self-sufficiency as well as for purposes of amenity and legacy.

QUANTITATIVE ASPECTS OF TOF IN BRAZIL

Data on land cover and use is summarised in different international databases. The World Resources Institute (see above) compiled data about forest cover, land area and use on the base of FAOSTAT Statistics (WRI, 2000).

The most important national database in Brazil is IBGE (Brazilian Institute of Geography and Statistics). The IBGE survey in the area of agriculture/land use ("Censo agropecuário", IBGE, 2000) does not account for TOF explicitly. As land uses only forests (native and planted), agricultural land (permanent and temporary) and different categories of degraded and unproductive land are distinguished. One type of information, which is accessible, is the number of trees obtained by different types of producers, different landowner sizes or land use forms.

In Brazil no other systematic assessment on TOF (forest inventory) has been made until now, neither on a national nor on a regional level.

The available data for the above described TOF systems is summarised in Table 2 (note: total area of Brazilian territory = 845652000 ha, with a percentage of 65.2 of forested land).

Table 2: Accessible quantitative information about TOF in Brazil.

TOF system	Area [ha]	[%] of Brazilian territory	[%] of Brazilian forested area	Source
Trees within agroforestry systems				IBGE (2000)*
Fruit tree plantations or orchards	2500000	0.3	0.4	Fachinello et al. (1996)
Trees and parks in urban areas	case study Curitiba, <i>see detailed study</i>			Secretaria do Meio Ambiente (2000)
Scattered trees and forest patches in transition zones	135418430	16.0	23.6	UNEP/WCMC (2000): Brazil Statistics

* IBGE provides data of the agricultural survey 1996 based on more than 4.8 million properties in Brazil. There the number of trees within different land uses is given (e.g. 24347921 *Acacia mearnsii* on pastureland within Brazil, for more see IBGE website in references).

It must be stated that the estimates of Brazil's current forest cover differ significantly, depending on the source. FAO's estimate encompasses 573000000 ha whereas e.g. UNEP-WCMC on the basis of the US Geological Surveys (USGS) Earth Resources Observation System (EROS) only found 443562180 ha. Therefore, also the TOF data available are very uncertain.

CASE STUDY: THE SITUATION OF URBAN FORESTRY IN THE CITY OF CURITIBA (SECRETARIA DO MEIO AMBIENTE, 2000)

Curitiba, the capital of the Brazilian federal state of Paraná, is the eighth largest city of Brazil with 2.42 million inhabitants (greater Curitiba) and one of the regional metropolises of Brazil. The city is located on the first highland plateau of Paraná, at an altitude of 905 m asl. Towards the E the nearly 2000 m high coastal mountain range delimits the highlands from the coastal zone (distance 80 km). Further urban growth and expansion still is possible towards the N, W and S. The climate is subtropical humid with the occurrence of several frost nights in winter. The natural (forest) vegetation of the highlands in the surroundings of Curitiba is the tropical moist mixed forest ("floresta ombrófila mista") with predominance of *Araucaria angustifolia* in the upper storey and a variety of broad-leaved trees in the lower storey. Today, however, only small fragments of mostly exploited Araucarian forests remain. The natural vegetation of the coastal range at the E of Curitiba metropolitan area is a dense tropical moist (cloud) forest, the so-called "Mata Atlântica". From 61 million ha of coastal rain forest in Brazil until today only 3 % survive (FAO, 1993). A significant fragment of this forest type near Curitiba is preserved as an UNESCO biosphere reservation.

In the 1960s and 1970s modernisation in agriculture in south and south-eastern Brazil (including Paraná state) but also severe dry periods in other regions of Brazil (especially Northeast) with a subsequent

displacement of small family farmers and sharecroppers led to enormous immigrant fluxes to the main urban centres, such as São Paulo and Curitiba. During those decades Curitiba experienced a demographic expansion of up to 5.7 % annually. The implementation of a progressive environmental policy in Curitiba dates back to that time. The demand for recreation and leisure areas increased rapidly. Parallel with population growth and urban expansion access roads to residential areas received linear green zones ("jardins ambientais"). Cycleways with "green" components were built along railway routes. Polluted areas with disordered development were treated and transformed into "green" areas. The city's authorities began to create parks and preserve remaining gallery forests to improve natural draining. Parks and groves were named according to the different immigration ethnics (German grove, pope grove, etc.) to support cultural identification. The arborisation of the city's streets was intensified with the planting of 70000 trees (annual mean number of trees planted since then: 3000). Moreover, programmes of environmental education were launched to accompany the shaping of an environmentally friendly attitude among the citizens.

Recently the metropolitan area is experiencing another accelerated growth process due to intensified industrialisation (e.g. the establishment of international firms such as Renault and Volkswagen). An interesting current urbanisation phenomenon of many Brazilian metropolises can be observed, too. Especially former suburbs and not necessarily the capitals themselves profit from industrial and population growth. This is the case with São José dos Pinhais, 40 km south to Curitiba, where the establishment of a Volkswagen plant and the new airport has led to an exorbitant growth and land consumption.

Despite all problems today, Curitiba is known beyond the national border for its policy in favour of a well-ordered urban development, sophisticated public transportation system and environmental conservation, attributes, which gave Curitiba the character of a modern model city in Latin America. Already during the last 30 years Curitiba has focused on its urban planning. A master plan for an orderly urban development was implemented beginning with J. Lerner's administration in 1971. The development of the master plan was accompanied by the IPPUC ("Research and Urban Planning Institute of Curitiba") and permanent discussions throughout society ("Tomorrow's Curitiba" seminars). Today the city moves forward to extend its solutions to the whole metropolitan area. The special "Municipal Secretary for Metropolitan Affairs" links Curitiba to the governments of 24 surrounding municipalities. Recently the city's administration launched 24 inter-divisional "core ideas projects" for the metropolitan area such as "zoning and land use" with time tables for execution.

In 1973 the former IBDF (today IBAMA) transferred the legislation responsibility for Curitiba's green areas to the city authority. Green areas were defined to be native forests with the purpose to protect water, soil, fauna and scenic assets, thus excluding plantations of fast-growing exotic species like *Eucalyptus* and *Pinus* (law 6819 of 1986, see Table 6). In the following the former city's park directory became directly connected to the mayor's office. In 1991 the environmental policy law was created which established general measures of environmental protection, conservation and melioration within the capital. After several organisational changes, the Environmental Secretary of Curitiba is now in charge of the supervision and monitoring of parks, isolated trees and conservation areas as well as the arborisation of streets. 93 areas of tree vegetation, which belonged to former permanent preservation areas, were mapped and registered in the year 1974. In 1998 already 1100 forests of permanent preservation existed within Curitiba's special green area sector (forests of permanent preservation are native forest remnants on real estates within the municipality). As a special category of the green area sector preservation areas ("Unidades de conservação e lazer") like parks, groves or squares were delimited (for a summary of these areas see Table 3). The specially protected areas as well as the forests of permanent preservation underlie the local municipal norms. Today Curitiba has about

52 m² of green area per capita which is under the municipality's control and monitoring. Recent surveys even indicate an increasing trend in green area, but with strong variations throughout the different town districts (e.g. the city centre only accounts for 5 m² per capita). The UN Health Organisation's recommendation is 12 m² of green area per capita (Secretaria do Meio Ambiente, 2000). The legislation development relating to TOF systems in Curitiba is documented in Table 6.

Table 3: Type, number and size of conservation and leisure units in the city of Curitiba
(source: Secretaria do Meio Ambiente, 2000).

Types of green area	III.	Number	Area [m]
Parks ¹¹		14	18407873
Forests (groves, "bosques")		12	612295
Squares		351	2017789
Gardens ("jardinetes")		289	303839
Places ("largos")		52	58571
Environmental gardens ("jardins ambientais")		6	51100
Sport centres		2	64100
Environmental cores		11	6676
Animation axes		14	417118
Total		751	21939361

The main goals of Curitiba's parks and green area policy are to create compensation areas in the "urban ecosystem". Often the parks and groves are connected with leisure areas, thus supporting environmental education of the population. In the responsible authority's philosophy *green* areas have to play a pre-eminent role in the urban environment to further guarantee a sound urban development. Another goal is the preservation of typical vegetation (forest) formations of the region. One of these parks, which turned out to be the symbol of Curitiba, is the new botanical garden with the famous greenhouse, which was inaugurated in 1991. Completed with a botanical museum, this park still shows one of the few remaining native forest fragments with *Araucaria angustifolia* within the urban area. Another example is the "German grove" with a secondary forest mainly of deciduous trees. In the south of Curitiba a new park recently was dedicated to Brazil's 500th anniversary. Some more areas will be delimited soon, especially in the periphery.

According to the current regulations in Curitiba the felling of isolated trees requires a permit from the Environmental Secretary (see so-called "árvores imunes de corte", appendix, Table 4). If cutting permission is obtained two trees of recommended species (in the case of *Araucaria angustifolia* four) have to be planted or donated to the city by the landowner. The trees and forests in the city's special sector of green areas no longer lose their destination of being forest. That means that in the case of forest degradation or destruction the forest has to be fully restored. Soil occupation in the city's real estates is regulated in detail considering

¹¹ within the park area "Parque Iguaçu" is considered to be the largest urban park in Brazil with a total area of 8264316 m².

the size and vegetation cover of the real estate. Furthermore, the landowners in the special sector of green areas are encouraged to preserve forest fragments with a reduction or suspension of property tax proportional to the forest cover registered on their land. The city also benefits from a state law (so-called "ICMS ecológico"), which allows the city to keep 5 % of value added tax from the state if it manages conservation areas or forests with springs. Thus Curitiba gets 300000 R\$ (1US\$^a 1,85 R\$, October 2000) weekly which can be spent on ecological purposes. A special fund (Municipal Environmental Fund) was created to allocate the money from surcharges, donations and other sources in order to establish environmental priorities. Currently Curitiba is discussing a further extension of environmental regulations within a municipal forest code.

There are few detailed studies assessing the situation of green areas and street trees in Curitiba (Milano, 1984, Roderjan & Barddal, 1998). Based on a systematic inventory street trees were sampled and identified including crown and root characteristics, as well as diseases and other damages (Table 7). In total 4382 trees were investigated. Of the 93 species, which could be found in the city's streets, 18 species accounted for 92 % of the population. The two most abundant species (*Lagerstroemia indica* and *Ligustrum lucidum*) account for 39 % of the population, indicating a great risk because *Lagerstroemia* is highly susceptible to fungi. One third of the trees were damaged. 3 % of the trees caused damages on the streets due to superficial root systems. It could be observed that many of the trees had already reached electricity lines, which in most cases provoked inadequate severe tree pruning. The spacing between the trees in general was found to be sufficient. To summarise the city's arborisation was considered still to be good.

Today a significant part of the population is involved in Curitiba's environmental programmes. There are several activities in the field of environmental education like "Olho d'Água" where municipal students carry out survey programmes about river quality or "Câmbio Verde" where recyclable trash is exchanged for food or teaching material. For 4 kg of trash one gets 1 kg of fruit. In a programme conducted since 1989 the Municipal Health Secretary supports the production of medicinal plants which are freely distributed to local health stations. In a project called "Cesta Metropolitana" fruits are sold 30 % below market price especially for poor people from peri-urban areas. There are no explicit projects in the fields of urban agriculture in Curitiba but small producers of the metropolitan area have the right to sell their products on special markets without middlemen. Curitiba's environmental project with the most success concerning participation of the local people is the communal planting project ("Plantios Comunitários"). Supported by the Environmental Education Department planting native (fruit) trees is carried out together with the local people. Once suitable areas are localised, the Department gets into contact with local representatives and involves them in the planning process. Areas for planting always are public areas, mostly threatened by erosion or inundation like steep slopes or riparian zones. The local people are also provided with knowledge about the tree or shrub species. The above described activities are not restricted to the city centre but have an emphasis especially on the periphery of the urban agglomeration.

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APPENDIX

Table 4: List of tree species which can not be cut ("árvores imunes de corte") in Curitiba.

Scientific name	Popular name
<i>Chorisia speciosa</i>	Paineira
<i>Populus nigra</i>	Poplar
<i>Castanea vesca</i>	chestnut
<i>Eucaliptus spp.</i>	eucalyptus
<i>Araucaria angustifolia</i>	Brazilian pine
<i>Araucaria bedwillyi</i>	
<i>Tipuana tipu</i>	tipuana
<i>Schizolobium parahybum</i>	guapuruvu
<i>Olea europea</i>	olive tree
<i>Carya illioensis</i>	nogueira

Table 5: List of institutions and agencies which promote the management and utilisation of TOF systems.

Name of institution	Character	Seat
Brazilian Agroforestry Network	NGO	Rio de Janeiro, RJ, Brazil
Executive Commission for the Development of Cacao (CEPLAC)	Governmental	Ilh us, BA, Brazil
Agroforestry Formation Centre (CFA-Jatob)	NGO	Pira -do-Norte, BA, Brazil
International Centre of Tropical Agriculture (CIAT)	Governmental	Cali, Colombia
State Secretaries of Agriculture (EMATER)	Governmental	different federal states
EMBRAPA ⁺ /CPAA	Governmental	Man us, AM, Brazil
EMBRAPA/CPAF	governmental	Rio Branco, AC, Brazil
EMBRAPA/CPATU	governmental	Bel m, PA, Brazil
EMBRAPA-Cerrados	governmental	Planaltina, DF, Brazil
EMBRAPA-Florestas	governmental	Colombo, PR, Brazil
Brazilian Institute for Environment and Renewable Natural Resources (IBAMA)	governmental	different federal states
International Council for Research in Agroforestry (ICRAF)	governmental	Nairobi, Kenya
National Institute for Research in the Amazon (INPA)	governmental	Man us, AM, Brazil
Brazilian Society of Urban Forestry (SBAU)	NGO	Rio de Janeiro, RJ, Brazil
Terra viva	NGO	Itamarju, BA, Brazil

⁺EMBRAPA=Brazilian National Council for Agricultural Research

Table 6: Important laws and decrees of the environmental legislation in Curitiba referring to urban planning and TOF.

Name of law, decree	Subject
Lei ⁺ 4557/73	protection and conservation of trees
Lei 5234/75	zoning of land use
Decreto ⁺ 400/76	preservation of riparian zones
Lei 6819/86	formation and preservation of green areas, tree compensation planting
Lei 7833/91	environmental policy
Decreto 471/88	establishment of municipal parks
Lei 8353/93 and Decreto 782/95	parameters for occupation of real estates, criteria for tree cutting
Municipal Forest Code 1998 (not yet passed)	collection of all environmental relevant legislation

The last two figures of the number in the first column indicate the year when the law passed (e.g. /73=1973).
+ lei = law; decreto = decree

Table 7: List of TOF vegetal species found in the streets of Curitiba
(according to Roderjan & Barddal, 1998).

Scientific name	Family	Native (n) or exotic (e)
<i>Acer negundo</i> Linn.	Aceraceae	e
<i>Aleurites fordii</i> Helmsl.	Euphorbiaceae	e
<i>Anadenanthera colubrina</i> (Vell.) Brenan	Mimosaceae	n
<i>Aspidosperma olivaceum</i> Muell. Arg.	Apocynaceae	n
<i>Balfouodendron riedelianum</i> Engler	Rutaceae	n
<i>Caesalpina leiostachya</i> (Benth.) Ducke	Caesalpinaceae	n
<i>Caesalpina peltophoroides</i> Benth.	Caesalpinaceae	n
<i>Cassia leptophylla</i> Vog.	Caesalpinaceae	n
<i>Chorisia speciosa</i> St. Hil.	Bombacaceae	n
<i>Citharexylum myrianthum</i> Cham.	Verbenaceae	n
<i>Clethra scabra</i> Loisel.	Clethraceae	n
<i>Cybistax antisiphilitica</i> Mart.	Bigoniaceae	n
<i>Erythrina falcata</i> Benth.	Fabaceae	n
<i>Eugenia uniflora</i> Berg.	Myrtaceae	n
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	e
<i>Holocalyx balansae</i> Miq.	Caesalpinaceae	n
<i>Jacaranda mimosaeifolia</i> D. Don	Bigoniaceae	e
<i>Jacaranda puberula</i> Cham.	Bigoniaceae	n
<i>Koelreuteria paniculata</i> Laxm.	Sapindaceae	e
<i>Lafoensia pacari</i> St. Hil.	Lythraceae	n
<i>Lagerstroemia indica</i> Linn.	Lythraceae	e
<i>Leucaena leucocephala</i> (Lam.) de Wit	Mimosaceae	e
<i>Ligustrum lucidum</i> Ait.	Oleaceae	e
<i>Magnolia grandiflora</i> Linn.	Magnoliaceae	e
<i>Melia azedarach</i> Blanco	Meliaceae	e
<i>Michelia champaca</i> Linn.	Magnoliaceae	e
<i>Parapiptadenia rigida</i> (Benth.) Brenan	Mimosaceae	n
<i>Peltophorum dubium</i> Taub.	Caesalpinaceae	n
<i>Pittosporum undulatum</i> Guill.	Pittosporaceae	e
<i>Populus nigra</i> Linn.	Salicaceae	e
<i>Robinia pseudoacacia</i> Linn.	Caesalpinaceae	e
<i>Salix babylonica</i> Linn.	Salicaceae	e
<i>Senna macranthera</i> (DC. Ex Coll.) Irwin & Barn.	Caesalpinaceae	n
<i>Senna multijuga</i> (L.C. Richard) Irwin & Barn.	Caesalpinaceae	n
<i>Syagrus romanzoffiana</i> (Cham.) Glassm.	Arecaceae	n
<i>Tabebuia alba</i> (Cham.) Sandwith	Bigoniaceae	n
<i>Tabebuia chrysotricha</i> (Mart. Ex DC.) Stand.	Bigoniaceae	n
<i>Tabebuia heptaphylla</i> (Vell.) Toledo	Bigoniaceae	n
<i>Tibouchina pulchra</i> Cogn.	Melastomaceae	n
<i>Tibouchina sellowiana</i> Cogn.	Melastomaceae	n
<i>Tipuana tipu</i> (Benth.) Kuntze	Bigoniaceae	e
<i>Vochysia bifalcata</i> Warm.	Vochysiaceae	n

SOCIAL AND ECONOMIC FACTORS INFLUENCING TREES OUTSIDE FORESTS DEVELOPMENT: THE COSTA RICAN CASE

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ABSTRACT

Central American countries changed from forested areas to agriculture land and pasture in the last half century. The predominant vision of development and economic growth in the fifties was linked to agro-export production, which supported the expansion of agriculture and cattle ranching. Forest was perceived as an obstacle for development and growth; therefore incentives for land use changes were created by governments and encouraged by international agencies and donors. Nowadays, forest cover is recognized not only as key natural resource, which provides basic environmental services to humanity, but also as source for raw material for economic activities. We may say that there has been a forest value evolution. This kind of change, in countries such as El Salvador or Costa Rica, --which was once one of the most deforested countries in the world— where the forest cover for production purposes is very reduced, make a counter effect increasing the value of trees outside forest (TOFs).

There are no specific policies favoring TOF; however, the countries with clearer policies on forest activities and forest services, seem to have greater appreciation for TOF. The most common TOF in the region are constituted by trees on agricultural and pasture land and in urban and peri-urban areas. Farmers who have trees within their agriculture plantations, in the farm fences and pastures, appreciate them not only because the additional services they provide, but also because they constitute a saving and a financial resource to use in any future emergency. In this sense, farmer's livelihood is also changing from considering forest as an obstacle, towards a more integrated forest resource concept which provides goods, services and income.. TOF are becoming a very important source of raw material for industries. Legally or illegally cut, these trees are currently providing an important part of the total wood supply to primary transformation industries. Therefore, TOF produce benefits, providing jobs, raw material for the industry and dynamic to the sector; but in the other side, it affects the formal forestry sector if the resource is illegally cut, introducing unloyal trade practices affecting market prices and the transparency of the sector in general.

After reviewing the current role of TOF, the paper emphasizes that it is very relevant to enhance research and create innovative policies. The knowledge of economy is also entering TOF resources. Their values are evolving and it is important to sustain and to promote the institutional change that is happening.

INTRODUCTION

Goods and services from forest and trees outside the forest (TOF) are very important for people's livelihoods and economic activities (TOF definition in section 5). In spite that this is a fact all around the world, it is not until recently that we may find some examples of economic internalization of such benefits. In general, forests and trees are valued for the timber they produced and not valued for the rest of services they provide to society. Why is this situation like that? What is the kind of information we need in order to really include all TOF values into everyday economics and decision making?

Forest values in Central America are slowly changing and Costa Rica is in the forefront. These countries are in the process of recognizing, through market mechanisms and other instruments, several forest services. A new economic instrument called Environmental Payment Services (Pago de Servicios Ambientales, PSA) was created by law in Costa Rica, recognizing those services from forest and forest plantations. However,

the law does not include TOF for this payment. In this sense, TOF are harvested with no consideration and somehow weak resource management, since they are not competing with alternative activities such as agriculture and cattle. Therefore, another question we should try to address in this paper is: how to increase the market value for TOF?.

We focus on the Costa Rican case, just as an example, trying to unveil the process and reviewing the applicability of such innovative mechanisms for TOF management in there and other countries. After all, forest as TOF seem to produce the same kind of services to people. The second section explains the Costa Rican evolution in the forest cover, which shifted from being a deforesting country in 1950s to a well recognized conservation and reforestation country nowadays. In the third it is included a description of the forest value evolution towards a higher value of forest. The fourth section deals with the theoretical explanation of the “learning economy” and economics of knowledge which may lead us into innovations for TOF. The fifth section evaluates the applicability of the Costa Rican example and the innovation theory to TOF, including a short list of potential business opportunities from TOF and finally some conclusions and recommendations are presented in the last section.

THE FOREST VALUE EVOLUTION IN COSTA RICA

Relatively to its size, Costa Rica was once one of the most deforested countries in the world. Today it is a pioneer in policies to support forest use and forest services. In the same way that many other countries in Latin America, land use change is highly sensitive to both, forest internal and external policies. This was especially true in Costa Rica, where land use change has reflected support for agricultural and cattle policies during long time in the past (1950s to 1990s). However, during the last decade this situation has been changing.

Table 1. Land Use Changes in Costa Rica (1979-1992)

<i>From</i>	<i>To</i>	<i>Area Change (ha)</i>	<i>% of Area Change</i>
Natural forests	Pastures	322,515	6.3
Secondary forest	Pastures	401,828	7.9
Secondary forests	Seasonal crops	13,324	0.3
Secondary forests	Permanent crops	43,073	0.8
Permanent crops	Pastures	30,516	0.6
Permanent crops	Secondary forests	14,158	0.3
Seasonal crops	Pastures	22,892	0.4
Pastures	Permanent crops	61,696	1.2
Pastures	Seasonal crops	33,420	0.7
Pastures	Secondary forests	105,490	2.1
Seasonal crops	Secondary forests	12,415	0.2
No change		4,041,989	79.2
Total		5,103,316	100.0

Source: IMN/MINAE/UNEP. 1996.

According to the IMN/MINAE/UNEP¹² study, it is possible to state that, as shown in table 1, between 1979 and 1992 there was a change of 20.8% of the country's land, equivalent to 1,064,327 hectares¹³. Out of this total, 322,515 ha (6.3%) were transformed from natural forests into pastures. The conversion of secondary forests amounted to 458,225 ha, or 9% of the land area; however this was not considered deforestation as the land had been used for pastures or crops. Total deforestation of natural and secondary forest during that period was 780,740 ha, or 15.29% of the total area, equivalent to a deforestation rate of 1.18% per year.

The most recent study, titled "Survey of Forest Cover in Costa Rica, 1986/87–1996/97" identifies changes that occurred during that decade by evaluating deforestation, natural regeneration, and reforestation. Using NASA's Pathfinder methodology for tropical deforestation, the study proposed four categories of forests: primary forests, intervening forests, secondary forests, and forest plantations whose density and crown cover could be determined by the method.¹⁴ According to the study, out of the 1,608,459 ha of forest studied,¹⁵ 164,245 ha were deforested and converted to other uses, and 126,873 ha were secondary forests and forest plantations recovered. These changes, observed in table 2, resulted in a deforestation rate of approximately 16,400 ha/year and a net loss of 3,737 ha/year during the period of the study.

Table 2. Net Change in Forest Area (1987–1997)

<i>Parameters</i>	<i>Area (ha)</i>	<i>% of Total Area</i>
Total area covered by the study	1,608,459	31.49
Deforestation	164,245	3.22
Recovery	126,873	2.48
Net loss	37,372	0.74

Source: Survey of Forest Cover in Costa Rica. CCT-CIEDES, 1998.

The same document CCT/CIEDES as may be seen in table 3, showed that forests covered in Costa Rica was 40.5% of the total land in 1996/97. And the final balance reflects an annual deforestation rate of 16,400 ha/year, and an annual reforestation rate of 22,282 ha/year, with a net positive annual balance of 5,857 ha/year.

Table 3. Forest Cover in Costa Rica (1996/97)

<i>Cover Type</i>	<i>Area (ha)</i>	<i>% of the Total Area</i>
Natural nondeciduous forests	1,885,782	36.92
Deciduous forests	126,884	2.48
Mangroves	40,848	0.80
Highlands	9,973	0.20
Total	2,063,487	40.40

Source: CCT/CIEDES/FONAFIFO. 1998.

¹² IMN/MINAE, PNUMA; MAG; IGN, DGF. 1996. Evaluación del cambio de Cobertura de la Tierra en Costa Rica 1979-1992. San José, Costa Rica.

¹³ Among other titles, this section is based in my coauthor document De Camino, R., Segura, O., Arias, L and Pérez, I. (1999).

¹⁴ Primary forests are untouched by humans. Intervening forests have been harvested at least once for timber production. Secondary forests result from the natural regeneration of abandoned pastures or farmland. Forest plantations are forests that result from planned reforestation of land that was occupied by pastures or crops.

¹⁵ The analysis of the change in forested area is partial (only 1,608,459 ha), the caducifolius forest of Guanacaste (126,884 ha) was excluded because it was impossible to compare, and 13% of the country showed only clouds and shadows when the image was taken.

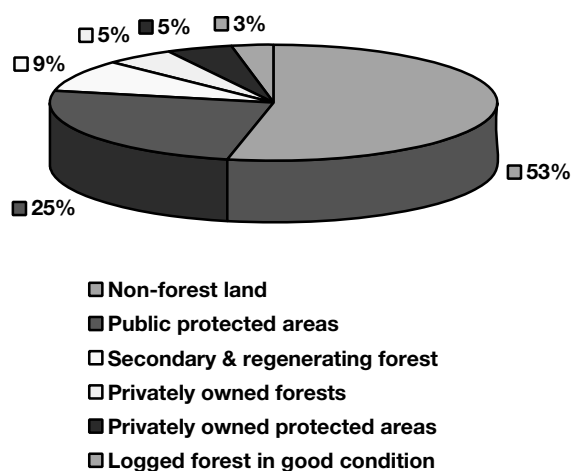
In this sense, as stated above, Costa Rica's forested areas are increasing annually. This is largely because of reforestation and the regeneration of secondary forests in abandoned pastures. It is very clear that the increased area of plantations and secondary forests has less environmental value than natural forests, and they are not substitutes, however, it is possible to say that a significant change has been happening along these years.

However, the area of privately owned forests that are used for wood production has been greatly reduced. According to the National System of Conservation Areas (*Sistema Nacional de Areas Conservación*, SINAC), there were about 250,000 ha of privately owned production forests in 1997, and out of this amount, only 50,000 ha were virgin forests.

The protected area system of Costa Rica has also been an important factor in reversing deforestation and is a practical approach to protecting biodiversity. The system is composed today by a mixture of public and private reserves, of more than 120 protected areas, totaling over 1.2 million ha in 1998¹⁶ and encompassing about 24.8% of the land.

Figure 1 shows that there are 1,287,000 ha of public protected areas, close to 25% of the land; 44,026 ha of private reserves belonging to the Costa Rican Network of Private Reserves (CNPR), for approximately 5% of the territory, and 205,974 ha of other kinds of natural forests that may be protected through private ownership. Private sector participation grew rapidly between 1980 and 1999, and it is very much due to eco-tourism activities very well developed lately in the country.

In short, there has been a significant change in the land use cover in Costa Rica in the last 40 to 50 years. Agriculture and pasture lands are partially converting to secondary forest, forest for production purposes is being reduced significantly and protected areas increased even in private hands. Why is this happening? It is discussed in the following section.



Source: Solorzano et al., 1991; MIDEPLAN, 1995d; MINAE-SINAC, 1996a; IMN, 1995; Davies, 1997; Alpizar et al., 1997.

Figure 4. Forest Land in Costa Rica

¹⁶ Mena, Y.; Artavia, G. 1998. Parques Nacionales y otras áreas Silvestres Protegidas de Costa Rica. SINAC/MINAE. There are also higher figures, but in any case the positive trend is the same.

THE EVOLUTION TOWARDS HIGHER VALUE OF FOREST

Forests, and especially forest plantations, benefited when incentives for agriculture and cattle ranching diminished and meat prices fell. But also, reforestation started in the country when specific incentives were introduced. First there was profits tax exemptions for those reforesting; second these were transformed into Forest Certificates (Certificados de Abono Forestal, CAF) which were granted to those who reforest and use them also to pay all kind of taxes. Third, these certificates were paid in advance (CAFA), precisely in order for those people who did not pay taxes and did not have any resources to start the forest plantation, to receive the necessary resources to start with such activity. With the creation of this kind of incentive a larger democratization was introduced in the system. Later there was created a Forest Development Fund (FDF), a revolving fund which lent money to farmers with less than 25 hectares to reforest. The resources for this fund were donated by the Dutch Government and complemented the CAFA for small farmers. Other kinds of subsidies were also created for Municipalities and small farmers. All these kind of incentives together, yielded reforestation of more than 147,000 ha in approximately 20 years.

One important piece of information so far, is that the potential of plantations as a resource (147,810 ha planted) could probably produce at least 1.5 million cubic meters of raw material for the industry, sequester about 500,000 tons of carbon annually, and maintain a stock of 10 million of tons of carbon over a 20-year rotation.¹⁷ This means that forest plantations are standing not only because it needs to grow more, but because there is an important quantity of resources being accumulated.

Forest management was also introduced and incentivated. Several technical assistance projects, such as the German Agency of Technical Cooperation (GTZ), the United States Agency for International Development (USAID), the Agency for International Development (DFID) of the United Kingdom, the Agronomical Tropical Center for Research and Education (CATIE), tried to improve forest management in the country, especially in the North Region. Improvements included the following:

- Simplified guidelines yielded better management plans.
- Timber inventories, harvest planning, harvesting and logging technologies, and design of logging roads all improved.
- Forest owners and government authorities provided better control of harvesting and timber transport.
- Post-harvest silvicultural interventions (timber production and forest improvements, such as first-time planting) were introduced. These included vine cutting and thinning for the selection of better tree species.
- Forest farmers formed large associations, which provided technical assistance and simplified the paperwork needed to apply for incentives.

Until 1993, forest sector incentives were oriented solely toward plantations. After these improvements, however, the government began to provide financial support for natural forest management through Certificates of Payment for Natural Forest Management (*Certificado de Abono Forestal para Manejo*, CAFMA), instituted in 1994. Like CAF and CAFA, CAFMA is a title of nominative value in national

¹⁷ This calculation assumes a growth of 10 cubic meters/ha/year, a wood density of 0.45 grams/cubic meter, a 1.6 ratio of stem volume to total biomass, and a coefficient of 0.46 tons of wood/tons of carbon.

currency, which may be traded or used to pay national or municipal taxes or tariffs. CAFMAs supported the preparation of forest management plans and the implementation of silvicultural treatments.

All these kind of incentives created along time evolved into Payment of Environmental Services (Pago de Servicios Ambientales, PSA). The law created in 1996¹⁸ this instrument, which has the objective of financing forest management, reforestation, natural regeneration, forestry nurseries and recovery of damaged areas. FONAFIFO (National Fund for Financing Forestry) manage the resources transfers between groups of the private sector who pay and who receive the payment. FONAFIFO is operationally independent of the government and has legal identity; however, the board of directors has three members appointed by different governmental offices, namely the Ministry of Agriculture (MAG), Ministry of Environment and Energy (MINAE) and the Central Bank (BCCR), plus two private sector representatives. FONAFIFO pays forest owners for forest environmental services (PSA) with the funds from carbon sequestration plus funds from fossil fuel taxes¹⁹, plus resources that they may receive from hydroelectric plants that pay for the water cycle maintenance and other resources coming from forest services payments. The four legally established forest services are: carbon sequestration, water cycle maintenance, biodiversity conservation and natural scenic beauty.

According to De Camino, et al (1999), PSAs were introduced in Costa Rica for five reasons. First, according to the Structural Adjustment Program, distortions introduced through subsidies such as CAFs, CAFMAs, and CPBs should be eliminated. Second, the goal of PSAs is not simply to lighten the burden on the public budget, but also to incorporate the “polluter pays” principle to shift the burden to the beneficiaries of environmental services. Subsidies were a necessary incentive for reforestation activities since the revenues from traditional forest products, especially wood, were largely insufficient to make these activities competitive with other types of land use. These subsidies reached \$100 million between 1979 and 1996.

Third, subsidies had at least two negative consequences for the forest sector. They perpetuated the image of a poor sector and a deficit-plagued branch of the economy dependent on uncertain and irregular state subsidies. They also encouraged a fixation on a single product, typically wood, valued in monetary terms, with a tendency to neglect other forest services. Subsidies also created dependency on the government, PSA does not.

Fourth, the analyses show that private landowners must be paid for the environmental services they are providing to the national and international communities; otherwise, private landowners will mine the forests or convert their land to other uses. Finally, one goal of PSAs is to attach noticeably greater monetary value to environmental services, which so far, have been largely ignored. The payments should have a positive effect on forest management: when a forest owner receives payment for environmental services, he will give greater consideration to managing his forests and be less inclined to change to other land uses.

Now, why the Costa Rican case is so particular, what is behind this whole change and what is behind the logic of PSA? Next section tries briefly to explain it.

¹⁸ However, the National Congress is currently discussing a possible name change to National Fund for Environmental Services (Fondo Nacional de Servicios Ambientales, FONASA), and among other things, the possibility of transferring it to the civil society, since it is financing most of the PSA.

¹⁹ Costa Ricans also pay for the emission of carbon into the atmosphere at the national level, through a tax of 5% on the hydrocarbons. One third of the amount collected is allocated, by law to FONAFIFO, for carbon sequestration.

WHAT IS BEHIND THESE CHANGES? “THE LEARNING ECONOMY”

Positive environmental services from forest ecosystems are classified as externalities in economics. The challenge is to identify those externalities, value them and internalise them into the economic sphere. Some of these services or externalities are enjoyed by the forest owner; others are enjoyed by the national community, and the rest by the international community. We need, therefore, to bring or to pull those values into the inflow of resources the private owner is receiving, in order him to really value them. In Costa Rica this process of internalisation is being done in five different services (see table 4) through the PSA.

Table 4. Forest environmental services recognised by the Costa Rican law.

Environmental services	Private ownership	National	Inter-national
Wood/timber	X		
Hydrological cycle		X	
Scenic beauty		X	
Carbon sequestration			X
Biodiversity conservation			X

The creation of PSA is considered an innovation for the forest sector in general and the Costa Rican in particular (Segura, O., 1999). This innovative instrument is taking advantage of the common knowledge that we have about forest services and the increasing environmental consciousness, in order to internalise those externalities. There is nothing new about the relationship between forest resources and the maintenance of the hydrological cycle or carbon sequestration, etc; but what is new is the *economically use* of these knowledge.

According to Lundvall (1992) *Systems of Innovation* “are constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge.” Systems of Innovation may be local, national or regional according to geographical areas; however, it seems very clear—even in globalization times—that National Systems of Innovation are very relevant since legislation, incentives, rules and other actions favouring or disesteeming policies are generally nationally drawn. In our forest case, the creation of PSA is obviously at the national level according to national legislation.

The performance of a national innovation system is influenced especially by specific parts of 1) the institutional set-up, 2) the knowledge infrastructure,²⁰ 3) the specialisation pattern, 4) the public and private demand structure (or consumer tastes in the broad sense), and 5) the government policy (Gregersen and Johnson 1997). Each of these parts have to take into account the environment and natural resources. In the Costa Rican case, each one of these five parts has its own characteristics which all together gave allowed the creation of such innovation. The law, including PSA creation, may be copied by other countries, but the characteristics of the parts of the national system of innovation and their interactions are actually the ones that stimulate or hamper the appropriate functioning of PSA.

Sometimes we do not use the existing knowledge, as in the case of environmental externalities. Some of the positive and negative impacts of production processes are well-known and there is well-developed

²⁰ Knowledge infrastructure refers to formal education and research organisations, such as universities, technical programs schools of engineering, and research centres.

knowledge of the benefits that we perceive from ecological services (for instance from water, forest, and others resources). However, we tend not to *use* this knowledge, or no to consider the effects which they produce in the system. According to the scholars who work with the SI framework, one important feature of good performance of the SI is not only to produce knowledge, or to have it (tacit or codified), but also to “use” it.

Knowledge and learning are very important for understanding systems of innovation. Furthermore, knowledge has been considered the most important resource and learning the most important process for the creation of innovations (Lundvall, 1995). National economies are moving towards this idea and from here emerges the concept of “learning economy.”

Institutions in the sense of patterns of behaviour and rules of the game (North, 1990 and Johnson, 1992) are common and central elements of the systems of innovation (SI). All definitions²¹ of SI include in one way or another, institutions as a key element which influences innovations. Institutions are path dependent and are not characterised by a specific purpose. Individuals and groups share institutional set-ups reflecting how they understand the functioning of the world and how they perceive their relations to nature.

At this point, it is important to stress the distinction between organisations and institutions, since both are going to be analysed in this research. Although, ministries and other formal structures are called “institutions”, in common language here they will be known as “organisations”. Organisations are formal structures (players or actors) with an explicit purpose and they are consciously created (North, 1990; Edquist, 1997). They are also important elements in the innovation system, since they serve as vehicles for change and thus affect new policies and incentives. For this paper about trees outside forest (TOF), entities such as firms, ministries, governmental offices and non-governmental organisations (NGOs), all, are important organisations.

Therefore, the SI of each particular nation or region will be shaped and built according to their institutional framework. For instance, in Central America, the basic common understanding was that development and economic growth should be achieved by exporting agricultural products. Then, the institutional set-up, including both formal and informal rules of behaviour and interaction in the economy, supports the idea of development as linked to agriculture, cattle ranching, and other “basic” activities. It was therefore common to perceive the forest mainly as an obstacle to development; consequently, all the policies and the whole institutional set-up were built to promote the agricultural sector. Firms, research institutes, and other organisations interacted with governments in a common institutional set-up, reproducing more or less the same innovation system within the strongly established dominating framework. It is impossible to change the general performance of the national system of innovation (NSI) without changing the institutional framework in which it is operating. An explanation of how this approach about SI may be related to TOF follows in the next section.

GOODS AND SERVICES FROM TOF

In general, it is necessary greater awareness about the benefits of maintaining and increasing TOF (definition in box 1). However, due that the System of Innovation (SI) is rooted in institutions, it is also necessary to realize fundamental institutional changes to truly value TOF. In the Central American case, if we consider

²¹ For definitions of “institutions” in economic terms, see North (1990); Nelson and Sampat (1998); Ostrom (1990); Johnson (1992) in Lundvall (ed) (1992).

that the forest sector as well as TOF may have possibilities of increasing competitiveness and of contributing to the economic performance of the region, then we need to encourage different ways of learning and innovation. Current consumer habits, as well as some of the organizations' methods, practices, incentives and technologies may be included as elements where changes are needed. In other words, there is a need for continuous technological, organizational, policy and institutional learning to really take into account the social, ecological and economic TOF values.

Box 1. Trees Outside the Forest (TOF)

TOF includes trees on land that fulfils the requirements of forest and other wooded land except that the area is less than 0.5 hectares; trees able to reach a height of at least 5 meters at maturity in situ where the stocking level is below 20 percent; scattered trees in permanent meadows and pastures; permanent tree crops such as fruit-trees and coconuts; trees in parks and gardens, around buildings and in lines along streets, roads, railways, rivers, streams and canals; trees in shelterbelts of less than 20 meters width and 0.5 hectares area.

Source: FAO, 1998; Kleinn, 2000.

We may say that farmer as well as other people who are in urban or rural areas living around TOF areas, are somehow valuing them. However, the important point we must stress is that most of these TOF are disappearing with no substitution. People are losing not only the beautifulness but also the rest of goods and services that they provide.

TOF produce, not the same, but similar functions than forested areas. For instance, carbon sequestration, biodiversity conservation, soil protection, water cycle maintenance, wood, firewood, medicinal plants, contribution for the biological corridors formation, and others (Kleinn, 1999). However, some of these functions are TOF specific such as, shade on pastures, windbreak, living fences, ornamental areas, forage, and others, but also beautifulness, urban amenity, recreation, etc.

In Costa Rica there are not well known statistics about the total timber harvesting from TOF. However, very reliable estimates produced by accounting the harvesting permits extended by the Ministry of Environment and Development (MINAE) leave us with the alert that timber is coming from other sources rather than only productive forest. According to Gonzalez and Lobo (1999), harvesting trees on pastures and agriculture areas, among others are in the range of 30 to 45% of the total harvested in the country in 1999. This without considering the illegal cutting. For 1998, the same study shows estimated volumes of approximately 447.344 cubic meters, out of which 228.982 correspond to TOF (51.2% approximately) and 248.362 is the volume coming from productive forests.

In spite of all the efforts coming from the public sector as well as from the private one, illegal deforestation still persist. MINAE, SINAC and the National Forest Office (ONF) as public sector have been joining initiatives with several NGOs such as CODEFORSA, FUNDECOR, JUNAFORCA and others, in order to stop the illegal cutting. TOF are also illegally providing a great deal of raw material, especially timber to sawmills in Costa Rica, but other cause of such underground activity is the land use change towards more profitable economic activities (Campos, et.al., 2001), and another reason why deforestation continues is the scarce forest and TOF management knowledge, the believe that there is not value attached to TOF and the need for immediate sources of income.

According to Campos, et al, 2001, there is no clear definition of illegal harvesting in the forest law, neither an efficient State Administration Office to enforce the law. He also states that the illegally extracted and commercialized timber in Costa Rica come from four different sources:

- Trees from pastures (TOF)
- Trees from primary forest without land use change objective,
- Remaining trees from intervened forest with management plans, and
- Trees from secondary forest with the land use change.

The owners of small and medium size farms are the ones who have been taking advantage of goods and services coming from TOF. Agro forestry and silviculture systems have included TOF products as part of the system, but also several services, such as soil recuperation, spring water protection and others have benefited them. Additionally, from the economic and financial point of view these trees represent in many cases, a complement or an extra income for the farmers.

Trees with annual and perennial crops, silvopastoral land, living fences, trees alones and mixed and associated trees with agriculture, trees in pasture and forage are common types of existing TOF in Costa Rica. These kind of relationships, including the names of the most common species used is documented by Current et al (1995) and shown in table 5 below.

Table 5. Major Agroforestry Systems Found in Costa Rica

Agro forestry System	Species	Products and Services
Trees with perennial crops	Cordia alliodora, Coffea arabica	Shade, timber, coffee
	Cordia alliodora, Coffea arabica, Erythrina poeppigiana	Shade, timber, coffee, nitrogen and organic matter
	Cordia alliodora, Theobroma cacao	Shade, timber, chocolate
	Cedrela odorata, Citrus spp., Inga spp.	Shade, timber, coffee, fruit, fuel wood
	Musa spp., Coffea arabica	Shade, timber, nitrogen and organic matter
	Alnus acuminata, Coffea arabica	Shade, timber, nitrogen and organic matter
Silvopastoral	Alnus acuminata – Pennisetum	Timber, forage, nitrogen and organic matter
	Clandestinum, Pennisetum purpureum, Axonopus scoparius	
	Cordia alliodora, Erythrina poeppigiana, Psidium guajava, Guazuma ulmifolia in pastures	Timber, fuel wood, fruits and pasture
Living fences	Bursera simaruba, Gliricidia sepium, Erythrina poeppigiana	Fence posts, fuel wood
Isolated trees	Cordia alliodora, Cedrela odorata, Bombacopsis quinatum	Timber shade

Source: Current, Dean. et. al Costs, Benefits, and Farmer Adoption of Agroforestry, pág. 56

Finally the official Forest National Development Plan (PNDF in Spanish), estimates that 25% of the commercialized wood in the country, is coming from natural forest, pastures and other TOF in illegal manner. McKensie (2000) estimates were a total cutting of 814,028 m³, therefore a the illegal part amounts to 284,910 m³.

According to the above arguments, it is necessary to improve TOF social, cultural, environmental and economic valuation. Again, it is necessary to institutionalize a new concept, or to develop a new paradigm for TOF. This may be related to the system of innovation which is in formation in Costa Rica, which includes environmental services into the economic scenario.

Reviewing the following table, number 6, we may identify all the different goods and services coming from TOF. In the same way that we detailed forest services in table 4 divided into the ones enjoyed by the private owner, the national beneficiaries and the international community, here we may divide TOF services. The necessary exercise again, is to create an innovation; which allow us to internalize these positive externalities. The innovation must consist on creating the necessary institutions and organizations to treat these services in the same way that if they were “commodities”.

Table 6. Environmental Services from TOF

TOF environmental services	Private ownership	National	Inter-national
Wood	X		
Fire wood	X		
Medicinal plants	X		
Shade on pastures	X		
Winde break	X		
Soil erosion control		X	
Living fences	X		
Forage	X		
Scenic beauty		X	
Urban ornamental		X	
Recreation		X	
Biodiversity			X
Carbon Sequestration			X
Water cycle maintenance		X	

According to table 6 there are already several services in the hands of TOF private owners; therefore there would be necessary to increase the information available to them and increase the learning process, for them to really take into account what they have and what they should manage. Some incentives –third generation incentives—may be created to assure this appropriation. These incentives include training, capacity building, awareness, facilitating information, advise and other services which indirectly help producers to participate in the market, but it is not a cash subsidy such as other kind of incentives which we were accustom to.

There are several opportunities and potential benefits from TOF which could improve people’s livelihood. They could be mixed with other economic and social activities, for instance:

- Increasing incomes and decreasing costs: The farm will have income diversification (selling products such timber, fruits and others)
- Reducing costs of external inputs (substituting fertilizers, maintaining water availability, maintaining biological control).
- New agro-business activities may emerge if using domestic animals and observable biodiversity to attract agro and silviculture sustainable tourism.

- New research and cooperation initiatives: Contracts with universities and research centers for teaching and research and to document economic and ecological changes.
- Taking advantage of the potential carbon sequestration at the national level. In the Costa Rican case with the hydrocarbons payment (PSA), but in other countries through innovative mechanisms that should be created.
- Payments from industries for water cycle maintenance, including brewery and soft drinks companies, hydroelectric projects and others.
- There is also willingness to pay from many people from urban areas to maintain forested areas, such parks, side wakes, streams and canals.
- There are probably several other examples.

CONCLUSIONS AND RECOMMENDATIONS

National legislation in Costa Rica is prohibiting the land use change; however, there is still illegal cutting of forested areas, and in the same way there is illegal and legal harvesting of TOF without considering the need to replant them. Other countries are very likely to facing the same problem. It is recommended to enhance awareness about the TOF benefits for the countries in general and people in particular.

TOF is providing with timber the industry in Costa Rica and similar situation is occurring in in other countries. Therefore, it is very important to maintain and if possible to increase the TOF cover.

Environmental services coming from TOF are not valued by the markets or in other words they are treated as externalities in the economy. In this sense, there are already experiences such the one in Costa Rica, where the National System of Innovation in formation is transforming the institutional set up of the forest sector and it could do the same with TOF.

Environmental services are nowadays paid via the so called Environmental Payment Services (PSA) in Costa Rica; therefore, if there is enough documentation and prove about the similarities of TOF services, there should not be any question for applying TOF the same principle (producer paid principle as opposed with the polluter pay principle).

There is not enough awareness of TOF benefits, neither in the academia, rural and urban communities, nor the policy makers. In this sense the recommendation is to encourage the participation of TOF advocate people in seminars, workshops and international organizations meetings, in such a way that people realize of the importance of TOF. Additionally, documentation of different TOF management experiences and benefits from rural and urban areas is very important to be developed. Comparability of case studies is advisable.

Finally, it is important to stress that those TOF goods and services are multicultural and multi-sectoral. In other words, TOF benefits are related to different types of activities in different sectors (agriculture, households, cattle, tourism, urban development, etc) and many people will perceive them according to their cultural values. Traditional economics does not take into account many of these unmeasurable values; however, new approaches such that of ecological economics and systems of innovation have been developing techniques to consider all these kind of economic values, through different types of assessments (e.g. multi-criteria valuation). In short, research should encourage assessing TOF from a holistic point of view including TOF monetary and non-monetary values.

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TREES OUTSIDE FORESTS RESOURCE STUDY AND MANAGEMENT: ASSESSMENT METHODOLOGIES AND INSTITUTIONAL APPROACHES IN INDIA

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ABSTRACT

Traditionally, forest inventories in various parts of the world have largely concentrated on assessing growing stock within notified forest areas. With rapid deforestation and loss of cover, there is an increasing interest to understand the role of Trees outside Forests (TOF) in providing ecological goods and services. TOF are playing a major role in carbon sequestration, fuel wood supply, erosion control, climatic stabilization and rural livelihood support. What needs to be ascertained accurately is the quantum of the TOF resource, its distribution and contribution. For this, large area TOF assessments need to be undertaken. The scattered and fragmented nature of the resource makes this task daunting and different from conventional forest inventories

This paper presents an overview of some of the important approaches used in India for TOF assessment. Assessment approaches have been categorized as ground based enumeration approaches or remote sensing aided approaches and discussed in context of their methodological details, merits and demerits. The potential use of remote sensing data has been highlighted as it can add accuracy and speed to certain TOF assessment tasks. A brief discussion on TOF management in India has also been presented focussing on legal issues impacting TOF conservation.

The overview suggests that there is inadequate data on TOF resources in the country and there is a need to evolve standard methods and institutional partnerships to collect data. The need to adopt enabling legislation in order to encourage private landowners and local communities to plant and conserve more trees has been highlighted.

Keywords: Trees Outside Forests, Remote Sensing, Assessment Methods, Sampling, Classification.

INTRODUCTION

In the last two decades, countries like India have experienced massive deforestation. Official estimates in India put total tree cover on forestlands at around 63.73 million ha which is 19.39% of the total geographical area of the country. Out of this 19.39% forest cover, dense forest cover is only around 37.74 million ha or 11.48% (FSI, 1999). Independent sources (non-governmental) on the other hand are more conservative about these estimates. The destruction of forests have led to numerous environmental problems, most notable among them include disturbances in the atmospheric carbon balance, change in water regimes and accelerated soil erosion.

While national and global forest inventories have largely concentrated on monitoring the status of forests on notified forestlands, they have almost completely ignored estimations of Trees Outside Forests (TOF). TOF refer to trees on land not defined as forest or other wooded land and generally include trees on farmlands, in cities and human settlements, orchards, sides of roads, pastures, banks of rivers, streams and canals and as shelterbelts which are less than 20m wide and 0.5 ha area (FAO, 1998). It is now being increasingly argued that the role of TOF in providing food and woodfuel to rural masses, carbon sequestration, prevention of soil erosion, biodiversity conservation, checking desertification, establishment of wildlife corridors and microclimatic stabilization, is quite substantial meriting a detailed inventory (Kleinn, 2000; Bhattarai 2000; Rowntree and Nowak 1991; Nowak 1994; Carucci, R, 2000). Ravindran and Thomas (2000) have shown how TOF resources provide livelihood support to local communities.

Notwithstanding the fact that pressure due to the demand for woodfuel has been one of the main factors that has contributed to deforestation, trees outside forests are also playing a significant role in meeting rural domestic fuelwood requirements. With the destruction of forest lands there is a marked shift in the supply of woodfuel for domestic consumption from forest to non forest lands. On an average, almost 50% of the domestic woodfuel in Asian countries comes from non-forest lands. These figures are significantly skewed in countries like Bangladesh, Pakistan, Philippines and Sri Lanka where non-forest land contribute close to 90% fuel wood (FAO, 1997). In India, this figure is around 50% (FSI 1996,FAO 1997). Share of wood energy from non-forest lands used for cooking in rural India is 59% while that of biomass energy is 90% (Saxena, 1997). Table 1 summarizes a comparative shift in supply share in rural household fuel wood in India from forestlands to non-forest lands in the period between 1978 to 1992 (CSE 1999).

Table 1. Rural Household Fuel Wood Collection in India

Fuel Wood Source	Percentage Supply Share	
	1978	1992
Forest Land	35%	17%
Non-Forest Land	59%	78%
Other	6%	5%

Source: Centre for Science and Environment, New Delhi, CSE 1999.

In another study, Rai and Chakrabarty (2001) estimate that of the total fuelwood requirement in India in 1996 (201 Mt), 51% (103 Mt) came from forestlands while the remaining 49% (98 Mt) came from non-forest lands.

In view of the above, it is now being increasingly felt that large-scale assessments and inventory of TOF is crucial to fully understand the role being played by trees outside forests. Such information is also needed to evolve plans for sustainable management of TOF.

METHODS FOR ASSESSING TREES OUTSIDE FORESTS

Globally, there are very few published studies on large-scale TOF assessments. Sylvander (1981), Holmgren et. al. (1994) provide a few notable examples of TOF surveys. Kleinn (1999) provides a pilot study compilation of TOF information for six Latin American countries. In the South Asian region some studies on the estimation of wood resources have been undertaken in India, Pakistan and Sri Lanka (Pandey, 2000).

Approaches to assessment of TOF have been somewhat adhoc and can be broadly categorized into the following two familial groups:

- Approaches involving Enumeration through Ground Based Surveys, and
- Approaches aided by Remote Sensing

In the past, there has been a dominance of ground survey based approaches to TOF assessment. Although such enumeration provides accuracy, it has limitations in terms of area coverage, time, cost and repeatability. One other factor for increased preference for ground based sampling in the past has been the poor spatial resolution and high cost of data from remote sensing satellites. As a result, assessments attempting to use satellite data for studying TOF have been constrained in varying degrees in terms of accuracy, costs, complexity and technological feasibility. However due to the availability of higher resolution satellite data

at increasingly affordable prices, the potential of remote sensing based approaches in aiding large area TOF assessments is generating wider interest.

Kleinn (2000) has highlighted some key knowledge concerns in collecting TOF data. Some of these issues include the need for an appropriate classification system for TOF data, ownership and geometry of TOF, appropriate sampling design, and high heterogeneity of TOF resources. These unique conceptual and methodological impositions make TOF assessments fundamentally different from classical forest inventory approaches. In this context, it is important to note that a number of studies which have been quoted in literature as TOF assessments have been undertaken with very specific and focussed study objectives. They are grossly deficient in the holistic TOF scope both in terms of their inclusion of the total TOF classification span and also in terms of addressing information needs to support the wide range of attributes listed to justify the need for conducting TOF assessments. Examples of focussing on one TOF component include studies concentrating solely on tree enumeration of farmlands or in urban areas or riparian habitats. Examples of focussed objectives include surveys on non-forestland to assess wood stock, woodfuel, and erosion control potential. With TOF emerging as an important area of research interest, it is desirable that TOF surveys cover the totality of the TOF concept in their assessment design.

Due to lack of standardization, suitability of an approach for TOF assessment for a specific situation invariably involves some kind of tradeoff analysis. A number of parameters can be involved in comparing different resource study approaches. Table 2 below highlights some of these parameters and the questions they aim to address.

Table 2. Parameters to compare different TOF methods

No	Parameter	Questions Being Addressed
1.	Area Covered	<i>How large an area can be covered using this approach? Does it permit large area coverage?</i>
2.	Time	<i>How much time does it take to complete?</i>
3.	Accuracy	<i>How accurate would the results be?</i>
4.	Representation	<i>How representative the results would be of the total Population?</i>
5.	Cost	<i>How expensive will it be to implement over large areas?</i>
6.	Repeatability	<i>How frequently can the method permit re-assessment?</i>
7.	Extrapolation	<i>How easy it is to use or replicate the method at other locations or for larger areas?</i>
8.	Complexity	<i>How complicated is the method to use?</i> <ul style="list-style-type: none"> ▪ Logistic complexity ▪ Technical complexity
9.	Feasibility	<i>How feasible is it to apply this method?</i> <ul style="list-style-type: none"> ▪ Is it technically feasible? ▪ Organizational feasibility

The following sections present a brief overview of some methods used for TOF assessment with particular reference to India.

GROUND SURVEY METHODS

There are very few published large area studies in India on systematic assessment of TOF. With the notable exception of studies done by Krishnankutty (1992) and the Forest Survey of India, most studies on assessment of trees on non-forest lands have mainly focussed on narrow geographical regions and very specific objectives. In terms of a review therefore, it is difficult to evaluate their applicability in the context of the currently emerging definition and scope of TOF. Nevertheless some of these studies do provide an insight into broad methodological issues involved in the assessment of TOF.

Chaturvedi (1990), focussed on the development of a methodology for fuelwood production from non-forest lands. The study concentrated on two villages spread over an area of 730 ha in the Gurgaon district of Haryana. Trees growing in these villages were classified as belonging to either homestead-planting stratum, commercial tree planting stratum or tree planting on farmland stratum. As the area to be covered was small, total enumeration was done for the first two strata while random sampling was resorted to for the third (the tree planting on farmland) stratum. Trees below 15 cms at breast height were not considered for this study. Regression equations for volume estimation of different species and local species volume tables were developed to calculate expected yield of fuelwood for the two villages. The methodology developed as a result of this work is deficient for comprehensive TOF surveys on almost all parameters mentioned in table 2 with a possible exception of accuracy. Infact there are few methodological lessons from this study that can be used for a direct large area TOF survey encompassing all TOF classes and issues. It will be fair to mention however that this work did not aim to develop a large area TOF methodology and concentrated specifically on assessing village fuel wood supply.

A study conducted by Krishnankutty (1992) is by far, the first large area TOF assessment done in India. The study estimated volumes of growing stock of trees on the homesteads for the entire state of Kerala. Although the survey excluded from its scope trees grown on non-agricultural areas such as plantations (rubber, tea, coffee), roadsides and public building compounds, it was very comprehensive in covering trees grown on agricultural land of the state for various purposes. Krishnankutty used a three stage stratified sampling procedure to select areas for enumeration of trees. The percentage of dry land area under agricultural use to the total area (dry land area + wet land area) under agricultural and human population density were calculated for all revenue villages in Kerala. Five class groups were created for percentage of dry land to total area under agricultural use while three class groups were created for population density constituting 15 strata in all. Stages of sampling involved - (a) random distribution of 30 villages (2.5 % of total revenue villages) in the above strata ensuring that at least one village was included from each stratum, (b) selecting one census village (several make a revenue village) from each chosen revenue village and (c) considering all households in the selected census village for collection of information. This study estimated that during the period of the survey (88-89), the state of Kerala had 347.23 million trees growing on homesteads. The volume of growing stock of trees above 10 cm dbh was estimated to be 112.685 mcum. The study concluded that homesteads account for 80 percent of the wood supply in Kerala with 15 percent coming from estates and imports and only 5 percent coming from forests. The total contribution of non-forest area (minus imports) was 92.6 %.

The Forest Survey of India (FSI) is the national forest mapping agency in India. With reference to TOF, FSI started an inventory programme in 1991 with an objective to assess the extent of plantation raised under

different forest schemes and estimate growing stock & species wise tree numbers of trees outside forests (Kumar, 2001; Pandey, 2000). As detailed by Kumar, the TOF classification adopted by the FSI is quite comprehensive and includes a total of eight TOF categories (Table 3). The sampling design is based on stratified random sampling with agro-climatic zones of the country providing the first stage strata, districts (or groups of districts) providing the second stage strata and villages in districts selected through proportional allocation providing for sampling units. Total enumeration of standing trees is conducted in the villages falling in the sample (the 1999 revision of this method does not stipulate total enumeration).

Using the above method, FSI has completed TOF assessments for Haryana, West Uttar Pradesh (UP) and West Bengal (Table 4). The study for the above areas reports a high positive correlation between village area, population and number of trees. Inventory work for the states of Andhra Pradesh, Gujarat and Rajasthan is nearing completion (Pandey 2000). In all the above FSI surveys, TOF resources within municipal limits of towns and cantonments were not included.

Table 3. FSI TOF Categories

SNO	TOF Category	Explanatory Remark
1.	Farm Forestry	Trees along the farm bounds and in small patches up to 0.1 ha in area
2.	Village Woodlot	Naturally growing trees/planted on community/private land
3.	Block Plantation	Patches covering an area of more than 0.1 ha. and not falling in any of the above
4.	Roadside Plantation	
5.	Pond side Plantation	
6.	Railway side Plantation	
7.	Canal Side Plantation	
8.	Others	Trees not falling in any of the above categories.

Source: Kumar, 2001, Forest Survey of India, Dehradun, India

Table 4. Results of the FSI TOF Study

State	Number of Trees (000)	Volume (000)	Cover ^(a) (Sq. Km)
Haryana	54,984	10,328	1,375
West U.P.	1,33,982	30,306	3,350
▪ West Ben gal	1,96,000	----	4,900 ^(b)

^(a) Notional . Calculated on the basis of 400 trees per hectare.

^(b) Includes trees having a girth of 5 cm and above.

Source: Kumar, 2001, Forest Survey of India, Dehradun, India

Although FSI revised its initial methodology in 1999 with a view to optimize time considerations by not stressing on total tree enumeration of sample villages, it would still take considerable time to cover the entire country. In such a scenario, it is likely that by the time a national picture emerges, part of the data may become dated and possibly unrepresentative of the prevalent ground situation. Management plans using such data may have to offset possible discrepancies due to timeliness of data. Revision of the existing method to include remote sensing based techniques might provide a viable mechanism to counter time lag problems.

Some other studies, particularly Ravindranath and Someshekar (1995) and Malhotra and Kumar (1987) use alternative sampling schemes for TOF assessment in rural and urban settings respectively. These studies have been briefly reviewed by Prasad et.al (2001).

As these studies concentrate on very small areas, it may be difficult to extrapolate techniques used for large area surveys.

The Indian Institute of Forest Management (IIFM) has also been working to evolve institutional partnerships in assessment of TOF. IIFM organized a workshop involving thirty Non-Government Organizations in June 2000 to assess TOF in India. As a prelude to this workshop, secondary data was collected from a variety of sources such as district rural offices, land record offices, district statistical offices, village interviews, municipal corporation offices and other similar sources. Primary data was also collected through sample field surveys conducted in the state of MP in urban, semi-urban and rural settings. Using the above data sources, an attempt was made to assess the total number of trees outside forests in India. This exercise resulted in estimating 24 billion trees outside forests in India (Prasad et. al. 2000). Pending a detailed inventory for the country, this figure has been suggested as a rough TOF estimate for India.

A study was also undertaken by IIFM to develop a methodology for assessing TOF in urban areas. This study resulted in the development of the Cardinal Grid Method (CGM) which was tested in the city of Gwalior, in Madhya Pradesh (MP). The CGM is a ground survey based method, which essentially divides the urban landscape into residential, institutional, roadside and other (garden/pond/park/temple) cover categories. Four quadrants are laid in each of the east, west, north, south and central zones of the city. Tree information in these quadrants for all the categories is collected by total enumeration. Different sampling distributions are employed for different landscape categories. Collected data includes number, species, girth and height of trees. Using this method, an estimation of the tree population in the city of Gwalior was made. The CGM is currently under development and the test experience at Gwalior has provided important inputs for the further refinement of this method.

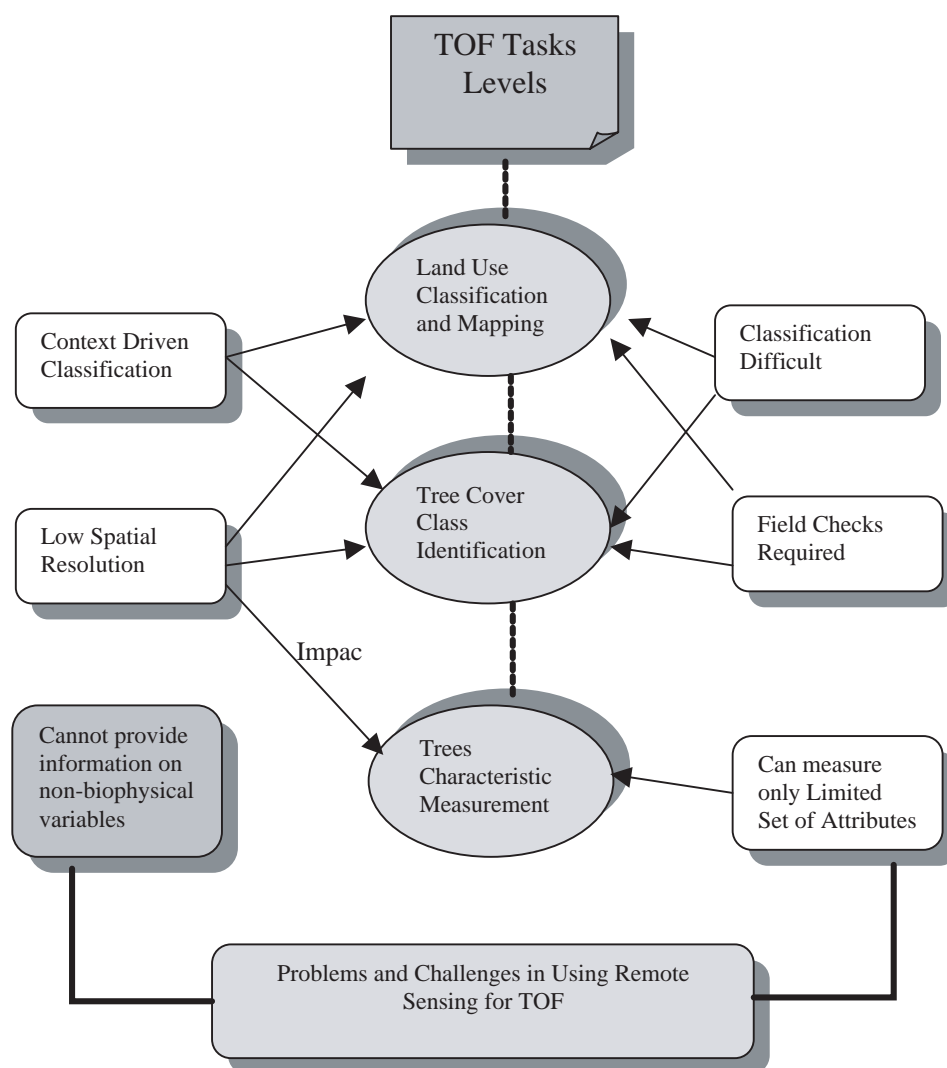
IIFM with support from FAO also organized a National Workshop on the information analysis on TOF. One of the major focus of this workshop was to bring together a diversity of institutions to evolve partnership and standardize TOF assessment methodology. Most desirable methodological scenarios for TOF assessment were developed during this workshop, which have been summarized in Prasad et al. 2001.

REMOTE SENSING AIDED APPROACHES

A search of literature reveals that the use of remote sensing for TOF assessments has not been widespread. In a large part, low spatial resolution data from satellites, high cost of aerial photographs and the inability of the hitherto available remotely sensed data to provide TOF specific information have been some of the limiting factors in the use of remote sensing for TOF work. Kleinn (2000) argues that of the three levels of tasks involved in TOF assessments namely Land use classification and Mapping; tree cover class

identification and measurement of tree characteristics, remote sensing is particularly suitable for the first two. Figure 1 summarizes some of the important limitations and challenges suggested by Kleinn for using remote sensing for TOF assessments. The cost of high-resolution satellite data and equipment and expertise required for analysis can also be prohibitive in using remote sensing techniques for TOF surveys.

In spite of these inherent limitations, remote sensing has been used for TOF assessments. Wood sources in non-forest areas have been estimated in Sri Lanka during 1981-83 using aerial photographs and satellite data (Pandey, 2000). The study was successful in assessing non-forest areas having good crown cover but could not isolate sparsely vegetated patches or isolated tree clumps.



After Kleinn, 2000.

Figure 1. Some of the important limitations and challenges for the use of remote sensing for TOF assessments.

In the Indian context however, there have been no major attempts in the past to use remote sensing in TOF surveys. Recently Ashutosh (2001) has attempted to use IRS I-C LISS III & PAN data in the Bijnor district of Rajasthan for mapping TOF and analyzing the tree cover map in GIS for suggesting an inventory design.

The methodology essentially uses satellite data to identify TOF patches through digital classification. Principal Component Analysis was used to first segregate tree vegetation from agricultural vegetation. The remaining area (minus the agricultural vegetation) was then classified using a hybrid classification strategy involving isodata clustering and maximum likelihood classification to map TOF patches. Out of the total 338 Sq. km of forest area for Bijnor (which is 7.4 % of the geographical area of this district), this study estimated that TOF resources in the district occupy 2360.2 ha. The TOF distribution (coverage/occupancy) assessed in these areas included 1.91% area of 60m buffer along canal, 17.10% area of 40m buffer along road and 5.42% area of 1 Km radial buffer around villages.

The analyzed data (raster) was vectorized into a GIS layer to facilitate development of an inventory design. The minimum size of the TOF patch considered for mapping (and vectorization) was 0.2 ha. The TOF patch size was then used as a basis for generating three homogenous strata and assigning patches to different strata (Table 5).

Table 5. Stratums and polygons identified after considering TOF Patch Sizes

Strata Number	Strata Criteria	Number of Patches Qualifying for this Strata
Stratum I	Patches of size between 0.25 – 0.1 ha	12088
Stratum II	Patches of size between 0.1 – 1 ha	3321
Stratum III	Patches of size >1 ha	214

Source : Ashutosh, 2001.

Samples were then drawn from these strata and enumeration work using ground survey techniques was undertaken for the selected patches. The ground enumeration and data analysis work is currently under progress and is likely to be completed soon. As results of the enumeration come, it will be useful to see how successful and accurate the classification has been to identify TOF patches. As the Bijnor district of Rajasthan is a relatively dry area with sparse vegetation cover, classification success in locating TOF patches may not be replicable in more vegetated areas where spectral confusion could be substantial.

Although not specifically directed towards TOF assessments, Rathore (1999) has demonstrated the potential of a model aircraft fitted with an ordinary camera for rapid low cost qualitative aerial surveys of tree resources distributed in a relatively small area. A model aircraft having a five feet wing span (figure 2), was fitted with a simple auto focus, auto film advance camera (Minolta AF-E) loaded with a Kodak 400 ISO colour film. The camera was placed in the belly of the aircraft looking vertically down at the nadir.

Photographs taken from this craft (figure 3) show that identification of species and count of trees can be easily done for sampling units spread in a local area. As photographs generated from this platform lack the geometric qualities of conventional aerial photographs, quantitative estimation of individual trees is not possible. The aircraft can also easily support small sized camcorders, which can provide instant results on completion of a survey sortie. The aircraft is very economical to operate with the cost of obtaining 36 colour photographs in

about 10 minutes of flying time being around 7 US dollars (inclusive of fuel, film and processing in India). The craft can be launched by hand and its flight is controlled using a remote controlled device from the ground. The use of this technique can provide accurate tree counts, approximation of girth classes based on canopy cover and species identity serving as an invaluable TOF survey aid. It can also be used to support satellite data analysis by providing excellent ground truth information and aiding signature extraction.

With the availability of IRS PAN data having 5.8 meter resolution and IKONOS Panchromatic and Multispectral data having 1 and 4 meter resolutions respectively, many constraints faced in the use of remote sensing techniques for TOF could now possibly be resolved. Leatherman (2001) reports on a project underway to map trees in the Washington metropolitan region covering an area of 634 square miles. The project proposes to use IKONOS data to map every tree in the region. It is suggested that the information through the survey would provide thematic layer information in a GIS permitting tree information to be viewed with other planning parameters. The methodology developed as part of this project will be replicated at other sites.

In the near future, new and emerging remote sensing technologies may lend themselves for TOF assessments. For example, in the last few years, there has been considerable interest in the Lidar (Light Detection and Ranging) remote sensing. Lidar data has been found very useful for forest inventory and volume estimations. Means et. al.(2000) have used Lidar based techniques on 50m by 50m experimental plots in Oregon USA. These plots had all developmental stages of vegetation, which included shrub dominated, young, mature and old growth cover. They were able to accurately estimate stand characteristics such as height & volume using regression analysis based on lidar and ground data. Means et. al. have estimated that on a comparable basis, an inventory involving 14 weeks and \$32,000 could be done using lidar methods in 10 weeks costing \$15,000. They have indicated that the technology has good potential for non-forest cover estimations such as mapping vegetal cover along streams. The availability and costs of the use of this technology may however be prohibitive for large area TOF studies currently.

With particular reference to India, the cost of using high-resolution satellite data like IKONOS (or even IRS PAN) for large area TOF assessment is currently prohibitive.



Figure 2. Model Aircraft developed at IIFM for taking low cost pictures

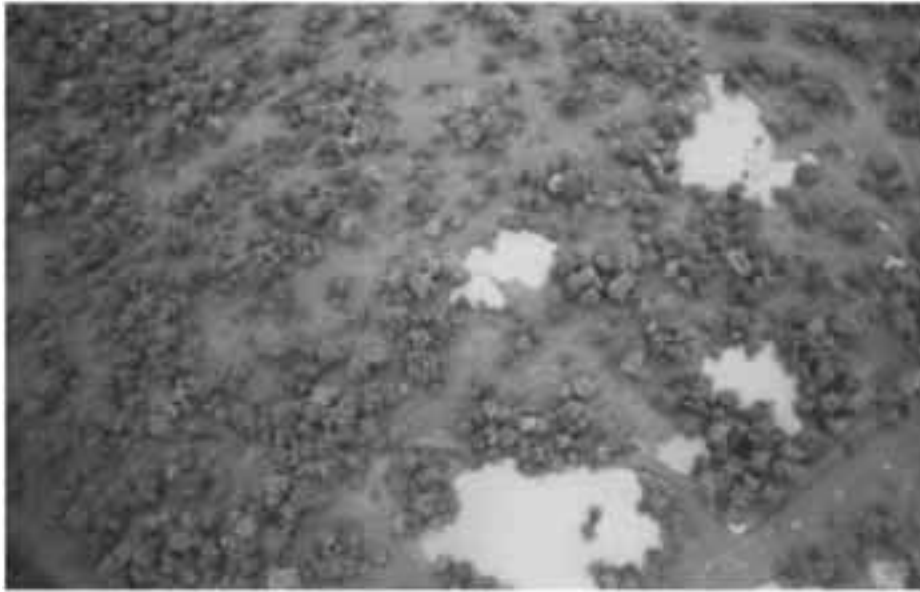


Figure 3. A picture taken from the model craft showing individual trees

As field studies cannot be avoided altogether even with the use of remote sensing, ground based sampling is currently a cheaper and more accurate option. Although, the combination of IRS PAN and LISS-III data has potential for TOF assessments, more studies would be required to standardize and integrate remote sensing techniques with ground based information collection methods to cover the full range of TOF information issues. The use of GIS to view TOF information with other data will also prove useful in preparing management plans.

EMERGING PERCEPTIONS ON TOF MANAGEMENT IN INDIA

In a large part, TOF resources in India are distributed over community lands, revenue lands, common village land and private land. Traditionally, the provisions of the Indian Forest Act of 1927 have largely influenced TOF management in India. With reference to implications on TOF conservation and management, Chapter V of the Indian Forest Act (1927) details instruments for 'control over forest and lands not being property of the government' (Table 6). This act has provided the basic framework for enactment and adoption of forest acts and rules in different states in India. Through many legal and executive provisions under this legal ambit, tenural rights to own, fell, transport and dispose TOF resources are defined and enforced by state governments. Provisions of the Land Revenue Codes of different states also govern tenural rights of TOF resources on revenue lands. For a long period, these tenural laws and regulations have not provided much incentive for growing trees on private lands being regulatory in nature. Rather in some ways, they have created disincentive for tree cultivation on private land.

Table 6. Sections of Indian Forest Act 1927 for control over Non-Government forests and lands

Section	Provisions
Section 35	Protection of forest for special purposes.
Section 36	Power to assume management
Section 37	Expropriation of forest in Certain purposes
▪ Section 38	Protection of forests at request of owners
Section 41	Power to make rules to regulate transit of forest produce.

Srivastava (2001) provides an excellent and detailed analysis of the legislation in India for non-forest lands. This detailed analysis of the legislation of various state governments reveals that most laws have been extremely regulatory in their legislative intent.

In the recent past however, there has been a perceptual shift drawn out of the above scenario where state forest departments are envisioning a change in their role of being regulators to enablers and facilitators. The Lok Vaniki Act (M.P. Act No. 10 of 2001), adopted recently by the Madhya Pradesh (MP) Government epitomizes this perceptual change that aims to substantially improve management of private forest lands and encourage management of TOF resources on community lands through participatory effort.

The objective of the Lok Vaniki act "is to regulate and facilitate management of tree clad-private and revenue areas in the state of Madhya Pradesh and matters connected therewith or incidental thereto." In summary, the act empowers farmers to manage and extract benefits from their land by selling forest produce and timber. As an enabler, the role of the government is to dilute prohibitory laws, encourage participation of people and pull out once the system is set. As part of the Lok Vaniki scheme, it is required that private holdings be brought on record and a management plan be prepared by a chartered forester. The plan has duration of 15-20 years and stipulates prescriptions for scientific management of trees on private lands. Some salient features of such management plans include provision for felling only those trees that are above a certain girth, trimming of branches to open tree canopy and provision to fell upto four to five percent of trees annually (CSE, 2001). Another notable feature of the Lok Vaniki act is that the landowner is required to submit an annual 'Self Assessment Return' to the Divisional Forest Officer providing status of the implementation of the management plan & comparative assessment of actual and estimated. The act also prescribes that all land for which management plans have been prepared under the Lok Vaniki scheme will remain out of the purview of the land revenue code of MP with respect to permissions for felling of trees thus creating a single permission interface. Some specific provisions of the Lok Vaniki Act as highlighted by Srivastava (2001) are summarized in Table 7.

While the Lok Vaniki initiative can be considered a milestone act with reference to the TOF conservation, it needs to be seen how effectively deviations (stated in 'Self Assessment Returns') from management plans would be monitored and how corrective action for such deviations would be implemented on private land. The Indian Supreme Court's decision on it's December 1996 interim order suspending felling of trees (including private land) would also be a determining factor in the long term success of the Lok Vaniki scheme. There is an opinion that the penal clauses in the Lok Vaniki act outlined in sections 8 and 9 are quite stiff and in some way retain the bureaucratic legacy of earlier acts. The major penal clause in section 8 mentions that "any person who acts in contravention of the provisions of this act or rules made thereunder or who after having

approved management for tree-clad areas, fells trees or removes trees or any logs of the trees from the holding included in the approved management plan shall be liable to such penalty which may extend to twice the value of the trees involved but not exceeding One Lakh (0.1 Million) Rupees " (MP Government, 2001). There is no provision in the Lok Vaniki act for individual trees or isolated small tree clumps.

Table 7. Summary of some highlights of the Lok Vaniki Act

Act Highlight	Details
An Enabling Law	<ul style="list-style-type: none"> ▪ Removes regulatory intent. ▪ Reposes trust in people. ▪ Provides a legal framework suited to the requirements of an independent, democratic and modern India. ▪ Encourages owners of private forests and other tree clad areas to manage their natural resource on scientific lines. ▪ Encourages owners to assume responsibility of management themselves. ▪ discourages clearing and conversion of area for non-forestry purposes. ▪ Strengthens village institutions, empowers people.
Provides Technical Forestry Knowledge to People	<ul style="list-style-type: none"> ▪ Chartered Foresters bring in scientific management expertise.
Provides for Self Assessment by the Owner of Private Forests	<ul style="list-style-type: none"> ▪ Individual Assess himself through an annual Self Assessment Return. ▪ Assessment records status of implementation of management plan, estimated & actual yields. ▪ Encourages owners to invest in management of their forest exclusively as a private enterprise without any burden of sharing with the Government, anything from their profit.
Provides a Single Window	<ul style="list-style-type: none"> ▪ areas covered by management plan under Lok Vaniki to remain outside the purview of the MP Land Revenue Code 1959. ▪ No need to go to multiple agencies for permission to fell trees.
Impetus towards Collective Mobilization and Organization Building	<ul style="list-style-type: none"> ▪ Promotes organization and coming together of owners to form associations to influence policy makers and cope with market fluctuations.

Summarized from Srivastava, 2001.

Another facet of the enabling process to facilitate better TOF management in India is through a move to include community forestlands in the ambit of Joint Forest Management (JFM). The Indian forestry sector in tune with the Indian National Forest Policy of 1988 has been an active proponent of JFM. Most states in

India have adopted JFM resolutions and have implemented JFM on a large scale with a view to encourage village and community based institutions in managing forests.

There are however institutional and operational concerns that have been raised by a number of workers in context of JFM that may have some bearing on the success of similar initiatives for TOF management and conservation. Jeffry and Sundar (1999) challenge some of the assumptions in community participation particularly focussing on the manner in which 'community' and 'participation' are being perceived by the forestry sector in India. Supported by a number of cases by noted workers, Jeffry and Sundar have expressed a view that the manner in which JFM is being operationalized is resulting in the creation of a new 'moral economy'.

Such a situation according to them stands to further curtail customary and legal rights of the least privileged sections in the village society to natural resources. Long and Nair (1999) have examined some sociopolitico-institutional constraints to TOF development as widely adopted systems. The absence of a national policy on common lands has also been attributed by some as a possible reason for management problems for TOF resources.

CONCLUSION

This paper has attempted to present an overview of the resource assessment and management scenario for TOF resources with a focus on India. Like many other countries of the world, there is insufficient data on TOF resources in India. Looking at the role that TOF is playing as provider of environmental goods and services, there is an urgent need to develop institutional partnerships for carrying out large-scale TOF assessments. It is our view that TOF assessments on a national level require a strong collaborative framework of institutions and organizations working together for collecting TOF data. Such a framework is currently lacking in the country. It is strongly felt that if work of this magnitude has to be completed and systematized on a timely periodic basis, a partnership programme involving FSI, state forest departments, research organizations, academic institutions, NGO's and other related agencies would have to be created.

There is also an urgent need to standardize TOF resource assessment methods. The integration of remote sensing techniques with ground surveys will provide wide area coverage in shorter time spans saving costs. It is however felt that it may not be possible to altogether eliminate ground based data collection looking at information requirements of TOF assessments. Higher resolution data in the near future coupled with new remote sensing technologies like lidar will add accuracy to assessments and reduce survey time spans.

TOF management so far in India has been governed by largely regulatory forest legislation. With acts like the MP Vaniki act, a noteworthy effort has been initiated by the MP state government to express its intentions as an enabler and facilitator in TOF management. Strengthening of such legislation and adoption of similar schemes by other states in the country could have a marked impact on TOF conservation.

In conclusion, it will be worthwhile to stress that TOF assessments should be designed to include information collection over the full range of TOF issues that are used to justify the importance of TOF as a resource. Such a focus will help in creating a comprehensive TOF information structure that can be used to provide inputs for policy making.

ACKNOWLEDGEMENTS

The authors would like to thank Dr. D.S. Ravindran and Dr. R.K. Singh, Associate Professors at the Indian Institute of Forest Management Bhopal, and Mr. Pankaj Srivastava of the MP Forest Department for helpful discussions and comments.

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POLICY, INVENTORY AND MANAGEMENT OF TREES OUTSIDE FORESTS IN A DENSELY POPULATED COUNTRY: CASE STUDY OF THE UK

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SUMMARY

The UK is one of the more affluent, urbanised and densely populated countries in the World. As such it has little remaining forest and livelihoods derived from timber or other forest products are insignificant. However, trees in the countryside (farmlands) and urban areas are highly regarded in terms of landscape, ecological and biodiversity value. This paper explores the consequence of this in terms of policy, inventory and management planning. There are lessons of relevance to the inventory of TOF which can be drawn from the recently completed national inventory of Small Woodlands and Trees in the Countryside. Perhaps the most useful finding is that the number of plots enumerated needs to be carefully considered to ensure that errors are acceptable across the wide range of feature sizes represented by TOF (small woods, linear features, groups and individual trees). UK policy is mixed with some powers being vested in the Forestry Authority and others with the Countryside agencies. The main emphasis in management is the maintenance and replacement of trees as amenity and conservation features rather than as sources of income or products. Harvesting of TOF is hampered by problems of scale and a lack of wood-using rural enterprises. There are initiatives designed to stimulate farm forestry and related enterprises but it is probably too early to judge how they are performing.

INTRODUCTION

Farming, forestry and rural life in the UK²² is currently undergoing an unprecedented change in forest, agriculture and rural development policy. This is a consequence of great changes in farming and forestry resulting from falling farm and forest incomes and public pressure to protect the UK's unique anthropogenic rural landscapes for amenity and recreation. Decentralisation has acted to facilitate change as it has resulted in the promulgation of three new forestry strategies for England, Scotland and Wales, which for the first time, permitted a wide and public debate on the role of trees, woods and forests in the unique landscapes and economies of the three countries. Likewise, the creation of a new Department for Environment, Food and Rural Affairs (DEFRA)²³ earlier this year has afforded an opportunity to re-define policies for sustainable development²⁴ for the UK.

This paper examines how these changes will affect trees outside forests (TOF) and their role in the maintenance and enhancement of rural landscapes and livelihoods though it is acknowledged that urban TOF are very important.

²² The UK is made up of England, Scotland and Wales on the island known as Great Britain (GB) and Northern Ireland which is a part of the neighbouring island of Ireland.

²³ Formerly the Ministry of Agriculture, Food and Fisheries.

²⁴ DEFRA's aims and objectives were released on the 14th November 2001. Its aim is: Sustainable development, which means a better quality of life for everyone, now and for generations to come, including:

- A better environment at home and internationally, and sustainable use of natural resources;
- economic prosperity through sustainable farming, fishing, food, water and other industries that meet consumers' requirements;
- thriving economies and communities in rural areas and a countryside for all to enjoy.

BACKGROUND

The United Kingdom is an affluent country with one of the highest population densities in Europe (average of 2.4 people per ha) with a total population of just under 60 million people. Needless to say this goes hand in hand with extreme deforestation with only around 2% of the land remaining under ancient woodland²⁵ cover. Overall levels of forest cover reached an all time low during the First World War and this led to the establishment of the Forestry Commission (FC) in 1919 which was charged with the task of planting forests. By 2000, forest cover in the UK had risen to 11% with the planting of large scale plantations of exotic conifers. More recently there has been a shift. After the large scale afforestation of the uplands in the early 20th century there has been a significant shift towards the management and establishment of small scale woods within agricultural landscapes and on the promotion of public participation in woodland-based activities.

The UK countryside is a palimpsest of anthropogenic landscapes dating back to the Bronze Age (~ 1000 BC). The field patterns created largely in Anglo-Saxon times (~1000 AD) were marked by boundaries of hedges and walls as a consequence of the Enclosures Acts passed by Parliament between 1750-1950. The resultant landscape was an intimate mix of small scale woods and fields marked with hedgerows²⁶ and punctuated with large isolated trees. These hedgerows and associated trees were managed as production systems for poles (as pollards and coppice), fruit, timber and a range of other products. They also help to prevent soil erosion and water run-off, shelter and control livestock and protect crops from wind. However, during the mid 20th century wholesale mechanisation of agriculture and urban sprawl made large changes to the familiar landscape of the countryside. This was viewed with dismay by a large part of the UK population, both urban and rural, who hold the countryside in high esteem as an integral part of their cultural and aesthetic heritage.

It is this background that forms UK TOF attitudes, policy and activities. It is interesting to note that this is being driven by aesthetics and conservation more than production or the environmental functions of trees. This is probably a natural consequence of the TOF agenda being driven by a wealthy and essentially urban society who have long since ceased to consider rural TOF as a source of products or livelihoods.

INVENTORY OF TREES OUTSIDE FORESTS

The 1919 Forestry Act gives the Forestry Commission a statutory responsibility to collect statistics on the country's stock of woodland and trees. The first inventory of TOF was in 1951 and TOF have been incorporated in national forest inventories ever since²⁷ (inventories were done in 1965 and 1979-82). The fourth national inventory of TOF was completed in 2000 and the first report for England has just been published (Forestry Commission 2001). The sources for the protocols for the Small woods and trees inventory are: Wright 1998, Jordan and Wright 1997, Smith & Gilbert *pers comm*.

²⁵ 'Woodland' and 'woods' are terms often used in the UK synonymously to 'forest' to describe areas of land carrying trees in the UK. The term is used as a diminutive in the same manner as a hill is less than a mountain.

²⁶ A hedgerow is a boundary formed from woody shrubs which is maintained as a barrier of around 1.5m height. Standard (full sized) trees are often incorporated at intervals in the hedge.

²⁷ This is a rare example of recurrent inventory for TOF in Europe. The only other countries to formally inventory TOF are France and the Netherlands (although this has been discontinued).

The inventory of Small woods and trees collected data on four classes of TOF feature with a tree being defined as more than 2 m tall. The features identified are:

- small woods - woods of between 0.1 and 2 ha²⁸ in area and canopy coverage greater than 20% (unless felled or recently planted),
- groups of trees - areas of less than 0.1 ha but more than 1 tree including young trees spaced less than 5 m apart,
- individual trees - crowns should have no contact with any other trees, further divided into:
 - o boundary trees - an individual tree on a boundary²⁹
 - o middle trees - an individual tree not on a boundary
- linear features³⁰ - not less than 25 m long and four times as long as they are broad. Further divided into:
 - o wide linear features greater than 16 m wide (treated as small wood in field survey)
 - o narrow linear features less than 16 m wide (treated as group in field survey).

Given these definitions, it is clear that TOF in the UK could be described as trees covering an area of less than 2 ha and more than 2 m tall. The Small woods and trees inventory did not consider urban trees which are found in profusion as avenues along roads, in parks and private gardens. It was considered that these trees are the responsibility of the urban councils which had often undertaken their own surveys of street trees. However, urban trees were included in the 1951 TOF inventory.

The inventory used a stratified systematic 1% sample of 1x1 km grid squares across the whole land area of the UK. The stratification was at two levels, the coast and counties (administrative units) were sampled separately. The total sample size was 2,347 squares (km²) for GB.

Tree and land use features were mapped for each sample square from 1:25,000 scale aerial photography. Areas of more than 2 ha were counted as 'countryside' within developed (built up) areas and areas of more than 2 ha of buildings were counted as developed land and trees within them were not sampled. Trees within developed land of more than 2 ha were not included in the survey. The extent of small woods and the lines of linear features are mapped and measured. Groups and individual trees are only recorded in the field. The 1 km square was subdivided into 16 250x250 m squares and two of these were chosen at random for field survey.

In the two 250x250 squares the following attributes are recorded in the field:

- Individual trees - species, alive or dead, height³¹ (in 5 classes), number of stems and a health code were recorded.
- Groups - species, height, number of dead and living trees and average health was recorded.

²⁸ Woods greater than 2 ha are included in the main woodland survey (=forest inventory).

²⁹ Includes trees standing in a hedgerow.

³⁰ Hedgerows were not included unless the plants within it were large enough to be considered trees in which case it was recorded as a linear feature.

³¹ The trees were considered to be 'unproductive' and mainly of interest as landscape features so only height was recorded.

- Small woods - management practices, crop data, timber potential, mammal damage, percent dead wood and natural regeneration were recorded.
- Linear features - width, species, height, number of live and dead trees and average health are recorded.

Within stands of more than 0.05 ha a 0.01 ha circular plot was laid out in a subjectively chosen 'representative' part of the stand at the rate of one plot per 0.5 ha to a maximum of four. To compensate for sparse stands, the plot size was increased to 0.02 ha if less than 5 trees were recorded in the 0.01 ha plot. In each plot, the species and diameter of each tree and top height (height of the largest diameter tree) of the stand is recorded.

The gross results of the survey for England are given in Table 1. Broadleaves are much more common than conifers with the commonest species being; Ash (*Fraxinus excelsior*), Oak (*Quercus spp.*), Willow (*Salix spp.*) and Sycamore (*Acer pseudoplatanus*).

Table 1. Occurrence of TOF features in England

Feature type	Number of features	Mean area (ha)	Area (ha)	Length (km)	Numbers of trees		Dead (%)
					Alive	Dead	
Small woods	131 900	0.47	62 300	-	-	-	-
Wide linear features	34 800	0.37	12 800	4 800	-	-	-
Narrow linear features	1 172 800	-	-	91 200	60 100	509 100	1 056 1.7
Groups	3 299 200	-	-	-	22 100	431 366 900	1.6
Individual boundary trees	-	-	-	-	4 700	489 91 200	1.9
Individual middle trees	-	-	-	-	1 000	787 45 600	2.5

Because of differences in design it is not possible to directly compare the results of this inventory with the previous one in 1980. However, it does give an indication of the type of changes that have occurred (Table 2). What is clear is a large reduction in the number of groups and individual trees. The pattern of changes is consistent with the mortality figures given in Table 1 and suggests that the trees are dying or being removed and not replaced. Middle trees are the most susceptible as they impede tractor cultivation and are therefore often removed, even if tolerated they experience repeated root damage, suffer high mortality and seldom re-planted. The increase in linear features is probably not unrelated to the groundswell of public opinion against their removal and the institution of grant incentives to restore them (see below).

Table 2. Comparison between 1980 and 1998³² inventories of TOF for England (000s trees)

Feature type	1980	1998	Change (%)
Boundary tree	6 010	3 868	-34
Middle tree	8 331	1 165	-85
Groups	23 461	12 998	-45
Linear features	24 601	31 351	27

The intention is for TOF inventory to become continuous so that a smaller sample of fixed plots if measured every year over a five year cycle and planning for this is underway. The main lesson that has been learnt from the 1998 inventory was that insufficient data was collected on groups and individual trees as they were only sampled from a sample of 0.125% of the UK land area (one eighth of the 1% sample of 1 km² grid squares). Given the low density of groups and isolated trees this meant that there were very few trees recorded in the survey. It is proposed to address this by doubling the sampling fraction for groups and individual trees (making it 0.5%).

MONITORING LANDSCAPE CHANGE - THE COUNTRYSIDE SURVEY

The term 'countryside' is used to denote all areas which are not built up as such it encompasses a range of land uses from agriculture, parks, forests, wildlands and villages. Over the past century the nature of agriculture and consequently the appearance of the countryside has changed dramatically. Many of these changes are perceived as damaging and there is concern to monitor the rates of change and intervene to protect the intrinsic qualities of beloved landscapes. The Countryside Survey was established more than 20 years ago with previous surveys in 1978, 1984 and 1990 with the most recent assessment completed in 1999 and reported in 2000 (CS2000, Haines-Young *et al* 2000). The CS2000 survey was financed by the Department of Environment, Transport and the Regions³³ with a wide range of partners representing the statutory conservation agencies and regional government and was undertaken by the Centre for Ecology and Hydrology³⁴.

The Survey is based around recording the existence, extent and health of 18 broad habitats recognised by the UK Biodiversity Action Plan. Field sampling is based on a stratified random sample of 1 km² grid squares. The strata are the ITE Land Classes which themselves result from an ordination analysis of landscape features and represent the major environmental and anthropogenic gradients present in GB. In total 569 sample squares were visited, 366 in England and Wales and 203 in Scotland. Ninety percent of the squares had been previously visited in 1980 and formed the basis for an evaluation of landscape change over the intervening 20 years. Within each grid square a stratified random sample of small vegetation plots are measured with the strata being major landscape elements such as field boundaries, streamsides, road verges etc.. Soil and freshwater habitats are also sampled to track pollution and water quality. A large scale satellite image interpretation to generate land cover maps and a public computer-based Countryside Information System are other important outputs of the survey.

³² Differences in figures from Table 1 result from the harmonisation of categories between the two inventories.

³³ Now part of DEFRA

³⁴ The former Institute of Terrestrial Ecology and Institute of Hydrology.

The CS2000 reports on the changing stock and condition of a broad habitat described as 'Boundaries and Linear Features'. This habitat is relevant to TOF as it includes hedges, hedgerow trees and lines of trees whether part of a hedge or not. Table 3 gives a summary of the results for these features for GB. The results show no significant change in the total stock of hedges between 1980 and 1998 but the length of remnant hedge decreased by 21% (mostly due to continued degradation to relict status) while the length of lines of trees and shrubs (153,000km) had increased by 31%.

Table 3. Stock and change in linear landscape features in GB from CS2000

Linear feature	England and Wales		Scotland	
	1998 stock (000s km)	% change from 1990	1998 stock (000s km)	% change from 1990
Hedge	449.3	0.0	19.0	4.6
Remnant hedge	52.3	-20.9	5.3	-20.0
Wall	105.8	-2.5	87.1	-1.7
Line of trees/shrubs and relict hedge and fence	70.0	30.8	11.1	14.0
Line of trees/shrubs and relict hedge	83.4	31.4	13.3	22.2
Bank/grass strip	70.0	-2.5	12.4	6.3
Fence	423.2	6.6	233.7	3.9

The condition of the hedges was recorded from two plots measuring 1x10 m in each square containing hedges. All vegetation including herbs growing along the bottom of the hedge were recorded. The data from remeasurement of these plots indicate that in the eastern lowlands of England that there has been a 12% decline in species richness due to less intensive management (perhaps due to falling farm incomes). Older hedges which are characterised by woodland vegetation had not changed.

In 1998, for the first time up to ten 30m sections of hedge the diversity of trees and shrubs were recorded. The density of woody species in a standard 30m length of hedge is used in the definition of species-rich hedgerows in the UK Biodiversity Action Plan and the Hedgerow Regulations. The results of this survey indicate that 26% of sampled hedges had five or more woody species and would therefore qualify as a species-rich hedge according to the UK biodiversity action plan definition.

VALUATION OF TOF

There are few rural enterprises which use the products of TOF. Studies in the 1980's clearly showed that few TOF are converted into timber because of the high cost of transport, low quality of the logs (embedded metal which can damage saws) and a lack of small-scale local wood-using enterprises. NWFP i.e. fruit, nuts etc. collection ceased at least a generation ago. The main use for TOF is as a source of firewood for local, usually rural, households which does not generate a significant income and as a decorative hardwood (burr elm for small-scale crafts).

However, this does not mean that TOF do not have a value. IERM & SAC (2001) were commissioned by the former MAFF to conduct a valuation of field margins and hedgerows. Using a contingent valuation they report a willingness to pay of between £14-26 per household per year to protect against further losses of hedgerows and £11-14 for a 5% increase. The values for hedgerows was. The ability to generate such figures is required for appraising agri-environmental policy which have hedgerows maintenance targets.

It is perhaps easier to value urban trees and the National Urban Forestry Unit presents figures which suggest that trees can save up to 10% of energy consumption in nearby buildings through their moderation of local climate and can increase property values by up to 18%.

CHANGING ATTITUDES TO AGRICULTURE AND FORESTRY: CHANGING POLICY

TOF do not exist in isolation but are part of a wider landscape which is perceived through a social filter which often has little to do with agriculture or livelihoods and much to do with the aspirations and concerns of a largely urban populace. It is most often perceived as a whole, as a better place to live than towns and under threat (Countryside Agency 2001). Public concern for the countryside and awareness of rural issues has increased markedly over the past decade with many concerns being shared by rural and urban people.

Over the past decade there have been a number of developments which have served to shift the rural agenda in the UK. Among these are:

- loss of farm incomes: there has been > 80% fall in UK farm incomes over the past few years so that average farm incomes are now around £8,000 per year which counts as poverty in the UK. This fall is largely blamed on globalisation, large scale retailing and the effects of disease (BSE, FMD etc) on livestock prices,
- uncompetativeness of UK timber in the face of global competition (from eastern Europe),
- conflict between rural and urban sensibilities with regard to fox hunting,
- increased concern with erosion of traditional rural landscapes,
- erosion of rural services as communities shrink (schools, post offices, police, public transport being withdrawn etc.),
- conflict over access to rural housing by local people (houses in some areas are prohibitively expensive for rural poor because prices are driven up by urban demand for second homes),
- conflict between recreational access to farmland,
- a perception that urban-based government is out of touch and unconcerned with rural issues.

At the same time devolution and Ministry re-organisation together with a commitment to public consultation conspired to facilitate the formulation of new policies for agriculture and forestry at the same time. This has provided an unprecedented opportunity for change in policy and hopefully action to integrate ideas on rural, urban and sustainable development. This is summed up in the recent Rural White Paper (DEFRA 2001) for England which offers a utopian vision of a living, protected countryside with thriving prosperous rural communities.

However, there is much work required to genuinely integrate forestry and rural agendas. The extent of the divide is evident from the observation that both the environment and forestry agencies undertook assessments

of TOF in 1998-9 and it is not even possible to directly compare the results of the two sets of data. It is to be hoped that a greater degree of integration can be achieved in the future.

POLICY AND INCENTIVES FOR TOF MANAGEMENT

Over the past year, three new forestry strategies have been developed for England, Scotland and Wales. There is little mention of TOF in the policies and few direct interventions planned though there is general support for initiatives lead by DEFRA and the countryside and conservation agencies. In brief this is what the three strategies have to say about TOF.

England

Ensure that policies promote not only substantial woodlands but also rejuvenated hedgerows, parklands, orchards, copses, shelter belts and urban trees'.

However, no targeted actions towards this are identified in the strategy but this is addressed in complementary rural development and conservation strategies.

Scotland

Priority for action	Increase diversity of the farmed landscape
Why?	Because the loss of traditional woodland cover e.g. shelterbelts and hedgerows has created an open landscape devoid of the benefit of woodland structure Because this represents an opportunity to integrate forestry and farming, helping to ensure that complementary land use can enhance overall environmental value.
Benefits	Improving the attractiveness of the landscape; opportunities for game, small-scale timber (and wood fuel) production, providing an alternative use for agricultural land Riparian woodlands for pollution mitigation, protect river systems and improve river habitat quality Establishing connections between existing woodlands Absorbing development and screening new buildings Re-creating where appropriate, historic landscapes for their cultural value
Costs	Depends on scale of activity, incentives of more than £2000 per ha may be needed for new planting, with grant support for project such as restoration of shelterbelts
Partners	Rural Affairs Department (Farm Woodland Premium Scheme, Rural Stewardship Scheme) Scottish Natural Heritage (identification of priority areas and grant support) Local Authorities (identification of local priorities in Indicative Forestry Strategies) Forestry Commission (targeted grant support and technical advice) Private sector (farmer, growers and agents - by taking advantage of grant support and advice to provide land and undertake the work)

Wales

Strategic objective 2.4.3 To provide support for farm woodlands and the wider rural economy

Activities

- work closely with the farming sector to establish a farm woodland subject group
- encourage farmers to diversify their agricultural businesses through Farming Connect (business development grants), providing information on woodland management, contracting, and development of small scale wood processing
- help farmers make best use of farm woodland resources for livestock shelter and for timber products for on-farm use, better integrating the woodlands into the farming businesses and into the landscape
- help Coed Cymru (NGO) to continue to deliver support to farmers.

These different perspectives reflect the realities of the three countries and emphasises the importance of finding markets for the produce of small woods to support rural livelihoods (Wales), recreation and environmental functions (Scotland) and in landscape maintenance (England). All of these strategies are very new and many of the activities have yet to begin but it represents a major change in attitude and appreciation of trees.

Regulations to protect TOF

The principal instrument within the town and country planning system to protect trees and woods is the Tree Preservation Order (TPO). The purpose of a TPO is to prevent the felling or mutilation of the tree or trees covered by the TPO and to make provision for replanting them, if such an action is considered necessary. The TPO can prohibit the felling, lopping or destruction of the trees unless a planning consent has been obtained. They can also require the replanting of a woodland area, the felling of which has been permitted, subject to any specified conditions. TPOs are often only sought when a tree comes under threat and are instigated by local people.

Designated Conservation Areas are used by local planning authorities to protect the special character of areas under building development. All trees greater than 7.5 cm d are automatically protected in such areas.

In 1997 new legislation, the Hedgerows Regulations were passed. These regulations require that consent from the local planning authority is required before removal of hedgerows, if it is judged to be important according to certain criteria (historic, archaeological, landscape, biodiversity etc). The planning authority may prohibit the removal of such hedges by issuing a Hedgerow Retention Notice. The criteria include historic, archaeological, biodiversity, landscape or amenity value. The Countryside Survey 2000 revealed that around 26% of hedgerows would qualify for protection under the biodiversity criteria alone.

Agri-environment schemes, forestry grants and rural development initiatives

Under the Common Agricultural Policy operated by the EU, there is a provision to make available payments under agri-environmental schemes. There are three such schemes in operation: the Rural Stewardship Scheme (Scotland), Countryside Stewardship Scheme (England) and Tir Gofal (Wales). Entry into the scheme is voluntary and is conditional on the farm meeting certain environmental requirements i.e. it must contain features worthy of support from public funds. Entrants to the scheme agree to manage the farm according to an agreed management plan to cover things such as hedgerow management, stocking levels,

pesticide usage, application of fertilisers etc.. In return the farmer receives annual payments for the environmental, landscape and biodiversity benefits created. The Tir Gofal scheme in Wales expects to enroll 600 farms (from more than 1300 applicants) into its first round of agreements at an annual cost of £5.5 million.

A further development of the realisation that it is better to target whole farms than individual field margins is the Countryside Agency's Landscape Character Initiative. Working from the premise that a landscape is more than just biodiversity, landscape or history it is seeking to understand how local character is formed from the unique juxtaposition of town, country and coast, of land form and landscape, of history and progress that create the many facets of England's character. Contrasts in local character make each location unique and lend it a 'sense of place'. The Initiative seeks to extend landscape principles to the whole of the UK rather than just specific designated areas. This programme is in an early stage and so far has mapped the country into 159 separate, distinctive character areas. It is intended that the maps and associated narratives will form the basis for planning of stewardship schemes and other countryside management initiatives.

The Forestry Commission operates a grant-based incentive scheme to promote the planting and management of private woods. There are two grants available; the Woodland Grant Scheme (WGS) and the Farm Woodland Premium Scheme (FWPS). Both of these are targeted at the creation of woods within agricultural landscapes. The WGS has £17-18 million and the FWPS £4 million to disperse annually.

The WGS makes a payment of £1,350 per ha for native species plantings of less than 10 ha, eighty percent of the grant is paid in the first year with remainder five years later. The minimum area for grants is 0.8 ha. In England and Wales the majority of WGS plantings are very small. The aim of the WGS are to create new woodland to increase the production of timber, provide new habitats for wildlife and recreation, promote good management of woodlands, provide jobs and to provide a use for land other than agriculture.

The FWPS is more specifically targeted at the creation of woods on farms with the intention these can become a productive asset on the farm. Under the scheme annual payments of £140-300 per ha are made to compensate the farmer for agricultural income forgone on the planted land.

Alongside schemes which target husbandry of the landscape there programmes which seek to increase the opportunities for alternative rural jobs. Grants (such as the Rural Enterprise Scheme operated by the Countryside Agency for England) are available under these programmes to support the diversification of farm enterprises and the development of new rural businesses. Much of this is targeted at local processing and value addition and there is nothing specific that mentions the potential of TOF though there is also nothing to preclude funding of projects based on TOF. Indeed, most of the initiatives for small-scale local wood using enterprises would probably utilise TOF at least as a source of burrs and other decorative hardwood timbers.

Community forests

Since 1991 a consortium of partners including the Forestry Commission, Countryside Agency, NGOs and local authorities have operated a scheme designed to stimulate the creation and management of community forests. There are 12 of these forests all in urban fringe areas covering 452,649 ha within 20 km of 26.4 million people. The aim of these forests are to regenerate derelict land, green the urban fringe, provide for conservation and recreation and to establish a supply of timber and other woodland products and associated jobs. Since the 'forests' are actually to be created from plantings on private, public, agricultural and developed land they are not intended to become unbroken expanses of trees but rather a mosaic of woods and other land

uses in which trees are treasured and managed. This then represents the overlap between urban and rural TOF. Since 1991 the scheme has been responsible for the planting of over 7,419 ha of new woodland, bringing 24,000 ha of existing woodland and 170 km of hedgerow into management and reclaimed 1,638 ha of brownfield. The scheme has also been successful in obtaining £7 million in sponsorship, donations etc. and £18 million from the National Lottery.

Since the mid-1980's there has emerged a new type of public-private-NGO forestry partnerships. The 12 community forests mentioned above are just a few of the 98 regional forestry initiatives emerging from local authorities, Forestry Commission, NGOs and communities themselves. They are regional in that they focus on maintaining, enhancing and establishment of woods and trees across landscape bigger than a single farm. They are partnerships as they include many privately owned farms as well as public land. At first the emphasis was on amenity but increasingly they are seen as opportunities for jobs and the creation of small forest product-using enterprises. Most initiatives are multi-institutional and are business-like as they employ a few people to administer business plans to secure funding from government grants, industry sponsorship, EU and National Lottery etc. and co-ordinate activities. Examples of such initiatives are Anglia Woodlink, Cumbria Broadleaves, Marches Woodland Initiative, Wessex Coppice and Yorwoods.

Perhaps the most ambitious community forest is the 200 square miles of National Forest being established by the National Forest Company which is a public body created by the former Countryside Commission. The Company is using innovative partnerships with local authorities, farmers, landowners, companies, local communities and people from all over the country to create a new forest on what will largely be private land. The forest itself will be designed to provide a landscape for amenity, public enjoyment, education, nature conservation and economy of the area. In the Company's own words a 'blend of ancient woodlands and new plantings to frame a glorious and varied mosaic of farms, open country, towns and villages'.

NGO INITIATIVES

There is a whole range of community and NGO-facilitated forestry projects in the UK many of which relate to TOF both in terms of management and exploitation. There are many examples of community councils, individuals, schools etc. initiating local action on behalf of individual trees, woods, forests or landscapes. Pre-eminent among these is Reafforesting Scotland which started out with the idea of restoring the Scots Pine forests of the highlands of Scotland. Many such groups have taken up the dream of planting forests for the future and have been able to secure funds from the National Lottery to create a Millennium Forest. There are increasing numbers of locally led forestry initiatives notably the emergence of Crofter Forestry in which estate tenants are given management rights and ownership of land they occupy. This is supported by the new Scottish Forestry Strategy which adds its voice to the calls for tenural reform in Scotland to facilitate the transfer of land rights from feudal estates to communities usually under co-operative arrangements. However, this is more like small scale forestry than TOF.

Here are some examples of NGOs which have specific TOF initiatives (in no particular order) to give an indication of the level of public involvement with TOF.

National Urban Forestry Unit - established in 1995 to raise awareness of the positive contribution that trees make to the quality of life in towns. They note that even in towns, trees yield traditional products such as timber and fruit, while emerging commercial products such as wood chip mulch, renewable fuel and extractives (taxol from yew) are helping to finance urban tree and woodland management. They run a range of projects:

- Trees of time and place - sponsored by Esso with the intention that everyone would grow at least 1 tree from seed during their lifetime
- Woods on your doorstep
- Woodlands for the Millennium

Tree Council - works to promote trees. It runs several campaigns many with industry sponsorship.

- The National Grid Tree Warden scheme is design to co-ordinate volunteers to play an active role in conserving and enhancing their local trees and woods. The Wardens are appointed by parish councils or other community organisations. Since 1990, Tree Warden Networks have been set up throughout the UK with over 7,000 voluntary Tree Wardens.
- Family tree scheme - requests that people make a donation to plant a tree in the name of a relative or to commemorate an family event in a permanent planting on 23 sites mostly in community forests.
- Trees for schools - encourages the planting of trees around schools
- Trees love care - education and advice in the care of young trees
- Seed gathering Sunday - a designated day for mass collection of tree seed for local planting

Woodland Trust - largest and most politically active NGO. It provides advice and grants to woodland owners and campaigners. Campaigns on woodland issues including hedgerows and other TOF. Owns and manages native woodlands.

Coed Cymru - Welsh NGO that provides management and marketing advice to farmers with small woods. The woods they manage are entered into a FSC group certification scheme.

Common Ground - NGO interested in promoting the use of Commons. Has a programme to save and create orchards.

Small Woods Association - Provides technical advice. More interested than most in incoming generating initiatives associated with small woods. These are a selection of small projects from the SWA register.

- Clun Valley alder charcoal pilot project - management and charcoal production from overgrown riverside alder coppice
- Local woodland products initiative - promote the use of poles (hazel coppice) as bean poles and peasticks to local gardeners to finance the creation of more shrubby habitat in urban areas.
- Kentish Cobnuts Association - promotes the propagation and marketing of cobnuts
- Tree register of the British Isles - list of remarkable trees

Greenwood Trust - established in 1984 to promote the use of green, small diameter wood in traditional crafts.

British Charcoal and Coppice Group - endeavours to promote coppice management and the marketing of produce from small woods principally as charcoal.

PROTECTING AND MAINTAINING HEDGEROWS

A case study of how these different instruments have been applied to hedgerows in the UK demonstrates how an undesirable situation can be turned around.

In 1945 there was an estimated 500,000 miles of hedgerows but in the period 1947-1969 the mechanisation and intensification of agriculture lead to hedgerow clearance at the rate of 2,600 miles per year with clearance reaching its peak between 1984-1990 at 5,378 miles per year. This combined with neglect and dereliction brought about a radical change in arable landscapes particularly in England. The adverse impact of this on amenity and biodiversity values lead to increasing calls for public intervention in the processes of landscape change.

In 1984 the Countryside Survey revealed that 23% of hedgerows had by then been lost. This confirmed the magnitude of the problem and served to raise the profile of hedgerows as a conservation and heritage issue. By the late 1980's grants to destroy hedgerows for farm intensification were withdrawn and in 1992 replaced with the Hedgerow Incentive Scheme (England) and Hedgerow Restoration Scheme (Wales). These schemes grant aided the replacement and restoration of priority hedges (ancient, important wildlife habitat, on degraded landscapes or of particular amenity value). The grants were to cover initial restoration followed an agreed 10 year management programme. Since 1996 these grants have been incorporated into stewardship schemes. In 1997 the Hedgerow Regulations came into force bringing a 'stick' to join the 'carrot' of grants.

In 1999 the Government introduced its strategy for sustainable development (DETR 1999). The contribution of hedgerows and other field boundaries to the quality of the rural landscape and biodiversity was recognised in the strategy and one of the Quality of Life Counts indicators was targeted at hedgerows. The indicator sets three targets for hedgerows, by 2005:

- to halt loss of hedgerows,
- to bring 50% under favourable management and
- to maintain overall numbers of hedgerow trees.

The data to assess the Quality of Life Counts indicator for hedgerows is derived from the Countryside Survey (as in Table 3). Comparison of the 1998 with 1990 survey permits an investigation of the types of changes which are taking place and provides a measure of the success or otherwise of hedgerow management. What emerges is that the net loss of hedges reported in 1990 has been halted by a seven-fold decrease in hedge removal, that planting rates have remained constant and degradation through neglect has been to some extent mitigated by restoration. These findings are generally supported by the FC inventory which found a significant increase in linear groupings of trees.

It would appear from CS2000 that the incentives and awareness raising have been successful in halting the loss of hedgerows as there has barely been time for the Regulations to have had a measurable effect. The remaining problem of hedgerow neglect and dereliction (the shift of hedges to relict hedges and loss of species diversity) is being targeted by the stewardship schemes and the next task is to bring more of the hedgerows back into active management and good heath.

CONCLUDING COMMENTS

Generally the TOF scene in the UK is dynamic perhaps because of, rather than despite, the high degree of urbanisation. There is an apparently large willingness to pay for quality countryside. It could be argued that these values are being directly translated into livelihoods through annual payments for environmentally sensitive management through stewardship and farm woodland premium schemes from public money. Public money is also being used to facilitate and support the creation of community forests which seek to make forests more accessible to city dwellers thus avoiding conflict with farming.

The lead on TOF issues is coming from the agriculture/conservation sectors rather than forestry. Forestry responsibility stops at the 0.8 ha cut off for the WGS grants. Features below this size are inventoried and reported by the FC but they have no responsibilities or programmes directed at their management. The development of regulations and incentives for TOF is lead by DEFRA which represents the agriculture and rural development sectors.

Although NGOs are able to access public funds through the grant schemes many seek to raise funds and generate income through the sale of TOF products such as charcoal, extracts, flowers, fruit, nuts and poles etc.. Much of the processing of such products is done using traditional craft skills and small scale 'green' enterprises. There is a growing appreciation that to be sustainable and contribute to the sustainability of rural life there is a need to market and use the products of farm woods and trees. There are a number of initiatives in this area, both of a practical nature and research sponsored by the EU and countryside agencies.

Consideration of developments in TOF reveals some interesting dynamics; there has been a shift from targeting interventions at features (hedgerow incentives) to farms (stewardship schemes) and onwards to larger scales as demonstrated by the Countryside Character Initiative. There has also been an emphasis on incentives and civil concerns acting like peer pressure rather than regulation. In this context, TOF ceases to be about trees and much more about integrated, multi-purpose management of land.

This is a case study of the UK but these developments are echoed across Europe as demonstrated in the ILO review of public participation in forestry in Europe (FAO/ECE/ILO). It is encouraging to think that even in affluent, urbanised countries with intensive high tech farming practices that there is still a role for TOF in rural landscapes and life and it provides an entry point for urban people to enjoy and be involved with nature.

SOURCES OF INFORMATION

The material presented in this paper was drawn from the following sources.

Government agencies

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Countryside Council for Wales	www.ccw.gov.uk
Countryside Survey 2000	www.cs2000.org
Department of the Environment, Food and Rural Affairs	www.defra.gov.uk
English Nature	www.english-nature.gov.uk
Environment and Heritage Service (Northern Ireland)	www.ehsni.gov.uk
Forestry Commission	www.forestry.gov.uk
National Urban Forestry Unit	www.nufu.org.uk
Scottish Natural Heritage	www.snh.gov.uk

NGOs

National Forest Company

www.labmeps-emids.fsnet.co.uk/natfor.htm National Urban

Forestry Unit

www.nufu.org.uk

Small Woods Association

www.sma.org.uk

Tree Council

www.treecouncil.org.uk

Woodland Trust

www.woodland-trust.org.uk

Personal communication

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SECTION V: ANNEX

SECTION 5.1: MEETING BACKGROUND AND PROGRAMME

Expert Consultation on Trees Outside Forests FAO HQ, Rome Italy, 26-28 November 2001

“Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”

Venue: FAO HQ, Rome

Date: 26-28 November 2001 (3 days)

Organiser: Forest Conservation, Research and Education Service (FORC),
Forestry Department, FAO

1. Background and Justification

The importance of the trees outside the forest (TOF) in providing goods and services is increasingly recognised by institutions involved in natural resource planning, management and monitoring, as by those concerned with forestry, agriculture and livestock. Several countries have been assessing in various ways TOF among the resources contributing to wood and non wood “forest” products supply, land and ecosystem conservation and poverty alleviation. However, most of the time, TOF are generally not taken into account in forest and tree resources assessments and are not systematically well integrated in decision making concerning land resources, including forests.

According to FAO definition, “Trees outside the forest” are the trees, shrubs and their systems on land not defined as forest and other wooded land³⁵. Trees Outside Forests are mainly on agricultural land and in urban and peri-urban areas, and under the responsibility (resource use and management, decision, policy, economic) of several institutions, including private or individual owners. Issues related to TOF must be analyzed in the context of environmental protection and sustainable forest management, as well as sustainable agriculture and planned urbanisation.

In countries with low forest cover (LFCCs), Trees Outside Forests constitute the main source of tree products and are at the heart of land resources conservation strategies. In places with extensive forest areas, TOF as they are generally more accessible, may still offer major contribution to household livelihood. TOF may also constitute a key element of strategy to reduce pressure on forest. However, their contribution is affected by several constraints: i) lack of general awareness among managers, policy and decision makers about the role and potential of TOF in supplying social and economic products; ii) the low economic incentive for the husbandry of tree-based systems compared to other land use (annual crops), iii) the

³⁵ Trees outside the forest: “Trees outside the forest” are the trees, shrubs and their systems on land not defined as forest and other wooded land. They are on the other lands, which comprise: farmlands (including meadows and pastures), built-up areas (human settlements and infrastructures) and bare lands. They include a variety of trees and shrubs of all functions (e.g. protection, production, amenity, ornamental, landscape) and all domains (e.g. agricultural, forestry and urban development).

unfavourable policy and inadequate institutional support (land tenure and legislation) to tree based systems. The contribution of TOF in fragile ecosystems (drylands, mountains, watersheds and densely populated areas) deserve special attention.

Studies have shown that economically and environmentally-sound TOF systems can increase wood and non wood product supply, improve land productivity, reduce pressure on forests, contribute to ecosystem conservation and improve urban environmental conditions.

During the last 2 years, a specific attempt has been made to collect information on TOF at national and international level and promote dialogue around them. The FAO/IRD (ex-ORSTOM) workshop in Orléans, France (21-23 September 1998) and the ICRAF/Sokoine University “Off-Forest Tree Resources of Africa” workshop held in Arusha, Tanzania (12-16 July 1999) confirmed the importance of harmonizing concepts and activities at national and international level. Other works as those undertaken by FAO (FRA 2000, Africover and the EC projects on forest data collection), CATIE, FSI and many other institutions constitute a rich source of information and expertise in the process to develop standardised, efficient, cost-effective methods for planning, monitoring and assessing TOF. Countries and institutions have accumulated sparse knowledge on the status of TOF resources and on the methodologies of assessment, in line with national and institutional perspectives. The FAO Conservation Guide No.35 (in printing) highlights TOF issues through 8 case studies based on an extended review of bibliography, studies and discussions, shows the extent of this knowledge.

One conclusion arising from all these recent developments is that the forestry sector is interested in facilitating the identification of roles and responsibilities among all major actors concerned by TOF and promote collaboration among them. Such collaboration offers potential for common approach to outstanding issues related to definition, policy design and programme development including legal aspects to enhance TOF contribution. In this, special attention will certainly be given to a) the environmental contribution of trees on farmlands; b) the productivity and economic return of tree outside forest, and; c) the general contribution of trees to rural and urban livelihood.

In order to agree on a definition of TOF, and identify roles and responsibilities among all major actors concerned by TOF and also promote collaboration, an expert meeting is planned to be held at Headquarters from 26 to 28 November 2001. The proposed Expert Consultation is the first international gathering of forestry experts to discuss with professionals and practitioners from other sectors to build a shared vision and elaborate on elements of an action programme on TOF. The meeting will discuss analytical framework and methodological tools for studying TOF, identify key areas for future cooperation and will eventually recommend strategic components in national programmes (e.g. national forest programmes) and international processes and agreements (e.g. Teheran process, CCD, CBD and UNFCCC). The Consultation builds on the results of previous meetings as referred above and will probably lead to an other Expert Consultation on policy issues towards end 2003.

2. General Objective

To harmonize cross-sectoral approaches and identify constraints to the contribution of trees outside the forest to sustainable development in general, and in particular to sustainable livelihood and food security.

3. Specific objectives

To propose processes and strategies in order to enhance TOF contribution to sustainable livelihood by (i) improving national policy framework, (ii) strengthening information and knowledge systems and (iii) fostering the participation of concerned actors in the decision-making processes related to forest product supply, land and ecosystem management, and poverty alleviation.

1. **Information:** To exchange information on the status, related issues and knowledge on TOF resources; and identify the key issues, needs, constraints and priorities.
2. **Shared analytical framework:** To define a shared conceptual framework (concepts, terminology, resources) on TOF and identify the key issues, needs and constraints and priorities.
3. **TOF Assessment methodologies:** To propose strategies, action and partnership for the development of methodologies for TOF assessment in the framework of on-going mechanisms for priority resources and users.
4. **TOF Integration in on-going plan of action and mechanisms:** To propose strategies, actions and partnership for integration of TOF, in specific on-going national and international processes: national forest programmes, Teheran process, CCD national action plans.
5. **Awareness and responsibility sharing:** To recommend specific strategies and action to raise awareness (forestry, other sectors and general) and improve the definition of respective role and responsibility sharing among major partners.
6. **General recommendations:** To formulate recommendations to countries, institutions and other on-going processes/mechanisms for the assessment, conservation, management and development of tree resources and systems outside forests.

The participants will establish a common language and approach of work by clarifying the conceptual framework, sharing information on the status of their knowledge on TOF, analysing the issues and trends faced by the resources, and looking at the institutional constraints and opportunities in order to respond to local needs, national priorities and to global norms, agreements and international conventions.

The participants will also discuss and recommend mechanisms and capacities required at local and national level in order to provide high quality and timely information to the wide range of stakeholders involved in decision making processes with impact on forest and other tree systems. It is expected that efficient use of TOF information will improve the economic and ecological valuation of these resources and help to eliminate policy and economic constraints to their sustainable use and conservation.

The participants will discuss and propose priority action to improve the contribution of TOF resources to sustainable livelihoods through improved policy frameworks, better information knowledge systems, raised awareness and improved participation of concerned actors in the decision-making processes.

The participants will focus on three main ecological systems: arid and semi-arid zones, mountain areas and densely populated areas. Key tree-based systems important for their extension, fragility and socio-economic importance will be analysed in depth (e.g. pasture, parklands, coffee, home garden and intensive agroforestry farms). The debate will elaborate on actual mechanisms established around sustainable forest management, sustainable agriculture and ecosystem conservation.

At the end of the workshop, recommendations of actions will be made to FAO, countries, participating institutions and other institutions concerned at local, national and international level in order to enhance policies and actions regarding tree-based systems and their contribution to sustainable land use management and poverty alleviation. Recommendations will also target specific on-going processes/mechanisms : national forest programmes, the CCD and the Teheran process.

4. Outputs of the consultation

Papers presented, Summary of discussions and Report of the meeting (proceedings) will be made available to the general public under electronic form at the FAO website. They will also be made available in printed copies in limited number.

5. Duration

The Expert Meeting will have a duration of 3 days.

6. Language

The meeting will be held in English.

The contributions will be provided in English.

The proceedings will be produced in English (Marc 2002)

7. Participants

Twenty five participants (17 external and FAO Task Force Members and other) are expected to participate in the consultation.

External participants: 17 external participants (6 Invited Experts and 11 Resource Persons) are invited and sponsored by FAO. Most of them have collaborated with FAO in TOF related activities in the field of resource assessment, outlook studies and international conventions, such as CATIE, CIRAD-Forêt, ICRAF, FAO/EC projects on data collection and authors of case studies on TOF.

From FAO: Considering the cross-sectoral and disciplinary aspect of these resources, FAO officers from FO divisions and other departments (including AG, SD, GI and ES) are invited to participate.

From UN Bodies: UN Secretariat on Desertification (CCD), UN Secretariat on Biological Diversity (CBD), Teheran Secretariat on Low Forest Cover Countries (LFCC), UN Organisation on Human Settlements (UNCHS).

8. Themes

The approach is to present, in the plenary, an overview of the complex issues related to TOF dynamic, the knowledge on their status, the information available (systems/data basis, quality and flow), the trends for the future at local, national and international level. While still in plenary session, participants will present on-going programmes and mechanisms, constraints and opportunities related to TOF. The next step

would be for Working Groups to establish a common language and approach of work; analyse needs, priorities and actions around 3 themes; look at institutional needs and design strategies and actions for specific mechanisms and programmes. around three themes. Returning to plenary, the participants will discuss and approve the results of the working groups and workshop.

SESSION 1: General issues, needs and trends

Key papers will be presented. Here is a list of suggestions:

1. Introduction to TOF: Concept, general issues, including linkages to the diverse sectors.
2. The wo
3. rld of information: Data where, why and how used for planning and monitoring TOF and related resources.
4. Policy and legislation frameworks – the influence on the dynamic of resources related to TOF. Decision-making process in related sectors: impact on resource degradation; potential for TOF on poverty alleviation and sustainable development.
5. Social and economic factors influencing TOF development: resource tenure and land use; potential, constraints and opportunities for the promotion and the economic valorisation of TOF resource.
6. TOF Outlook studies, issues, constraints and challenges for the future.

SESSION 2 : Institutional Experiences

Participants will present their respective programmes (issues, trends, objectives, constraints, opportunities, needs, activities, etc.) and experiences from their countries or region on TOF studies.

Discussion papers:

1. TOF resource studies: assessment methodologies and institutional approaches related to the sustainable management of land and TOF
2. Case studies: policy, assessment and inventory initiatives, approaches, resource management, information, ect.: i) Asia, ii) North Africa and Near East, iii) Sub-Saharan Africa, iv) Latin America, v) Europ, vi) North America.
3. FAO's activities: FRA, AG related initiatives, NWFP, FO/EC projects, TOF programme (FORC), IDWG "Food for cities", PAIA/PRODs and Good Farming Practices, Community forestry, CCD and Teheran process.
4. Eco-regional initiatives: Agroforestry and Soil conservation
5. Urbanisation and TOF issues

SESSION 3 :Defining common language and approach

The Working Group will review definitions, terminology, concepts and classification related to TOF, and methodologies of TOF inventory and evaluation. It will take into consideration the actual perceptions in relation with the needs at national, regional and international level.

Working Groups

- Group 1: Trees Outside the Forest: Concept, definition and resources
- Group 2: TOF assessment: inventory methodology and data collection and processing
- Group 3: Challenges of TOF : Sustainable land use, Forest resource management Agricultural production

SESSION 4 : TOF issues, needs and priorities

The Working Groups will review issues, needs and priorities in the following areas: i) Policy and decision makers; ii) Social and Economic valuation of high potential resources TOF.

Working Groups

- Group 4: Policy issues
- Group 5: Social and Economic issues, Livelihoods
- Group 6: Research, Education, Extension

SESSION 5 : TOF Institutional Capacity and Needs

The Working Groups will review the institutional capacity and needs, and also Information systems and sharing on TOF resources.

Working Groups

- Group 7: Review of Institutional capacities: TOF studies, assessment of resources, programme formulation, monitoring and evaluation, etc.
- Group 8: TOF Information system and sharing

SESSION 6 : Strategies and Actions for specific mechanisms

The Working Groups will review for data users related to TOF, the institutional needs and propose (i) strategies and action to integrate TOF into decision making processes, (ii) and potential activities and institutional partnership for the biennium 2002/2003.

Working Groups

- Group 9: Integration of TOF with on-going FAO and international processes (Teheran process and Convention on desertification (CCD))
- Group 10: Policy framework at national and international levels

SESSION 7 : Conclusions and Recommendations

In plenary, the participants will discuss the plan of action and will propose ways and means to implement the recommendations.

SECTION 5.2: AGENDA OF THE MEETING

“Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”

(FAO HQ, Rome Italy; 26-28 November 2001)

AM	PM
DAY 1 – 26 November 2001	DAY 1 – 26 November 2001
<p>08H15-09H25: Arrival and registration of the participants 09H30-10H: OPENING</p> <ul style="list-style-type: none"> • Welcome • Opening address • Introduction by participants • Election of the Chairman and Vice-Chairman • Adoption of the programme <p>10H-10H30: Key note address 10H30-10H45: Coffe break</p> <p>SESSION 1: GENERAL ISSUES, NEEDS AND TRENDS 10H45-12H: Presentation of Key Papers(30 minutes including discussion) 12H-12H45: Plenary 12H45-14H15: LUNCH</p>	<p>SESSION 2: INSTITUTIONAL EXPERIENCES (Presentation of experiences and on-going programmes – Background Papers) 14H20-14h40: TOF studies 14H40-15H30: Case Studies 15H30-15H45: Coffee break</p> <p>15H45-16H15: Case studies (continuation) 16H15-16H45: FAO’s activities <i>16H45-17H10: Eco-regional initiatives</i></p> <p>17H10-17H30: Plenary <i>17H45: COCKTAIL</i></p>
DAY 2 – 27 November 2001	DAY 2 – 27 November 2001
<p>SESSION 3: Defining common language and approach 09H00-12H15: Working Groups 1, 2, 3 at work (Meeting Rooms), including Coffee break 12H20-12H45: Plenary and closure</p> <p><i>12H45-14H15: LUNCH</i></p>	<p>SESSION 4: TOF ISSUES, NEEDS AND PRIORITIES 14H20–16H45: Working Groups 4, 5, 6 at work (Meeting Rooms), including Coffee break 16H45-17H00: Plenary</p>
DAY 3 28 November 2001	DAY 3 – 28 November 2001
<p>SESSION 5 : TOF INSTITUTIONAL CAPACITY AND NEEDS</p> <p>09H00-12H15: Working Groups 7 & 8 at work (Meeting Rooms), including Coffee break</p> <p>12H20-12H45: Plenary</p> <p><i>12H40-14H00: LUNCH</i></p>	<p>SESSION 6 : STRATEGIES AND ACTIONS FOR SPECIFIC MECHANISMS 14H20–15H30: Working Groups 9 & 10 at work (Meeting Rooms) 15H30-15H45: Coffee break 15H45-16H15: Working Groups 9 & 10 16H15-16H30: Plenary</p> <p>SESSION 7: CONCLUSION AND RECOMMENDATIONS 16h30-16h45: Discussions and adoption of the final conclusion and recommandations</p> <p><i>16H45-17H00: Closure of the Consultation</i></p>

