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European Tropical Forest Research Network

ETFRN

NEWS

Forest Resources Assessment

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Dear readers,

Many thanks are due to our guest editor for this issue, Giovanni Preto. He was involved in the FAO Forest Resource Assessment 2000, and this experience has not deterred him from offering to guest edit an ETFRN News issue on *'Forest Resources Assessment: Issues and Perspectives'*. In his overview article (p.5) he presents the objectives for this issue. He also highlights the challenges in forest resources assessment. These are definitely not limited to finding and applying the newest inventory techniques.

Many of the unanswered questions relate to the actual use of the assessment information in forest management and policy development. This is a recurring theme in most development-oriented research: how does one bridge the gaps between research, policy and practice; and how can research results be communicated in such a way that they contribute to sustainable development? One example of an attempt to bridge some of these gaps was the ETFRN workshop on participatory monitoring and evaluation of biodiversity (p.2 and p. 75). The workshop explored the potential of participatory assessment, monitoring and evaluation of biodiversity (PAMEB) for reconciling local and national information needs in biodiversity management. One of the conclusions was that 'The *process* of negotiating, observing and analysing indicators may bring about more change than the data gathered itself, and in particular can enhance benefit-sharing, as well as be more sustainable than externally led processes. However to achieve this, changes in education, training of scientists, and institutional networking are needed.'

This leads to the thought that in forest resources assessment research, probably as much attention should be paid to the process, and to who should be involved, and at what stage, as to the development and use of new techniques. The new techniques discussed in this issue do present exciting opportunities. Visualising land use change through satellite images and aerial photographs can be a powerful tool to generate discussion on the use and management of forest and land resources. Has anyone been involved in using GIS in participatory assessments of forest resources?

Hoping you will enjoy reading this issue; please rememberthat ETFRN CU always welcomes comments, and contributions for future issues. Please note the themes and deadlines for the next two issues on the back cover.

Willemine Brinkman
ETFRN Coordinator

PS Please note that we have included a list of past issues on the last page, following a suggestion by one of the participants in the ETFRN Steering Committee.

ETFRN Coordination Unit
c/o Tropenbos International
PO Box 232, 6700 AE Wageningen
The Netherlands
Tel: +31 317 495516 Fax: +31 317 495521
Email: etfrn@iac.agro.nl
Http://www.etfrn.org/etfrn

Editor: Willemine Brinkman
Guest Editor for this issue: Giovanni Preto
Editorial assistance: Jacqui McGrath

Cover illustration: Measuring the biomass of conifers, Cape Verde

Photograph by: Ch. Errath 1987
Source: FAO Mediabase
http://www1.fao.org/media_user/_home.html

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Challenges in Forest Resource Assessment

By Giovanni Preto

The Spring/Summer 2002 ETFRN-NEWS focusses on "*Forest resources assessment: issues and perspectives*" and covers the technical aspects of inventory and monitoring techniques, particularly in developing countries. While planning this issue of the ETFRN-NEWS, our main objective was to provide an overview of the current stage of development of forest resources assessment techniques. This overview has two main purposes. First, it is aimed at evaluating the effectiveness of forest resource inventories in achieving expected results and required statistical outputs; second, it aims to develop sound appraisals of the manifold functions and values (ecological, economic, social) of tropical forest ecosystems in view of their sustainable use. Moreover, the intended objective of the NEWS is to provide updated information on the use of the information acquired through forest resource assessments in attaining a sustainable use of forest resources; and on the drawbacks and successes of scientific inventorying and monitoring activities of natural resources.

These objectives have been accomplished only to some extent. Most of the contributions have only given partial account of the problems faced in planning and implementing local, nation-wide, regional, and global surveys of forest resources (in the broadest sense); of the response of the acquired information to the surveying objectives; and of the actual use made of the information for the practical implementation of forest resource management plans at various levels. Many of the contributions submitted are based on local experiences or on specific techniques applied in particular contexts. As such they can only marginally contribute to an objective evaluation of the relevance and applicability of different surveying procedures for good forest ecosystem management in other socio-economic and environmental conditions; and their contribution to the evaluation of the viability of the applied inventorying techniques under different circumstances is limited.

In spite of the significant number of articles and technical notes on specific inventory techniques and of the widespread circulation of information on experience gained in land-cover surveying and mapping, or in forest resource assessments, little is known regarding the impact of the inventory activities in promoting sustainable use of forest ecosystems. It appears that forest resource assessment is only marginally linked to forest ecosystem management, and that evaluation of forest resources is an end in itself and not a prerequisite for proper management of these resources. While forest users and managers want research to be more relevant and applied and require greater knowledge about others' experiences and decision-making processes, forestry research - particularly that related to evaluation and monitoring forest and environmental resources – is becoming more and more sectional and fragmented, and is increasingly less related to the objective of devising an approach to sustainable use and sound ecological, economic, and ethnologic balance of natural resources.

Notwithstanding the progress made in interdisciplinary research processes, most analyses of forest and natural resources are still highly site specific, thematically partial, sectorally compartmentalised, and composed of fragmented information. This lack of clear interaction and co-ordination, and of well-defined, and practical target-oriented objectives results in natural resources assessment and monitoring becoming more and more disconnected from real-life practices of natural resource management and use, as well as being unresponsive to the actual needs and requirements of pursuing an environmentally sustainable livelihood.

In the last twenty years many new technologies have been introduced and applied in forest resource assessment and monitoring. Computers, databases and programs have shown an exponential growth and are steadily becoming more powerful and cheaper. Data capture devices permit the easy recording of data in permanent and temporary plots. Other remote sensing techniques are currently used in animal population studies, to record and monitor environmental parameters such as stream flows, temperatures, daily changes in tree diameters, etc. Space borne remote sensing is now widely and successfully used in many large area inventories and imagery data processing has made extremely rapid progress. By means of Global Positioning System (GPS) the location of sample areas and relevant terrain features has become more and more accurate and easily recorded and digitised. Geographical Information Systems (GIS) have been widely implemented for land and human resource inventories and have become operational for forest inventory and monitoring applications in most temperate and tropical countries. At the same time Digital Elevation Models (DEM) have contributed to a better understanding of forest characteristics in relation to other environmental features. Even in tree measurements substantial improvements have been achieved with the introduction of laser devices for measuring timber volumes, and with permanent plots, both terrestrial and aerial, for monitoring forest changes and growth.

The task of assisting developing countries in compiling, analysing and exchanging forest resource data and in developing a continuous system of inventorying and monitoring the land-use and land-cover changes, at national and international level, is enormous. Besides adequate financial support networking users, scientists, and institutions in order to achieve a broader contribution to the global forest resource assessment program is urgently needed. There is also a need to raise awareness and inform people as objectively as possible on the state and change of forest resources, using all available media and forms of education and extension.

Wider co-operation among research institutions and national and international organisations is also required for tackling the following inventory problems:

- The compatibility and possibility of integrating various inventories on a spatial, temporal and institutional level;
- The realisation of international co-operation towards unifying global monitoring programs of all natural resources and the environment;
- The transfer of information and technology from industrialised countries to developing countries;
- The integration of various fields of research in order to attain sustainable yield and overcome the current imbalance in the distribution of wealth.

Technological advances, matched with scientific progress in bio-ecology, geo-statistical sampling procedures, mathematical modelling, and information technology, play an essential role in speeding up data collection and in ameliorating information quality and reliability, but the availability and disposability of this new knowledge remain limited and only a few highly specialised institutions are in the position to make full use of them. Training facilities and programs, teaching and up-grading courses, technical and knowledge extension tools for implementing new inventory and monitoring techniques are limited. Moreover, the flow of scientific information, particularly from the advanced countries to the lesser developed ones and to the field operators, is lacking. Linking researchers, practitioners, and users through networks plays an important role in sharing experiences, in returning research findings to the research sites and participants, in improving communication among research institutions and in fostering the globalisation of knowledge. Transferring knowledge on inventory techniques and concepts will not only promote scientific work and collaboration and create new channels for fostering sound management of forest resources, but will also contribute to the emergence of new research topics and to shaping new fields of knowledge.

Regrettably, the inventory infrastructure of most forestry organizations and services is obsolete relative to current information science/technology and/or societal information requirements about forest ecosystems. This organisational handicap, matched with the increasing scientific/technological gap between advanced industrialised countries and the South and the "top-down" approach in carrying out regional, national, and global inventories, is hampering the acquisition of comprehensive information on forest ecosystems and the possibility of sound resource management. Informational integration needs to be addressed and knowledge on innovative statistics relevant to multi-resource and ecosystem-oriented forest inventory must be spread and appropriate computerized knowledge-systems must be developed to provide easily used and understandable interfaces for field foresters and resource managers.

It is commonly agreed that forestry research and natural resources inventory programmes should be based on the needs of forest users/stakeholders and policy makers, and that they should provide basic knowledge on natural resources and detailed information on ecological, economic, social and operational parameters for sustainability. However, in most cases these statements are wishful thinking and there are only a few signs that forest managers and scientists, locally and globally, have started to look beyond the trees forming the forests and are no longer regarding the forests as "large tracts of land covered by trees", instead of considering them as a complex ecosystem[1], as dynamic, totally integrated synergistic system complexes, of which mankind is a part and integral expression.

In the past, forests have been considered an inexhaustible source of goods - particularly wood-, and forest resources have been considered as "properties or materials" to be found in the woodlands. The increasing awareness that forest resource use is bound to ecological factors and to the capability of the forest ecosystems to generate, without deteriorating, an ecological surplus upon which all life depends"[2] should lead to abandoning the traditional reactive and passive way of using natural resources. With deeper knowledge of the dynamics and interactions taking place in the forest ecosystems, we should improve our capacity to influence the process of generating ecological surpluses and, at the same time, to maintain and renew forest ecosystems.

The problem is how to build up an interdisciplinary approach in assessing natural resources and environment, how to break with the traditional methods of singly inventorying natural resources and how to integrate inventory information with economic, social and political data in order to identify alternatives to the current approach in the use of the biosphere. Modern inventories should not be limited to simply recording with ever greater accuracy the global level of decay produced by consumer society, but they should also propose alternatives and

solutions, eliminating the barriers between the information gathered through monitoring systems and its use. They must anticipate the demand for information that accompanies economic development, analyse the intrinsic contradictions in man's relationship with nature under the current system of production and point out possible alternatives. The challenge for forest resource assessments is to link technological and scientific achievements with management practices and to reorganise and formalise the existing scattered knowledge into consistent operational scientific reference-points.

Overworked expressions, like stakeholders, sustainable use/development, policy/decision makers, etc., often hide a shortage of analysis of the real objectives of forest resource assessments and of the people and target groups that should benefit from the research results. Forest resource assessment is an integral part of the forest management process, which is essentially a knowledge and action system. As a knowledge system, forest inventories must ensure that comprehensive information on forest ecosystems is obtained and presented to the users by using the most appropriate scientific instruments and technical tools. However, the conventional view of forestry as a professional activity needs to change and more attention should be given to traditional local understanding of the role of forest in the communities' livelihood and to the wide variety of conditions under which forest resources are managed. A closer link among forestry research institutions, field operators, and local communities is required in order to implement environmentally sound management practices, while institutional adjustments in the formal professional organizations and in the structure of the forest administrations is required to make full use of both the scientific advance in resource assessment techniques and the traditional knowledge of forestry users.

Giovanni Preto
Italian National Node – European Tropical Forest Research Network (INN-ETFRN)
Instituto Sperimentale per la Selvicoltura,
Via delle Cascine 1, 50144, Firenze,
Florence
Tel:+39 055 360061 Fax: +39 055 362034
Email: giopreto@ats.it
Http://www.cesit.unifi.it/amazon/

1. According to the definition of Sukachev "from a siviculture point of view any area of forest must be regarded as a specific natural unit, where all vegetation, fauna and micro-organisms, soil and atmosphere exist in a state of close interpersonal relationship and interaction" (Sukachev V. & N. Dylis: Fundamentals of Forest Biogeocoenology. Oliver & Boyd, Edinburgh & London 1964).

2. The term ecological surplus provides a better understanding of the holistic nature of ecosystems and mans integral part therein. "Ecological surplus depends both on the inherent capacity of the different components to generate a surplus and our capacity to influence the process". Alston R.M., Wikstrom, J.H., 1989: Ecological Surplus: defining the concept Proceedings of the Global Natural Resource Monitoring and Assessments: Preparing for the 1st Century. G. Lund & G. Preto (eds), American Society of Remote Sensing, Bethesda, USA.

Forest Resources Assessment: Issues & Perspectives

by Dr. Ashbindu Singh

Issues

There are numerous studies and reports on forest area and forest loss. However, there are significant differences in results due to different methodologies, perspectives and definition of forests. Furthermore, due to a lack of regular monitoring systems it has been a challenge to assess the status and trends of actual forest cover in many countries. Despite the apparent accuracy of the quoted figures for the area under forests and the annual rate of deforestation, there is a large uncertainty regarding the exact magnitude of the problem. A detailed review of the problems associated with assessment of deforestation is available in various Food and Agriculture Organisation (FAO) Forestry Papers (1982, 1996, 2001), UNEP (2001) and WRI (2000). According to these reports, the assessment of global deforestation within a country is complicated due to several reasons:

- There is no globally accepted definition of forest or deforestation. Some definitions include only primary forest whereas others include all forests (primary or disturbed, and closed or open).
- Assessing deforestation requires a minimum of two consistent observations over time. In many countries or regions, even one observation is lacking due to weak capacity in forest inventory.
- Rain forests located in inaccessible terrain are costly to survey. Perpetual clouds in the equatorial zone prevent acquisition of cloud free imagery aerial photographs. Radar imagery, due to the cloud penetrating capabilities, holds a promise, but offers less information.
- Sometimes, ineffective methodologies are employed and figures are reported for a country without giving the associated error.
- Even in countries with a tradition of forest inventory, techniques used have not always been very appropriate for monitoring changes and do not provide a statistically sound comparison of estimates on two dates.
- Sometimes areas reported as "forest" based upon remote sensing studies may not be considered "forests" by others - i.e. orchards, oil palm plantations, etc.

For the assessment of global forest resources, FAO mainly depends upon the information furnished by the countries. FAO compiles the statistics related to forests following a common system of classification and definitions. Because of the differences in the classification and definition the figures published by FAO sometimes do not tally with the figures reported by the individual countries. Furthermore, areas, designated as "forest lands" may not necessarily have tree cover.

For example, in India after regular monitoring of forest cover using satellite data, it was discovered that although the designated forest area in the country was about 23% of the geographical area, some kind of forest cover existed over 19% but real and meaningful forest cover (i.e. closed canopy forest with density >40%) extended to only about 11% of the area (FSI, 1997). The World Resources Institute (WRI, 1997) in the report "The Last Frontier Forests" assessed the state of the world's remaining large intact natural forest ecosystems using the existing global map of current forest cover and input of experts around the world. The quality, accuracy and dates of these national and regional maps vary and annotation of boundaries of forest areas by experts seems to be a rather subjective.
Some definitions of forests are cited here to highlight the issue.

Definitions of Forests
Forest Area: Forest includes natural forests and forest plantations. The term is used to refer to land with a tree canopy cover of 10 percent and area of more than 0-5 ha (FAO, 2001).

Recorded Forest Area: All lands statutorily notified as forest though they may not necessarily bear tree cover. (FSI, 1997).
Forest Cover: All lands with a tree canopy density of more than 10 per cent, though they may not be statutorily notified as forest. (FSI, 1997).
Closed Forests: is defined as all lands with a forest cover of trees with their crowns interlocking and a canopy density of 40% or above. The boundary of 40% coverage is convenient because it can be estimated with ease when the coverage of the trees is 40% the distance between two tree crowns equalling the mean radius of a tree crown (UNESCO 1973).

Frontier Forests: are the world's remaining large intact natural forest ecosystems. (WRI, 1997).
Forest Land: Land at least 10% stocked by forest trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated (USFS, 1993).
Forest Land: The data regarding Canada's forest land are based on the Canada Forest Inventory 1991 (revised 1994) (CFS, 2000).

In order to obtain geographically comprehensive and up to date information there have been several studies to map forest cover using satellite data at the regional or continental scale. Unfortunately, remote sensing based studies are also based on varying classification systems and methodologies, making the comparison of the results of numerous studies rather difficult.

Perspectives
It is critical to reach an international consensus on the definitions of forests to at least facilitate the higher level of aggregation. It is not feasible to change the definitions currently employed in numerous forest inventories but it may be possible to develop some sort of objective translation mechanism. Remote sensing data should be used to develop baseline information and analysis change. A network of ground sample plots is needed for growth and yield studies and biomass estimation. Technological innovation can contribute to the way forests are protected. The use of satellite imagery for regular monitoring and Internet for information dissemination provides an effective tool for raising awareness worldwide about the significance of forests and intrinsic value of nature.

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Dr. Ashbindu Singh, Regional Coordinator
UNEP Division of Early Warning and Assessment -North America
EROS Data Center
Sioux Falls, South Dakota 57198
Tel :1 605 594 6107/6117
Fax: 1 605 594 6119
E-mail:singh@usgs.gov
http://www.na.unep.net

The Information Needs Assessment (INA)

By H. Gyde Lund

The information needs assessment or analysis (INA) is the most important step in developing a forest resource inventory. If you are a large company or agency and have not performed an INA since 1992, then you probably need one now. The concept of forestry and the information required for sustainable forest management has changed dramatically in the last ten years especially since the United Nations Conference on Environment and Development. In the past the main focus of forest inventory was for timber production. Now we need to be concerned about biological diversity, carbon sequestration, and environmental protection as well. This means we may have to collect more information in our inventories.

A basic question is "what data should be collected?" The answer is simply answered by the following equation:
(What do you NEED to know) – (What you already know) = Information you must gather.

There are certain key questions that must be answered to help you decide what you truly need.

1. **First and foremost "Why do you need a forest inventory?"** Possible answers – the inventory is needed for national strategic planning, you need to meet international commitments, or your boss says so. Table 1 lists typical information needs by various decision levels.

Many nations need a national level inventory for strategic planning and to meet international obligations especially those resulting from the United Nations Conference on Environment and Development in 1992. Documents arising from UNCED include Agenda 21, the Forestry Principles, the Conference on Biological Diversity, the Framework Convention on Climate Change, and the Convention on Desertification. If your last national inventory was carried out before UNCED chances are that you do need a new inventory, as there are new information requirements as a result of these agreements.

2. **Who wants to know and when?** People requiring the inventory may be the government, NGOs, the public, industry or academia. As to when, the answer is usually as soon as possible. How soon the information is actually required helps dictate the method used to gather the data.

3. **What do 'they' (those wanting the information) need to know?** Start with the rules, regulations, and laws that apply to your organization. Examine them for data requirements. Next look at any international obligations you may have. In all probability "they" will want to know the amount, condition, production and location of the ____ resources on ____ lands. (The blanks to be filled in later).

We do know that we have to manage our forest resources on a sustainable basis. Since 1992, the concept of sustainable forest management has changed. The old concept was essentially *the use and management of forestland by producing more timber than is harvested.* The new concept is *the stewardship and use of forests and forestland in a way and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill now and in the future, relevant ecological, economic and social functions, at local, regional, national, and global levels and does not cause damage to other ecosystems.*

Tables 2 (P.13) and 3 (P.14)list the types of

areas and indicators to be monitored for agreements arising from UNCED.
Figure 1(Pg 13) – Start with laws, regulations that govern your organization. Next identify criteria and indicators. From these, determine the measurements or observations to be made on various parameters.

You should be able to trace any data element you collect or measure in the field back to a required report or law. If such a link cannot be made, there probably is no need to collect that data.

4. **How often will 'they' need the information?** The answer to this question has a huge bearing on the inventory infrastructure one sets up and on the inventory design employed. Given the requirements for tracking change, one may wish to consider establishing a continuous forest inventory system using permanent sample plots.

5. **What would happen if Ireland did not have an inventory? / How good do the answers have to be?** The answers depend on what is the impact on the resources, what is the impact on the decisions, and what is the impact on the decision-maker if there is no inventory or if the data are weak.

6. **The big question - How much are 'they' willing to pay?** In my opinion, those that are requesting the information should pay for it be it timber data, biological diversity, etc. What funds are likely to be available also impacts the inventory design and how 'good' the information will be.

7. **Which lands shall you include?** International agreements tend to promote the increase of forest area. That implies that you will need data on areas that currently do not have trees but should have. Do you wish to include these current non-forested areas in your assessment?

By answering the above questions you will be well on your way to designing a meaningful and up-to-date forest inventory.

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H. Gyde Lund
Forest Information Services
8221 Thornwood Ct.
Manassas, VA 20110-4627, USA
Tel: +1-703-368-7219;
Fax: +1-703-257-1419

Exploring community priorities in tropical forest landscapes.

By Douglas Sheil

The Challenge

The academic approach to biological surveys has generally been to match specific methods to specific questions. However, the most obvious and urgent practical questions remain too broad for such clear resolution. One such question encapsulates the essence of our study of marginalized Dayak communities in Kalimantan: "How can we find out what we should know to make better decisions about tropical forest landscapes?"

For many stakeholders, especially commercial enterprises, their motivations are relatively clear and easily communicated, and decision makers can take note. But, for indigenous rural communities, their needs and perceptions remain veiled to most outsiders unless a specific effort is made to uncover them. When the real impacts on the land come from external forces, as they often do, local communities and the environment

Table 1. Typical Decision Level Characteristics

Level	Characteristics and information needs
International	Goal: To develop international programs or action plans to foster development, reverse the depletion of resources and degradation of the environment; foreign trade agreements to shift surplus to meet demands; or cooperative agreements to control pests and diseases or to address other catastrophic occurrences. Information sought includes the present state of the resources and the rate and pattern of change. Data are usually collected nationally and assembled by an international organization.
National	Goal: To develop long-range Federal policies and programs for public and private land-administrating organizations within a given country. National assessments often provide basic and relevant data on renewable resources held by all types of owners within a nation, appraising changes in supplies of resources and demands for them, the outlooks for future, and possible alterations in these outlooks by changes in national program end policies. National assessments include descriptions of the present situation and estimated changes due to management, cultural influences, and natural or secondary factors. The data are usually assembled and compiled by a Federal agency or an association dealing with a specific resource product. The primary users of the information are the executive branch, Congress, and regulatory agencies. Private industries also use long-range estimates of production and trends to develop their own strategies.
Agency	Goal: To develop an overall strategy for the management of resources within the agency's jurisdiction; define a policy; to express that policy as a set of regulations; and to carry out and execute the policy through agency's program. The information required usually reflects current values end or and rates of change. Inventories conducted at this level may be considered as a prelude to the development of the resource. Inventories focus on the resource stock and the land's capability to produce on a sustained yield basis. The inventory units used in planning are usually based upon political or administrative boundaries. Broad management goals and objectives and financial plans for the organization are the eventual products
Region, Forest, District	Goal: To develop long-term direction for each management or administrative unit (e.g. Region, Forest, District) within an organization. The resources and their condition and potential are described only in sufficient detail to direct the manager's attention to specific portions of the management unit for more intensive planning. Area, volume, and production estimates are usually tied to each unit. For timber planning, information sought includes areas by land class, soil-vegetation types, estimates of growing stock within the classes, and accessibility. The product is a management plan.
Compartment and Stand	Goal: To determine what, where, and when specific treatments are to take place. Decisions regarding timber sale locations and prescriptions for specific stands are examples. Inventories to assist the decision maker often include maps of vegetation conditions by compartments and stands, description of vegetation and terrain within the units, and accessibility and relevant classification of the units with respect to the alternatives selected under the land use planning process. Data observed include vegetation factors, potential productivity, accessibility, and economic factors in order to determine specific management actions to take place within the treatment unit. The local resource manager usually conducts the inventories. The output is a functional action plan showing the treatment areas and indicating what is to be done when, where, and how. The plan is used for the day-to-day operations of the lowest level field office.

Table 2

Organisation - Institutions - Programmes

Areas to be monitored according to documents arising from UNCED (Anonymous 1992,1993).

Area	Agenda 21	Forestry principles	Convention on Biodiversity conservation	Convention on climate change	Convention on Certification
Low-lying coastal			Yes	Yes	
Arid and semi-arid			Yes	Yes	Yes
Suitable for reforestation		Yes			
Suitable for afforestation	Yes	Yes			
Prone to natural disasters	Yes			Yes	
Liable to drought & desertification				Yes	Yes
High urban athmospheric pollution	Yes			Yes	
Fragile ecosystems			Yes	Yes	
Forested	Yes	Yes	Yes	Yes	

Figure 1

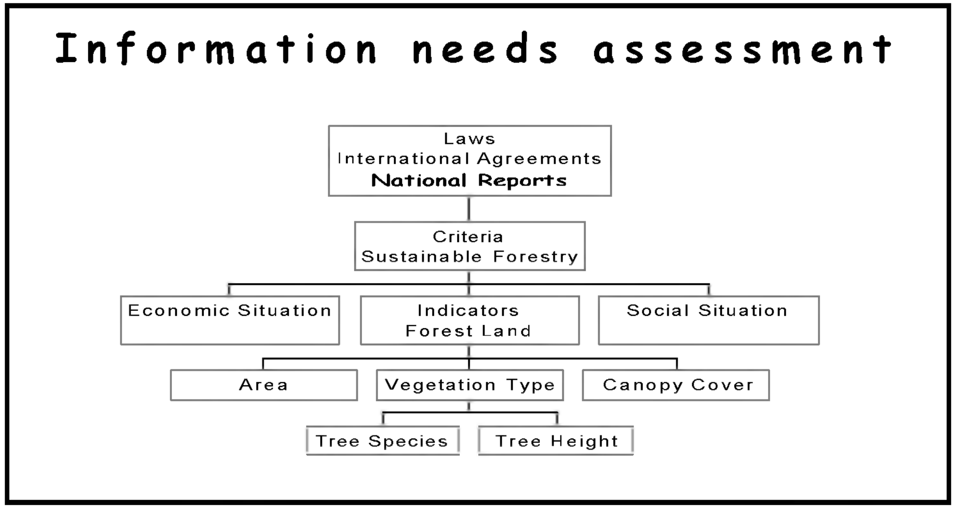

Figure 1 - Start with laws, regulations that govern your organisation. Next identify criteria and indicators. From these, determine the measurements or observations to be made on various parameters.

Table 3

Indicators to be monitored according to documents arising from UNCED (Anonymous 1992,1993).					
Area	**Agenda 21**	**Forestry principles**	**Convention on Biodiversity conservation**	**Convention on climate change**	**Convention on Certification**
Biomass	Yes			Yes	
Climate	Yes			Yes	
Ecosystems & Habitat		Yes	Yes		
Emission sources and removals		Yes		Yes	
Employment		Yes			
Energy	Yes				
Fodder		Yes			
Food	Yes	Yes			
Fuel		Yes			
Land Cover	Yes				
Land degradation	Yes				Yes
Land Productivity	Yes				
Land use	Yes			Yes	
Landscape Diversity		Yes			
Minerals	Yes				
Medicine		Yes			
Plants & animals	Yes	Yes	Yes		
Recreation		Yes			
Shelter		Yes			
Soils	Yes				
Water and water use	Yes	Yes			
Wildlife	Yes	Yes			
Woodstocks		Yes			

Note that many of the indicators involve observing things other than trees and nearly all require the measurement of change. This new direction means new information. To protect and create more natural biological diversity for example, one needs information not only on the trees but on other flora, fauna, soils, site, and habitat as well. These kind of things should be built into new inventories. Once the information requirements are known, the next task is to break the requirements down into data to be measured (figure 1) are often joint losers. The problem is that policy and decision makers are poorly guided on how to address the needs of local communities and biodiversity in landscapes. Field surveys are not an end in themselves. Understanding what matters is fundamental.

What is needed are methods, that can reduce the understanding gap and provide a comprehensible summary of what matters locally, determine what is important, to whom, by how much and why, and provide a means to make these preferences more apparent in the decision making process. CIFOR and a team of national and international partners have set about trying to address this.

The Methods

The initial approach we have developed is detailed in a new CIFOR publication (Sheil et al. in press), developed during a study of seven communities in the forest-rich upper portion of the Malinau watershed. The Malinau area (East Kalimantan, Indonesian Borneo) was, until recently, little known biologically though it was suspected that the rugged forested landscape, next to the Kayan Mentarang National Park, would have a high conservation significance. A major emphasis of CIFOR's Biodiversity research in the areas has been to begin to document this biological wealth and its local relevance.

Our methods emphasise quantitative approaches, but not exclusively. A village-based survey collected a wide range of qualitative and quantitative information about the needs, culture, institutions and aspirations of the communities, and examined general perceptions of the local landscape. A parallel field survey assessed sample sites and recorded soil, vegetation and other site characteristics using both 'scientific' and local approaches. These field methods emphasized landscape-scale characterization through a large number of small data-rich samples, and assessments of community territories based on these samples. The data collected represents a 'baseline diagnostic' phase within a longer-term research strategy.

Our results clearly underline that local communities have complex dependencies upon forest landscapes that *need to be respected and understood*. For Indonesia, this message requires a steady revolution that must impact all the institutions and processes related to forest management.

While our methods attempt to be systematic, results are not easily generalised. We need to evaluate the complexity while avoiding simplification. We tried to develop a "one–off" systematic "diagnostic" method, and collected massive quantities of diverse data. Ultimately though, there will be difficulties in assessing local views unless we see the process as iterative – at the very least we will need to check our conclusions with the communities. The key point is to develop a dialogue by learning to understand each other. Our methods provide a step in the right direction.

One crucial area that involves a distinct set of concerns is intellectual property. There is little doubt that the information provided by the community could have commercial potential, whether in the identification of pharmaceutically active plants or areas with specific resources. In our studies, we also made explicit that communities need not tell us anything they did not want to tell us. We specifically did not record detailed accounts of how plants were used, or how medicines are prepared and administered.

What is the immediate value of such surveys to the community? These surveys take time and involvement from local people. Despite our own fears about possible community impatience, they have stayed enthusiastic and appear genuinely pleased that outsiders seek them out and discuss their views with them. The more tangible benefits they

perceive include the recognition of their use of the forest by us, as a third party, and maps and documents that reflect this recognition. It was clear from their feedback that they also recognise benefits of openly discussing topics that they have previously not given much explicit attention, and in learning how to make their views apparent to outsiders like ourselves.

Conclusions

Decision makers require guidance on how to deal with the needs of local communities and biodiversity in landscapes. Our published methods bring together one suite of effective methods that can be used to survey tropical forest landscapes. The techniques provide conventional biophysical descriptions of the landscape and explicitly relate this information to local needs, preferences and value systems. These methods can be used to make recommendations on options about land use and policy, and to guide future research. The approach described provides a foundation for deeper dialogue between scientists, policy makers and the forest communities.

Acknowledgements

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http://www.cgiar.org/

Douglas Sheil
Center for International Forestry Research (CIFOR),
P.O.Box 6596 JKPWB,
Jakarta 10065, Indonesia.
Telephone: +62 251 622622,
Fax: +62 251 622100,
Email: D.Sheil@cgiar.org

Experiences in the elaboration, implementation and follow-up of forest management plans in natural tropical forests using computers, computer software and other technological packages: a Case Study on Borneo.

By Froylan Castaneda & Christel Palmberg-Lerche

This is a summary of a Paper based on the work of Michael Kleine, with contributions from Evelyn Jugi, Yosep Ruslim, Robert C. Ong, Albert Radin, Bernd Hahn-Schilling and Alexander Hinrichs. August 2001. Forest Management Working Papers, Working Paper 2, Forest Resources Development Service, Forest Resources Division. FAO, Rome *(unpublished)*.

This case study summarises the experiences in the use of computers, computer software and other technological packages in the planning, implementation and monitoring of forest management in natural tropical forests. The methods and procedures presented here have been tested and are currently being used in three projects in the Indonesian and Malaysian territories on the Island of Borneo, Asia. The projects located in East Kalimantan, Sabah and Sarawak are collaborative efforts between the local forest authorities, the private sector and the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), the German Agency for Technical Co-operation. They aim to develop management systems suitable for the sustainable utilisation of tropical forests within the local socio-economic context.

The report is organised according to the basic management concept for sustainable tropical forest management as pursued in all three projects.

In the first section the reader is introduced to the forests and forestry sectors of East Kalimantan, Sabah and Sarawak. Brief descriptions are provided on the ecological and socio-economic environment, the current condition of the forest resources and the institutional framework under which forest management takes place. This section also outlines the basic management concept pursued in all three projects. This approach is characterised by distinct levels and phases of management ranging from planning, implementation and monitoring to control. In order to better understand the function and use of the various computer-supported methods and procedures of forest management, they have been organised according to this structured management concept.

The second section presents three key components of strategic planning in forest management, i.e. forest zoning or land use planning, forest inventory and yield regulation. The various aspects of land use planning are processed using a comprehensive process of data collection, compilation with computer software and spatial representation with the help of GIS technologies. The inventory data processing and yield regulation procedure make use of specially designed program packages. Their applications are explained in detail.

Operational planning at the compartment level is the component within the forest management system dealt with in the third section. A computer-assisted method to design improved topographic and tree location maps is presented. These are important for reduced-impact harvesting operations. In addition, this section also contains a description of a silvicultural decision-support system that is based on silvicultural diagnostic survey. This survey applies aerial photographs to pre-stratify the forest area followed by a more detailed field survey.

In the fourth section two monitoring and control systems that are fundamental to sustainable forest management are described. Both systems are complementary and build on each other, in terms of data procurement and computer-supported processing. The so-called compartment register provides the most detailed information on forest conditions, input and output at the lowest level of forest management. A comprehensive cost and resource accounting system uses the databases generated at the compartment level. Through a structured process the information is compiled and aggregated allowing an overall financial analysis and profit calculation for the entire FMU.

For further information please contact:
Froylan Castaneda, Forestry Officer (Tropical Forest Management)
Or
Christel Palmberg-Lerche, Chief
Forest Resources Development Service
Forest Resources Division
Forestry Department FAO
Viale delle Terme di Caracalla
I-00100 Rome (Italy)
Christel.palmberglerche@fao.org

Emerging Technologies for Forest Resources Appraisals and Land Use Planning

By K. D. Singh

Introduction

This paper presents a short account of recent technological developments such as GPS (geo-positioning systems), GIS (geographic information system) and Modelling, which could be used with advantage in national (forest as well as agroforest) inventories. These technologies, in no way, obviate the importance of good field work or good interpretation of images. Their contribution consists of reducing the cost and/or time of inventories and enhancing the analytical capacity, undoubtedly a contribution of great importance.

Geo-positioning systems

The GPS is a satellite-based navigation system, which can be used for determining the coordinates (x-y-z) of any observation point. It is accurate within a few metres and enables one to map points, lines and areas quickly and easily. The accuracy depends on the equipment, field conditions (in particular, canopy cover), as well as the procedure used. Combined with survey maps such systems could replace the traditional method of locating field plots with maps, chain and compass. An added benefit is that operations such as clearing paths and bypassing obstacles, are no longer required. In the past these operations significantly added to the cost of forest inventory. Through GPS, the plot location becomes near-foolproof, fast and in-expensive.

The trend is toward cheaper, more flexible GPS. This generally means cellular phone-size equipment. Hand-held models allow one to collect and maintain spatial data for GIS use which is an ideal solution for mapping and managing spatial data in many applications, including natural resource mapping and environmental studies. One may also record customized attributes of information. These field data can then be incorporated seamlessly into GIS.

Geographic information system

The term GIS is currently used in two different senses. In the narrow sense, it refers to computer hardware and software for handling geographic information. In the broader sense, it includes all GIS equipment and operations, including the hard and software, input data, editing and storing, processing of data and reporting (see figure 1 pg 20)
The value of GIS to deal with complex problems such as land use and environmental planning, resources management, integrated area development, etc., has been known for a long time. However, recent advances in computer technology such as data base management systems (DBMS), computer- assisted drafting and mapping (CAD/CAM) and modelling techniques have made GIS a very powerful and at the same time affordable tool even at the individual level. Using a relatively inexpensive PC, it is now possible to input, integrate and store information in the form of data as well as maps; analyse and manipulate data and combine these with complex modelling algorithms and display results in the form of computer graphs, maps or tables. Together with the word processing capability of computers, the final report can be produced directly.

Experience indicates that input data for GIS has to be very well prepared if cost and time associated with a GIS project is to be minimized. In fact, to get the best out of a GIS, a total planning is required, starting with survey and analysis of user's output requirements, followed by input design, reliable and relevant data collection and modelling.

Modelling

Models are an abstraction of reality in a mathematical statistical language with a view to study the interaction among various components or dynamic behaviour of the entity or the process of change under alternative assumptions. Models need not include all associated observations or measurements, but a subset of them which are relevant to the problem. A good model should, in fact, exclude unrelated details and focus on fundamental aspects of the reality under study.

Because models are used in such a wide variety of contexts, it is difficult to define even broad types of usage without ambiguity. One major division is between descriptive and normative (or predictive models). The former is concerned with some description of the real world, such as a scale model, a map, a series of equations, and some other analogue; the latter, an ideal type, is what might be expected to occur in the real world under certain conditions. Models have also been classified as static (steady state) or dynamic according to their changing nature; deterministic and stochastic according to degree of probability associated with their prediction; or holistic and reductionist according to the level of detail included in the model.

In complex modelling work, a start is made with establishment and testing of descriptive models to determine causal relationships between various variables. Once causal relationships are known, it is possible to develop a hypothesis, theory, or model, which can predict outcomes given the same or similar circumstances in another area. Well-established relationships can make for very powerful normative models essential for pro-active land management.

An example of modelling: formulation of alternative wood-energy policies

This section presents a model with the acronym APM (Area Production Model), which was originally developed by Nilsson and the present author for a World Bank investment study in India back in the seventies. Since then it has undergone a long period of improvement(see Nilsson 2000). The model simulates possible developments of land use and primary area production. It can be used in connection with production and consumption studies at the level of civil district, commune or a development block to demonstrate impact of alternative developments in the future land use. If possible, it should be run based on the experience of the current and past land use.

The use of the model will be illustrated here to analyse the impact of alternative policy decisions on fuelwood production and consumption in a district of India viz. Adilabad in Andhra Pradesh. Four scenarios are presented using the available forest resources and socio-economic data. Effort was made to make the model as realistic as possible. The alternative scenarios and underlying assumptions are given in Table 1 and results in Figure 2 Pg 21. in a graphic form.

The following conclusions could be drawn from the model study:

i) even in a district like Adilabad, with a forest cover of 40% today, a long term program is essential to balance the supply with the demand. In the best case scenario, it will take about 25 years to balance supply and demand.
ii) Both increasing production and controlling consumption are necessary. This suggests the need for an integrated development

planning. iii) The program for forest plantations must be high yielding to achieve self-reliance in the shortest possible time.
iv) The establishment and development of plantations must be secured with people participation with control of grazing and illicit removals.
v) Adequate finance on a continuing and long-term basis must be secured. This will call for an effective, creditworthy and efficient management environment.

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For further information Please contact:
K. D. Singh,
Adjunct Professor
University of Massachusetts at Boston,
USA. Email: karan.singh@umb.edu

Application of remote sensing and Geographic Information Systems for the monitoring and protection of a Special Protected Area in Greece.

By Ioannis Meliadis, Alexandros Tsiontsis

During an E.E. project in Greece for Special Protected Areas, the techniques of remote sensing and Geographical Information Systems (G.I.S.) have been used for monitoring and protection purposes. The primary objective for the Special Protected Area (SPA) was to reduce pressure on natural habitats while supporting sustainable development. The success of such activities depends to a large extent upon knowledge of both the ecological and socioeconomic environments.

The main objectives were to:

- Develop image processing techniques to identify land cover changes using multi-temporal satellite imagery
- Develop a G.I.S. data bank which will be the baseline for the monitoring project
- Incorporate remote sensing and G.I.S. data for management and protection of the study area
- Identify the environmental parameters that are critical for the area.

The study area was the Mountain Antichasia - Meteora found in the central part of Greece. The size is almost 826.127 ha and it belongs to the Mediterranean zone. The SPA includes a mosaic of different vegetation types of a Sub-Mediterranean character. Most of the area is covered by *Quercetalia pubescentis* and only a small part of the higher altitudes is covered by vegetation of the beech zone. The area has a poor economic development; the main sources of livelihoods are agriculture, animal husbandry and forestry. This zone has been characterised as an Important Bird Area (IBA) according to the EC Instruction 79/409/EC and it is considered very important for the coherence of the Special Protection Network.

For the study area the following data sources were used:

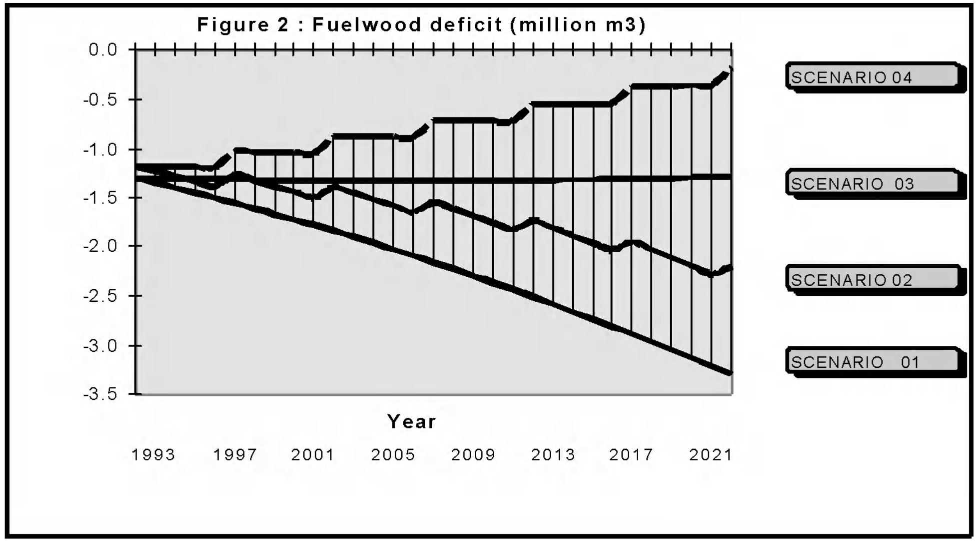
- Two LANDSAT TM images dated 28/7/1989 and 1999
- Aerial photographs at a scale of 1:20.000
- Management plan maps at a scale of 1:20.000
- Topographic map at a scale of 1:5.000.
- Land Resource Map at a scale of 1:50.000.

For the analysis two multi-temporal images were used. The methodology adapted for this study involved the classification of the LANDSAT data for both dates into land cover classes. A supervised classification using all available bands was performed on a portion of a 30-m resolution TM image. With the

Table 1: Assumptions made in the model regarding future state of the district

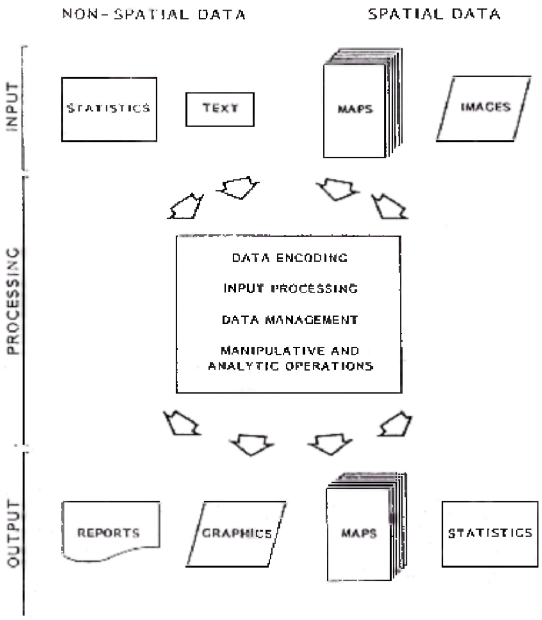
Scenario	Supply -side Assumptions	Demand - side Assumptions
01	No change	No change
02	-Improvement of wood production on agricultural land; and -Establishment of 100 000 ha of fuelwood plantations	No change
03	No change	-Reduction of population growth rate; and -Reduction of 2% per year of biomass demand per capita
04	-Improvement of wood production on agricultural land; and - Establishment of 100 000 ha of fuelwood plantations	-Reduction of population growth rate; and -Reduction of 2% per year of biomass demand per capita

Figure 2



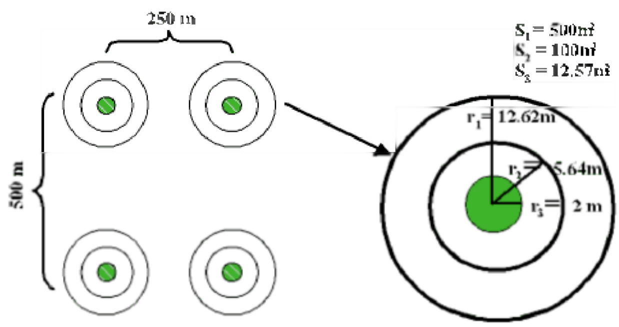
Emerging Technologies for Forest Resources Appraisals and Land Use Planning

Figure 1 Overview of a GIS system



Tropical Forest Inventory in the Costa De Jalisco Region Mexico: Methodology and Preliminary Results

Figure 1. Systematic sample showing sample and sub-sample with different radii and evaluated areas



most recent TM data available, a map of land cover classes was produced. This map contains: Forests, Partially Forested Areas, Agricultural Lands, Rangelands, Shrublands and Urban Areas. These six classes are sufficient to accurately capture biomass of the area and estimate the habitats for the wild fauna.

In order to obtain land use change data, the digital image of 1989 was used. The photo interpretation of the aerial photos of 1987 was used for the delineation of the land cover classes which were used as reference in the classification of the '89 LANDSAT image. The same digital processing procedure was used for the older image. The change detection analysis was conducted by subtracting the two classified images and developing a cross – tabulation operation.

Comparison between the images indicated that the areas occupied by forests, partially forested land and shrublands decreased during the ten year period, while the remaining classes showed an increase. A new map was produced, indicating the areas where land cover had changed.

The new map was overlaid with G.I.S. layers. Showing the contour lines, point elevations, road and river networks, habitat, land use, soil, geology, land ownership, watersheds, game refuges, culture, and protected areas. New information was derived by the processing of the above layers, such as the aspects, slopes and the Digital Elevation Model.

The data bank of the G.I.S. was used for spatial research on the parameters that most influence the area. For example, land ownership layers and access were determined to evaluate the necessity of conducting wild fauna surveys on non-public lands which would require access permits and authorization from individual land owners. Buffer zones around the protected areas served as restriction zones for any annoyance of the wild fauna. The "habitat polygons" were also used as an input for the imagery-based analysis of potential habitat. Individual positions of birds and expert delineation of historic habitat polygons served as the primary sampling unit for the purposes of habitat prediction. In this analysis, the temporal dynamics of wild fauna areas were evaluated as a function of the temporal change in vegetation spectral signatures obtained from satellite imagery. Changes in vegetation communities are related to features of the landscape such as vegetation phenology and condition.

The main conclusions can be summarised as follows:

a) Effective Monitoring requires techniques that have an acceptable cost and provide information at the required level of accuracy.
b) Digital remote sensing data are very flexible and show potential for monitoring programs
c) The combined use of multi-date satellite imagery and the digital ancillary data sets of G.I.S. has proved a useful technique for producing the baseline for monitoring projects.
d) Multiple G.I.S. layers can easily be used for a more detailed spatial analysis of the ecosystems and isolation of environmental parameters that influence the monitoring project.

Proper use and monitoring of our land and environmental resources for quality of life and sustainable growth requires that timely, accurate data on land cover and land use be available continually. The complex questions being addressed internationally require that researchers take advantage of new technologies including remote sensing, Geographic Information Systems (G.I.S.) and Environmental Information Management Systems that may lead to simulation models for land management decision-making processes.

Dr. Ioannis Meliadis
NAGREF – Forest Research Institute
Lab of Remote Sensing & G.I.S.
Vassilika, Thessaloniki
570 06 Greece
Meliadis@fri.gr

Dr. Alexandros Tsiontsis
NAGREF – Forest Research Institute
Lab of Forest Soils
Vassilika, Thessaloniki
570 06 Greece
tsiontsi@fri.gr

Weather Independent Tropical Forest Monitoring in Indonesia

By Vincent Schut and Arjen Vrielink

This article demonstrates some of the current possibilities of Remote Sensing (RS) techniques for weather independent monitoring of tropical forests on different scales, both temporal and spatial.

Traditional forest monitoring and inventory techniques in the field suffer from three major problems: relatively small areas; no replicability/timeliness; relatively high costs. In other words: it is really expensive to have a fieldwork campaign for a large area every two months. Research has shown that satellite and airborne RS techniques can overcome these problems. However, one major constraint of optical techniques is that their observations are hindered by cloud cover and haze and are limited to observations by daylight.

Contrary to optical systems, radar is characterised by the possibility of unhindered observation during cloud cover, smoke (forest fires) or during the night. Therefore radar is the ideal instrument for forest monitoring, especially in the humid tropics.

An important parameter of radar systems is the frequency band. The most common bands are: C-band (5.3 GHz), L-band (1.2 GHz) and P-band (440 MHz). C-band has a relatively high frequency for earth observation and is characterised by low penetration in vegetation layers. At lower frequencies the penetration is much stronger and consequently also characteristics of the terrain underneath closed vegetation can be made visible, eg (forest-) inundation, logs or biomass.

There are many kinds of radar systems. By addition of extra antennas modern radar systems can do a lot more than just imaging the earth. The so called interferometric radar can make three dimensional observations. Polarimetric radar uses different polarisations through which it can observe additional structural characteristics of the terrain and vegetation.

SarVision is currently implementing several monitoring systems in Indonesia. In this article, we focus is on two of these systems. First a nationwide optical monitoring system is discussed: SPOT vegetation mapping. Second a regional radar monitoring system is discussed: monitoring the Mawas Reserve.

SarVision has developed a new system for large scale weather independent forest monitoring. Using SPOT Vegetation data, this system gives a fast overview of the remaining forest resources of a large area, in a resolution of 1 x 1 km. An algorithm has been developed to aggregate the raw data into a cloudless, contrast-enhanced and classifiable product. The resulting forest and forest change maps can be used for ecological monitoring, (forestry) law enforcement, forest fire damage investigation, etc. They are ideal for a multisensor approach, pointing towards deforestation hotspots that can then be investigated in more detail using spaceborne or airborne radar, or other (future) sensors.

The system is applicable worldwide and is perfect for extensive and long term forest monitoring. Due to the processing algorithm cloud and haze influences are effectively eliminated. Patches of recent deforestation can easily be found and then investigated by other sensors, e.g. MODIS (250 m. resolution), spaceborne radar or even airborne radar for a very high resolution investigation. Our straightforward and automated processing algorithms and the guarantee of future availability of SPOT Vegetation data ensure a previously unknown stability and accuracy in large scale forest monitoring.

Large forest areas in Indonesia are under severe threat because of illegal logging, poaching and increased susceptibility to fire due to recent forest degradation. One of the areas of major interest is a 273,000 ha area in Central Kalimantan, east of Palangkaraya: the Mawas reserve. This area still comprises substantial areas of pristine lowland forest and the largest remaining orang-utan population (3,000 individuals). Under co-ordination of the government, local authorities and the Balikpapan Orang-utan Survival Foundation (BOS) a three-component program is executed. These components are: (1) fast detection of illegal logging, encroachment or any other threatening conditions by remote sensing satellites, (2) a flying team to collect evidence and prosecute offenders, and (3) moving local population to buffer zones and providing them income and training.

SarVision is setting up a monitoring system based on spaceborne radar observation to deal with the first of the above mentioned components. Of course, because of cloud cover, radar remote sensing plays a major role. The objective is to set up an operational service to be able to inform local teams as fast as possible. It is planned to do this at least every two months, with a delay of less than one month.

Currently 25 m resolution ERS-2 (European Radar Satellite, C-band) data are used, along with historical data (mainly ERS-1/2 and JERS-1 (Japanese Earth Resources Satellite, L-band)). In the future the use of ENVISAT-ASAR (recently launched) and ALOS-PALSAR (L-band system) is foreseen. L-band seems superior to C-band for forest monitoring. Visibility of drainage and hydrology in these swamp forests are much better than in C-band (or in optical sensors such as Landsat TM). It is therefore very likely that L-band will contribute to refined ecological forest type mapping of this area. Within two years the service should be completely operational. This monitoring concept can then also be applied to other similar (forest) areas in the world.

Until now large scale weather independent RS monitoring is primarily discussed in relation to research projects. However, the examples above show that SarVision is already operating RS monitoring systems in Indonesia. There are Plans to extend the current monitoring areas to more forest areas in Indonesia and also to other countries with tropical forests.

SarVision is currently working hard to develop more advanced monitoring techniques. The aim is to combine observations from different sensors in one monitoring system. Also high resolution (3D) airborne radar mapping systems are being developed for detailed monitoring such as individual tree mapping.

For further information please contact:
Vincent Schut
email: schut@gissrv.iend.wau.nl
Arjen Vrielink
SarVision BV
Oudlaan 37
6708 RC Wageningen The Netherlands

Tel: +31 317 421526
Fax: +31 317 428880
E: info@sarvision.com
W: www.sarvision.com

Optimization Applied to Management of Natural Forests

By Gilson Fernandes da Silva; Rinaldo Luiz Caraciolo Ferreira; William Arthur Hoffmann; Nilton César Fiedler, Gerard Janin

Abstract: The objective of this ongoing research is to evaluate the use of multi-objective optimization models for the management of natural forests and to develop algorithms capable of solving the proposed models, with particular emphasis on evolutionary algorithms. Economic, environmental and social objectives are considered in the management model to be optimized. The multi-objective model will be capable of incorporating the above objectives and will evaluate diverse strategies for management. We also expect to implement an algorithm capable of solving the model optimization, utilizing evolutionary algorithm theory.

Introduction

The increasing demand for wood and non-wood forest products associated with increasingly globalized market pressures require that forestry companies become increasingly competitive by producing high-quality products at low cost. Modern forest management requires integration among the forest, industry, and the market to maximize financial return while guaranteeing a sustainable growing stock. Additionally, legal, environmental and social issues must enter into a management plan designed to guarantee continuous production.

One of the potential tools for forest managers to deal with this type of problems is multi-objective optimization, an active area of research in science and engineering. The interest in this area arises because many real-world problems are complicated by the need to consider multiple objectives, but also because there are still unresolved questions in the area.

Ecosystem management is an arduous task due to the great complexity of the system and the large number of variables that must be taken into consideration during planning. Climatic and biological processes and the large number of other variables that affect forest growth, compounded with long production cycles and uncertainty in markets and societal demands make it unclear what alternative is best. Brazilian forests are considered fragile ecosystems with regard to regeneration, growth, production, and biodiversity maintenance, therefore requiring management regimes appropriate for these characteristics and permitting sustainable production.

Proposals to rationally use forest resources must be critically examined to consciously deal with the above problems. It is necessary to determine which parameters best characterize forest composition, structure and dynamics, and subsequently seek to develop management plans incorporating multiple goals, with economic, environmental and social objectives. This requires not only a management model for the forest, but also methods and tools that make it possible to solve and implement the model.

Due to the need to increase production in a rational manner, using all the goods and services that the system can sustainably provide, this research is based on current understanding as well as on maintenance and protection of the plant diversity in these forests. The results of the research described here, integrated with current knowledge, will be directed to generate technology that will make viable sustainable use of natural forest resources.

Objectives
The objective of this research is to generate new approaches to use and manage natural forests. The specific objectives are:

- Determine which variables or indices are of primary importance for management of these forests, considering the objectives to be reached, the philosophy of mathematical modelling, and the available information on natural forests.
- Propose a management model for natural forests, taking into consideration multiple economic, environmental, and social objectives.
- Develop an algorithm to solve the above model based on the theory of evolutionary algorithms.

Material and Methods
The project with be carried out in two sites protected by law:
1) Fazenda Água Limpa (4000 ha), a research farm owned by the University of Brasília, and
2) the IBGE Ecological Reserve (1300 ha).
The vegetation of both sites is well preserved. Repeated censuses in cerrado (savanna) and gallery forests have been carried out by researchers in the Forestry Department of the University of Brasília who have offered their data to parameterize the management model.

Expected Results
- Identify specific variables that characterize natural forests which will serve to develop management plans for natural forests.
- Generate a management model for natural forests that permits optimization of resource use by evaluating multiple objectives of forest planning.
- Elaborate an evolutionary algorithm for multiple objectives which will be implemented by computer to solve the model proposed above.

For further information please contact:
Gilson Fernandes da Silva; Rinaldo William Arthur Hoffmann; Nilton César Fiedler, Gerard Janin,
Professor do Departmento de Engenharia Florestal da UnB, Brasilia DF, Brazil
Email: gsilva2000@yahoo.com

Rinaldo Luiz Caraciolo
Ferreira Professor do Departmento de Ciencia Florestal da UFRPE,
Recife, PE, Brazil
Email: rmsantos@elogica.com.br

Tropical Forest Inventory in the Costa De Jalisco Region Mexico: Methodology and Preliminary Results

by Efrén Hernández, Agustín Gallegos & Dieter R. Pelz

Introduction
Tropical forests are an important resource in the coastal area of Jalisco/Mexico. They show a high species diversity. Important species such as "Cedro Rojo" (Red Cedar) *Cedrela odorata* and the "Caoba" or "Mahogany" *Swietenia macrophylla* can be found in these forests. Also non-timber products like "Palma real" and "Palma chamedora" are used for ornamental purposes. In Jalisco State, changes in land use for agriculture and cattle raising have been the cause of fragmentation of this forest on approximately 171,333.00 ha, according to the 1994 Forest National Inventory. The inventory also confirms that the forest located in the tropical zones has suffered the greatest impact during the last decades.

In the Costa de Jalisco region there are forests with good management. However many areas are still without a forest management plan. There is little information available on forest resources and no monitoring of forest dynamics has been done. On the other hand, Ortega & Curiel (2000) found technology deficits in the productivity growth of new timber species

and a lack of specialised technicians in this type of forest. Therefore, a study has been undertaken to develop a forest management basis for the "La Quebrada" watershed as well as to gain better understanding of this vegetation type.The main objective of the project was the development of a forest inventory methodology for the management of the Jalisco tropical forest using Geographic Information System (GIS) and remote sensing.

Methodology
The study area, "Cuenca La Quebrada", is located approximately 70 km south of Puerto Vallarta on the Pacific Ocean Coast. The size of the area is 44,6 km². The altitude within the study area ranges from 128 m.a.s.l. (meters above sea level), the location of the "Cajon de Peña" hydroelectric project, to 760 m.a.s.l. (Krüger, 2000). The dominant vegetation types are the mixed deciduous forest and pure deciduous forest.

Basically, the sample design was a systematic grid of 500 m x 250 m. Plot locations were permanent. A metal rod was located in the sample plot center and the plot shape was concentric with 500 m² for mature forest, sub-samples of 100 m² for intermediate forest and sub-samples of 12.57 m² for regeneration (Fig. 1). A total of 357 samples were taken, resulting in a sampling intensity of approximately 0.4 %. The central point was localised using a global positioning system (GPS), Garmin Personal Navigator 45 model. This instrument was programmed with spatial data of the grid that was previously designed. The exact location was determined by the metal rod in the plot center. The trees within samples and sub-samples were localised with an azimuth (compass). The distance was determined by laser measurements.

Results and Discussion
Approximately 5,000 trees of 131 different species were included in the larger plot. It is important to remark that 17 different tree species where found in one sample. In another sample, 48 different tree species where found. 1100 individual trees of intermediate forest and 650 individual trees in regeneration were included. Using the Index of importance value (IIV) suggested by Lamprecht (1990), it was determined that the species with the greatest value are *Brosimum alicastrum, Hura polyandra*, and *Tabebuiae rosea* with 37.5, 33.8 y 16.3 % respectively (Gallegos R. *et al.*). In relation to the calculated basal area, the analysis shows that only in 5 samples the basal area was greater than 60 m²/ha., the average number of trees for the mature and intermediate forest per sample was 18 and the average time required for recording the information was 22 minutes.

Conclusions
The tree species of greatest ecological importance in the area are concentrated in two species; *Brosimum alicastrum* and *Hura polyandra*. It is important to remark that the *Sabal mexicana* and *Acrocomia aculeata* palms represent 8.1 % of the IIV total. This indicates the presence of disturbance in the area. There is a low abundance and dominance of commercial species, due to selective harvesting executed in an inappropriate way, extensive cattle grazing, and forest fires.
It should be noted, that the field work for the location of the samples was much easier because of the GPS. Similarly, the use of a laser instrument to measure the distances facilitated the daily work. More data can be collected in less time compared to traditional procedures.

Future Activities
Considering that there are no volume tables available for the most important species of the region`s medium forest, a special effort will be undertaken to develop such tables. The ecological aspects of the area will also be evaluated. On a more technical level,

further studies on the use of high resolution satellite images (IKONOS) for inventory of the tropical forests in Jalisco will be evaluated.

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For further information, please contact:
Dieter R. Pelz
Email: dieter.pelz@forst.uni-freiburg.de and
Efren Hernandez
Email: efren.hernandez@forst.uni-freiburg.de
University of Freiburg,
Department of Forest Biometry,
Werderring 6 D-79085 Freiburg,
Germany. Tel: +49 761 203 3750

Inventory techniques in French Guiana to elaborate and apply multi-functional forest management plans

by Olivier Brunaux, Julien Demenois, Florent Ingrassia

Global context of sustainable forest management in French Guiana

By ratifying the Rio agreement in 1992, France made a firm commitment to ensure sustainable and exemplary management of its forests. To honor this commitment in French Guiana, and to break rapidly with the existing «mining» permit-style system, an essential step toward sustainable management was made between 1993 and 1998. ONF (*Office National des Forêts*, State Forest Service) instigated a simplified form of forest management. The first steps in this process established a permanent forest area for timber production restricted to a coastal strip 70 km wide; and implemented a harvesting system, organized in space and time, aimed at sustainable use.

Since 1998, ONF, which is in charge of the state-owned forests, has drawn up a new development strategy for this forest area, with the aim of implementing sustainable and multi-functional management as the expression of a true concern to maintain biodiversity. This method is based on a rapid characterisation of the forest composition. This approach provides information concerning timber resources and their geographical location, and takes especially into consideration the biological diversity within the forests concerned.

As the moist tropical forests of French Guiana are still not well understood (aspects of ecosystem functioning and of the distribution, abundance and status of the animal and plant species present), not easily accessible and very extensive, the approach relies on habitat study rather than on the species themselves. However, since a precise map showing all habitats in the forests to be managed is unrealistic, an indirect approach was adopted, based on a geomorphological analysis of these areas.

Several steps to elaborate a multi-functional forest management plan

The aim of forest management is first to define long-term objectives and localise them inside the coastal strip. This area is divided into 54 forests (10 000 to 100 000 ha). Each managed forest is also divided into several areas defined by their dominant objective, called «series», combining the individual Management Units 1 (MU, *parcelle* in French) with the same dominant objective. Five types of series have been defined:

- timber production and global protection of habitats and landscapes series;
- uses series;
- visiting public series;
- general ecological interest series;
- particular ecological interest series.

The forest management plan is elaborated as follows:

1. Preliminary analysis

Step 11. *Definition of the study area*

Step 12. *Definition of the forest borders*

Step 13. *Definition of the geomorphological units 2*

Step 14. *Elaboration of the theoretical road network*

Step 15. *Definition of the areas not to be exploited*

Step 16. *Definition of Access Network Units (ANU) 3*

Step 17. *Definition of Management Units*

Step 18. *Classification of MUs into series; map of series*

2. Management Field Inventory (MFI, *DIAM* in French) for each ANU of the production series

Step 21. *Establishment of inventory trails*

Step 22. *Dendrologic and ecological survey*

Step 23. *Data analysis: resource assessment, proposal of a road network, proposal of MUs to be inventoried and diagnosed*

Step 24. *Possible fitting of the classified MUs into series for this ANU. The MFI is a light inventory which first aim is to confirm, or not, step 18. Secondly, it gives a reliable assessment of the most abundant marketable species and is also a reliable tool to judge the exploitability of a MU.*

The MFI is based on transects of 40 m wide. Inside this strip, for each tree with a DBH > 55 cm (for most species), the species and the diameter class are visually determined and noted. Besides, all marketable trees (35 cm < DBH < 55 cm) are noted. They form the future tree population. Environmental particularities are also noted.

The inventory or diagnosis trails cross the technically exploitable areas defined at step 15. In order to verify the feasibility of the theoretical road network, they cross the passes and the other necessary roads.

Data analysis consists of the calculation of the resource index (number of trees/ha, volume/ha for each species or group of species) at three different scales: 100 linear meters, one MU and one ANU. Thus, poor and non-exploitable areas, slightly rich areas where logging is possible under some conditions, and rich and exploitable areas are defined inside the production series. Based on these analyses, a forest management plan is drawn up for a five-year period. This document will define an operational plan: roads to be created, MUs to be diagnosed and then MUs to be exploited.

Implementation of a multi-functional forest management plan

ONF both elaborates and implements the forest management plans. Each year, as the first step in the implementation of a forest management plan, it invests in the road network and creates 40 km of roads.
Then, each MU of the production series is inventoried and diagnosed. To this end a Thorough Management Unit Inventory (TMUI, DIPA in French) is carried out. Each MU is divided into Prospecting Units (PU, Unité de Prospection in French) of 20 to 100 ha. Each PU is topographically homogeneous. Next, for each PU a TMUI is carried out in order to determine its accessibility, its exploitability and the resources of the marketable species.

The TMUI explores the whole area of the PU, not only transects. Nevertheless, some parts of the PU can be not diagnosed because they are small or poorly accessible. The visually collected data are the same as those collected for the MFI. The timber quality is also noted and the future trees are physically marked. Thus, several results are obtained through the TMUI. It gives ONF and the logging companies a reliable assessment of the floristic composition and also of the volume of the exploitable trees.
When the road network has been created and the TMUI completed for a MU, the latter is sold to a logging company. Hence, this company is in charge of the exploitation of the MU. ONF controls the work throughout the exploitation. Each year, ONF sells about 12 000 ha of primary forest – 40 MU as an average – which can produce 60 to 80 000 m^3 (round wood).

Discussion
ONF wishes to use the TMUI results as an attachment to the contract when selling a MU to a logging company. This measure appears necessary in order to better control the exploitation – volume of timber extracted compared to the resources, respect for the future trees marked – and to improve the yields (5,5 m^3/ha in average).

Service Amenagement Forestier, ONF Guyane,
Oivier Brunaux, oliver.brunaux@onf.fr
Florent Ingrassia florent.ingrassia@onf.fr
Direction Regionale, ONF Guyane
Julien Demenois
B.P. 7002 97307, Cayenne Cedex,
French Guiana. E Mail: DR.guyane@onf.fr

1 A Management Unit is defined by the most important natural, and where necessary artificial, field borders. The area of one MU in the timber production and global protection of habitats and landscapes series is about 300 ha.

2 A geomorphological unit is defined as an area homogeneous according to its relief and its geology and characterized by the area and the distribution of relief shape units, by the shape and the direction of ridge lines and the hydrographic network, the dimension and the direction of the interfluves, the average and maximal altitudes of reliefs and the kind of slopes.

3 An Access Network Unit (*Unité de Desserte* in French) is an autonomous forest area considering its accessability. It is defined by the rivers or the reliefs which can not be jumped over by loggers.

A New National Inventory for Australia's Forests

By Phillip Norman, Jerome Vanclay

In a first for Australia, the National Forest Inventory has embarked on an ambitious plan to establish a new comprehensive inventory program of the nation continent's forests and woodlands. The new program, known as the Continental Forest Sampling Framework, will provide for the very first time, consistent independent and reliable statistics to describe the full extent and trends of Australia's forests and woodlands. The program is being designed specifically to meet Australia's obligations under National and International reporting protocols (such as the Montreal Process) by establishing an accurate means of measuring trends in important forest characteristics such as age, size, and species composition, as well as changes in forest management and tenure.

Australia has in excess of 150 million hectares of vegetation that meets the accepted national definition of forest (National Forest Inventory 1998). Forests are broadly distributed in a band of variable widths around the coastline of the continent, across latitudes ranging from cool temperate to tropical, soils ranging from deep fertile, recent volcanics to heavily leached tropical laterites, and rainfall ranging from several metres to less than 500 mm per year.
It is not surprising, given the variability of these environments, that Australia's natural forests are extremely variable in their nature. Whilst two largely endemic tree genera, *Eucalyptus* and *Corymbia*, overwhelmingly predominate, the more than seven hundred species contained in these genera take the form of anything from tall single-stemmed forest trees to low sprawling multi-stemmed shrubs. Adding to this diversity are a variety of other more restricted forest types including rainforest (of various forms from the most northerly tropics to the most southerly cool temperate), *Acacia* forest, and conifer-dominated forests (predominantly of endemic species of *Callitris* and *Araucaria*). Substantial areas of plantations of exotic (predominantly *Pinus*) and native (predominantly *Eucalyptus* species) have also been established throughout the country.

Australia is a Federation of 8 States/Territories. Under the National Constitution established in 1901 responsibility for management of natural resources, including forests, rests principally with the State/Territory Governments, whilst responsibility for external affairs, including international reporting on forests rests with the Federal Government. Individual State/Territories have maintained forest inventory programs of varying standard since the early 1900's principally to quantify and plan the utilisation of timber. Recent National and International forest policy initiatives (of particular note the National Forest Policy Statement of 1992 and the Montreal Process of the mid to late 1990's) have highlighted the need for national level forest statistics. The National Forest Inventory (a partnership of Federal and State/Territory Governments) was established in the early 1990's to provide a vehicle for Australia-wide forest inventory and reporting.

The limited resources available to the NFI, the demand for immediate information, and the nature of the system of Government, meant that it had to rely initially on a compilation approach, bringing together existing data from a variety of sources and collected to a variety of standards. This approach was largely successful in meeting the urgent requirement for a snapshot of Australia's forests. However, its limitations have been evident in attempts to report comprehensively against their condition or trends (eg the Montreal C&I First Approximation Report (Commonwealth of Australia 1997) and Australia's State of the

Forests Report (National Forest Inventory 1998)). In each instance the reports acknowledged that major gaps existed in Australia's capacity to report nationally (in particular for areas of forest other than those most intensively managed for timber production) and as a consequence many of the indicators could only be reported in a narrative fashion making quantification of trends through time impossible. Even for those indicators for which quantitative reporting was possible, trends are at best indicative only due to the extent of spatial and temporal inconsistencies in measurement methods and the sampling base.

These limitations have lead the NFI to the conclusion that the only way to substantially improve Australia's capacity to meet its monitoring and reporting obligations is to implement a standardised inventory across the whole country using proven direct measures of relevant attributes. A quick review of international activity in this area has revealed a number of parallel attempts by other countries toward similar ends and in response to similar drivers. Of particular relevance are the efforts of Canada, which shares many similarities to Australia in the extent of its forests and their use and in its system of Government, to implement a new sampling-based inventory.

The NFI has developed a set of Terms of Reference for the proposed inventory (see below) and has commissioned a project team to develop detailed technical specifications for a pilot regional implementation from late 2002.

Terms of Reference for Proposed Continental Forest Sampling Framework for Australia
The sampling framework will:
- be designed to meet national reporting and monitoring requirements
- measure a specified list of metrics (including - forest extent and structure (height, crown canopy cover), forest type (genus, species), growth stage, tenure (including private individual, industrial, institutional), reserve status (including reserves on private land), intended landuse (areas zoned or intended to be managed for various objectives), disturbance, and forest health)
- be simple flexible and repeatable
- be based on permanent/relocatable site-based measurement
- report to accuracies commensurate with current international practice
- provide estimates of change at 5 yearly intervals

The sampling framework will apply measurement methods that are:
- objective and measured (rather than subjective/estimated)
- yield continuous numerical values rather than categorical values
- repeatable
- a direct measure rather than a surrogate of the attribute of interest
- not technology dependant (i.e. enduring)
- link directly to the relevant Montreal indicator
- meet national and/or international standards (where they exist)

The Project Team is working, under the guidance of a Technical Review Panel including international experts, to develop a comprehensive inventory program that will meet these Terms of Reference, whilst taking advantage of the efficiencies offered by contemporary technologies (such as remote sensing) and still stand the "test of time".

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Mr Phillip Norman,
Principal Scientist – Sustainable Forestry Sciences,
Environment Protection Agency Queensland
Australia

Prof Jerome Vanclay,
Department of Forestry,
Southern Cross University,
Lismore, NSW,
Australia. Email:Jvanclay@scu.edu.au

Methodology for Assessment of Growing Stock of Forests in India

By J. K. Rawat and Alok Saxena
(Forest Survey of India, Dehradun, India)

Introduction
India is a vast country with a geographical area of 3.3 million sq km. The variety of its climate and agro-ecological zones has made India one of the 12 mega-biodiversity regions in the world. Its forest resources, covering about 19.4 percent of the country's geographical area (FSI, 2000), have been classified into 16 major and 221 minor forest types (Champion & Seth, 1968). It is not easy to estimate at any one point in time the growing stock of a resource of such vastness and variability by traditional field inventory methods. Recently, remote sensing technology, through aerial photography and satellites, was found capable of providing the total picture of actual forest cover in the country in a short span of time. By merging this information with the field inventory data from well-scattered sample plots a method was developed for assessment of forest growing stock in the country. This was done by the Forest Survey of India (FSI), a premier organisation of the Government of India in the field of assessment of forest resources.

Though FSI has been assessing the forest cover of the country using satellite data on a two-year cycle since the beginning of the eighties, it developed a methodology for estimating the growing stock of the forests of the country in 1995. The methodology involved interpretation of satellite data and aerial photographs and processing of forest inventory data collected from about 170,000 sampling units distributed all over the country. Presently, this methodology is being used by the FSI in assessment of changes in forest cover and growing stock of forests in India between the period 1984 and 1994.

Methodology
Growing stock for the entire country (strata-wise according to major forest types) was assessed using information available from the vegetation maps, thematic maps and the ground forest inventory conducted by the FSI. For this purpose all the then 31 States and Union Territories (UT) were divided into grids of 2.5'x 2.5' (latitude x longitude). From approximately 170,000 such grids, data were collected on parameters related to growing stock. This exercise yielded information on the extent of forest cover, composition (21 species strata), density (3 classes) and inventory data on growing stock. The following information for each grid was collected:

Density: The land use category occupying more than 50% of the grid area was taken into account e.g. if more than 50% of the area is forested, the grid was marked as forested otherwise 'non-forested'. Then in each forested grid only one major density class was taken as the density class for the entire grid. This information was collected from the latest vegetation maps prepared by FSI on 1:250,000 scale based on satellite image interpretation for the period 1989-91 (FSI, 1996a). For each grid any one of the following three density classes were obtained from the vegetation maps:

Density Class	Crown density
1. Very dense forest	70% and above
2. Dense forest	40 to 70%
3. Open forest	10 to 40%

Areas, with less than 10% forest density, were treated as scrub. Grids falling under non-forest and scrub were not used further. Any grid, which spread over more than one state, was included in the state in which its maximum area fell.

Forest composition: The major forest type/strata in each grid was marked using information from the following resources.

- Thematic maps prepared by the FSI on a 1:50,000 scale using aerial photographs were used to marking the major species composition of each grid.
- For the areas for which thematic maps were not available in FSI, the information on species composition was collected from the stock maps of the State Forest Department, irrespective of the year and scale of preparation of the stock maps.
- For the areas for which neither thematic maps nor stock maps of state forest departments were available, the information was collected from the inventory field forms.
- In areas for which none of the above sources of information was available on species composition, the information, of adjoining area was taken into consideration.

In all, twenty-one forest strata for major species compositions were identified (FSI, 1995a). These include fir, spruce, blue-pine, deodar, chir pine, mixed conifers, hardwood mixed with conifers, upland hardwoods, teak, sal, bamboo, *Dipterocarpus*, khasi pine, khair, salai, alpine pasture, western ghats evergreen, western ghats semi-evergreen, western ghats deciduous and miscellaneous.

Forest inventory data: The data of forest inventory surveys conducted by the FSI in various states were used for determination of growing stock (FSI, 1996b). Forest inventory design was based on the methodology developed by the Forest Survey of India (FSI, 1982).

In the present methodology, for estimation of the growing stock of any state, the number of grids for each combination of density and each forest stratum was calculated. The volume per ha for a particular combination of density and forest stratum was generated by processing data from forest inventory surveys carried out in various states/UTs by the FSI. Three wood volume factors were calculated for each stratum and density class for each mapsheet for each state. Wherever the inventory data were not available for a grid, wood volume factors were borrowed from nearby areas considering the agro–ecological zones (i.e., areas falling under the same agro-ecological zone were taken into consideration). Trees with less than 10 cm diameter and branches less than 5 cm in diameter were not taken into account. The growing stock was first estimated for each mapsheet and then summing up all the data in the mapsheets for each state, the total growing stock of each state was calculated.

Results

In 1995, the total forest cover of the country was estimated to be 63,900 sq km and this constituted 19.46 percent of country's geographic area (FSI, 1996a). Using this method the growing stock of the country was estimated to be 4,740.9 million m^3 and overall volume per hectare of forest cover to be 74.4 m^3. The State/Union Territories wise estimates of the growing stock and volume per hectare are given in Table I. These estimates are for forests with more than 10% crown density.

Applications

This methodology was again used in 1998-99 to estimate the country's growing stock in the forests for supplying information to the Food and Agriculture Organization (FAO) of the United Nations for the Global Forest Resources Assessment-2000 (FAO, 2001). The same methodology is being used by the FSI to prepare 'Land use change in the

forestry sector' for India's National Communication (NATCOM) to the United Nations Forum on Climate Change (UNFCC). This is an important component in the overall information being compiled on green house gases inventory on behalf of Ministry of Environment & Forests, Government of India. Under this project, changes in the forest cover and growing stock of India's forests between the period 1984 and 1994 are assessed.

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Abstract

India's forests are spread over about 640,000 sq km constituting 19.4 percent of its geographical area. A large variety of ecosystems, forest types and tree species occur in the country. Forest Survey of India, an organisation of the Government of India, has been engaged in field inventory, creation of thematic maps and assessment of forest cover in the country using aerial photographs and satellite data for the last three decades. It developed a methodology, using information generated from all the above sources, for assessment of growing stock in the country's forests. Based on this methodology, the growing stock in the forests of India in 1995 was 4740.9 million m^3 with volume per ha as 74.1 m^3. The paper briefly describes this methodology.

Assessment of Tree Resources Outside the Forest

by Christoph Kleinn and David Morales

The resource TOF and its status

One of the current lines of development of the assessment of tree populations, forests, and renewable natural resources tends towards the inclusion of the tree resource found outside the forests. Trees outside forests (TOF) constitute a resource that has received increasing attention during the past few years. While most forestry and non-forestry experts are in complete agreement when it comes to the acknowledgement of the economic and ecological role and relevance of TOF, which is obviously locally very different but in general high, there is likewise agreement on the fact that little or no hard data are available on this resource. This fact was also confirmed by an international Expert Consultation convened by FAO in November 2001.

Traditionally forest inventories exclude TOF and also agricultural surveys do not take them into account. In order to integrate TOF into a "forest" inventory, the exercise must be extended to all potential tree lands outside the forest so that the inventory becomes a "landscape inventory", or a "tree inventory". The Forest Resources Assessment (FRA) Programme of FAO included TOF as one of the Special Studies into the 2000 Assessment and a series of projects have been ongoing aiming at a more concrete

Growing Stock in the Forests of India

Table 1

State/ UTs	Geographic area (sq.km.)	Forest cover (sq.km.)	Forest cover (%)	Growing Stock (million m^3)	Volume/ha forest cover (in m^3)
Andhra Pradesh	275,068	47,112	17.1	291.4	61.7
Arunachal Pradesh	83,743	68,621	81.9	775.1	112.8
Assam	78,438	24,061	30.7	304.4	124.2
Bihar	173,877	26,561	15.3	96.7	36.4
Delhi	1,483	26	1.7	-	-
Goa, Daman & Diu	3,814	1,250	32.8	12.6	101.2
Gujarat	196,024	12,320	6.3	63.9	53.1
Haryana	44,212	603	1.4	1.4	27.9
Himachal Pradesh	55,673	12,501	22.4	254.4	203.5
Jammu & Kashmir	222,235	20,433	9.2	458.9	224.5
Karnataka	191,791	32,382	16.9	272.4	84.2
Kerala	38,863	10,336	26.6	98.9	95.7
Madhya Pradesh	443,446	135,164	30.5	698.2	51.6
Maharashtra	307,690	43,843	14.2	225.6	51.4
Manipur	22,327	17,558	78.6	95.5	54.1
Meghalaya	22,429	15,714	70.1	104.1	66.0
Mizoram	21,081	18,576	88.1	66.0	35.3
Nagaland	16,579	14,291	86.2	94.9	66.1
Orissa	155,707	47,107	30.3	246.2	52.2

State/ UTs	Geographic area (sq.km.)	Forest cover (sq.km.)	Forest cover (%)	Growing Stock (million m^3)	Volume/ha forest cover (in m^3)
Punjab	50,362	1,342	2.7	1.0	7.1
Rajasthan	342,239	13,280	3.9	12.9	9.8
Sikkim	7,096	3,127	44.1	39.3	125.9
Tamil Nadu	130,058	17,766	13.7	69.6	39.3
Tripura	10,486	5,538	52.8	15.5	27.9
Uttar Pradesh	294,411	33,986	11.5	338.6	99.7
West Bengal	88,752	8,,276	9.3	22.9	37.7
Andaman & Nicobar Islands	8,249	7,615	92.3	79.6	119.6
Chandigarh	114	7	6.1	-	
Dadra & Nagar Haveli	491	204	41.5	0.9	42.2
Lakshdweep	32	–	-	-	-
Pondicherry	493	-	-	-	-
Total	**3,287,263**	**639,600**	**19.46**	**4740.9**	**74.1**

Table 1 Cont'd

identification and formulation of the issue; and at local and regional quantification of the TOF resource. The authors have been involved in several of these activities with a geographical focus on Central and Latin America .
Some ofthe resulting experiences have been summarised below. In Kleinn (2000) the issue is discussed in more detail.

Some characteristics of TOF inventories
An inventory of TOF has much in common with forest inventories: observation and assessment of *trees* as the main objects of interest are the essential elements in both. Therefore, a TOF inventory will draw on general and specific experiences from the field of forest assessments – in particular when foresters are involved in the planning. However, there are also a series of specific characteristics of TOF inventories with respect to their technical and organizational implementation, some of which are briefly addressed below.

- Compared to a forest the resource TOF, though also consisting of trees, has a completely different structure. This is reflected, among others in a lower density, a different spatial distribution pattern, different species composition, and different growing conditions. Also, the functions of the trees are more variable (such as production of wood and non-wood products, shadow for crops, live fences, ornamental purposes), though essentially similar to many of the forest tree functions. Low density also means that the resource has a relatively low value per unit area (particularly when only timber value is considered). Inventories have to be justified also in economic terms which is then obviously even more difficult for TOF. The diverse spatial distribution leads to problems in plot design. The probability that independently selected plots do not contain one single tree is high. This obviously has implications for the plot design and for field work organization.
Low density and diverse patterns also make that the possibilities of detection and assessment by remote sensing are limited mainly to aerial photography and high resolution satellite imagery. This depends very much on the actual situation. The heterogeneity of TOF makes a classification difficult. At present, there is no generally accepted system available. Classification criteria include geometric configuration (single isolated trees, tree lines, strips of trees groups of trees, …), origin (planted, natural), function (shadow, wood, fruits, ornamental function)
- Many of the trees outside forests are found on land which is predominantly used for non-forestry purposes, frequently on agricultural fields. This poses problems for field work organization as these trees are practically exclusively on private lands; access permission has to be sought and may be denied, or impossible (during crop maturation) – on the other hand, some measurements (like total height) are facilitated.
- The TOF inventory data analysis has its peculiarities also. While for forest inventories there are usually volume functions available (of varying quality and local validity) there are practically no models available for trees outside forest nor is it clear to which extent forest volume functions would apply. It is easy to see that TOF grow under completely different conditions, and different form factors etc. may be suspected. This argument indicates that TOF volume functions are different from forest volume functions. However, particularly in Central America, many of the huge trees on pastures that regionally make up the major part of the wood volume are remnant trees that have grown most of their lives inside the forest – there, forest volume functions would probably apply.

Examples

Assessment of TOF is not standard. There are many small-area studies that assess the tree resource on a farm level, particularly in agroforestry projects and research. There are also examples of large area assessments, though they are scattered: TOF assessment actually has a long history in Great Britain where hedgerows and other non-forest tree elements of the landscape are also included in assessments. A national inventory of Small Woodlands and Trees in the Countryside has recently been completed. Also in France and in the Netherlands, non-forest trees were included in National Forest Inventories. Further large area assessments have taken place in countries such as India (FSI 1997), and Ghana (Affum-Baffoe 2001). The FRA programme of FAO in its initiative to support National Forest Inventories launched pilot forest inventories in four countries (Costa Rica, Guatemala, Cameroon and The Philippines) which include the tree resource outside forests by also interpreting non-forest aerial photo-plots and by extending the clusters of field plots to non-forest land use classes.

In a research project carried out in Central America (INCO DC Program of the European Commission Project No. ERBIC18 CT98 0323 with three Central American and three European partners) basic properties of TOF inventories were analysed combining two data sources: A field inventory and aerial photographs (or corresponding very high resolution satellite imagery). Field observations are required to observe tree-related attributes not measurable in aerial photographs, and the aerial photographs are used to optimise the overall efficiency by facilitating field work planning and improving area estimates. For a large-area assessment through a field inventory a pre-stratification is recommended (political boundaries, life zones etc.). The strata are then subdivided into primary units, where squares of an area of 1km^2 were found to be workable under the prevailing conditions. Within the primary units, secondary units for field measurements should be selected such that plots without trees are avoided. Air photos or high-resolution satellite imagery are best suited for this stratification into full and empty plots, which proved to have the potential to drastically raise efficiency of sampling. When a cluster design is to be used, analysis of covariance functions of the attributes number of trees and basal area suggested that a minimum distance of about 350m should be maintained between neighbouring plots under the conditions found in Central American TOF lands.

Conclusion
TOF inventories do exhibit some particular characteristics but forest inventory techniques can be employed. Some examples for and experiences with large-area TOF inventories exist. It is likely to be most efficient to integrate TOF inventories into forest inventories or other ongoing programmes as the relatively low direct value of the resource TOF would not justify an independent assessment. Integration into forest inventories is straightforward and is in line with a current trend to extend forest inventories towards landscape level inventories. Also, in forest inventories there is the specific expertise necessary to assess trees outside forests. With this new component (TOF) forest inventories would develop towards tree inventories taking into account the tree resource on all lands. Then, talking about areas with different tree densities, maybe some day the never-ending discussion on the definition of forest may be overcome.

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Authors:
Professor Christoph Kleinn
Institute for Forest Assessment and Forest Growth Science
University of Göttingen
Büsgenweg 5
D-37077 Göttingen
Tel:+49 551 39 3473 Fax:+49 551 39 9787
e-mail:ckleinn@gwdg.de

David Morales
Research Associate
Department of Forest Sciences
CATIE
Turrialba 7170
Costa Rica
Email: dmorales@catie.ac.cr

Mapping Human Induced Threat to a Sanctuary, South India

By Aravind, N. A.,1 Narayani Barve,1 Uma Shaanker, R. 3 ,Poulsen, J.2 and Ganeshaiah, K. N.4

1. Ashoka Trust for Research in Ecology and the Environment (ATREE), India.
2. Center for International Forestry Research. CIFOR
3. Department of Crop Physiology and
4. Department of Genetics and Plant Breeding, University of Agricultural Sciences, GKVK, Bangalore 560 065, India.

Introduction

Conservation and management of the network of protected areas is becoming the major practice for protecting biological diversity, especially in tropical countries such as India. These protected areas however, are not completely insulated from threats and are frequently subject to human associated pressures from both within and outside.

These pressures are temporally dynamic and spatially heterogeneous. These threats are particularly severe in the developing tropical countries where the daily needs of millions of humans dwelling in and around forest ecosystems are derived from the protected areas. But most of these pressures are not easily visible and quantifiable. Consequently, identifying the sensitive areas that require special attention and protection is a demanding task and as yet there are no generalized methodologies available to construct models of such threats in protected areas.

Understanding these pressures is important for formulating appropriate management strategies. Recent developments in GIS and RS techniques have offered fresh opportunities to address these issues more efficiently.

Methods

Here we describe a general protocol of developing such threat maps and demonstrate its application to the Biligiri Rangaswamy Temple wildlife sanctuary (BRT sanctuary) (77- 77°16' E and 11° 47'–12°9'N), a wildlife protected area that is uniquely complicated due to human settlements within its boundaries. It harbors about 6000 indigenous people in 57 settlements who are dependent to a great degree upon forest products, farming and plantations located inside the forest. We also evaluate the resultant threat maps of the sanctuary with field data and discuss strategies to mitigate the threats. During our work in and on the sanctuary for the past ten years, we have identified the most important threats that are likely to be affecting the forest health structure and diversity.

We considered the human settlements, human, cattle, and sheep population, roads and slopes of the areas as the factors influencing threat levels. We divided the entire sanctuary into 30 ha grids and for each grid we computed three types of threat values: a) the settlement associated pressures from human populations, cattle and sheep, b) developmental activity associated threats due to major and minor roads in the sanctuary and c) the accessibility threats due to steepness of the terrain. Combining these three components we derived a composite threat value for each grid and correlated it with a) observed parameters of disturbance b) disturbance activity levels and c) tree diversity of the grids. The details of the computation of threat values will be published elsewhere (Barve, et. al. 2002, communicated to Conservation Biology).

Results

The threat values were found to reflect the actual disturbance caused by harvesting and grazing and the disturbance activity levels of the grids. Highly threatened areas also had low tree diversity suggesting that the derived threat maps do reflect the actual levels of anthropogenic pressures. We propose that the protocol followed here for mapping threats to the sanctuaries can be applied to other areas as well, with appropriate modifications.

Based upon the identified threat components, we suggest the following mitigation measures to maintain the health of the ecosystem of the BRT sanctuary: a) Ban plantations and encourage the labour force working there to settle outside the sanctuary by means of suitable incentives. b) Facilitate the willing forest dwellers to move and settle outside the sanctuary. Alternatively encourage agro-forestry such that the dwellers derive their needs from within their agro-ecosystems. c) Provide more protection to the flat areas identified in the maps. d) Facilitate erecting 'invisible' barriers along the edges such that the impact of the villagers settled outside the sanctuary and their activities on the forest is minimized. This can only be done by creating alternate sources for their needs and by making them realize the importance of the forest for their agriculture. e) Avoid the 'tragedy of commons' syndrome by regulating access to resources.

Implications

The methodology developed demonstrates the identification of sensitive and threatened areas of a sanctuary. Based upon several physical parameters and socio-economic data layers and by using GIS tools, we show that threat maps developed for protected areas indeed represented the actual disturbance levels to different areas of the sanctuary. The methodology followed is not location specific and hence can be employed for any protected area and other forest ecosystems with appropriate modifications. The protocol is less demanding on groundwork and thus could serve as a cost effective procedure for developing management strategies in areas constrained by resources.

Contact:
Aravind, N. A
Ashoka Trust for Research in Ecology and the Environment (ATREE),
#659, 5th 'A' main, Hebbal,
Bangalore 560 024,
India.

Forest Inventory and Sustainable Forest Management on the hillsides of the Dominican Republic

PROCARYN[1] – a practical experience

by Peter Henning

Introduction

The project area of PROCARYN is situated in the watershed of the upper Yaque del Norte river on the central hillsides of the Dominican Republic. The watershed is one of the most important with respect to issues related to water (protection and production) as well as the supply of classical forestry products (wood).

The project PROCARYN aims to support smallholder farmers in their efforts to conserve and sustainably manage their natural resources, in particular forest resources. Reforestation and sustainable forest management play a central role in this context. The project applies two different forestry inventory methods to provide data for the generation of development management plans for the forestry resources of the watershed.

Satellite image based inventory

One inventory aims to obtain general information about the forest resources of the watershed, by using satellite images of Ikonos. The project will be assisted by a student of the University of Göttingen taking her doctorate in this field. The information the project will obtain includes the extent of different forest types as well as estimated volumes per forest type and hectare.

With this information the project will be in the position to:

- calculate the production potential of the forest resources of the watershed
- identify the needs to reforest wasteland or agricultural land on steep slopes
- monitor the change of forest vegetation by comparing the results of this inventory with future inventories conducted in 5 or 10 years time

Forest inventory for management plans

The project elaborates management plans for the forest resources of its partners (in the great majority smallholder farmers). For this purpose more detailed information about these resources is required.

The inventory for relatively small plots which vary between 1 and 100 hectares (the majority up to 20 ha) aims to obtain the information that is necessary to develop a sound (but simple) management plan that functions as a suitable planning, implementation and management tool.

The inventory follows the steps below:

1. measuring the boundaries of the smallholders compounds, including all different land use types (with GPS)
2. differentiation of agricultural crops and forest resources (GPS)
3. differentiation of different stands within the forest resources – production and protection (GPS)
4. description of the characteristics of each stand
5. sample survey to obtain quantitive information on the stand

The most important steps seem to be step 4. and 5., since they collect the basic

information, required to develop the management plan and later on, to monitor the interventions.

Description of the characteristics of each stand

Describing the characteristics of the stand is the linchpin of the inventory. Collecting qualitative information about the stand leads to a sound decision about how to manage it and define the aims and goals of the stand's management.

The description is short and easy to conduct and compiles the following information:

- Exposition
- Inclination
- Tree Height
- Development stage of the stand
- Structure and composition of the stand
- Origin of the stand
- Canopy density
- Conditions of the crowns
- Stability of the trees
- Quality of the stems
- Susceptibilities
- Observations

All these characteristics of a tree stand are collected using a standardised form and a standardised language. This is important since different users of the information should be able to understand it in the same way.

Sample survey

In order to obtain information on wood volumes, basal area and density, it is necessary to conduct a survey that gathers exactly this information. In the case of PROCARYN a simple sample plot method seems to be the most adequate. The project uses the Bitterlich relascope with plots of varying sizes. This method is easy and very quick.

Within the plot the following data are collected:

- Number of trees within the plot
- DBH of each tree within the plot
- Number and DBH of trees which will be felled.

Use of inventory data

The description of the stand as well as the results of the sample survey form the basis for the management plan. The information obtained is used to describe the state of the art of the different stands, and it enables the development of long- and short-term goals for the all activities to be conducted.

The resource owner receives information about wood volumes and qualities to be harvested and a sound analysis of the production capacity of his forest resources. Therefore the management plan is not only a planning and monitoring tool for foresters but an important tool for the forest owner to calculate the economic benefits of the forests.

The management plan is elaborated on a 5-year term basis. After 5 years a new plan must be developed. This means, that all the steps mentioned above will be conducted again. Thus changes are easy to monitor. The comparison of the situation of the forest resources every five years can reveal changes in the structure, composition, quality and wood volumes of the forest resources. This information will have important implications for decisions about management strategies and activities.

Contact address:
Henning Peter
PROCARYN
Estela Geraldino No. 7
Jarabacoa Dominican Republik
Tel.:809-574-6727
Fax:809-574-6994
Wald.meister@web.de

1 Proyecto Manejo y Conservación de la Cuenca Alta del Río Yaque del Norte (the upper Yaque del Norte river watershed management project).

Assessment of Tropical Deforestation and Carbon Release in South-Eastern Bangladesh using Remote Sensing and Field Inventory

By M. M. Rahman, E. Csaplovics, B. Koch and M. Köhl

Introduction and Objective

Atmospheric concentrations of carbon dioxide have risen to current levels at least ten- possibly a hundred- times faster than at any other time in the last 429,000 years, and continue to rise sharply (Prentice *et al.* 2001). The recent dramatic increase in atmospheric CO_2 is unquestionably the result of human activities. Deforestation, specially in the tropics is one of the reasons of increasing CO_2 in the atmosphere. However, the current net flux of carbon between tropical forests and the atmosphere due to forest cover change is not well-documented.

Hence, studies on the regional and local level will be useful to understand and estimate the carbon release due to tropical deforestation in order to explain the global climate change. Consequently, the proposed project is designed to estimate forest cover change and carbon emission at a regional and local level in south-eastern Bangladesh, where a considerable amount of deforestation has been documented (Rahman and Csaplovics 2000). The result of the study will be quite useful to initiate a political decision to stop further deforestation and carbon release in the region.

Materials and Methods

Landsat TM/ETM data of 1985 to 2001 will be used for the study. The satellite image will be geometrically and atmospherically corrected. Topographic normalization will be done using a digital elevation model. Double (two phase) sampling with regression estimator (Cochran 1977) will be applied for estimating the carbon content of the forest ecosystem. The field-samples will be selected on the basis of satellite image interpretation.

At the first-phase of double sampling a digital classification will be applied to separate different class. All different combinations of Landsat bands will be checked to achieve optimal stratification. The objective of stratification is to minimize the sample variance within a stratum and optimize variance among strata. In order to facilitate correlation of field estimates and the remote sensing image a 3X3 pixel window will be created to calculate the first order texture. 3x3 pixel windows with a highly diverse texture will not be selected for field sampling. A GPS will be used to locate the centre of each 90mX90m sample plot, which corresponds to the 3X3 pixel window of the remote sensing image. The size of the field sampling unit will not be reduced at this first phase, in view of the accuracy of plot location and problem of neighbouring canopy illumination.

At the second-phase of sampling carbon content will be estimated by field-measurement. However, measuring all trees inside such a big plot is a laborious job. Hence, a sub-sampling or two stage sampling (Cochran 1977) at this second-phase will be applied. In this process four 10mX10m sample plots will be randomly distributed within the 90mX90m plot. Above-ground biomass of the plots will be measured and converted to carbon content using appropriate conversion factors.

A regression estimator (Cochran 1977) will be used to relate carbon content and remote sensing spectral information of the recent remote sensing image. The following spectral responses will be tested:

- Single band DN / radiance(6 TM bands)
- Rotational transformed image: Tasseled cap transformation (Crist and Kauth 1986), Principal component analysis
- Band ratios: Normalized difference vegetation index / NDVI = (IR – R) / (IR + R) (Rouse *et al.* 1973), MIR index = (MIR – R) / (MIR + R) etc.
- Image structure and texture analysis

Statistical and geographical software will be used for generation of geographic carbon content using a simulation technique. An overlay analysis of the geographic carbon databases (recent and historical) will provide a spatio-temporal estimate of the amount of carbon release from the ecosystem during the synoptic time interval. A number of carbon release classes representing a certain quantity of carbon loss from the historical to recent time, can be defined on the superimposed databases. The sum of the individual carbon release classes multiplied by the extent of area will calculate the total carbon release during the synoptic study period. Statistics on forest growth, mortality and decay function will be incorporated to get a better estimate.

Expected results and outputs

The result of the study is useful to estimate the carbon release due to tropical deforestation. The results might be used beyond the science community as an important policy-making support tool.

Proposals for further study

An additional study can be carried out examining the applicability of microwave sensor to estimate the woody-biomass content beneath the forest canopy. Laser-scanning data can be helpful to estimate the canopy height to get accurate information about carbon content. Permanent sample plots can be established in the forest ecosystem to estimate the biomass-fall, conversion of biomass-carbon to litter and soil carbon to explain the carbon dynamics in a tropical forest ecosystem. The carbon-flow of logged biomass can be trailed by sampling the end-use of forest products and their fate.

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Contact author. M.M Rahman
PhD student, Institute of Photogrammetry and Remote Sensing,
Dresden University of Technology, Germany,
Tel. +49-0351-463-32861,
Fax:+49-0351-463-37266,
E-mail: mr265552@rcs.urz.tu-dresden.de

B.Koch, Albert-Ludwigs University, Frieburg, Germany.

orest Inventory and Landcover lapping in Zambia At the Provincial orestry Action Programme ii

By Vesa Lauri & Sitwala Wamunyima

In the year 2000, the Government of Zambia, with assistance form Stora Enso Forest Consulting Ltd of Finland, initiated the second phase of the Provincial Forestry Action Programme (PFAP II). The programme builds upon the work and experiences of the first phase of PFAP, during which Forestry Action Plans were prepared for three Provinces of Zambia, namely Copperbelt, Central and Luapula. The main aim of the project is to build up national, provincial and local capacity for sustainable management of natural resources in Zambia. The implementing institution is the Forestry Department (FD) in the Ministry of Tourism, Environment and Natural Resources.

The Management Unit of the Forestry Department is responsible for Forest Resource Assessment for the whole country. The main tasks that the unit focuses on are Forest Inventory and Landcover mapping. Both assignments are implemented simultaneously and they complement each other.

The Forest Reserve inventory is an activity of the FD and it is carried out mostly in the natural forests. Sampling is systematic whereby the location of the first sample plot is randomly selected inside the area of interest. The sample plot type is concentric plot (3 radius) and the plots are placed on a transect at distances defined during the inventory planning phase. In the field, all plots locations are mapped with the help of GPS. The attribute data are collected at the plot, tree and seedling level.

The software selected for the forest inventory data calculation and reporting is ForestCalc (*http://www.forestcalc.com*). ForestCalc offers a flexible solution for this inventory because of the customisable structure of the database parameter tables (in MS Access format): tree species, volume equations, timber prices, administrative province information (districts, forest areas), coordinate zones, plot and tree level parameters could be modified according to the local needs without touching the program's code. Hence, data input and calculations are made with ForestCalc, but the final charts are created in MS Excel from the result tables.

The Forestry Department is also undertaking the Landcover Mapping in the Southern Province of Zambia. The main objective of this mapping is to determine the extent of forest cover and other land areas and to obtain estimates of the land cover types. There data will be used to determine the wood resources for the whole province. So far, the open areas i.e. areas outside forest reserves in the province have been inventoried. The forests are classified into three classes: 1) dense, 2) medium and 3) low forest.

The software selected is ESRI Arcview 3.2a (plus Image Analysis Extension) for mapping and remote sensing analysis. Digital Landsat 7 satellite imagery is used and pixel-based supervised classification methods are applied. After the classification, the raster maps are converted to vector files to facilitate the analysis and attachment of attribute data. GIS is used to visualize the inventory layout (plot locations) and the thematic maps derived from the inventory results are essential outputs for the official reports.

Although there is a working inventory system at the moment, the development of the forest inventory is necessary. Especially as there are strong demands to build up a proper forest management planning system and to make the forest inventories to serve it. Also

development of better timber volume functions is necessary. The information regarding forest yield and sustainable cutting removal are scarce in Zambia. Moreover, estimates for the charcoal yield are needed, especially on the areas near the cities. For this purpose the FD has established some permanent sample plots (PSPs). However, local villagers should be informed about the purpose of the PSPs, poles and paintings in the trees, so that they do not unintentionally destroy the trials.

The number of inventory groups is very small (max. 2), but hopefully the number of the groups can be raised in the future. The staff at the FD is well aware that more training is needed in inventory planning, but also forest growth and yield research should be strengthened. The new inventory results, such as real biodiversity indices and biomass results, combined with GIS, will offer new interesting methods for determining and understanding the state and development of the forest resources.

Mr. Lauri Vesa
University of Joensuu
Finland
Email: lauri.vesa@joensuu.fi

Mr. Sitwala Wamunyima
Forestry Department
Zambia
sitwalaw@yahoo.com

erspectives for Sustainable lanagement of Mangrove Ecosystems n Cameroon

By Ndongo DIN and, Dina Emmanuel Ngollo

Summary
In this article we look at some of the issues surrounding mangrove management in Cameroon and propose a national steering committee to oversee their sustainable development.

Threats and opportunities

Mangroves, special forests of the intertidal zone, are subject to continental and marine ecological constraints. Mangroves in Cameroon are subject to many threats including agricultural activities, forest and mining exploitation, hunting, urbanization and various infrastructure developments, as well as the need to supply fuelwood to rapidly growing cities. At the same time as many mangroves are being degraded, favourable mesological conditions are enabling them to expand in those regions where people find it difficult to pursue their activities. This may lead to conflict as the progressive advance of mangroves obstructs tidal channels, closing and blocking access to waterways and shifting fishing areas to remote zones.

Cameroon mangroves border the Atlantic Ocean, and occupy a surface area of about 2500 km^2 (Fig. 1 Pg 50). Although it is difficult to predict trends in human activities, it is likely that mangrove ecosystems in Cameroon will still occupy about 2000 km^2 in the year 2050. The efforts of all parties should now focus on conservation and total protection of certain sites.

The major threat to Cameroon's mangrove resources is exploitation for wood. Use of mangroves as public dumps is another problem. Mangroves are unable to recycle all the domestic organic waste deposited by city households. Similarly, the proximity of factories should be restricted because mangroves are very sensitive to pollution.

Any mangrove exploitation should be based on the ability of the resource to regenerate naturally. Although important quantities of seeds are available year-round, artificial regeneration of mangroves has not yet been tried in Cameroon.

The legal context

The legal context for the management of mangroves, as a type of forest ecosystem, is provided by Cameroon's forest policy. This has a general goal of promoting the long-term economic, ecological and social functions of the forest within a framework of integrated management that ensures sustainable conservation and use of available forest ecosystem resources.

In spite of the existence of a law that completely protects Cameroon's mangroves, no action to preserve them has been taken to date. Given that mangroves are the property of the State, the Government should take an interest in this biological resource, its multiple ecological functions, and possible financial returns which might cover the costs of protection and the creation of jobs. A better understanding is also needed of how local populations benefit from mangrove resources and could contribute to their protection.

A steering committee for mangroves

The ministries concerned should create a steering committee for the mangrove ecosystem. Such a committee would guarantee the involvement of the State, the only authority with the power to create natural reserves and the structures responsible for monitoring and evaluating the implementation of recommendations in the field. Its first task should be to identify resource persons to prepare the background documents necessary for the establishment of a sound development plan.

The next step would be to create a management structure to implement the plan and preserve all current stands of mangroves, regardless of size. This structure should have permanent staff as well as working with volunteers interested in mangrove conservation. Collaboration agreements with administrative authorities and law enforcement agencies should be prioritized, especially at the beginning of the implementation of the development plan.

Combining conservation and use

Ecosystem conservation can be compatible with careful identification of exploitable zones for given periods of time. Rotation cycles based on demand and the available supply of resources, could maintain the ecosystem functions in many previously unmanaged sites. Decisions about exploitation should be taken on the basis of biological and ecological information from each candidate site, which should be analysed relative to that from other stands.

All current camps should be counted and considered as permanent dwellings. Any other settlement besides those identified should be strongly prohibited and punished as a cause of environmental degradation. Mangrove ecosystems play an important role in supporting fishing activities and in coastal protection, so it should be possible to work with local populations towards sustainable use of available resources.

New legislation concerning the status of mangrove ecosystems may be required. This should take into account the protection of both the market and non-market values of mangroves. It should specify the conditions under which mangroves may be exploited, excluding all industrial activities, as their role in employment creation is often used as an argument to counter any intervention in their practices. The legislation should transfer the powers and prerogatives of environmental management from the ministries to the Steering Committee.

Non-governmental organizations should have a privileged place in the organizational chart of the new mangrove management structure. In particular, they should be assigned the task of disseminating the legal texts and environmental education. They will need well-qualified personnel and the committee will be responsible for organising seminars for the training of trainers. 'Lead agents' should be identified from the resident population at each site. These would be responsible for local-level monitoring and regularly reporting any difficulties in the implementation of their tasks to the committee, thus allowing for management to be improved.

Research programme

The development plan should define a research programme for which the general goal will be the preservation of the mangroves. Experimental sites should be identified and turned over to the research community. The committee should be in charge of finding funds from the Government and international financial institutions and donors. International cooperation and involvement in the elaboration of an integrated programme of activities should be sought through the United Nations Environment Programme, as well as organizations such as IUCN, WWF, Ramsar, IWRB (International Waterfowl and Wetlands Research Bureau), etc. and especially ISME (International Society for Mangrove Ecosystems).

Ndongo DIN (Author)
Department of Botany, Faculty of Science,
University of Douala,
P.O. Box 24157 Douala, Cameroon;
Tel. (237) 983 37 63, Fax (237) 40 75 69,
E-mail: ndongodin@yahoo.com

Ngollo, Dina Emmanuel
Department of Biological Sciences,
University of Maine,
305 Deering Hall, Orono Me 04469
USA
Current Address: The World Bank,
1818 H-Street NW,
Washington DC 20433, USA

Development of a Protocol for Eco-efficient Wood Harvesting on Sensitive Sites (Ecowood)

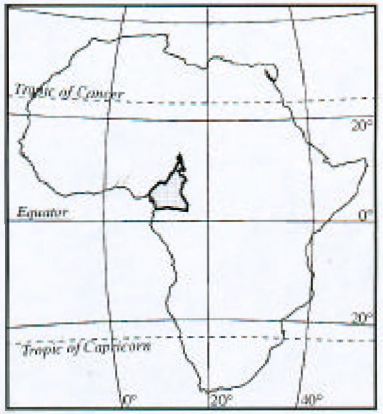
By P.M.O. Owende, K. McDonnell and S.M. Ward

Summary

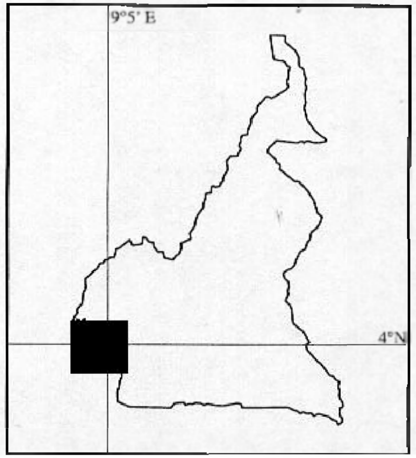
Wood harvesting conditions vary considerably across Europe, ranging from the wet peat-based soils of Ireland and Scotland, to the alpine conditions of the continent (Italy, France, Austria), and the seasonally frozen soils of Fennoscandia. Many of the sites may be considered to be "sensitive", hence, the need for development of eco-efficient and cost-effective mechanisation systems for wood harvesting and extraction on such sites. A sensitive forest site is where alterations to the normal mechanised harvesting practices are required in order to avoid adverse effects on ecological, economic, and social functions of the forest and its surroundings.

Environmentally sensitive wood harvesting and extraction on sensitive forest sites present considerable challenges to the use of ground-based machines as damage to the forest ecosystems may be incurred from:

- *soil disturbance and compaction* — may impede the growth of residual trees in thinning operations, and also increase the potential for soil erosion;
- *physical damage to residual trees, tree-roots, and other vegetation* — may lead to timber value and volume loss in subsequent harvest, and;
- *direct and indirect damage to streams, and the installed drainage and soil stabilisation features* — for example, such damage can be caused by the skidding/forwarding of timber across streams and steep road embankments without proper temporary bridging structures.



Cameroon in Africa



Location of Mangroves in Cameroon

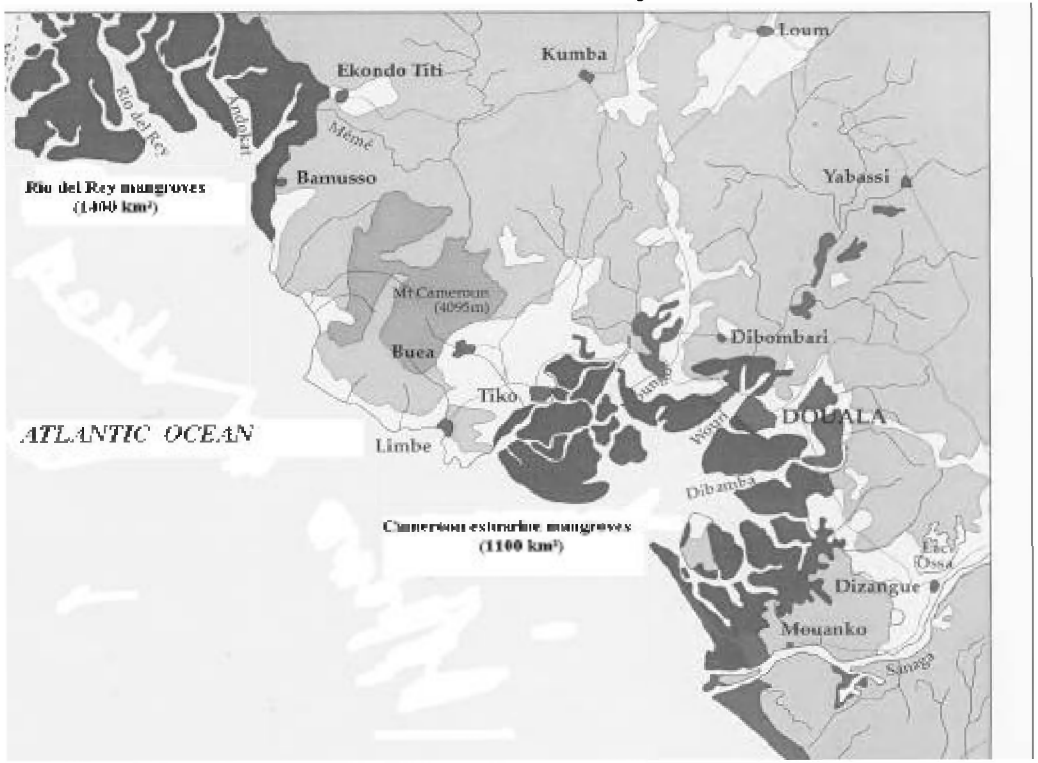


Fig. 1 – Principal areas of mangroves in Cameroon (dark).

The ECOWOOD project is developing an *Operations Protocol* (OP) for ecoefficient wood harvesting on sensitive sites. The OP will integrate the systems in wood harvesting, extraction and transportation, by matching the functional requirements of the forest machines with the environmental and socio-economics concerns in order to achieve cost-effective and sustainable operations.

Research Methods

The ECOWOOD Project consortium includes, University College Dublin (Ireland)–Co-ordinating partner, Coillte Teoranta (Ireland), University of Helsinki (Finland), Servicios Forestales Innoveciones (Spain), Consiglio Nazionale Delle Ricerche (Italy), Plustech OY (Research and Development section of Timberjack forest machinery company of Finland). There is also a three-member quality assurance group (QAG) that reviews the progress of the Project. The affiliations of the QAG team include, Technical University of Munich (Germany), National Council for Forest Research and Development (Ireland), and Danish Forest and Landscape Institute (Denmark).

The multidisciplinary scope of the ECOWOOD Project covers the key elements of an integrated wood harvesting and extraction system, including: a state-of-the-art review of wood harvesting systems; modelling of soil-machine interaction (*viz.* influence of site characteristics on machine mobility, site disturbance, and soil damage, including the development of a computer-based decision support system); time-motion studies, and computer based optimisation of machine productivity and operational costs; machine ergonomics; log quality predictions from stem data (*viz.* log-form and branching indices); real-time and delayed (batch) information and communication technologies (telemetric systems); life cycle analysis (LCA) of machines, and; analysis of the socio-economic impacts of increased levels of mechanisation of wood harvesting systems.

Results

This is an ongoing project which is scheduled for completion in December 2002. The main research findings to-date, are:

- Generally, the influence of forest machine traffic on soil physical properties is confined to the top 400 mm layer of soil profile, and damage may be checked by controlling the number of machine passes, and limiting the contact pressure imposed by the wheels or tracks through appropriate dimensional specifications;
- Tree size and form significantly affect the productivity and operational costs of cut-to-length (CTL) wood harvesters (Spinelli et al., 2002), and the tree-form indices may also be used to predict and categorise log quality;
- The estimated cost of integrated navigation, and information and communication technologies (ICT) (including telemetric systems) range from 0.01 to 0.1 euro/m^3 of harvested wood. Inherent operational benefits include, optimal machine and transportation routeing (truck utilisation on complex route networks may be up to 90% as compared to 50% for conventional systems), timely delivery of wood with minimal handling and storage costs, reduced fuel costs, machine maintenance and downtime, and the monitoring of machine movement and location of forest products (Kanali et al., 2001);
- Cable extraction is a viable complement to ground-based systems for harvesting of sensitive forest sites (Tiernan et al., 2002). Its lower productivity (1-10 m^3 per Productive Machine Hour) when compared to ground based systems (typical > 10 m^3 per Productive Machine Hour), may be enhanced by integrated log processing and handling (including the use of steep terrain harvesters), and ergonomic design of systems for the securing and releasing of logs/trees during extraction;
- Tyre inflation pressure has a significant influence on the level of whole-body vibration (principally in the vertical axis) that is experienced by CTL machine operators during machine travel over the forest terrain. The machines should therefore be operated at the lowest practicable tyre pressures to enhance operator comfort.

Acknowledgement

The ECOWOOD Project is supported by the European Community under the 5th Framework RTD programme on Quality of Life and Management of Living Resources Contract No. Contract No. QLK5-1999-00991 (1999-2002). (see The ECOWOOD Project at URL: www.ucd.ie/~foresteng/).

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Note:

An extended reference list can be obtained through the authors

P.M.O. Owende, K. McDonnell and S.M. Ward
Forest Engineering Unit,
Department of Agricultural and Food Engineering,
University College Dublin,
Earlsfort Terrace,
Dublin 2, Republic of Ireland.
Tel: (+353 1) 7167 346
Fax: (353 1) 4752 119
Email: forest.eng@ucd.ie

The Challenges of Bamboo Forest Management in India

By A.C. Lakshmana

Abstract

India's natural bamboo forests constitute nearly 9.5 million hectares, about 14% of the forest area. Their management is a challenge to foresters. This article touches on the problems of congestion, jhum cultivation, flowering and regeneration, and growing stock assessment, suggesting some suitable management practices to overcome each one. If not handled properly, India may lose one million hectares of bamboo forests.

Introduction

India's tropical forests are very rich in bamboos. However, of nearly 130 species, only about 15 are found in substantial quantities and are of economic importance. Particularly important are *Dendrocalamus strictus*, *Bambusa* species, *Melocanna bambusoides*, *Bambusa tulda*, *Pseudooxytenanthera stocksii*, and *Ochlandra* species. The earliest mention of bamboos is in the Rigveda, a Sanskrit text at least 3,000 years old. Bamboos have over 100 uses from cradle to coffin.

Congestion

There are two types of bamboo: sympodial (clump forming) and monopodial (non-clump forming). *Dendrocalamus strictus* and *Bambusa* bamboos are clump forming and often suffer problems of congestion. Although the working plan prescription is that all mature culms ('stems') of three years and older should be exploited, with no extraction of one-year old culms, this remains a paper prescription. Contractors or extracting agencies often use bill-hooks attached to long poles and extract the top third of bamboo, which is free from thorns, branches and congestion, leaving the remaining two-thirds in the clump.

To overcome this the author has developed a W-shaped cutting system, with a V-shaped clear cut at one end during the first year and another V-shaped clear cut at the other end during the second year. In the third year an inverted V-shaped clear cut should be carried out. This will help to reduce congestion. Incidentally, if the side branches are pruned in their tender stages, congestion can be avoided completely. The practice of pruning side branches is common in private farms, which cultivate bamboo groves. Congestion is not a problem for monopodial bamboos like *Melocanna bambusoides*.

Jhum cultivation

Jhum cultivation is a form of shifting cultivation that is posing an increasingly serious threat to the environment and ecology of India's bamboo-rich North-Eastern states. Annually about 200,000 hectares of forest, consisting mostly of bamboo, are cut down and burnt to make way for agricultural production through shifting cultivation. This system was sound and sustainable in the past when it was being practised on a long rotation basis by a small population. But increasing population pressure has forced farmers to shorten the rotation to 6-7 years, resulting in impoverished soils producing lower farm yields. This, in turn, has led farmers to expand jhum cultivation to ever larger areas.

People and Governments of North-Eastern India need to switch to an integrated approach of mixing horticultural crops with agriculture, pisciculture, apiculture, forestry and poultry. Improvement of roads, markets and the development of value-added products could provide an attractive alternative to the increasingly unsustainable jhum cultivation.

Flowering and regeneration

Bamboo flowers regularly. For bamboos such as *Arundinaria*, *Bambusa* and *Ochlandra* it may be every year. For others, intervals between flowering periods vary from 25 to 50 years. In Karnataka state, *Bambusa* bamboos and *Dendrocalamus strictus* are flowering and fruiting now (2002), while *Ochlandra* species have already done so. Here the scientific exploitation of drying bamboos and how to encourage natural regeneration are two important agendas.

The other critical aspect of bamboo flowering is the resulting increase in the rodent population, which causes untold misery – as was the case in 1900 and again in 1958, particularly in Mizoram. *Meloccana bambusoides* is expected to flower around 2004 but the consequences are very unclear. A cautious and integrated approach managed by people with extensive field experience will be required to avoid hardships for the local people. The International Network for Bamboos and Rattans (INBAR), based in Beijing, is currently carrying out a consultancy in Mizoram and Tripura to advise on this matter.

Growing stock assessment and monitoring

Traditional forest inventories require a sampling intensity of 5 to 10% of the total population, taking into account the time and resources available. The huge areas covered require a lot of time. Recently sample plot techniques have been employed effectively.

Sample plots are usually squares of 0.1 hectare, the number of which is determined statistically to achieve a given percentage of allowable error (10% for forest inventory) and depends on the variability of the forest. The variation in the population for any given parameter like volume, plants per hectare, crown density, etc., can be worked out.

For the purposes of monitoring, it is desirable to lay out permanent sample plots in four different representative areas for each species. Recommendations for these sample plots include:

- Permanent boundary fixing and marking.
- Enumeration of bamboo culms in each clump.
- Classification of enumerated bamboos in each clump as 'current year', 'above 5 years' and 'all others'.
- Assigning a permanent serial number to all clumps.
- Recording the production of new culms, as well as any bamboo extracted or thinned, in a register (with a balance recorded each December).

- Rigorous fire protection and protection from grazing for three years after a forest area flowers.
- Provision of partial shade (as determined by research in different silvi-ecological zones) to promote the establishment of regeneration after flowering.
- Establishment of 5-6 years before selection felling starts.
- Exploitation only when clumps average 25 culms.
- Marking and extraction of no more than 33% of the culms annually.
- Recording of the green and dry weight of bamboos to facilitate the calculation of the yield by weight (yield is currently expressed as number of bamboo culms per hectare or by volume in cubic metres).

Conclusion

Along with wheat, paddy rice, papyrus, pepper and rubber, bamboo is one of the ten crops that have had the greatest significance in the history of human society, providing environmental, ecological and economic benefits. Few other species can match bamboo in its utilitarian value. When bamboo forests are destroyed by negligence, therefore, the potential to cause harm to society is great. India runs the risk of losing 1,000,000 hectares of bamboo forests if some of the above challenges are not met with adequate caution and preparation.

A.C. Lakshmana,
Former Forest and Environment Secretary
Bangalore-98 INDIA
E-mail: aclakshmana@yahoo.com
Tel no: (080) 8601942

Mangrove research at the Vrije Universiteit Brussel II : the remote sensing aspect

by Farid Dahdouh-Guebas & Nico Koedam

An integrated research framework on mangrove vegetation structure dynamics, regeneration and restoration was presented in the Forests and Water Issue of ETFRN News 33 (Dahdouh-Guebas, 2001b). It discussed the broad framework in which changes in the vegetation structure of mangrove forests, amongst other research topics, were studied over several decades using remote sensing techniques. This contribution emphasises 'why' such monitoring is necessary and 'how' this remote sensing aspect is carried out.

The need for monitoring

In many countries the coastal zone is subject to ever increasing anthropogenic pressure. The mangrove destruction occurring as a result of for instance reclamation for village expansion, agriculture, tourism, freshwater diversion and particularly aquaculture impoundments (Farnsworth & Ellison, 1997; Dahdouh-Guebas *et al*., 2000b; Dahdouh-Guebas et al., in press) necessitates a rational management of ecosystems and resources on a local, regional and global level. This is particularly true for developing countries, where local people are often dependent on the nearby ecosystems (Cormier-Salem, 1999; Dahdouh-Guebas *et al*., 2000a). This requires an integrated interdisciplinary approach in order to reach a sustainable equilibrium between the ethnobiological needs and environmental conservation. This cannot be done without understanding the direct and indirect impacts of man on these ecosystems, without foreseeing the consequences of these impacts, the ecosystem's lag-time, resilience and recovery capacity, or without considering mitigating measures.

The study of the above aspects in mangrove areas requires research with respect to the high spatio-temporal dynamism in land-cover patterns (marine and coastal changes), in order to assess and predict the extent of anthropogenic impacts or environmental changes. An excellent tool that is increasingly important in the detection, description, quantification and monitoring of those changes is remote sensing, which, in combination with geographic information systems (GIS) and fieldwork, is an effective management tool (Dahdouh-Guebas, in press).

Remote sensing approach

In order to study human impact and continuously monitor its consequences remote sensing and geographical information systems (GIS) have become indispensable tools. Not only has remote sensing evolved from purely visual, photographic data to multi-spectral imagery, but at the same time the resolution has improved tremendously. Whereas aerial photography produced imagery with an unbeaten resolution (ca. 30 cm x 30 cm) within the circuit of publicly available imagery and also formed the only set of data available for long-term retrospective research, the image resolution is now challenged for the first time by panchromatic and multi-spectral imagery (4 m to <1m resolution) of the recently launched Ikonos, Eros and Quickbird satellites (Fig. 1).

In addition, even greater spatial resolution improvements are announced. Considering that this recent space technology can generate imagery with a regular frequency this opens possibilities to new research into dynamics and changes in mangrove vegetation and coastlines. The advantage of retrospection by aerial photography cannot be equalled at present; and obviously a calibration will be required of the new image data and their use to identify genera, and, thanks to the multi-spectral nature and the possibility to construct 'true' and 'false colour composites', probably for the first time unambiguous identification of mangrove species. The latter is also aided by the possibility to localise GPS-(global positioning system) points unambiguously on the field and on the digital satellite images.

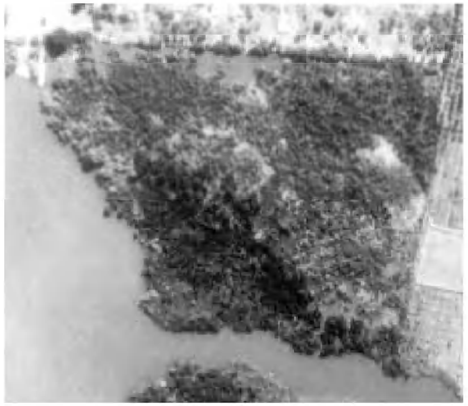
For this purpose, our existing studies on sequential aerial photography applied to mangrove forests (Dahdouh-Guebas *et al*., 2000b; Verheyden *et al*., in press) integrated new space-borne remote sensing technology of very high resolution (Ikonos), thereby enlarging the time frame over which vegetation structure dynamics and anthropogenic impacts can be monitored (Fig. 1). In addition, through fieldwork data and experiments the project continues to build on existing studies in the framework of error modelling and changes in mangrove vegetation assemblages with a field of application in other forests as well (incl. biocomplexity, empirical studies on vegetation description methods). The relatively poor flora of mangroves allows for a floristic complete investigation. The research is focused on mangrove sites in Kenya, Sri Lanka, India and Mauritania, of which good background knowledge exists already in our research unit and which represent a large diversity in mangrove vegetation types.

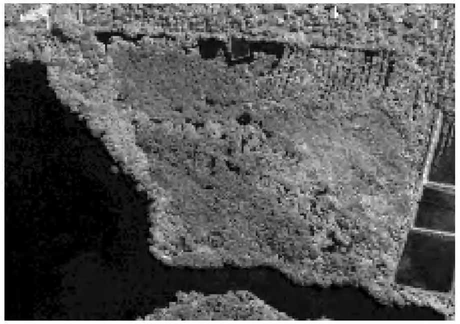
Our Kenyan and Sri Lankan case-studies on this topic have shown for instance how mangroves have changed qualitatively and quantitatively over the last two to four decades. In some cases qualitative mangrove degradation has been observed without an actual decrease in area (Dahdouh-Guebas, 2001a; Kairo, 2001). Adverse changes in mangrove area as a result of freshwater diversion have been indicated, but also colonisation of new areas as a result of the same (Tack & Polk, 1999; Dahdouh-Guebas *et al*., 2000b). Also the never-ending expansion of shrimp aquaculture in mangrove areas has been documented (Dahdouh-Guebas *et al*., in press), even in areas IUCN-identified for conservation and rehabilitation. The above findings are now complemented with the new Ikonos imagery, and both updates and new directions in the monitoring and modelling of mangrove vegetation structure dynamics have been identified and analysed.

The current challenge is the prediction of future scenarios and the establishment of early warning systems in order to assist in the identification of such priority areas. Dahdouh-Guebas (2001a) elaborates on how future mangrove vegetation structure and degradation can be predicted based on vegetation history and current vegetation structure in the field, and how remote sensing technology can be combined with multivariate analysis to do so. For instance, sequential remote sensing with very high spatial resolution can be used to view whether a mangrove forest is dynamic or static (*i.e.* in a steady-state) and whether or not it has degraded. Interviews with local people may help to understand what are the underlying causes of degradation, and current distributions of adult, young and juvenile trees in the field can be studied and compared and with the past situation (Dahdouh-Guebas *et al*., 2000a). These three aspects together generate information about the regeneration capacity of the ecosystem and act as an early warning system. If degradation symptoms appear, human interference such as rehabilitation may be required. It is equally important to evaluate and monitor the rehabilitation effort and study successional aspects and biotic migration patterns. In the analysis and interpretation phase data originating from ecology, geography, sociology, and other disciplines should be integrated. (Dahdouh-Guebas, in press).

Figure 1. (Below & Pg 58) Black and white aerial photograph and (Pg 58) panchromatic IKONOS satellite image of a little changed mangrove formation (Pambala-Kakkapalliya, Chilaw Lagoon, Sri Lanka), to illustrate how vegetation structure features so far available from aerial photography only, can now in part be detected from very high (spatial) resolution space-borne imagery. In addition, a 'pansharpenend' multispectral image with the same resolution can be produced by for instance substituting the 'intensity' component of a true or false colour composite in HIS format (hue, intensity, saturation) by the panchromatic image shown (Pg 58) in order to reveal more spectral details (not shown). Note that water bodies (black), even those below canopy, are more conspicuous in (Pg 58) because of their high absorption in the near-infra-red wavelength, which is included in the spectral resolution ofthe IKONOS satellite (0.45-0.90 • m). Dahdouh-Guebas (in press).

Figure 1





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Farid Dahdouh-Guebas & Nico Koedam
Laboratory of General Botany and Nature Management, Mangrove Management Group,
Vrije Universiteit Brussel,
Pleinlaan 2, B-1050
Brussels, Belgium.
Tel. ++ 32 2 629.34.22,
Fax. ++ 32 2 629.34.13
E-mail : fdahdouh@vub.ac.be

Forest Surveys Using Non-specialist Volunteers

By Craig Turner & Sarah Cadbury

Forest resource assessment offers a paradox. They are required to aid conservation planning but are often necessary in areas that lack the capacity to undertake such assessments at an appropriate scale. However, a possible solution is offered in the Philippines where a local NGO, the Negros Forests and Ecological Foundation, Inc (NFEFI) has formed a unique partnership project with Coral Cay Conservation (CCC). The partnership utilises a 'participatory model' using trained volunteers to conduct resource assessments in order to provide baseline information for conserving the montane rainforests of the central Philippines.

Tropical Forests of the Philippines

The Philippines is a unique area of biodiversity with over 57% of species in the major faunal and floral groups occurring nowhere else in the world. However, due to high forest loss it has proportionally more threatened endemic and restricted range bird and mammal species than most other countries. This cocktail of isolation, endemism and threat also means the Philippines has no other country with whom to share the burden of the conservation effort required.

Consequently, many areas are biologically poorly known and require baseline surveys to underpin future conservation. This is the situation on Negros Island where NFEFI and CCC have established their unique conservation initiative, the Negros Rainforest Conservation Project (NRCP) in the North Negros Forest Reserve (NNFR), the second largest tract of montane rainforest remaining in the central Philippines.

Overview of the Negros Rainforest Conservation Project

The NRCP is a joint programme of community based conservation, education, and restoration. A primary aim of the project is to obtain quantitative, base-line ecological data on the relative abundance and distribution of biological resources. It is intended that such data will underpin the development of integrated community-driven management recommendations for the NNFR. These aims are broadly similar to many other forest conservation projects, however, it is the mechanism by which it achieves these goals, using a stream of self-financing conservation volunteers, that makes the project unique.

Use of volunteers in resource surveying

Volunteers (local and international) are used in the majority of NRCP forest inventory work following a week-long training course on site by experienced ecologists. Volunteers are trained in forest ecology and field monitoring techniques and must achieve a minimum basic standard of competence before undertaking any fieldwork. Survey techniques are applied that require minimal expertise yet permit the collection of accurate ecological data. Volunteers work under the guidance of professional practitioners (NRCP staff) to ensure, via continuous monitoring that stringent survey standards are maintained and thus more technically demanding surveys can be completed, such as tree species inventories and vertebrate surveys.

Whilst the use of volunteers may be questioned with regard to expertise in data collection it is acknowledged that conservation biologists have long used "non-professional" volunteers to collect information needed to make informed decisions concerning resources they are trying to protect (Bildstein 1998). There is also a growing body of literature supporting the use of trained volunteers in baseline ecological monitoring work where resources are limited (e.g Mumby *et al*, 1995; McLaren & Cadman 1999).

The NRCP undertakes rapid biodiversity assessments of major faunal groups (focussing on birds, mammals, reptiles, amphibians and insects) in conjunction with long-term vegetation monitoring, working with local research collaborators. The botanical inventories, for example, have been co-ordinated with the botany department of the Philippines National Museum using the internationally recognised permanent sample plot technique. These allow spatio-temporal comparisons of the species composition of different forest habitats.

Results and project outputs

Surveys reveal that the NNFR is a biodiversity hotspot of importance to many endangered and endemic species. Vegetation surveys have documented 15,000 tree specimens across 3 forest types and this scale of survey effort would not be possible without the army of volunteers who permit long-term and large-scale data collection. Avian inventories over extended periods, for example, have identified 123 bird species, approximately 20% of all species (572 in total) known to occur in the Philippines.

The information so far obtained is providing a valuable baseline for vegetation community structure and how this relates to faunal diversity and distributions. For example, the empirical outputs of the completed vegetation inventories will aid reforestation efforts in terms of species to be used and the relative composition of reforestation plots. Additionally, NFEFI promotes local involvement via a community managed reforestation scheme that also provides alternative livelihood opportunities via the sale of wild native seedlings to other landowners. Thus in tandem they will contribute to more effective ecological restoration.

The potential for volunteers within conservation

The project's unique participatory model of utilising trained volunteers represents an opportunity to increase both the spatial and temporal scales over which such inventory work can be undertaken and therefore not only evaluate the composition of the fauna and flora in differing forest types but also monitor change over time, accomplishing major research goals with minimal resources.

However, it is important to acknowledge the technical constraints of utilising volunteer (novice) labour when collecting scientific data. The NRCP has always used internationally recognised and peer reviewed survey methods (for major faunal and floral groups) but we often find that these have to

be adapted for volunteers and local community members in order to make them workable, reliable and provide usable data. Thus, situation specific development of methods is necessary if accurate and scientifically robust information is to be gained and recognised by peers. For example, bird observation surveys were initially undertaken using point and transect counts (Bibby 1998). However, these proved to be too unreliable and thus, Mackinnon lists (Mackinnon & Philips 1993) that are not limited by time are now used instead. Whilst the perceptive accuracy of data collection may be enhanced through the use of appropriate methods and training, there is still a need to validate any data collection process (MacLaren & Cadman 1999). To this end, the NRCP is currently undertaking a study to validate the data collected by volunteers using observation techniques.

Extensive resource surveys are vital in many tropical forests for conservation management and the use of a volunteer programme offers one mode of operation. The work of the NRCP in the Philippines illustrates how trained volunteers can be provided with no cost to the host country on a long-term basis and survey large areas of forests. Volunteer survey programmes therefore offer an important role for the provision of baseline biological information in conservation management strategies.

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CCC is continually recruiting volunteers for the NRCP and for more information, please contact:

Craig Turner (Terrestrial Science Co-ordinator)
Coral Cay Conservation
The Tower, 125 High Street,
Colliers Wood, London,
SW19 2JG, UK
T: +44-(0)20-8545-7722
F: +44 (0)870-750-0667
E: ct@coralcay.org
W: www.coralcay.org

Survey and monitoring of *Dracaena cinnabari* Balf. Fil. in Soqotra Island (Yemen)[1]

By Serena Petroncini

Dracaena cinnabari is an endemic species of Soqotra Island. It is one of the six species belonging to the Dragon's blood trees group, classified as follows: *Monocotyledones, Liliales, Dracaenaceae.*

It is registered in the IUCN Red List of the Threatened Plants 2000 with the following abbreviation: EN B1 + 2c.

Its area of distribution ranges from an altitude of 150 m to 1600 m above sea level. It is dominant above 600 m. It is not wide spread all over the Island. It is restricted to the area of the large central plateau of Diksam; the central granite massive of Haggeher; and the eastern area of Hamadero, Sirahon and Kilisan. Plant density is not homogenous. In some areas it is high, while in some others it is lower, reaching the stage of relicts. The plant is prevalently present at the stage of adult and very little regeneration is occurring.

For the greater part of the year *Dracaena cinnabari* is immersed in mists, dews and rains. These climatic conditions are due to the two monsoons that cross the Island in two different times of the year.

The resin is called Dragon blood and its uses and trade belong to ancient times and cultures. In the past the intensive collection of the resin was due to a strong demand for the product. Today the demand has decreased, but is still used in the Island for medical and decorative purposes.

The monitoring of *Dracaena cinnabari* is one of the basic aims of the Soqotra Biodiversity Project. The intention of this research was to propose a permanent system for the monitoring and study of this species, and to transfer all the information and knowledge to the local assistants that collaborated. Unfortunately the Soqotra Biodiversity Project was not provided with detailed maps and aerial photos, but this was not an obstacle for the development of the monitoring plan. Few materials were used:The vegetation map of the Royal Botanic Garden of Edinburgh, the vegetation classification of the Island; and the information gathered from the project team and from the indigenous people.

The study area was reached by walking from the camping point. Before starting the team exchanged information with the indigenous people. After a first general survey the study areas were chosen randomly. Places where the plant density of *Dracaena* was too low were not chosen, to avoid the risk of empty sample plots.

Two monitoring methods were used. The first was proposed by the Royal Botanic Garden of Edinburgh and consisted of filling in a form whereby the plants were subdivided into 5 classes of growth stages. A maximum of 100 plants were counted inside a ray of 500 m of length. If the number of plants inside the ray was higher, the ray was reduced; if the number of plants inside the ray was lower, outside the ray plants were ignored. General information about the areas was registered. The starting point GPS co-ordinates were random and the distance between one starting point and the next was at least one Km.

The second method consisted of monitoring rectangular transects of 1000 m² (10m x 100m). In each area with similar characteristics (slope, soil morphology and vegetation) three transects were repeated. The choice and the distance of the transects was random. The collected data were registered in two forms. The first contained general information about the transect: GPS co-ordinates , soil morphology, vegetation cover, associated species, presence of seedlings etc.

The second form contained specific data: numbers of plants, circumference, height, crown diameter, presence of faeces of goats and cows, presence of wounds on the trunk, nearest neighbour, distance from the nearest neighbour etc. For practical reasons the starting point of the transect was identified with a GPS.

These two methods were developed in parallel. Data were collected by a team of four people. The practical part of the research was usually followed by a social part in which the team held informal interviews with the indigenous population.

In total 17 areas were monitored. It was found that *Dracaena cinnabari* is mainly frequent at the stage of adult. Further results were also obtained from the data collected only with the transect method. The presence of *Dracaena* is related to individuals with big dimensions. The plant density is low in most of the study areas, except in the restricted areas of Rokeb Di Firmihin (500 - 700 m above sea level) and Skandt (1300 -1400 m above sea level). Here the plants are very dense and some young plants are present . In the other study areas seedlings and young plants are almost absent except on the cliffs and escarpments.

Wounds on the trunks, due to the harvesting of the resin, are very frequent. Faeces of cattle are almost a constant inside the transects.

After this first monitoring of *Dracaena cinnabari*, the situation of this extraordinary plant population was found to be critical.

Although livestock grazes almost everywhere on the island, this seems not to be the only reason for its extinction. Grazing is regulated by ancient rules, and if Soqotra is still environmentally well conserved, it is due to its people. It also seems that the harvesting of resin, although it seriously damages the plant, does not directly influence the lack of regeneration. It was considered that germination of the seeds might be difficult, but recent studies excluded such a hypothesis. Moreover, the indigenous people think that the lack of regeneration is due to the decrease of rains. Soqotra seems to be becoming drier, which will probably oblige many species of the Island to take refuge on higher altitudes. The combination of pasture and lack of water is a feature not to be underestimated for the protection of *Dracaena*.

Acknowledgements

Many are the people that I have to thank:

Prof. C.R. Lenzi Grillini my supervisor, Edoardo Zandri CTA of the Soqotra Biodiversity Project, the terrestrial team: Fahmi Abdulla Bashuan, Ahmed Saeed Siliman, Nadeem Talib, Ahmed Issia Ali; Sheik Alì extension officer, Kamis Taleb the driver. I thank the families of Saad Mbarak and of Adib Abdalla. I thank the EPC. I thank all the Soqotris who without their help I could not carry on this research. I thank Lorenzo Ceccolini, Lyndon De Vantier and Jacopo Monzini Taccone di Sitizzano.

Department of Plant Biology-Laboratory,
Piazza delle Cascine 18,
Florence, Italy
E.mail: spetroncini73@hotmail.com

1 The present article summarises the contents of the thesis: Prospezione di *Dracaena cinnabari* Balf. fil nell'Isola di Soqotra ai fini del piano di monitoraggio e di conservazione- 2001.

The Home Gardens of Soqotra [1]

By Lorenzo Ceccolini

Belonging to the Republic of Yemen, Soqotra Island is located in the Arabian Sea to the south of the Arabian Peninsula and east of the Horn of Africa. The Island is situated in the arid tropics and is subject to intense summer monsoon activity that has created a seasonal period of isolation. Traditionally, the people have survived through fishing, ranging of live-stock (mostly goats) and home gardening, particularly date palms.

Field trips to 22 villages were conducted in the Hadibo plain, in the south coast of Soqotra and in the central Sheeb valley to determine the general situation of home gardening practices. At each sampled village, interviews with the local people were conducted. The interviews were completed in part by PRA (Participatory Rural Appraisal) and in part through questionnaire interviewing. Participatory approaches were used primarily to assess the cropping patterns used in relation to the intensity of wind and rain. Stones represented months of the year and wooden sticks of different lengths represented different classes of intensity of rain, and wind. These data were combined with information about the agricultural work during the year. Additionally maps were drawn illustrating the home gardens and approximate ground cover area for each plant (identified with the local name). Plant collections were made to identify the species grown. A herbarium with dried samples was established to later aid in the identification of plants, usually to genus and, where possible, to species level.

The home garden activity is still not fully developed especially as a multi-layer structure, fertility maintenance, crop-livestock integration, integrated plant protection and indigenous knowledge. As elsewhere, many factors influence the development of home gardens on Soqotra. Among the most important are:

- ***climate*:** The Island is situated in the arid tropical zone where evapotranspiration generally greatly exceeds precipitation. The possibility to maintain a home garden during the dry season depends on time investment (watering the garden frequently), in knowledge (to raise the efficiency of work), in input (such as pipes, water pump, tanks) and in the availability of water (see below).

- ***location (rural/urban) and availability of land for cultivation:*** the home gardens in the main village of the Island (Hadibo) are usually small areas where a variety of plants are propagated, mostly in small quantities: the availability of land is scarce due to the strong urbanisation of the area. The recent expansion of the local market, following development of the commercial airport in 1999, has resulted in the ready supply of fruit and vegetables from the mainland, further restricting the local home gardening efforts. The home garden in Hadibo is, for these reasons, a little food supply of vegetable, fruits, and spices.
In most rural villages (e.g. Sirhin) the area under cultivation is larger and the household is more dependent on the produce of the garden. The lack of urbanisation of the area is reflected in the availability of land that is not used to build houses or roads. Also the availability of materials such as wood to build fences (to protect plants from the voracious livestock), is related to the location since the absence of rangeland near the village forces the people of this area to buy this input from other areas of the Island.

- ***household size and composition*:** the number of people that live in a soqotran house is commonly high; usually three generations share the area. Normally much of the work (and knowledge) related to home gardening is held by women. She is the major decision-maker with respect to home-gardening, and from sowing to harvesting there is relatively little involvement of the man, other than the undertaking of very hard physical work such as the building of fences or the digging of wells. The participation of the whole family increases when the importance of the home garden as source of food and money increases.

- ***volume of water*:** the availability of water during the dry season (from May to September) is guaranteed from the ground water table. Home gardens are mostly maintained by wells, either inside the yard or nearby. Collecting is done manually by the women with a rope tied to a tin of 2-3 litres (rarely is a pulley used). A large home garden normally indicates the presence of a water pump.

- ***Inputs such as seed, fertilisers, and tools:*** despite the rapid commercial development, especially in Hadibo, there is no interest in commercialising and distributing agricultural inputs. Seeds, modern tools, pesticides and fertilisers are not available in the shops. Water pumps and metal fences are the unique indicators of invested capital on home gardening. Where these two facilities are implemented, the home garden is sufficiently important for the household to justify the investment. The villages that have a high percentage (> 50%) of sampled home gardens fenced with iron material also have a high percentage (> 75%) of home gardens with principal destination of the products to the local market.

At present, only a small proportion of Soqotra's population cultivates home gardens, and there is considerable potential for expansion. Also, if the airport will supply the necessary food stuff for the local people nearby, they will need a cash resource to buy these products coming from the mainland. Moreover it is important that the family maintain their home garden to avoid complete dependence from outside products.

The harsh climate conditions are mainly present in the northern part of the island while the limiting factor in the south-east coast is the sand dunes. The most promising areas to develop home garden agricultural systems are located in the valleys in the core of the island and in the south-west coastal part. From present research it appears that here the unique obstacle to the development of agriculture is the absence of an infrastructure and of knowledge linked to this activity.

Department of Plant Biology-Laboratory,
P.zza delle Cascine 18,
Florence
Italy.
E-mail: lorenzo.ceccolini@poste.it

1 The present article summarises the contents of the thesis: Gli orti famigliari dell'isola di Soqotra – 2000. Department of Vegetal Biology-Laboratory, University of Florence.

Global Forest Information Service (GFIS)

By Martin Nöbauer

Introduction

In forestry and related disciplines, it is widely recognized that rapid, reliable and universal access to quality information is essential for informed decision-making concerning forests and all their inherent values. In response to this demand, the International Union of Forest Research Organizations (IUFRO) convened a consortium of international, regional and national organizations and created a IUFRO Task Force in 1998. The purpose of the Task Force was to develop a strategy for, and implement, an Internet-based metadata service to provide coordinated worldwide access to forest-related information. Now GFIS has become an international initiative and its mission is to develop a worldwide forest information infrastructure, and operate services in accordance with international, open standards.

The benefits of GFIS are an easier access to global forest-related information, better comparability of information and data sets, improved user feedback to information providers, identification of information gaps, generation of value-added products, dissemination of research results, and enhanced profiles for researchers.

Anyone with an Internet access and a web browser can obtain information via GFIS in the following 5 steps:

- connect to any GFIS node;
- select the topic and scope of databases to search;
- submit the search to multiple hosts and receive metadata from relevant information or data sources, and/or (in later stages of development) actual data;

- connect via links to selected sources for further searching if desired;
- examine/use the retrieved information or data.

GFIS is intended to become an open system to which information providers who use GFIS standards for cataloguing information may contribute by supplying resources. A "collection policy" is being elaborated which will define subject coverage, target audience, types of resources to be included, submission procedure, quality assessment, metadata standards, and maintenance arrangements.
Information can be supplied to GFIS via the Internet in the following way:
register as an information provider
submit metadata describing your information resources
create links to your on-line information

This advanced information service must be developed with due consideration to global relevance, accessibility and participation. This requires that attention be paid to on technical or cultural obstacles that may hinder the utilization of GFIS in certain regions of the world. In order to minimize the occurrence of such obstacles, it is intended that the GFIS user interface and relevant documents be made available in several languages. Assistance will also be provided to key institutions in developing countries in order to help them obtain the technology and training needed to fully participate in GFIS.

Underlying technical principles

GFIS is based upon the notion of a distributed network of databases which catalogue the information resources of contributing GFIS partners by using a common metadata standard. The Internet and WWW are used to facilitate locating and searching metadata catalogues. GFIS shall function by providing a standardized core of metadata (catalogue) fields, a standardized set of key words for searching, and a standardized interface between web sites and the databases. This will facilitate interoperability among catalogues. The Data/Information Objects (DOs) are the items that the user wants to find by using metadata. These items are of different contents, spatial and temporal scales, formats and other attributes specific to each database. Metadata are data about data. Each metadata item is used to describe a data/information object. The metadata definition of GFIS is based on the Dublin Core metadata standard, and is used to describe specific GFIS DOs. A GFIS Node is a GFIS partner institution which collects, maintains and manages GFIS metadata submitted by data provider(s) or others. Nodes also collect regional information about their members, organizations, events and activities. GFIS Affiliated Nodes are institutions that offer forest-related websites with their own metadata which are not in conformity with the GFIS metadata standard. In order to make the metadata available for GFIS multi-host search, the metadata at a GFIS Affiliated Node can either be converted to the GFIS metadata standard (phase 1) or mapped to the GFIS metadata structure (phase 2). The GFIS Information Server (IS) is the central component of GFIS. It collects GFIS metadata from the nodes, thus permitting global search operations. It also provides house-keeping functions and maintains records of GFIS members, organizations, events, announcements and projects.

Phases of development

The **Concept phase** (1998 to 2001), based on increasing awareness of the need for GFIS, comprised the designing of technical and architectural concepts, drafting of the collection policy, and selecting standards for metadata and thesauri.

The **Prototype phase** (2002 to 2004) consists of demonstrating the operation of GFIS, establishing the regional nodes, and developing multi-host searching within metadata of participating organizations.

The **Implementation phase** (2005 -) will concentrate on operating, maintaining and evolving the full scale forest information service.

The current status of GFIS

To date the development of the GFIS software for the Information Server with a multi-host search engine and the nodal software has been finalized. At this point the GFIS search engine is available. Now the Special Programme starts to cooperate with data providers worldwide: The webmaster workshop for the African Nodes at the beginning of April in Vienna, Austria, was a very important activity in this context. The five Nodes established in Africa (Ghana, Gabon, Kenya, Senegal and Zimbabwe) will provide about 4,500 metadata records of grey literature by end of August 2002. Three GFIS Nodes shall be established in South America (Brazil, Colombia and Chile) by end of April 2002. The respective partner institutions are already preparing for metadata entry and will provide a substantial amount of metadata records by the end of August 2002.

The next steps are finding data providers and developing further features of the GFIS software such as the GFIS information retrieval and repository functions (2002 – 2003) and Geographical Online Analytical Processing (2004 -). The GFIS Metadata Repository is a component to store integrated metadata from multiple nodes for efficient querying and analysis. The metadata repository shall ensure high performance, consistency, stability extensibility and sophisticated queries. The goal of the GFIS Information Retrieval is to develop tools that facilitate the rapid integration of heterogeneous forest information sources that may include both structured and unstructured data.

IUFRO European Regional Conference in Copenhagen, Denmark

The European Regional Conference in Copenhagen (27 – 30 August 2002) will be a milestone in the life of GFIS. It is planned to hold a two-hour presentation-cum-launching ceremony, designed as a lively event to convince participants that GFIS is a useful tool for their future work. The programme includes a presentation of the current status of GFIS development, a demonstration of a real-time global multi-host search using the first prototype of the GFIS software, and a real-time communication (e.g. by phone) during the GFIS presentation with a researcher working with GFIS somewhere in the world. Prof. Dr. Niels Elers KOCH, Director of the Danish Forest and Landscape Research Institute, will moderate this event, and many national and international partners and representatives of IUFRO are expected to participate. IUFRO President Dr. Risto Seppälä will be there and make a welcome speech and closing remarks.

Dear reader, as a potential user of GFIS, your contribution is of great importance! Have a look at our homepage **http://www.iufro-gfis.net/** and tell us what kind of information you expect from the Global Forest Information Service. You will find a discussion forum on this webpage. Your comments and suggestions are most welcome.

Contact persons:
Special Programme Coordinator:
Martin Nöbauer,
IUFRO
c/o Federal Forest Research Institute,
Sekendorff-Gudent-Weg 8
1131, Vienna, Austria.
Tel: +43 (0) 1 877 0151-14
Fax: +43 (0) 1 877 9355
Noebauer@forvie.ac.
Http://www.iufro.boku.ac.at
at and GFIS Task Force Coordinator
Risto Päivinen risto.paivinen@efi.fi

SAFORGEN Programme

SAFORGEN Programme is the IPGRI Sub-Saharan African Forest Genetic Resources Programme based in Cotonou, Benin.

The Programme would like to assess and develop a database on the forestry networks in Sub-Saharan Africa. The Programme will therefore appreciate receiving from any holder, information on the network and its contact address this includes:

- Name of the network
- Name and address ofthe network contact
- "Its area of interest"
- Anyadditional information or document on the network

This information should be sent to SAFORGEN Coordinator

Address:

Eyog Matig Oscar, Docteur d'Etat
Coordinator of IPGRI/Sub-Saharan Forest Genetic Resources Programme (SAFORGEN),
c/o IITA 08 BP 0932 Cotonou, Benin
Tel.: 229 350188 / 350553 / 350600
Fax: 229 350556
E-mail: o.eyog-matig@cgiar.org

The International Plant Genetic Resources Institute (IPGRI) is supported by the Consultative Group on International Agricultural Research
http://www.ipgri.cgiar.org
http://www.ipgri.org

Journal of Tropical Forest Science

The Journal of Tropical Forest Science (JTFS) is concerned with the development of tropical forest sciences. It welcomes papers relevant to the field. It also includes short articles, notes, and letters to the editor, book reviews and announcements. English is the official language of the journal. At a regular basis special issues appear, such as one on secondary forests published in October last year.

The journal is published quarterly by the Forest Research Institute Malaysia. Editorial office, subscriptions, announcements and enquiries:
Forest Research Institute Malaysia
Kepong, 52109 Kuala Lumpur
Malaysia.
Tel.: 603-62702155; Fax: 603-62767753;
Email: ska@frim.gov.my

Exchange of Scientific Papers for publishing

The Ghana Journal of Forestry published by the Forestry Research Institute of Ghana was founded some eight years ago with a maiden publication of Volume 1:1994.

The Journal publishes papers on various subjects of forestry in the tropics and related sciences with particular reference to studies in the humid tropics. Only articles that have been reviewed by renowned researchers and recommended for publication are published. All accepted articles are published free of charge. The journal is subscribed to by more than 300 individuals, groups and institutions from home and abroad.

The Editorial Board of the Journal is proposing free exchange of publishable papers with Editors of reputable Journals. Under this arrangement, the list of titles of papers to be exchanged will be sent to Editors of collaborating Journals who will select one or two papers of interest. The full papers will then be sent to the Editor of a collaborating Journal with the consent of the Author(s) of the papers. The Author(s) will have to meet all the editorial guidelines of

that Journal. This arrangement, we hope, will not only assist scientists of collaborating Institutions to publish in diversified journals but could facilitate research collaboration among Scientists and institutions. Volume II of the Ghana Journal of Forestry is due to come out in the last quarter ofthe year and it is our hope that the first batch of about six exchanged papers from collaborating Journals will be published.

We take this opportunity to inform you that subscription to our Journal is only USD $65 per annum of two issues including postage. All cheques made payable to the "Forestry Research Institute of Ghana".

We hope you will embrace the proposal for our mutual benefit and look forward to hearing from you at your earliest convenience.

A. A. Oteng-Amoako [Ph.D]
Editor-in-Chief
Ghana Journal of Forestry,
Forest Research Institute of Ghana
P.O. Box 63,
UST Kumasi.
Email:oamoako@forig.org
Fax No 233-51-60121

Call for Ideas
CGIAR Challenge Programs

The Consultative Group on International Agricultural Research (CGIAR) invites all interested parties to suggest concepts for Challenge Programs that could be financed by the CGIAR and its partners. Details are provided below in a "Question & Answer" format . Recipients are encouraged to share this note with their respective constituencies.

1. What is the CGIAR?
The CGIAR (www.cgiar.org) is an association of 58 public and private members who support a system of 16 international agricultural research centers that generate public goods for the benefit of developing countries. The Food and Agriculture Organization of the United Nations (FAO), United Nations Development Programme (UNDP), International Fund for Agricultural Development (IFAD), and the World Bank are the CGIAR's co-sponsors. More than 8,500 CGIAR scientists and scientific staff work in more than 100 countries around the world, harnessing the best of cutting-edge science to increase food security, reduce poverty, and protect the global environment.

2. What is a Challenge Program?
A CGIAR Challenge Program (CP) is a time-bound, independently-governed program of high impact research, that targets the CGIAR goals in relation to complex issues of overwhelming global and/or regional significance (and with global impact), and requires partnerships among a wide range of institutions in order to deliver its products.

3. What is an idea for a CGIAR Challenge Program?
An idea or theme for a CGIAR CP is one that: addresses an issue of overwhelming significance. The issue addressed can be global, regional or sub-regional in importance, but with a global impact; fits within the CGIAR mission and goals; is likely to generate significant outputs and impact.

4. Who can submit ideas for Challenge Programs?
The CGIAR invites all stakeholders to submit ideas which could become agricultural research and development programs of global relevance. Submission of ideas, presented as short Concept Notes (2-4pages) is the first step in a competitive process leading to the identification and preparation of CPs.

5. How should the ideas be submitted?
Ideas may be transmitted to the CGIAR

System Office preferably by e-mail to the following address: **cpideas@cgiar.org.** Proponents who have limited e-mail access may fax the concept notes to the System Office at the Science Council Secretariat: **Fax no. (39-06) 570-53298.**

6. Does the CGIAR provide financial support for submitting ideas?
No, resources are not available from the CGIAR at this phase of CP development.

7. Is there a deadline for submitting ideas?
The generation and submission of ideas is a continuous process. Evaluation of ideas will be conducted periodically every year, depending on the number submitted.

8. Will the submitted ideas be publicized?
The idea titles and names of proponents will be posted on a special page for CPs at the CGIAR web site (www.cgiar.org).

9. How will the submitted ideas be evaluated?
The Science Council (SC) of the CGIAR is responsible for the evaluation and recommendation to the Executive Council of the ideas submitted by all stakeholders. Once endorsed by the Executive Council, the ideas will be submitted to the CGIAR for final approval.

10. How will one know if an idea submitted has been selected?
The proponent of the selected idea will be formally notified by the CGIAR System Office. All the selected ideas and the names of proponents will also be posted on a special page for CPs at the CGIAR web site.

11. What will happen to the selected ideas?
The selected ideas will be promoted to the next stage of the process (phase 2). The Executive Council will issue calls for submission of pre-proposals on the selected ideas.

12. If an idea is selected, will the pre-proposals on that idea be eventually funded?
Not necessarily. Once an idea is selected, open and competitive processes will also be implemented at the succeeding phases described in the document titled "Process and Guidelines for Developing and Implementing Challenge Programs". (see Challenge Program web page) There is no guarantee that an individual, institution or group who submitted a selected idea will be awarded a grant.

13. What will happen to the other ideas submitted but not selected?
The list of submitted ideas will be kept in the CGIAR web site. Some of the ideas could be developed by the proponents and other interested parties into proposals that may be submitted to non-CP funding sources.

14. When will the next phase, i.e. development of pre-proposals, be launched?
As soon as the CGIAR approves the ideas or themes recommended by the Science Council andendorsed by the Executive Council, a call for submission of pre-proposals will be issued.

15. Where can additional information on the CGIAR Challenge Programs be found?
All information relating to the different phases of Challenge Programs are available on the CGIAR website. This site, in addition to presenting detailed information on the Consultative Group, its activities and major impacts, also provides linkages to the sixteen international agricultural research centers (known as Future Harvest Centers) supported by the CGIAR.

By Jelle Maas

For the FAO Global Forest Resources Assessment 2000 (FRA 2000) please see **http://www.fao.org/forestry/fo/fra/main/index. jsp** The report reflects on the current condition of our planet's forest resources and the events contributing to the present situation.

The World Resources Institute has prepared a briefing note in response to the launch of the Forest Resources Assessment 2000, commenting on the methodology and principal findings of the new FAO report. **http://www.wri.org/forests/fra2000.html**

Global Forest Watch is an international data and mapping network that combines on-the-ground knowledge with digital technology to provide accurate information about the world's forests. Global Forest Watch started working in four pilot countries in 1997; Cameroon, Canada, Gabon and Indonesia. They now also work in Chile, Russia, Venezuela, the Democratic Republic of Congo (DRC), and the United States; and are planning to expand to Brazil in the near future. More information at: **http://www.globalforestwatch.org/**

The Global Vegetation Monitoring (GVM) Unit of the Institute for Environment and Sustainability (Joint Research Centre, Ispra, Italy) has a mission is to provide accurate information on changes in the world's vegetation cover as needed for EU policy in the areas of environment, development and external affairs. The focus is provision of information and methodologies that support the implementation of international environmental treaties and conventions (such as the Framework Convention on Climate Change, the Convention to Combat Desertification and the Convention on Biological Diversity) and to support the EU's aid and development programmes. Research concentrates on the generation of information and products on forest condition, fire dynamics, land cover change and physical and biophysical parameters for bio-geological models through the quantitative analysis of data from Earth observing satellites. Products (including scientific publications, algorithms, time-series of measurements, maps, images, models, statistics, assessments and reports) are made available to policy-makers, the science community, space agencies and where appropriate, to the general public. **http://www.gvm.sai.jrc.it/**

The Carbon offset verification of forest ecosystems project presents a new method for estimating above-ground biomass, and hence carbon stocks of conifer forests utilising remote sensing techniques and carbon partition modelling. **http://www.eci.ox.ac.uk/carbon/default.htm** The lead partner in the project is Oxford University. Other partners include: Institute of Terrestrial Ecology; University of Wales, Swansea; SGS UK Ltd; EcoSecurities Ltd; Biffa Waste Ltd. The project is funded under the Earth Observation LINK Programme supporting innovative Earth Observation data applications research. **www.nerc.ac.uk/funding/thematics/eolink/**

Forest Information Update (FIU) is a free weekly email newsletter on the inventorying and monitoring of natural resources. FIU is produced by Forest Information Services **http://home.att.net/~gklund/** and is supported by organisations, agencies and individuals working in the natural resources field. All the FIU's are now posted on the GAOF portal **www.foresters.org/portal** under topic (Forest Information Update). Currently FIU

is sent to about 6,000 email addresses world-wide.

The mission of the IUFRO Task Force on Global Forest Information Service (GFIS) is to develop a strategy for, and implement, an Internet-based metadata system that will provide coordinated worldwide access to forest information. The resulting system will provide multiple benefits to information users and providers including, facilitating user-friendly access to a greater amount of information, and improving the dissemination and quality of forest-related data and information. **http://iufro.boku.ac.at/iufro/taskforce/hptfgfis.htm.**

http://www.gofc.org/gofc/index.html
Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) is a coordinated international effort working to provide ongoing space-based and in-situ observations of forests and other vegetation cover, for the sustainable management of terrestrial resources and to obtain an accurate, reliable, quantitative understanding of the terrestrial carbon budget. Originally developed as a pilot project by the Committee on Earth Observation Satellites (CEOS **www.ceos.org)** as part of their integrated Global Observing Strategy, GOFC-GOLD is now a panel of the Global Terrestrial Observing System (GTOS **www.fao.org/gtos/index.html**).

The UNEP World Conservation Monitoring Centre (WCMC) produces integrated and accessible information on the conservation of the world's forests and their biodiversity, as well as providing support in managing this information

www.unep-wcmc.org/forest/homepage.htm

The 'User Requirements Study for remote sensing based spatial information for the sustainable management of forests' is available in downloadable PDF format at:

http://www.itc.nl/forestry/URS/ Spanish and French versions of the executive summary are also available. The study aims to address the following issues:

- Assessment of requirements for spatial information in order to support sustainable forest management;
- Preliminary evaluation of the extent to which these requirements for spatial information can be met by existing and planned remote sensing systems;
- Identification of the requirements for, and components of, an improved information supply mechanism in the form of an "end-to-end" information system.

The User Requirement Survey questionnaire and an overview of available literature on spatial information needs can be found at Neonet **http://apex.neonet.nl/** Netherlands Earth Observation NETwork.

Last but not least, the ETFRN topics page on remote sensing and GIS

http://www.etfrn.org/etfrn/topics/remotesensing/index.html

provides access to all GIS and remote sensing related information on the ETFRN website; including the links page on this theme, the results of the ETFRN Directory search, as well as meetings and training courses on this topic. In addition, the 'searchable databases' link leads into the search results of web databases maintained by other organisations.

The International Foundation for Science - Call for Research Grant Applications from Developing Country Scientists

The International Foundation for Science (IFS) provides support to young Scientists of merit in developing countries by awarding research grants and providing grantees with additional services such as travel grants and purchasing assistance.

The IFS supports research related to the renewable utilisation of biological resources in areas such as crop and animal production, forestry, food science, natural products and fisheries, as well as research on sustainable utilisation and conservation of natural ecosystems, including themes such as water management and biodiversity. Proposals for projects may address biological, chemical or physical processes as well as social and economic relationships important in the conservation, production, and renewable utilisation of the biological resource base.

Research grants are awarded up to a maximum value of $12,000 USD for a period of one to three years and may be renewed twice. They are intended for the purchase of equipment, expendable supplies and literature. Applications must be citizens of, and carry out the research in, a developing country. Specificallyexcluded are countries in Europe, including Turkey and Cyprus, as well as countries of the former Soviet Union. Argentina and Uruguay are also not eligible to receive support. As well as being under the age of 40 (under 30 for applicants from China) and at the start of their research career, candidates must possess a higher academic degree, which should be at least an MSc or equivalent.

Applications are made on the application form in English or French, which is available from the IFS Secretariat or can be downloaded from the website.

International Foundation for Science,
Grev Turegatan 19,
S-114 38, Stockholm,
Sweden.
Fax: +46 8 5458 1802
Email: info@ifs.se
Http://www.ifs.se

ITTO Fellowships Offered

ITTO offers fellowships through the Freezailah Fellowship Fund to promote human resource development and to strengthen professional expertise in member countries in tropical forestry and related disciplines. The goal is to promote sustainable management of tropical forests, the efficient use and processing of tropical timber, and better economic information about the international trade in tropical timber.

Eligible activities include:

- participation in short-term training courses, training internships, study tours, lecture/ demonstration tours and international/regional conferences;
- technical document preparation, publication and dissemination, such as manuals and mongraphs; and
- post-graduate studies.

Priority areas: eligible activities aim to develop human resources and professional expertise in one or more of the following areas:

- improving the transparency of the tropical timber market;
- improving the marketing and distribution of tropical timber species from sustainably managed sources;

- improving market access for tropical timber exports from sustainably managed sources;
- securing the tropical timber resource base;
- improving the tropical timber resource base, including through the application of criteria and indicators for sustainable forest management;
- enhancing technical, financial and human capacities to manage the tropical timber resource base;
- promoting increased and further processing of tropical timber from sustainably managed sources;
- improving the marketing and standardisation of tropical timber exports; and
- improving the efficiency of tropical timber processing.

In any of the above, the following are relevant:

- enhancing public relations, awareness and education;
- improving statistics;
- research and development; and
- sharing information, knowledge and technology.

Selection criteria: Fellowship applications will be assessed against the following selection criteria (in no priority order):

- consistency of the proposed activity with the Program's objective and priority areas;
- qualifications of the applicant to undertake the proposed fellowship activity;
- the potential of the skills and knowledge acquired or advanced under the fellowship activity to lead to wider applications and benefits nationally and internationally; and
- reasonableness of costs in relation to the proposed fellowship activity.

The maximum amount for a fellowship grant is US$10 000. Only nationals of ITTO member countries are eligible to apply. The next deadline for applications is 4 September 2002 for activities that will commence May and November each year.

Further details and application forms (in English, French or Spanish) are available from
Dr Chisato Aoki,
Fellowship Program,
ITTO; Fax 81-45-223 1111;
fellowship@itto.or.jp

The Lincoln Park Zoo Neotropic Fund

The Lincoln Park Zoo Neotropic Fund supports field research in conservation biology throughout Latin America and the Caribbean. The fund emphasises support of graduate students and other young researchers, particularly those from Latin America.

Between five and fifteen projects are supported each year. Awards are seldom greater than US$7500 and most awards fall in the range of $3000-$6000. Initial support is for up to 12 months from the date of award. Maximum duration of support is 2 years. Deadline for receipt of Neotropical proposals is 1 September.
For information and application procedures, contact:

Lincoln Park Zoo Neotropic Fund,
Department of Conservation and Science,
Lincoln Park Zoo,
Chicago, IL, 60614,
USA
Email: conservation@lpzoo.org
Http: www.lpzoo.com/conservation

Source: What's Up, The newsletter of the International Canopy Network (ICAN) Vol. 8 No. 1 Fall, 2001

Training-Course in Forest Management, Inventory and Monitoring

The Department of Forest Biometry, University of Freiburg/Germany offers training courses from Sept 02 to Sept 13 and Sept 16-27, 2002 in the areas forest management, inventory and monitoring. The objective of the courses is to familiarize forest managers, project personnel, and scientists with methods of forest inventory and monitoring systems and procedures for sustainable yield management. More information and subscription forms can be found under: **www.forst.uni-freiburg.de/biometrie/training-courses**.

Participatory monitoring and evaluation of biodiversity: results of the ETFRN e-workshop

By Anna Lawrence

Participatory biodiversity assessment (PBA) provides a way of reconciling the need for national assessment, monitoring and reporting; with the increasing focus on involvement of all relevant stakeholders and particularly indigenous / local communities. PBA, i.e. biodiversity assessment by and with non-scientists can provide short-cuts to scientific assessments; provide data which is useful to local resource managers in a way which scientific assessment is not; link in to scientific information which is relevant to local needs; enhance inclusivity of decision-making.

The workshop sought to elucidate: the ways in which values affect the assessment process; approaches and methods in relation to objectives and information needs; the costs and benefits; and priorities for institutional / policy change to create an enabling environment. 300 Participants from 55 countries included the CBD secretariat, international donors and NGOs, universities, grassroots organisations.
All have different reasons for PBA, and varying information needs. Most national or regional decision makers expect information in quantitative spatially comparable forms. Participatory processes may not supply this so readily (or efforts to quantify may distort local perceptions) but may provide qualitative information of different and complementary value. It is very important to match objectives with methods and stakeholders, rather than apply a blanket set of recommendations to all situations which appear to need a participatory approach.

Assessment is affected by value judgements, regardless of who is conducting the assessment. It is often assumed that local people value only useful species; but research reveals spiritual, cultural and ethical values; and that species or habitats with non-material values may be at least as important as those with uses.
In documenting methods, the main debate was between those who sought local knowledge to develop wider-scale quantitative measures of change, and those who emphasised the importance of strengthening community capacity to make decisions about resource management, which in turn enhances their motivation to conserve. It appears that methods linking local and scientific assessments or values are scarce, and more work still needs to be done on the analysis and communication of results.

Participatory approaches take more time and different skills compared with scientific surveys, but there are benefits that are worth this cost. The potential for real synergy between different actors depends not only on good communication, but also on realistic understanding of the costs and benefits of involving different actors in such assessments, and above all ensuring that local people can take part in analysis and decision-making. The *process* of negotiating, observing and analysing indicators may bring about more change than the data gathered itself, and in particular can enhance benefit-sharing, as well as be more sustainable than externally led processes. However to achieve this, changes in education, training of scientists, and institutional networking are needed.

The conference ran from 8-25 January 2002. Please see the conference website:
http://www.etfrn.org/etfrn/workshop/biodiversity/index.html

For further information please contact:
Dr Anna Lawrence,
Environmental Change Institute,
5 South Parks Rd, Oxford
OX1 3UB, UK.
tel. +44 1865 281214 fax. +44 1865 281202
email:anna.lawrence@eci.ox.ac.uk

Bringing Back the Forests: Policies and Practices for Degraded Lands and Forests

Kuala Lumpur, Malaysia, 7-10 October 2002

A four-day, international conference on solutions to rehabilitation challenges in the forests and grasslands of Asia and the Pacific. The objectives of the conference are to:

- Review the current status of rehabilitation efforts and knowledge;
- Identify critical issues of policy and implementation that must be addressed if rehabilitation is to become a key component of forest management; and
- Encourage cross-disciplinary learning and partnerships among rehabilitation practitioners, resource managers, policy makers and other concerned stakeholders.

Conference organisers are the Asia Pacific Association of Forestry Research Institutions (APAFRI); Food and Agriculture Organisation of the United Nations (FAO); Forestry Research Support Programme for Asia and the Pacific (FORSPA); Forest Research Institute Malaysia (FRIM); and International Union of Forest Research Organisations (IUFRO).
For further details, and to register online, visit the conference homepage at http://apafri.upm.edu.my/reconf/index.html.

Alternatively, you can contact:
Mr Alias Abdul Jalil
APAFRI Secretariat Tel: +6-03-6272 2516
E-mail: foreconf@apafri.upm.edu.my

Genomic Approaches to Forest Tree Stress Tolerance - Short Course

This is to announce an EU funded short course / advanced research workshop to be held on September 16 - 27, 2002 in Crete, Greece and entitled "Genomic Approaches to Forest Tree Stress Tolerance".

The course should be an exciting, informative and enjoyable one, with confirmed speakers/lecturers including:

David Neale
Christophe Plomion
Giuseppe Vendramin
Nikolaos Panopoulos
Weber A. Neves do Amaral
F. A. (Phil) Aravanopoulos
Malcolm Campbell
Andreas Doulis

The course will cover the following topics, using a combination of lectures, laboratory practicals, and tutorials:

Stress Resistance Mechanisms, Resistance Engineering
Population Genetics, F-statistic, Genetic Distances, Linkage disequilibrium

Paternity Analysis
Genetic Designs and Linkage analysis
Quantitative Trait Loci (QTL) Mapping
Marker Assisted Selection
DNA fingerprinting
Functional Genomics, Response Mapping
Comparative Genomics
EST, SNPs, DNA arrays

More information on this course can be found at http://www.maich.gr/environment/news/genomics.html

Adaptive Management for Biodiversity Conservation: a collective learning approach in conditions of social and ecological change

Pre-announcement IAC-WU Seminar 2002

Welcome to this year's IAC-WU Seminar on Adaptive Management for Biodiversity Conservation. The seminar is part of the IAC Training Programme on Leadership and Adaptive Management in Forest Environments (LAMFE), to be held from September to November 2002. In this programme we bring together people from organisations involved in natural resources management to explore new ways towards sound and equitable land use. At the occasion of this seminar, audience from the Netherlands and abroad will join the international participants of the LAMFE training programme.

Biodiversity conservation is one of the important issues of this year's international environmental policy debate. Parties to the Convention of Biodiversity Conservation meet in April in The Hague to discuss the progress made. The topic is also one of the major subjects of our LAMFE training programme. Therefore, we want to focus this year's seminar on adaptive management as an approach which balances biodiversity conservation and livelihood sustainability.

Biodiversity conservation is only one of the many interests of different stakeholders in the use of natural resources. These stakeholders often have competing interests in the use and conservation of various natural resources. The interests depend on both regional ecological and socio-economic conditions, livelihood conditions of local communities and institutional arrangements for managing the natural resources. At present these conditions are often undergoing a rapid change. The complex and dynamic interactions between these conditions make decision-making for biodiversity conservation prone to uncertainty and surprise. Adaptive management addresses this situation by involving stakeholders in a decision-making process based on experiential learning. Active monitoring and feedback from the results of decisions are core aspects of this iterative process. Learning takes place collectively and is therefore also called social or collaborative learning.

At the seminar we will explore the potential of adaptive management to create space for biodiversity conservation in decision-making at the local level. This is particularly important when considering biodiversity conservation in conditions where local people's livelihoods are at stake, and where poverty, land degradation and loss of biodiversity have entered a vicious spiral.

Some of the issues to explore are: What is the potential of social learning for change, aiming both at improved livelihood and biodiversity conservation? How to facilitate a collaborative process involving actors with very different agendas? What are the implications of social learning for the formulation and adaptation of management plans? What management types are most appropriate in different circumstances? What is needed in terms of institutional environment, leadership and organisational change? Which kind of conflicts can we expect at different levels and how to deal with these conflicts? What is the influence of market forces and of external policies? How can networking and knowledge management contribute to upscaling the lessons learnt? In order to explore the opportunities and limitations, we will support our discussions with appropriate case materials.

The International Agricultural Centre (IAC) organises this seminar in collaboration with Wageningen University and other institutions and organisations in the Netherlands. The seminar will be held from 21-23 October 2002 in Wageningen, the Netherlands.

The closing date for application is 15 September 2002. More information can be obtained from Ms. E. Rippen at the following e-mail address: e.rippen@iac.agro.nl
Tel: +31 317 495 495
Fax: +31 317 495 395

Functional Grouping of Tropical Trees

By Jan Dick

One square hectare of tropical forest may contain as many as 500 trees of over 10 cm diameter representing over 200 different species. Classifying tropical trees into 'functional' groups rather than taxonomic groups is currently one of the most rapidly expanding areas of forest management and biodiversity research. Between the 10-13th December 2001, over 40 European scientists and practioners working on tropical forests met at Edinburgh, Scotland to discuss and learn together about the important topic of 'functional groupings'.

They define functional groups as a grouping of organisms that respond in a similar way to environmental factors. This meeting sponsored by the Human Potential Programme of the EU was the first to specifically bring European scientists together to exchange ideas on this topic. The meeting was judged by all to have been a great success because so many young and senior scientists came together with a real willingness to develop the tool of functional groups. A clearer understanding of tropical forests dynamics is needed now for a wide range of management and policy issues including biodiversity, conservation, global change, socio-economic and poverty alleviation.

The meeting started with internationally recognised keynote speakers presenting reviews of the functional group knowledge to date and these were interspaced with talks on current unpublished papers. During the next two days the participants discussed and agreed a list of important traits necessary to define these groups and many offered to send relevant methodologies for measuring the traits, which the organisers, Edinburgh Centre of Tropical Research (ECTF) agreed to post on the web www.nbu.ac.uk/tropical/CONFHome.htm

The Scientific committee including researchers from CIRAD-FORÊT, France; University of Wageningen, Netherlands; University of Edinburgh, and Centre for Ecology and Hydrology, Scotland were delighted with the consensus of the meeting. It is hoped that this group can help get a clearer understanding of tropical forests dynamics and advise on the management of these important global resources.

Dr Jan Dick
Center for Ecology and Hydrology, Edinburgh
Bush Estate PENICUIK
Midlothian EH26 0QB
Scotland, UK
Tel - (44)-0131-445-4343
Fax - (44)-0131-445-3943 Email: jand@ceh.ac.uk
Web - www.nbu.ac.uk/tropical

The Field Station "La Gamba" in Costa

Rica

The Bosque-Esquinas, one of the most species-rich forests of Central-America, is located in the south eastern part of Costa Rica. The endangered forest could be saved with the financial help of an Austrian non-profit organization which was initiated by the musician Univ-. Prof. Michael Schnitzler.

In 1993 a field station near the village La Gamba, which is now called the"Tropenstation La Gamba", was established. The station consists of a fully renovated farmhouse and annexes and is situated on the border of primary rainforest. At present accommodations for c. 14 (18) persons are available. The station has an electricity supply and is equipped with a kitchen, bathrooms, computers, cellular phone, microscopes, drying and collecting equipment, photo herbarium, and a small library. It is an excellent base for carrying out scientific work or for simply enjoying and exploring the lush rainforests. Since several years excursions and courses on tropical biology for students and for naturalists are offered by the staff of the station. The "Scientific Report 1993-2001" (in German) presents an overview on activities, publications and projects around the Tropenstation. It can be ordered from the following address:

Information and reservation:
Mag. Werner Huber & Mag. Anton Weissenhofer Institut für Botanik,
Rennweg 14, 1030 Wien,
Austria.
Tel. ++43-1-4277-54083,
Fax ++43-1-4277-9541
Email: Tropenstation_LaGamba@web.de
Homepage: www.regenwald.at

ASB Website

We are pleased to announce the completion of the ASB website (www.asb.cgiar.org). The site's new features, include information on ASB activities by region and topic, as well as a fully-searchable ASB Publications Database (developed with the help of Dennis Lisbjerg of BIOS, dl@bios.dk).

The ASB Publications Database currently lists 375 publications (in a variety of media) that were produced in part or entirely under the auspices of the ASB Programme. A subset of these publications are available in down loadable form, and in all cases e-mail, contact details are provided for further information. The database is set up to perform both standard, unlimited searches (by year, author, title, etc.) as well as limited searches by region, topic or publication type. Where available, abstracts and/or links to full text via on-line journals are provided in the "all details" section.

Many of you have already provided links from your organization's website to the ASB website (thank you). With this message, we are hoping to establish more mutual links, and would be very grateful if you could spread the word within your respective organizations about the site.

The ASB website provides a new medium for rapid and extensive communication with the rest of the world about ASB activities. From its launch in May 2001 through year-end, the site had approximately 25,000 hits, with an average duration per visit of over 10 minutes. The site had 2,869 'unique' visitors, among which 492 were repeat visitors. We expect these numbers to grow quickly as we establish more mutual links with partners and other organizations.
Many thanks for taking the time to browse the new site. We will be delighted to receive your comments and reactions.

Please contact:
Jessa Lewis
Global Coordination Office
Alternatives to Slash-and-Burn (ASB) Programme
+1 (858) 455 0738
J.Lewis@cgiar.org www.asb.cgiar.org

The Seventh Round Table Conference on Dipterocarps

“Dipterocarps in the new millennium: Conservation, Domestication & Utilisation”

7th-11th October 2002, Kuala Lumpur, Malaysia

Jointly organised by:
Asia Pacific Association of Forestry Research Institutes (APAFRI).
The International Union of Forestry Research Organizations (IUFRO Working Party S1.07-17),
Forest Research Institute Malaysia (FRIM), University Putra Malaysia (UPM)
Forestry Departments Penisular
Forestry Department Sabah
Forestry Department Sarawak

The organisers acknowledge the initial funding by CIDA through the Tree Link Project to prepare and distribute this first announcement. The organising committee will be a wide range of funding agencies seeking support from to offset costs from the 7th Round Table Conference.

Background
We have now stepped into the 21st century. The last Round Table Conference on Dipterocarps which was the sixth in the series was held at Bangalore, India in 1999. At the Bangalore meeting several resolutions were adopted by the participants. The resolutions covered the fields of conservation, domestication and utilisation of the dipterocarp family with the aim that more in-depth studies on these disciplines must be carried out and new knowledge generated in time for the next round table conference. After three years, the time is just right for this next Conference, which is now being organised .

The Seventh Round Table Conference will be convened in Kuala Lumpur Malaysia. It is anticipated that at this Conference, new research information on the species in the family of Dipterocarpaceae will be actively deliberated upon. The aspirations of this international conference therefore is to gather all researchers, policy makers, wood technologists, educationalists, conservators and foresters who work on this family from around the globe to participate and to exchange information at this Round table. The attendance of participants from all the regions will provide more networking opportunities for further collaborative work and a platform for fostering closer ties and exchange of information among all involved with dipterocarps.

Objectives of the 7th Round Conference
- To explore, exchange and update scientific and technological findings and information on dipterocarps;
- To provide a forum for dipterocarps researchers to present the results of their research and projects relating to conservation, domestication, utilisation and products of dipterocarps;
- To identify new directions and strategies for sustainable management of dipterocarps.
- To identify opportunities to develop collaboration among researchers and to strengthen the networking among them.

Scope and Topics
- Biology, physiology, ecology and ecophysiology of Dipterocarpace
- Silviculture and Management of Natural Dipterocarps forests
- Silviculture and Management of Dipterocarp plantations
- Economics and Social Aspects of

- Dipterocarp Forests
- Improved wood technologies and utilisation and other forest products of dipterocarps

The Conference will be of value to:
Researchers
Academicians
Decision/Policy makers
Forest Managers/Foresters
NGOs
Planters
Funding Agencies

Exhibition
Exhibition on products/services will be held during the conference. For further information please contact the secretariat.

Meetings
A satellite meeting of the Malaysian working group members will be held on the 11th October 2002. New members and observers are cordially invited for the meeting.

Special interest groups wishing to organise their own country meeting should inform the Secretariat in advance to facilitate room etc for such meeting

Language
The language of the conference is English.

Registration Fee
The conference fee, which covers a full set of papers/proceedings, lunches, welcome dinner and conference bag are as follows:

Participants
Local: Government- RM 600
Other- RM700
Foreign: USD 300
Local student: RM200 (without dinner)
(IUFRO or APAFRI members are entitled to a 30% Discount on the registration fees)
Local participants or students are encouraged to make payment for registration either by cheque or credit card. Payment should be made in favour of "APAFRI" For Overseas participants, payment should be made through bank draft or credit card(VISA/Master Card). Those who have confirmed their participation, please pay by 15th July 2002 to following address: See under Exhibition

Venue
The conference will be held at one of the leading hotels in Kuala Lumpur

Enquiries
APAFRI-Secretariat
(Attn: Dr Baskaran Krisnapillay / Mr Alias Abdul Jalil)
c/o Forest Research Institute Malaysia
Kepong 52109 Kuala Lumpur
Tel:603-6272 2516, 603-6277 3207
Fax:603-6277 3249
E-mail : dipconf@apafri.upm.edu.my
Website : www.apafri.upm.edu.my
Registration Form is available at the website at http:/www.apafri.upm.edu.my
You may register online.

CATIE's Database of Forest Seeds

Publications and Courses

CATIE takes an interest in assuring the availability of forest seeds of high physical and genetic quality. It provides services to enhance the results of (re)forestation programmes. Besides information on aspects such as collection and processing of seeds, biology, genetic improvement, management of seed sources and documentation CATIE also provides training courses in these fields. CATIE can be contacted at:

Banco de Semillas Forestales,
CATIE, Apdo: 7170 Turrialba,
Costa Rica.
Tel.: (506) 556 1933. Fax: (506) 556 7766.
Email: arogrigu@catie.ac.cr,

or bsf@catie.ac.cr.

Email newsletter on Reduced Impact Logging in Francophone Africa

RIL-Afrique- L est un bulletin électronique portant sur les pratiques d'exploitation forestière à faible impact en Afrique. Il veut être l'expression d'un réseau de communications, d'échanges et de discussions entre les différents acteurs du secteur forestier (professionnels et non) et il s'adresse plus particulièrement à l'Afrique francophone. RIL-Afrique-L est un service offert par la Division des produits forestiers (FOP) de la FAO.

Informations pratiques concernant la liste Ril-Afrique-L

Pour s'inscrire à la liste, envoyer un message à l'adresse suivante:
mailserv@mailserv.fao.org
en laissant la ligne objet vide et en rentrant la seule phrase: subscribe RIL-Afrique-L

Pour faire parvenir une contribution à la liste, envoyer un message à
l'adresse suivante:
RIL-Afrique-L@mailserv.fao.org

Pour toute question ou problème technique, envoyer un message à
RIL-Afrique-L@mailserv.fao.org

Si vous voulez annuler votre inscription, il vous suffit d'envoyer un message à : mailserv@mailserv.fao.org
en laissant la ligne objet vide et en rentrant la seule phrase: unsubscribe RIL-Afrique-L

Votre information est sûre: nous ne distribuerons pas votre adresse ou d'autre information sur votre inscription à des tiers.

Nous espérons et attendons des abonnés tout article intéressant qui contribuera au débat et à la connaissance.

Le coordinateur de RIL-Afrique-L

Quantitative Colorimetry in the Cielab and Cielch System Applied to the Development of a Catalogue of Colours of the Brazilian Tropical Woods.

José Arlete Alves Camargo, Joaquim Carlos Goncalez, Gérard Janin,

A colour catalogue of 400 species of brazilian tropical wood was produced to quickly identify and classify the wood colours. The colour of the wood, associated with the surface patterns, are the most important characteristics for the end-uses in the wood furniture industry. The quantitative colorimetry technology enables us to obtain numerical evaluation of the wood colours through the CIELAB and CIELCH system, with the values of the characters L*,a*,b*,C, h. This will also allow us to identify which woods belong to the same "cluster of the colours".
One of the biggest benefits of the catalogue is that it facilitates the choice of wood species which show the same, or quite similar, colorimetric attributes for substitution of species, and so to avoid extinction of these species in the forest .

José Arlete Alves Camargo,
Laboratório De Produtos Florestais,
Ibama , Brasilia

Joaquim Carlos Goncalez, Gérard Janin,
Departamento Florestal, Universidade De Brasilia
Email: gjanin@ub.br

By Bert van der Linden

Global Forest Resources Assessment 2000 - Main Report

FAO Forestry Paper (2001)

This publication constitutes the principal report of the Forest Resources Assessment (FRA) 2000. The FRA compiled and analysed a wide range of information about the extent, composition, protection and utilisation of forests for each country. Special attention was given to estimating the rate of change of forest resources and to documenting the factors implicated in these changes. Two approaches were used to the global assessment. The most important one was to collect data on field level and to aggregate information working upward to country level and eventually global level. This approach was supplemented by an another one, which looks down from above by means of satellite remote sensing. The information and knowledge provided by countries form the backbone of the FRA 2000.

The main findings on forest area and area change are presented in Part I, Chapter 1. Part one also presents the results of studies on wood volume and biomass, plantations and other key parameters studied in FRA 2000. Part II presents findings organised by geographic region and subregion. Part III describes the methodologies and processes underpinning the assessment. The development of a comprehensive forestry information system (FORIS) which was created to assemble and disseminate the FRA 2000 results is also described.

The publication is published in English, French and Spanish and is also available on the FAO Website at http://www.fao.org/forestry/fo/fra/main/index.jsp; the web site also provides more detailed data by country in the country profiles.

For further information contact
FAO,
Vialle delle Terme di Caracalla,
00100 Rome,
Italy.
Tel.: +39 065 7051. Fax: +39 065 7053 152.

The World's Forests Rio+8 policy, practice and progress towards sustainable forest management

M. Söderland & A. Pottinger (2001)

The Commonwealth Forestry Association (CFA) has published the third book in the series of publications entitled *The World's Forests*. This publication focuses on the forest policy developments under the umbrella of the Intergovernmental Forum on Forests (IFF) process (1997-2000) and other high-level initiatives in support of sustainable forest management. The book consolidates important international forest policy developments during the period 1997-2000.

The book consists of four parts. In part I focus is on the outcomes of the intergovernmental dialogue on forest in this period. Part II highlights the government- and organisation-led initiatives in support of the IFF process. An overview of the evolution of criteria and indicators for sustainable management over the last decade is presented in part III. Some initiatives on criteria and indicators are highlighted. Finally, in part IV an assessment is made of the progress achieved since Rio ('92).

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South Parks Road, Oxford OX1 3RB, UK.
Tel: (+44) (0)1865 275000.
Fax: (+44) (0)1865 275074.
E-mail: ofi@plants.ox.ac.uk.
Website:www.plants.ox.ac.uk/ofi/home.htm

Mapping and Monitoring Forest Remnants

A multi-scale analysis of spatio-temporal data

L.M. Tavares de Carvalho (2001)

Much attention is paid to forest destruction and ways to counteract it. A great deal of the effort is directed to the areas that remain extensively covered by forests. Forest fragments are largely overlooked although they are of significant importance to the local environment. This book explores the actual methodologies and techniques such as remote sensing and geographical information technologies which enable the acquirement of the necessary data for the development and validation of ecological models, management activities and decision making for forests, including fragments all over the world.

The book uses information from a research project dealing with semi-deciduous Atlantic Forest in Brazil, initiated in 1998 by a Brazilian research institute EMBRAPA and the two Brazilian universities (UFLA and UNB). It describes the strategy, based on remote sensing information, that was used to classify and monitor areas in a region with fragmented Atlantic Forest. The procedure that was followed to determine the location of deforestation over a large area is described. This method is not difficult and can therefore be used by local authorities as a warning system for deforestation.

PhD thesis. Wageningen University. 136 p.
For further information:
jan.clevers@staff.girs.wag-ur.nl
Ordering Information:
Secretariat,
Centre for Gio-Information,
Alterra, P.O. Box 339, 6700AH,
Wageningen,
The Netherlands.
Tel: +31 317 474640 Fax: +31 317 474567
On line ordering:
Http://www.agralin.nl/luwpubs/

Global and Regional Vegetation Fire Monitoring from Space; Planning a Coordinated International Effort

F.J. Ahern, J.G. Goldammer & C.O. Justice (2001)

Increasing conflagrations of forests and other lands throughout the world during the 1980s and 1990s have made fires in forests and other vegetation emerge as an important global concern. Both the number and severity of wildfires and the application of fire for land-use change seem to have increased dramatically compared to previous decades of the twentieth century. The adverse consequences of extensive wildfires cross national boundaries and have global impacts. Satellite remote sensing technology has the potential to play an important role in both monitoring fires and their consequences, as well as in operational fire management.

This book contains thirteen contributions authored by scientists who represent the most active international research and development institutions. These papers were initially presented at a workshop organised within the framework of the international pilot project Global Observation of Forest Cover (GOFC), initiated by the Committee on Earth Observation Satellites (CEOS) in 1997. GOFC was designed to bring together data providers and information users to make information products from satellite and in-situ observations of forests more readily available world-wide. The volume is a contribution by the GOFC Forest Fire Monitoring and Mapping Implementation Team to the Interagency Task Force Working Group *Wildland Fire* of the UN International Strategy for Disaster Reduction (ISDR).

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The Hague,
The Netherlands. Fax: (+31 70) 3300254.
Email: kugler.spb@wxs.nl.
Website: www.kuglerpublications.com/spb.

Criteria and Indicators for Sustainable Forest Management at the Forest Management Unit Level
2001 EFI Proceedings No. 38

A. Franc, O. Laroussinie, T. Karjalainen (eds.) 2001

This publication contains the papers that were presented at a conference organised by GIP Ecofor and the European Forest Institute (EFI) on behalf of IUFRO Task Force on Sustainable Forest Management, and under the auspices of FAO, CIFOR and CATIE, at Nancy, 22-25 March 2000.

The 18 papers in this publication attempt to contribute to the development of a consensus on Criteria and Indicators that deals with the paradox of sustainable forest management that appears to exist. On the one hand it seems very appealing, challenging and new for some groups, on the other hand it seems very classical and already implemented in management plans for other groups. Elements of the paradox are presented in the papers, such as the distinction between sustained yield and sustainable forest management, the extraordinary diversification of the functions, goods and benefits produced by the forests and the increasing diversity of stakeholders involved in forest planning and management. Moreover, recently new values have emerged as equally important to the values already recognised worldwide.

For more information contact:
European Forest Institute (EFI),
Torikatu 34, FIN-80100 Joensuu,
Finland.
Tel.: +358 13 252 020.
Fax: +358 13 124 393.
Email: publications@efi.fi.
Website: www.efi.fi/

Evaluating Transdisciplinary Research–an Assessment instrument
Panorama: Special Issue 1/99

In a special issue of its newsletter Panorama the Swiss National Science Foundation presents the results of a project that deals with the issue of adequate evaluation of inter- and transdisciplinary research; problem oriented research requiring the cooperation of science and the private sector. This issue has gained significance in recent years. The project involved the compilation of a Catalogue of Criteria for the Evaluation of Inter and Transdisciplinary Projects. This special issue is also available as pdf-file on http://www.ikaoe.unibe.ch/forschung. For hard copies contact
IKAÖ, Project "Evaluation Criteria",
Falkenplatz 16, 3012 Bern,
Switzerland. Fax: +41 31 631 8733.
Email: defila@ikaoe.unibe.ch.

The invisible Wand: Adaptive Co-management as an Emergent Strategy in Complex Bio-economic Systems
CIFOR occasional paper no.34

J. Ruitenbeek and C. Cartier (2001)

This paper provides an economic perspective on concepts related to adaptive co-management (ACM). The hypothesis is explored as to whether ACM can be regarded as an emergent strategy under specific conditions. The theory of "self-interest" as the determining factor that leads to stability and efficiency in economic systems against that of a complex bio-economic system in which "altruistic common interest" can act as a forcing factor (our "Invisible Wand").

For more information contact:
CIFOR, P.O.Box6596 JKPWB, Jakarta 10065, Indonesia.
Tel.: +62 (251) 622622.
Fax: +62 (251) 622100.
Email: cifor@cgiar.org.
Website: www.cifor.cgiar.org.

Rural Development Forestry 1985-2001

The Overseas Development Institute has produced a CD-ROM that contains 17 years of its publications on forestry-related issues.

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All papers are indexed by publication, keyword, author and region. Full text versions of the majority of publications are available in English, French and Spanish as Acrobat pdf files. The adobe acrobat reader is also included on the CD-ROM.

For more information please contact:
Overseas Development Institute,
111, Westminister Bridge Road,
London SE1 7JD
United Kingdom.
Email: forestry@odi.org.uk
Http://www.odi.org.uk

FAO's Forestry Activities in Asia and the Pacific

The FAO Regional Office for Asia and the Pacific supports agriculture, fisheries, forestry, and rural development across the region. Through the Asia-Pacific Forestry Commission (APFC,) member countries set policy priorities for the main forestry activities in the region. APFC has commissioned a number of studies to assist in the identification of the priorities in forestry in the region. The results have been published in reports, several of which are discussed below.

REGIONAL TRAINING STRATEGY
Supporting the implementation of the code of practice for forest harvesting in Asia-Pacific

APFC has developed the Code of Practice for Forest Harvesting in the Asia-Pacific, which encourages environmentally sound forest harvesting throughout the region. However, in many countries in the region personnel are insufficiently trained to practice the code properly, because of lack of training facilities. As a follow-up to this identified need the APFC agreed to formulate a regional training strategy. This document is the result of that effort. It presents a generic training strategy that can be adapted to specific needs and situations. The document provides a general framework of the strategy and guidelines for its implementation.

TRASH OR TREASURE?
LOGGING AND MILL RESIDUES IN ASIA AND THE PACIFIC
High wood residue volumes from forestry and wood processing activities have never been considered a problem, until recently. Nowadays, with declining forest and consequently wood resources, it has become an issue. Therefore, the APFC commissioned a study on the magnitude of the problem and on alternative uses for logging and mill residues. The overall objectives of the study were to estimate and describe the availability and use of residues in the processing chain (including harvesting, transport, storage and processing) of major forest product industries, from the standing tree to the final and semi-final product, and present options for reducing residues in the forest and in wood-processing industries. The results of the study are presented in this publication.

FORESTS OUT OF BOUNDS
Logging is viewed by many people as a key factor in deforestation and consequent loss of biological diversity, deterioration of watersheds, expansion of deserts and the demise of forest-dependent people. In response a number of countries in Asia and the Pacific have imposed partial or total bans on harvesting timber from natural forests. The study of the *Impacts and effectiveness of logging bans in natural forests* arose from the need to assess the success and failures of such strategies and approaches in the Asia-Pacific region. Its results have been compiled in this document.

National consultants carried out studies in their respective countries, covering a variety of experiences with timber harvesting bans. The results of each of the studies and a regional overview are presented in the document. An executive summary of the document is also available.

For more information please contact
Patrick B. Durst,
Senior Forestry Officer,
FAO Regional Office for Asia and the Pacific,
39 Phra Atit Road,
Bangkok 10200, Thailand.
Tel: (66-2) 697-4000. Fax: (66-2) 697-4445.
Email: Patrick.Durst@fao.org.
Website: www.fao.or.th/Technical_Groups/Forestry/forestry.htm,
and http://www.apfcweb.org.

Forest Genetic Resources No.29

Within the framework of the FAO's Forest Resources Assessment (FRA) 2000 programme, a vast amount of information on the status and trends in forest area, natural forests, plantations, protected areas, sustainable forest management and other, related variables, was collected and analysed. This information is available on the internet at www.fao.org/forestry/fo/fra/index.jsp.

In this publication a summary is given of trends in forest plantation development from 1980 tot 1990, based on findings in FRA 2000. A short article reviews the complementary roles for conservation of protected areas, managed natural forests, plantations and breeding programmes, as reported in the FRA2000 Final Report. Other contributions in this publication report on action, programmes and projects pursued in all regions of the world. This is the first in a series of three complementary booklets on genetic conservation, which will be jointly published over the coming months by FAO, the International Plant Genetic Resources Institute (IPGRI) and DANIDA Forest Seed Centre.

For more information contact:
Forest Resources Development Service,
Forest Resources Division,
FAO, Viale delle Terme di Caracalla,
1-00100 Rome, Italy
Fax: (39) 06 5705 5137.
Email: Forest-Genetic-Resources@fao.org.

An introductory field guide to the flowering plants of the Golfo Dulcerain forests, Costa Rica. Corcovado National Park and Piedras Blancas National Park

By Weber, A., W. Huber, A. Weissenhofer, N. Zamora & G. Zimmermann (eds.).

A remarkable plant book entitled "An introductory Field Guide to the flowering plants of the Golfo Dulce Rainforests, Costa Rica" was recently published. It is the result of a cooperation project of Austrian, Costarican and US-American botanists.

This book deals with the plant biodiversity of one of the most species abundant forest regions in the neotropics and represents a basic work about the little known rainforests in the Southeast of Costa Rica. With the book it is possible to identify all plant families and genera of the area. Over 900 selected species from different life forms (trees, herbs, lianas, epiphytes etc.) are described, many of them are illustrated. Details about distribution, pollination biology, fruit- and seed dispersal, use etc. add instructive information of phytogeographical and ecological interest. A general section covers geology, soils and climatic patterns of the region. This part also includes descriptions of the various forest types and their characteristic species. An extensive photosection with over 700 color photos of ecosystems, flowers, fruits etc., and numerous black and white illustrations in the text facilitate the identification.
In summary, this is a fine work about a neotropical rainforest. It seems of considerable interest for scientists and students as well as for naturalists interested in plant biology. The keys, the species descriptions and the very nice illustrations all add up to a high quality publication that will be used by anyone interested in working in these rain forest areas of Costa Rica. "The editors are to be congratulated on putting together such a fine piece of work".... Sir Ghillean Prance, Science Director, Eden Project, Cornwall.

The book is published in the STAPFIA

series from the OÖ Landesmuseum - Biologiezentrum Linz and can be ordered from the:
Institute of Botany,
c/o Mrs. Marion Dominikus,
Rennweg 14, 1030 Wien,
Phone 01-4277-54124, fax direct dial 9541,
email: marion.dominikus@univie.ac.at.
Costs: Euro 49 plus postage costs.

Bosques nublados del Neotrópico

M.Kappelle & A.D. Brown (Eds.) (2001)

This publication brings together the results of research on neotropical cloud forests with the aim to enhance the knowledge on these ecosystems. It is hoped that this knowledge will help to determine the requirements for monitoring the processes of degradation, for ecological restoration and for the conservation of this type of forest. A number of authors have contributed to the publication, which can be divided in two parts. Part I deals with general aspects of neotropical cloud forests, such as their unique ecological features, their diversity, flora and fauna and its history. For each of the countries in the Neotropics that have cloud forests within their boundaries more detailed information on these ecosystems is provided in Part II. The book also contains many coloured photos, pictures and maps on the subject.

ISBN 9968 702 50 1, 657 p. For more information contact:
Editorial INBio.
P.O.Box 22-3100,
Santo Domingo de Heredia,
Costa Rica. Tel. (506) 244 0690, ext. 802.
Fax: (506) 244 2816.
Email: editorial@inbio.ac.cr.
Website: www.inbio.ac.cr/editorial.

Flora Malesiana Bulletin

The Flora Malesiana Bulletin is an annual periodical providing information and contact between institutes and individual botanists collaborating in the Flora Malesiana Project and related fields.

Flora Malesiana is a systematic account of the flora of Malesia, the plant-geographical unit spanning six countries in Southeast Asia: Indonesia, Malaysia, Singapore, Brunei Darussalam, the Philippines, and Papua New Guinea.

The Bulletin is distributed free of charge to Flora Malesiana contributors. Cost to non-contributors is EUR 18.00 per copy (excl. Postage and handling)
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Nationaal Herbarium Nederland,
Universiteit Leiden. P.O. Box 9514, 2300 RA,
Leiden, The Netherlands.
Tel.: +31 (0)71 5273500.
Fax: +31 (0)71 5273511.
Email: veldkamp@nn.leidenuniv.nl.

Biodiversity and Development Project

The Biodiversity and Development Project (BDP) is a collaborative initiative of the European Commission, The UK Department for International Development (DFID) and the IUCN. However, it has involved much wider collaboration within Europe of staff from EU Member States' development agencies and from the European Commission. Beyond Europe,

national consultants in developing countries worked with project staff to produce 11 case studies.

Guiding Principles
This report captures the experiences and opinions of people working on biodiversity issues in EC partner countries. The production of this report involved consultation with 98 workshop participants, from 35 countries. It presents the 7 main principles and illustrates them with experiences from field projects and the lessons learned.

Strategic Approach
This document is the result of consultation between EC policy advisors and task managers dealing with biodiversity and the environment, and those working on natural resource and non-natural resource issues. The Strategic Approach addresses the important issue of integrating biodiversity into development cooperation policy and practice. The document highlights the need to realise biodiversity's full potential to support development, while addressing the direct and underlying causes of this loss. The Strategic Approach covers all terrestrial biodiversity, coastal areas and some marine issues relevant for development cooperation. It focuses primarily on the conservation and sustainable use of biological resources in developing countries, from both natural and farm habitats.

Biodiversity Briefs
The aim of the Biodiversity Briefs is to raise awareness about biodiversity issues within EC development cooperation. They are divided into three types:

Policy Biodiversity Briefs, which are intended for use by EC delegations and desk officers during the programming stage of the project cycle, and for policy elaboration. These Biodiversity Briefs indicate the main issues to be considered, make recommendations for action and suggest important principles to be followed,

Sector Biodiversity Briefs indicate important issues which need to be taken into account by technical advisors on natural resources and non-natural resources, at policy, programme and project levels, and

Background Biodiversity Briefs, for a general audience, which summarises topics and legal responsibilities, and indicate where more information can be found.

For further information contact
IUCN Publications Services Unit,
219c Huntingdon Road,
Cambridge,
CB3 0DL,
UK.
Tel. +44 1223 277894.
Fax: +44 1223 277175.
Email: info@book.iucn.org.

All documents can be found on the website: http://europa.eu.int/comm/development/sector/environment.

The Development and application of Ecological Networks

A Review of Proposals, Plans and Programmes

Bennet, G. & P.Wit (2001)

This report comprises a worldwide review of 38 ecological network initiatives that have recently being developed or implemented. It includes an inventory of a wide range of proposals, plans and ongoing programmes to establish ecological networks at scales varying from the regional to intercontinental, and summary findings on the main features of the initiatives. The report is intended as a contribution to IUCN's review of experience in developing and applying ecological networks, which was initiated through a resolution at the World Conservation Congress in 1996. In total a number of over 150 ecological networks were identified worldwide, of which 38 were studied in more detail.

132 p. First published by AIDEnvironment, Amsterdam. For more information contact AIDEnvironment: tel. 020-6868111, fax. 020 6866251.
Email. info@aidenvironment.org.
Website: www.aidenvironment.org

Forests of Fear: The Abuse of Human Rights in Forest Conflicts

G. Magin, C. Marijnissen, S. Moniaga and C. Meek (2001)

This report presents a pattern of widespread violation of civil and political rights in relation to forest conflicts. It provides examples from North and South, from tropical, temperate and boreal forests. Five detailed case studies in four different continents document the chain of casualties leading to human rights abuses. Three country analyses, of Indonesia, Mexico and Canada, show how human rights abuses are "institutionalised" by forest laws, power structures and lack of participation. A list of shorter examples illustrates the range of human rights abuses and the spread across different continents. All cases have been checked with the people directly involved and contacts for more information are provided.

For more information contact: FERN,
1c Fosseway Business Park,
Stratford Road,
Moreton-in-Marsh GL56 9NQ.
Tel.: +44 1608 652895.
Fax: +44 1608 652878.
Email: sara@gn.apc.org.

Des Forêts et des Hommes

A view on the people of the tropical forests

S. Bahuchet, P. de Maret, F. Grenand and P. Grenand (2001)

This richly illustrated book analyses the changing lives of forest dwelling people in the tropical forests of Belize, Guyana, Central Africa and Melanesia in the Pacific Region. In cooperation with local institutions the Centre d'Anthropologie culturelle in Belgium has conducted research on the characteristics of people who live in the forest and depend on this ecosystem for their living. The results of the study are presented by answering a number of questions regarding the relationship between these people and the forests they live and depend on. The main question addressed concerns the coherence between conservation of forests and supporting the people that live in it.

APFT – ULB
Centre d'anthropologie culturelle,
Avenue Jeanne 44 – 1050,
Brussels, Belgium. Tel.: +32 2-650.34.25.
Email:anthcult@ulb.ac.be

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22	Research Priorities	Dec 1997
23	South East Asia	Mar- May 1998
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Issues 19 -35 are available online at http://www.etfrn.org/etfrn/resource/news.html

ETFRN NATIONAL FOCAL POINTS

Austria	Institut für Waldökologie, Universität für Bodenkultur Wien, Peter Jordan Str. 82, 1190 Vienna. Tel: +43 1 47 65 44100, Fax: +43 1 479 78 96, Email: glatzel@woek.boku.ac.at, Http://ann-etfrn.boku.ac.at Contact: Prof Dr Gerhard Glatzel
Belgium	CIS/BIO, Federal Office for Scientific, Technical & Cultural Affairs, Wetenschapsstraat 8, 1000 Brussels. Tel: +32 2 238 34 53, Fax: +32 2 230 59 12, Email: deca@belspo.be, Http://www.belspo.be Contact: Brigitte Decadt
Denmark	Royal Veterinary and Agricultural University, Unit of Forestry, Rolighedsvej 23, 1958 Frederiksberg C Tel: +45 35 28 22 31, Fax: +45 35 28 26 71, Email: jd@KVL.dk, Http://www.flec.kvl.dk/etfrn Contact: Dr Jens Dragsted
Finland	Viikki Tropical Resources Institute, PO Box 28, 00014 University of Helsinki, Helsinki Tel: +358 9 19158643 , Fax: +358 9 19158646 , Email: olavi.luukkanen@helsinki.fi, http://honeybee.helsinki.fi/tropic/ Contact: Prof Olavi Luukkanen
France	ENGREF/SILVOLAB, BP 316, 97379 Kourou Cedex Tel: +5 94 32 26 75, Fax: +5 94 32 43 02, Email:reder.m@kourou.cirad.fr, Http://kourou.cirad.fr Contact: Marguerite Reder
Germany	Bundesforschungsanstalt für Forst- und Holzwirtschaft, Leuschnerstr. 91, 21031 Hamburg. Tel: +49 40 73962 101, Fax: +49 40 73962 480, Email: heuveldop@.holz.uni-hamburg.de, Http://www.bfafh.de/inst1/13/indexe.htm Contact: Prof Jochen Heuveldop
Greece	Directorate of Forest Resource Development, Section of Forest Research, Ippokratous St. 3, 10164 Athens. Tel: +30 1 036 08084/036 08042, Fax: +30 1 03608685 Contact: Nikolas Efstathiadis
Ireland	Council for Forest Research and Development, Dept of Agriculture & Food Engineering, University College Dublin, Earlsfort Terrace, Dublin 2. Tel: +353 1 7067346/7067700, Fax: +353 1 7061180, Email: eugene.hendrick@COFORD.ie, Http://www.coford.ie Contact: Eugene Hendrick
Italy	Instituto Sperimentale per la Selvicoltura, via delle Cascine 1, 50144, Firenze Tel: +39 055 360061, Fax: +39 055 362034, Email: giopreto@ats.it, Http://www.cesit.unifi.it/amazon/ Contact: Giovanni Preto
Netherlands	Tropenbos International, PO Box 232, 6700 AE Wageningen. Tel: +31 317 495500, Fax:+31 317 495520, Email: tropenbos@tropenbos.agro.nl, Http://www.tropenbos.nl Contact: René Boot
Norway	Agricultural University of Norway, Dept of Forest Sciences, PO Box 5044, 1432 As, Norway. Tel: +47 64 94 8916, Fax: +47 64 94 8890, Email: prem.sankhayan@isf.nlh.no, http://www.nlh.no/isf/english/research/etfrn/norwegian_home.htm Contact Prem Sankhayan
Portugal	Forestry Department, Tapada da Ajuda, 1300 Lisbon. Tel: +351 21 3602091/4181868 Fax: +351 21 3645000, Email: etfrn.rs@mail.EUnet.pt, Http://home.EUnet.pt/id006240 Contact: Prof Dr Raul M de A Sardinha
Spain	CIT-INIA, Carretera de la Coruna Km7, 28040 Madrid. Tel: +34 91 347 37 50, Fax: +34 91 347 14 72 Contact: Dr Alejandro Lopez de Roma
Sweden	Department of Forest Ecology, Swedish University of Agricultural Science, 901 83 Umeå, Sweden Tel: +46 90 7866617, Fax: +46 90 7867750, E-mail: Anders.Malmer@sek.slu.se Http://www.sek.slu.se/eng/etfrn/ETFRNsverige.htm Contact: Dr Anders Malmer
Switzerland	Eidgenössische Technische Hochschule Zürich, Groupe de foresterie pour le développement, c/o Department Wald- und Holzforschung, 8092 Zürich. Tel: 41 1 632 3214, Fax: +41 1 632 1033, Email: sorg@fowi.ethz.ch Http://www.fowi.ethz.ch/etfrn Contact: Dr Jean-Pierre Sorg
U K	UK Tropical Forest Forum, c/o Royal Botanic Gardens Kew, Richmond, Surrey TW9 2AB, United Kingdom Tel: +44 208 332 5717, Fax: +44 208 332 5278, Email: j.thornback@btinternet.com, Http://www.forestforum.org.uk Contact: Jane Thornback
EC Contact	European Commission, DG Research, Rue de la Loi 200, 1049 Brussels, Tel: +32 2 299 42 04, Fax: +32 2 296 62 52, Email: Nicole.Riveill-Bounaga@cec.eu.int Contact: Prof Nicole Riveill Bounaga Http://europa.eu.int/comm/research

The European Tropical Forest Research Network is a network of European organisations involved in (sub)tropical forest research. It is presently supported by Directorate General for Research of the European Commission under the INCO-DEV Programme.

For further information on ETFRN, please contact your National Focal Point (see inside back cover) or the Coordination Unit (address below).

European Tropical Forest Research Network
c/o The Tropenbos Foundation
PO Box 232
6700 AE Wageningen
The Netherlands
Tel: +31 317 495516
Fax: +31 317 495521
Email : etfrn@iac.agro.nl
Http://www.etfrn.org/etfrn

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