

1996 ANNUAL REPORT



CIFOR is a global independent scientific research institute which brings the best of science to resolving the problems of tropical forests and the people who depend on them.

The Center for International Forestry Research (CIFOR) was established in 1993 by the Consultative Group on International Agricultural Research (CGIAR) in response to global concerns about the social, environmental and economic consequences of loss and degradation of forests. It operates through many decentralised partnerships with key institutions and/or individuals throughout the developing and industrialised worlds (including government agencies, universities, NGOs and private sector research institutes). The nature and duration of these partnerships are determined by the specific research problems being addressed. This research agenda is reviewed regularly and revised as the partners recognise new opportunities and problems.

CIFOR has collaborative links with other CGIAR Centers, in development and implementation of research. CIFOR and ICRAF (the International Centre for Research in Agroforestry) are the principal organisations implementing the forestry-agroforestry agenda developed by the Technical Advisory Committee for the CGIAR.

CIFOR's Mission is to contribute to the sustained well-being of people in developing countries, particularly in the tropics, through collaborative strategic and applied research and related activities in forest systems and forestry, and by promoting the transfer of appropriate new technologies and the adoption of new methods of social organisation for national development.

CIFOR seeks to shape forest science for the twenty-first century and beyond so that forests can continue to be used without destroying them. CIFOR generates scientific policy and technology options and tools for sustainable forest management, and is an impartial international source of authoritative information on tropical forestry and related social issues. CIFOR works at the front line in partnership with national researchers in tropical developing countries.

CIFOR's Objectives

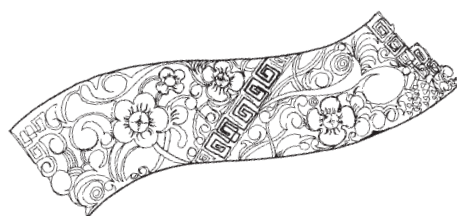
- » To improve the scientific basis for the balanced management of forests and forest lands.
- » To develop policies and technologies for sustainable use and management of forests.
- » To strengthen national capacities for research to support the development of policies and technologies for the optimal use of forests and forest lands.

The CGIAR System

The Consultative Group on International Agricultural Research (CGIAR) is an informal association of public and private sector donors (established in 1971) that supports a network of sixteen international agricultural research institutes, CIFOR being the newest of these. The CGIAR Centers are part of a global agricultural research system which applies international scientific capacity to solving problems of the world's disadvantaged people.

The CGIAR Mission

Through international research and related activities, and in partnership with national research systems, to contribute to sustainable improvements in the productivity of agriculture, forestry and fisheries in developing countries in ways that enhance nutrition and well-being, especially among low-income people.





This Annual Report is available in English, Spanish, French and Indonesian.
Ce rapport annuel est disponible en anglais, espagnol, français et indonésien.
Este Informe Anual está disponible en inglés, español, francés e indonesio.
Laporan Tahunan ini tersedia dalam bahasa Inggris, Perancis, Spanyol dan Indonesia.



Table of Contents

DIRECTOR GENERAL'S REPORT	1
The International Context	
CIFOR's International Role and Profile	4
CIFOR's Partnership Research Strategy	6
Africa – Increasing Collaboration to Improve Research	7
Priorities for Forestry Research in Latin America	8
The Bulungan Research Forest	10
Inauguration of CIFOR Headquarters	12
RESEARCH INSIGHTS	
Developing Incentives and Institutions for Protecting the Eastern Rainforests of Madagascar	14
Effects of Human Disturbance on Genetic Diversity in Tropical Forests	17
What is Sustainable Forest Management?	20
Extractive Reserves in the Brazilian Amazon: Prospects for the Future	23
Buying Carbon to Support Reduced-impact Logging	24
Rehabilitation of Degraded Tropical Forest Ecosystems	27
The <i>TROPIS</i> Information System	28
RESEARCH PROGRESS	
Underlying Causes of Deforestation, Forest Degradation and Poverty in Forest Margins	30
Forest Ecosystem Management	31
Multiple Resource Management of Natural Forests	33
Assessing the Sustainability of Forest Management: Testing Criteria and Indicators	35
Plantation Forestry on Degraded and Low-potential Sites	37
Conservation of Biodiversity and Genetic Resources	39
Local Livelihoods, Community-based Forest Management and Devolution	41
Sustainable Use and Development of Non-timber Forest Products	43
Research Impact, Information and Capacity Building	45
Policies, Technologies and Global Changes	46
Research Support Division	48
FINANCE AND ADMINISTRATION	49
Structure and Staffing	
CIFOR Board of Trustees 1996	53
Organisational Structure	54
CIFOR Staff 1996	55
APPENDICES	
1 CIFOR Publications	58
2 Publications by CIFOR Staff	60
3 Memoranda of Understanding with Partners	65
4 Common Acronyms and Abbreviations	66

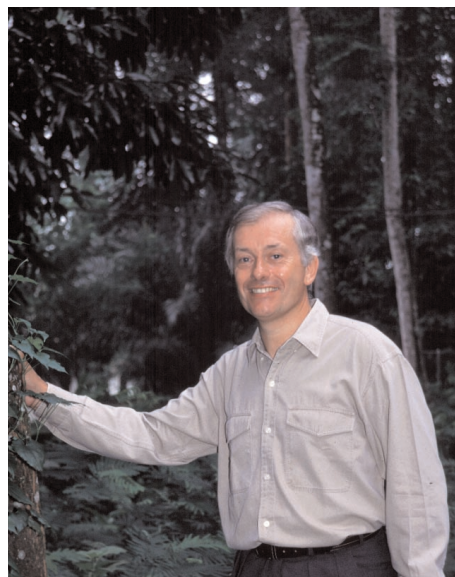
DIRECTOR GENERAL'S REPORT

CIFOR has just completed its third full year of operation. We now have over thirty Bogor-based scientists of seventeen nationalities including economists, anthropologists and sociologists, as well as forest scientists and ecologists. We are active in virtually all of the countries of the humid tropics and have expanded our activities to southern Africa, India, Indo-China and parts of China. CIFOR staff are now based in Zimbabwe, Gabon, Cameroon and Costa Rica and we are in an advanced stage of negotiation with our colleagues in Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Brazil, on the establishment of our presence in that country.

CIFOR's *Strategy for Collaborative Forestry Research* was published this year after extensive consultation with research partners, the Board of Trustees, donors, CIFOR staff and others. The Strategy represents a significant advance on the world's forest research challenges as it incorporates a multi-disciplinary approach to international forest science and the comparative advantage of CIFOR in addressing them.

CIFOR undertakes strategic or applied research to efficiently generate new knowledge about forests. This research will have:

- high potential for widespread application;
- substantial benefits to targeted clients, high adoption and minimum lag-times before adoption;
- high probability of success in both research and dissemination;
- potential to enhance the research capacity of partners; and
- potential to promote south-south co-operation.



Jeffrey A. Sayer, Director General

CIFOR is a "learning organisation"; we are continually listening to our partners, beneficiaries and supporters. Our strategy will continue to evolve as CIFOR responds to the needs of the diverse peoples whose welfare depends on the conservation and management of the world's tropical forest resources.

CIFOR had a productive and exciting year. As reflected in the following pages, CIFOR has achieved a strong international profile. The calibre of our science and the value of our research findings have been recognised and are having significant impacts on forests and people who use them. This was the first year in which we were operating with a full complement of scientists in our Bogor headquarters and our research productivity was much higher than in the past. In May 1996, Indonesia hosted the CGIAR mid-term meeting in Jakarta. The meeting was inaugurated by President Soeharto who spoke strongly in support of CIFOR. We used the occasion of the



mid-term meeting to inaugurate CIFOR's new headquarters in Bogor. Several hundred representatives of our donors and research partners from around the world attended the ceremony which was followed by a number of technical seminars. Our visitors responded favourably to this event and many of them expressed gratitude for the efforts made by the Indonesian authorities to provide CIFOR with world-class facilities.

In the course of the year we also hosted gatherings of our research partners in Africa and Latin America. The first meeting in February was co-hosted by EMBRAPA in Brazil and brought together, in the Amazonian city of Manaus, scientists from Brazil and Argentina in the South to Belize and Mexico in the North. Research needs for the Latin American region were agreed by the participants. In April, we collaborated with the then Division of Forest Science and Technology (FORESTEK) of the Council for Scientific and Industrial Research (CSIR) in South Africa to host a meeting of researchers from the countries of the Southern African Development Community (SADC) at Hazyview in South Africa. An ambitious programme for collaborative research in the region was discussed at this meeting and has

subsequently been further elaborated into a proposal for funding by the European Union. CIFOR collaborated closely with the Southern African Centre for Cooperation in Agricultural and Natural Resources Research and Training (SACCAR) and the Forestry Sector Technical Coordination Unit (FSTCU), both institutions of the SADC, in the organisation of this meeting and its follow-up.



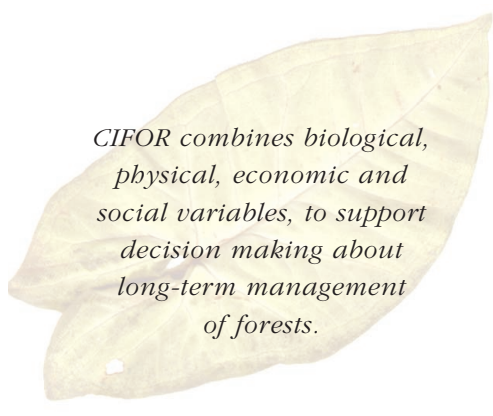
(front row, left to right) Bo Bengtsson, Mob. Hasan, Minister of Forestry Djamaludin, Jeffrey Sayer and MOF Secretary General Oetomo at the inauguration of CIFOR's headquarters

The calibre of our science and the value of our research findings have been recognised and are having significant impacts on forests and people who use them.

Throughout the year the Indonesian authorities, and most notably Minister of Forestry Djamaludin, continued to give CIFOR strong backing. The volume of research conducted in collaboration with Indonesian scientists, both from the Ministry of Forestry and from a number of other national organisations, has expanded. Investments have continued to be made in the development of CIFOR's headquarters facility and at the end of the year we were poised to occupy the premises. We continue to receive an encouraging flow of visiting researchers from both tropical developing countries and advanced research institutes in the north. A large number of meetings were held in Bogor in the course of the year

and CIFOR's network of contacts was greatly strengthened. Our ability to communicate electronically also improved and we were able to develop in-house capacity to put all our research publications plus some quite sophisticated databases onto CD-ROMs.

At the end of the year we had Memoranda of Understanding and active research collaboration with over thirty research partners throughout the world. We are now well-prepared to make major impacts over the coming years. The Strategy provided an excellent basis for the development of our Medium Term Plan for the period 1998 to the year 2000 which was being finalised at the end of the year. This Plan envisages continued growth of CIFOR's research programme through to the end of the century. After review by CIFOR's Board of Trustees it will be submitted to the Technical Advisory Committee of the



CGIAR in early 1997. I have no doubt that over this next three years, CIFOR will continue to make significant advances in developing policies and techniques for the productive, sustainable and equitable use of all types of forests for a great variety of goods and services.



CIFOR staff in Indonesia

During the year, two internally commissioned external reviews were conducted of our research on biodiversity and on the use of modelling as a means of integrating and prioritising CIFOR's research. These, together with a review of our gender policies and practices, will prepare the groundwork for the External Programme and Management Review which is scheduled for late 1997. CIFOR looks forward to this review to expose our achievements and account for the resources entrusted to us by the CGIAR.

On behalf of all members of the CIFOR "family", I would like to personally acknowledge the strong continuing support and confidence of the members of the CGIAR; the strategic direction of the Board of Trustees; the hard work, dedication and creativity of all staff; and especially the continuing co-operation of the partner researchers and institutions around the world.

Jeffrey A. Sayer

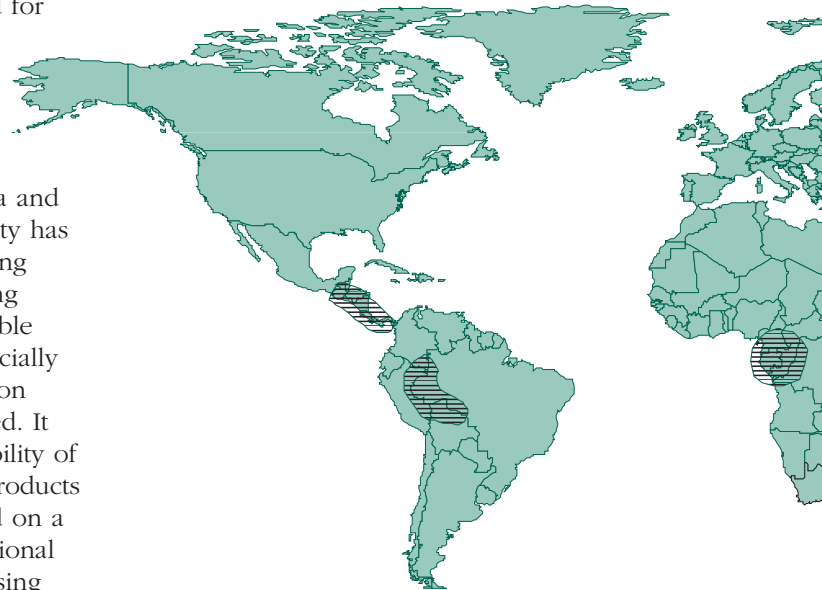


CIFOR's International Role and Profile

The past year has been one of intense activity in the world of forestry. The Inter-governmental Panel on Forests (IPF), set up by the UN Commission on Sustainable Development, met in Geneva in March and September. Most observers felt that it made significant progress in advancing the world's forest agenda. CIFOR, along with others in the scientific community, was heavily involved in a number of inter-sessional meetings sponsored by participating countries. The summaries and recommendations of the IPF meetings emphasised the need for more research and cited CIFOR as one of the potential leaders of a review of the world's forest research activities.

The international debate on criteria and indicators for assessing sustainability has had an important impact on thinking about forestry. Our work on Testing Criteria and Indicators for Sustainable Forest Management has been especially useful in bringing science to bear on some of the difficult issues involved. It has shown that assessing sustainability of the yields of conventional forest products is relatively easy and can be based on a hundred or more years of conventional forestry practice. Objectively assessing the impacts of forestry on biodiversity and on the social, cultural and economic well-being of the diverse forest stakeholders is much more complex. This need to identify all the elements that are pertinent to the debate on "sustainability" forces close examination of the objectives of forestry. People began to realise that sustainability can mean different things to different people both between countries and within countries. Sustainability is not a fixed steady-state situation but is a function of societies' needs and so varies over space and time.

The increasingly technical nature of the IPF debates has decreased the polarisation of views on forests. Even the most radical NGOs now recognise that the best conservation strategies must embrace use of the forest to meet both national development needs and the needs of the hundreds of millions of people who depend on forests in the



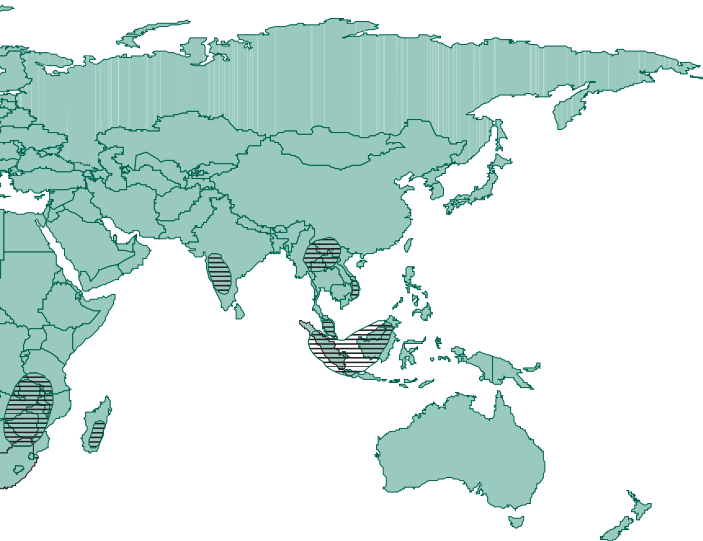
 CIFOR

tropics. Similarly industries and government forest departments are increasingly pro-active in attempting to curtail adverse social and environmental impacts of industrial forestry. The debate is shifting from being one about "halting deforestation" to being about how much forest do we need and for what purposes, how should the forests be distributed through the landscape, and who should be responsible for their care. CIFOR's research has contributed to many elements of the IPF debate.

One of the final inter-sessional meetings of the IPF took place at Kochi in southern Japan, and focused on incorporating research into forest management at the field level. The meeting concluded that new cultures of scientific research are needed to address forestry issues in a much more holistic manner. It went further than previous commentaries on this subject in advocating that research be fully integrated in forest management at the management unit level.

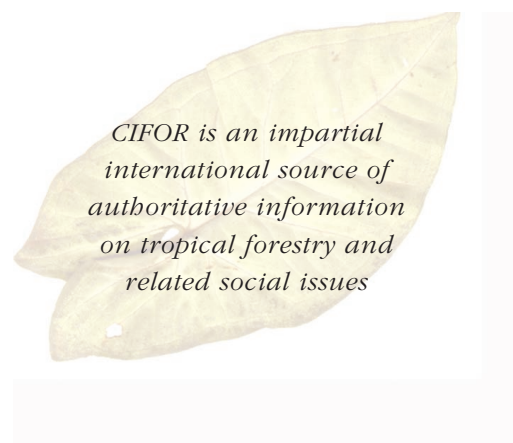
the SBSTTA meeting in Montreal. CIFOR's own research agenda has evolved significantly since our initial Medium Term Plan was adopted in 1993 and now addresses a number of the Convention on Biological Diversity priorities. Participants in the Convention recognise that a great deal of biodiversity will have to be conserved in managed forests and that protected areas alone will never be sufficient.

Also in 1996, the International Tropical Timber Agreement was re-negotiated. CIFOR has worked closely with the Secretariat of the International Tropical Timber Organization (ITTO), both in our work on Criteria and Indicators and in a number of policy areas related to reduced-impact logging and the impact of various trade regimes on forests. Recently we initiated negotiations with the ITTO for collaboration in support of sustainable forest management at the CIFOR research forest in Bulungan, East Kalimantan.



R Research Areas

Forests were also prominent in the debate of the Conference of the Parties (COP) of the Convention on Biological Diversity and of its Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA). The COP, meeting in Buenos Aires in November, agreed on research priorities for conserving forest biodiversity. CIFOR contributed to the formulation of these priorities, both through the workshop that we sponsored at the COP meeting in Jakarta in late 1995, and through our participation in



CIFOR is an impartial international source of authoritative information on tropical forestry and related social issues

CIFOR's Partnership Research Strategy

Research on forests has suffered from a lack of resources and a narrow disciplinary base. It has also been highly site-specific. Recent demands for a “new forestry” require a comprehensive view of the forest ecosystem, but there is still little research that combines biological, physical, economic and social variables to support decision making about long-term management of forests.

CIFOR works through research partnerships with a holistic, interdisciplinary approach to solving general or widespread problems. CIFOR's strategic research is focused on policy issues and technologies that will enable more productive, sustainable and equitable decisions about the management and use of forests. Approximately 70 per cent of the research is conducted away from the Bogor headquarters through collaborative arrangements with national scientists and institutes. The results complement the work of national, regional and international researchers and development agencies. The partnership process is essential not only to produce high-quality research “answers” but also to ensure the adoption and use of the findings at both the policy and field levels.

CIFOR presently gives priority to research in seven key eco-regions:

- the tropical moist forests in central-west Africa and the Congo;
- the drier forests (the Miombo woodlands) of eastern and southern Africa;
- the rainforest-dry forest continuum in southern India (the Western Ghats);
- the tropical moist forests in insular South-east Asia (e.g., Borneo);
- the uplands of mainland South-east Asia;
- the tropical moist forests of the western Amazon; and
- the mixed forest systems of Central America.

These sites have very high ecological and biodiversity significance and face rapid or sustained disturbance or clearance. But even more importantly, they are the homes of hundreds of millions of people – CIFOR's main target beneficiaries – whose livelihoods and well-being depend significantly and directly on forests.

Most CIFOR training in research is “learning by doing” as part of our research collaboration. CIFOR aims to strengthen the capabilities of our partner institutions in managing scientific information. We work with other research leaders in the tropics to promote a careful re-consideration of research needs and priorities. The CIFOR headquarters does not contain big laboratories. We believe it may be unnecessary and inefficient, and sometimes even counter-productive, to have expensive internal facilities while partners' facilities are under-utilised or under-resourced. Where appropriate, CIFOR favours funding to increase the skills, staffing and equipment of partners' facilities to achieve and sustain research objectives.



Over 500 research partners are now working on CIFOR's research agenda world-wide

CIFOR/CATIE research partners, Costa Rica (photo: Cesar Sabogal)



Priorities for Forestry Research in Latin America

The significant and varied challenges confronting forestry research in Latin America can best be faced by collaborative efforts. CIFOR's focus on strategic research can complement the essential applied and adaptive work conducted by national institutions and the basic research of universities. In March 1996, a regional consultation on collaborative forestry research priorities in Latin America brought together scientists from throughout Latin America to identify key areas for co-operative work.

Major areas of interest to the national research institutions were identified as:

- extra-sectoral policy influences on forests;
- forest ecosystem management (landscape-level forest conservation and management);
- management of forests for the sustainable production of multiple goods and services;
- improved forestry options on degraded and low-potential sites;
- management and conservation of biodiversity;
- forest valuation;
- household livelihoods, the potential for increased benefits from harvesting non-timber forest products (NTFPs); and
- assessing the sustainability of forest management: developing criteria and indicators.

The meeting emphasised CIFOR's role in adding value to national/regional initiatives, especially in conducting regional synthesis studies, validation and standardisation of methodologies, and information management. Support for strategic planning and impact assessment is particularly needed in identifying criteria for priority setting for research, implementation of effective co-operative mechanisms, and overcoming barriers to the adoption of research results.

CIFOR will endeavour to build on the work of national research institutions and use those effective networks that are already in place. CIFOR expects to be an effective partner to the regional and national institutes, such as EMBRAPA and CATIE, in addressing issues most relevant to the region.

Cesar Sabogal & David Kaimowitz

*Cattle in burnt rainforest, Concenciao, Amazonia, Brazil
(photo: WWF-Mauri Rautkari)*



AFRICA – Increasing Collaboration to Improve Research

Very few African countries have strong national forest research systems. However, collectively they do have the capacity to provide some of the science needed to underpin sustainable forestry. To determine how best to mobilise and complement the existing research capacity in the region, CIFOR sponsored two consultations in 1996.



Nursery of tropical eucalyptus and pines, Bururi region, Burundi (photo: Christian Cossalter)

Eastern and Southern Africa (Hazyview, South Africa)

The Southern African Development Community (SADC) group of twelve countries in eastern and southern Africa encompasses a range of forestry research capacity, from well-equipped to very basic centres. This capacity for research and for regional collaboration was assessed jointly by CIFOR and the then Division of Forest Science and Technology (FORESTEK) of the Council for Scientific and Industrial Research (CSIR) of South Africa. (see forthcoming CIFOR Occasional Paper). The results were presented at Hazyview, South Africa in April 1996. This meeting was attended by almost all heads of forestry research and senior staff from forestry departments and universities in the SADC region. ICRAF, the International Foundation for Science and the African Academy of Science were also key participants.

Three major discussion themes were: the forestry research master plan for SADC; the research focal areas of the international institutions represented; and international conventions/agreements related to forestry to which the SADC countries are signatories. The broad areas identified for regional forestry research for collaboration with international research institutions were:

- *Policy research and socio-economic studies:* forest valuation; local-level institutional arrangements for forest governance; enterprise development within the sector and at the local community level; and comparative analysis of forest planning processes, strategic policy studies and policy impact assessment.
- *Research on natural forests:* evaluation of the forest resource base with emphasis on non-timber forest products (NTFPs); development of alternative farming systems including domestication of indigenous food plants; involvement and empowerment of communities (including use of indigenous technical knowledge) in natural resource management; evaluation and adaptation of criteria and indicators of sustainability relevant to the region; and technology development in general (e.g., on pests and diseases, growth and regeneration studies, and fire as a management tool).
- *Research on plantations and tree planting in general:* understanding incentives and disincentives for tree planting; policy studies in the plantation forestry sub-sector (including the impact of National Forestry Action Plans and similar global initiatives); investigation and domestication of alternative (in particular local) species; tree planting

to rehabilitate degraded lands or those of low inherent productivity; urban forestry; technology improvement in harvesting, processing and utilisation of tree products and technology to support local enterprise development; and development of regional integrated disease and insect management.

The Southern African Centre for Cooperation in Agricultural and Natural Resources Research and Training (SACCAR) which oversees research in agriculture, forestry, fisheries and wildlife within SADC countries, and the Forestry Sector Technical Coordinating Unit have both “strongly supported the involvement of CIFOR in the development of forestry research programmes and activities in the region”. A research programme on Management of the Miombo Woodlands, to be implemented in Mozambique, Zimbabwe, Malawi, Zambia and Tanzania, is expected to expand the region’s capacity to examine key issues, share knowledge, and implement actions to improve the state of the forests.

*Central and West Africa
(Bangui, Central African Republic)*

The nations of the humid zone of West and Central Africa face many of the same issues. Collaboration is once more the key to advances by sharing the knowledge and capacity of individual

countries. CIRAD-Forêt, CIFOR and NARS are co-ordinating research in Cameroon, Central African Republic, Congo, Côte d’Ivoire and Gabon to synthesise and expand forestry knowledge on the effects of silvicultural treatments on forest dynamics in this region. These findings will be shared with the forest stakeholders – forestry departments, research institutions and the forest users.

During May, CIFOR and CIRAD-Forêt convened a meeting for the forest research community in this region, to identify research priorities and discuss ways of transferring information to stakeholders. With strong researcher representation from the five study countries, the meeting provided a good opportunity to evaluate areas of emphasis for collaborative forestry research. Four broad areas, which generally coincide with those identified in the southern and eastern regions of Africa, were listed as priorities for future research here:

- *Policy*
- *Natural forest silviculture*
- *Criteria and indicators of sustainability*
- *Non-timber forest products*

The next step in the process will bring together CIFOR and the Conférence des Responsables de la Recherche Agronomique Africains (CORAF), to identify the key players in forestry research and review their present capacity and activities. CIFOR will continue to support research by the key players in the regions who are our current and potential collaborators.

*Godwin Kowero & Mike Spilsbury
Robert Nasi & Christian Cossalter*



*Old eucalyptus plantation,
Kayengosi region, Burundi
(photo: Christian Cossalter)*

*Propagation of
eucalyptus by cutting,
Unité D'afforestation
Industrielle du Congo,
Pointe Noire, Congo
(photo: Christian Cossalter)*



The Bulungan Research Forest

In December 1995, the Indonesian Ministry of Forestry designated 303,000 hectares of forest in the province of East Kalimantan to be developed as a long-term site for research on exemplary scientific forest management.

The Bulungan Research Forest is adjacent to the Kayan Mentarang National Park where the World Wide Fund for Nature (WWF) has been working since 1990. Together the two areas constitute an expanse of almost two million hectares, lying in the heart of one of Asia's largest remaining areas of tropical primary rainforest. They also form a natural unit for integrated management. The research forest extends into the watersheds of the Tubu, Malinau and Bahau rivers.



*Dayak rice farmer
in the field
(photo: Esther Katz)*



Punan hunter (photo: Esther Katz)

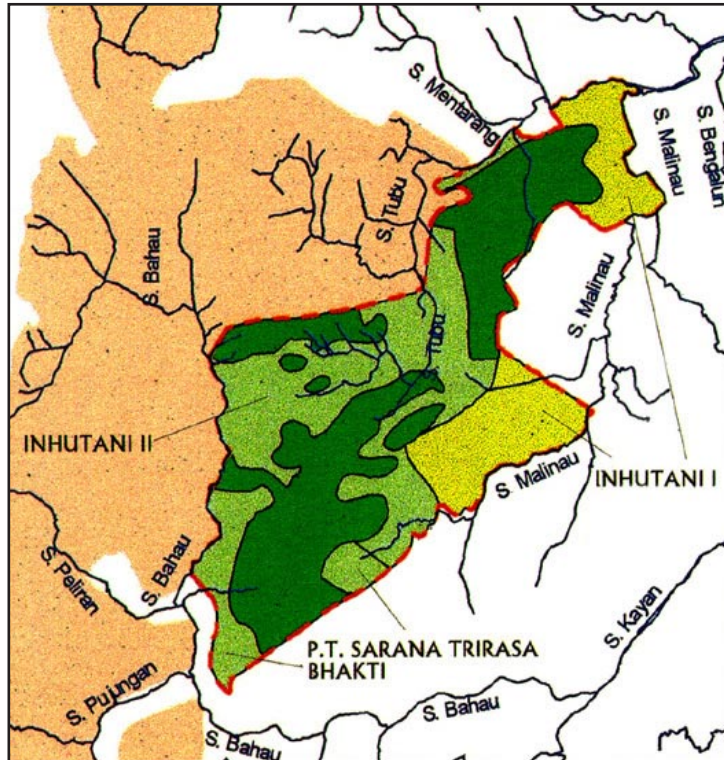
Elevation ranges from approximately 100 to 2000 metres. Although there are small areas of farmland and secondary forests on the Tubu and Bahau rivers, the area is almost entirely covered by primary lowland and hill dipterocarp forest. It has particular value for biodiversity conservation as it includes extensive tracts of forest on level terrain which is unusual in this otherwise hilly region.

The people inhabiting the area are mainly Punan hunter-gatherers (along the Tubu river) and Kenyah rice farmers. Both groups harvest significant amounts of non-timber forest products including gaharu (*Aquilaria* spp.). A state-owned logging company, INHUTANI II, will start selective logging in early 1998 in the eastern part of the area. The 303,000 hectares include production and protected forests. The site therefore shows many of the characteristics of other tropical forests, particularly the increasing competition for forest use among different interests (selective logging, shifting cultivation, collection of NTFPs, coal mining, oil palm plantations). Of particular importance in this region is the very rapid expansion of coal mining, and plans for large areas of palm oil and industrial timber plantations.

CIFOR will initiate numerous activities in the area over the next three years. These are mainly within four of our research projects: Forest Ecosystem Management; Multiple Resource Management of Natural Forests; Sustainable Use and Development of Non-timber Forest Products; Local Livelihoods, Community-based Forest Management and Devolution. The objective is to provide a basis for long-term sustainable forest management integrating social and silvicultural aspects. This will include assessing the effects of reduced-impact logging on biodiversity, understanding

CIFOR Research Forest

Kabupaten Bulungan, Province of East Kalimantan, Indonesia



LEGENDS:

CIFOR Research Forest

Rivers

Kayan Mentarang NP

Limited Production Forest

Production Forest

Protected Forest

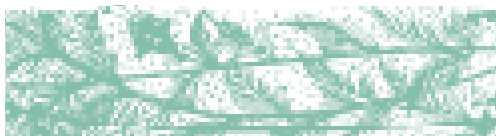


rural development trends, and predicting the effects of macro-level development activities on people whose lifestyles are dependent on the forest. The activities will build on research conducted by CIFOR and WWF on household livelihood strategies during 1995-96. CIFOR is seeking to develop collaboration with a number of national and international partners for research programmes in Bulungan.

Lini Wollenberg & Plinio Sist



Kenyah woman in front of her field but (photo: Alain Compost)



Inauguration of CIFOR Headquarters

The first phase of CIFOR's permanent headquarters was inaugurated by the Indonesian Minister of Forestry Djamaludin Suryohadikusumo on 20 May 1996. The complex is located in 60 hectares of experimental forest belonging to the Ministry of Forestry near Bogor, West Java. Within this forest, 10 hectares has been given to CIFOR as set out in the Headquarters Agreement signed in 1993. The buildings and related infrastructure represent an investment of US\$ 7 million by the Government of Indonesia.

Representatives from our Indonesian host government, the CGIAR system, donors, partners and diplomatic delegations attended the inauguration. CIFOR Director General, Professor Jeffrey Sayer, emphasised the key role of CIFOR on the cutting edge of forestry research in the 21st century. He expressed gratitude for the support provided by the Indonesian Government and Minister Djamaludin for the construction of the building, the establishment of CIFOR's research forest in East Kalimantan, and CIFOR's strategic forestry research.

Professor Bo Bengtsson, Chairman of CIFOR's Board of Trustees, summarised CIFOR's establishment and progress to date. He emphasised the Board's

gratitude to the Government of Indonesia and to the Minister for the excellent relations over this period of growth. Ismael Serageldin, CGIAR Chairman, reviewed the new direction of the CGIAR and its goals of poverty alleviation and conservation of the environment. He stressed the key role of CIFOR in achieving that mission.



(left to right) MOF Secretary General Oetomo, Bo Bengtsson, Jeffrey Sayer and Ismail Serageldin watch as Minister of Forestry Djamaludin signs the plaque inaugurating CIFOR's headquarters

Minister of Forestry Djamaludin assured the audience of Indonesia's commitment to adopting balanced principles of conservation and utilisation of forests for the benefit of the people and future generations. He expressed the wish that the establishment of CIFOR in Bogor will enhance Indonesia's scientific capability through co-operation between Indonesian and CIFOR researchers.

The second phase of the complex, expected to open in mid-1997, will contain additional laboratories, offices and facilities. It will also house the Asian office of our sister institution, the International Centre for Research in Agroforestry (ICRAF). CIFOR welcomes the opportunity that this will provide to further strengthen our already close links with ICRAF on forests, trees and people.

CIFOR's headquarters, Bogor, Indonesia



RESEARCH INSIGHTS



Developing Incentives and Institutions for Protecting the Eastern Rainforests of Madagascar

The thousands of families who create new *tavy* (swidden) fields from Madagascar's eastern rainforest each year have many reasons for doing so. Growing rice by rain-fed shifting cultivation is part of a Malagasy lifestyle and belief system, land being inherited from a collective referred to as "the ancestors" who include all deceased relatives. Pursuing a lifestyle similar to that of the ancestors is an important form of respect. Thus the practice of *tavy* is part of paying homage to them. For outsiders moving in, assimilation is important and this encourages them to also practise *tavy*.



Burning to create new tavy fields for upland rice production in Madagascar's eastern rainforest (photo: Louise Buck)

These families are among a rapidly growing, country-wide labour force that is 90 per cent agrarian, the vast majority of whom rely on subsistence farming for survival. Living in one of the poorest countries in the world, with an estimated per capita income of US\$190, they have few feasible alternatives to exploiting the forests and forest resources. Slash and burn agricultural techniques practised in

Madagascar generate low yields which decline quickly from year to year, making it necessary for farmers to move to new fields.

From the country's independence from France in 1960 until about 1985, anti-deforestation laws were virtually ignored. Though enforcement has since increased, the current complex of laws affecting forestry (colonial, Malagasy, constitutional and traditional) are often conflicting and unclear. Thus policy is variously interpreted by different jurisdictions and enforcement entities. The general land-tenure rule in the eastern rainforest region, however, is that the person who first clears and cultivates a piece of land gains exclusive agricultural rights to it. Because a household cannot secure rights to land without clearing it, the land-tenure regime encourages the match-box holder to strike and light!

The resources being lost due to these practices are enormous (though generally valued against a very different set of measures than the Malagasy farmer uses). The rain and cloud forests of eastern Madagascar have some of the highest species endemism in the world, and are among the most endangered vegetation types in this biologically unique island country. Perhaps most notable to the international conservation community is the forests' habitat value for numerous species of lemur, which exist nowhere else. Of considerable national economic as well as environmental importance, these forests are isolated remnants of a much larger primary forest system estimated to have been 65-70 per cent destroyed by human activity.

The Malagasy Government realised in the mid-1980s that intervention was needed to limit the rampant destruction. The

shifting cultivator needed alternatives (coupled with meaningful sanctions) and the national economy needed better ways to derive value from the remaining rainforest in order to maintain its many useful but under-valued functions. A concentrated government effort to create a conservation-related sustainable development system resulted in a National Conservation Strategy in 1984, a Forest Policy in 1985 (currently under revision) and a National Environmental Action Plan (NEAP) in 1989. The fifteen-year NEAP is supported by a co-ordinated international community of donors. The conservation of an expanded system of protected areas is a central element of the plan.

To help generate alternatives for the nation's exceptional forest heritage, the Malagasy Government has invested in a system of Integrated Conservation and Development Projects (ICDPs). These are "laboratories" for building institutions that can integrate the goals and practices of forest protection with the use and conservation of natural resources for sustainable development. ICDPs focus both on improving professional management capacity for protected areas, and on generating alternative livelihood opportunities for residents of designated "peripheral zones" whose activities threaten the protected forest.

A central challenge in the ICDP effort has been expanding local community authority and capacity for natural resource management while addressing needs for enforcement of existing protected area and forest regulations. Gaps in Madagascar between legality and practice, and between "customary law" that is embedded in local social codes known as *Dina* that have legitimacy with local people, and official law which often does not, are notable. Helping to understand and bridge these gaps has served as a strategic intervention strategy for CIFOR's action research in Madagascar on Protected and Peripheral Area Management Systems.



Principal investigators (left to right) Jean Rakatoarison, Bruno Ramamonjisoa and Maminiaina Razafindrabe at Ranomanafa (photo: Louise Buck)

Until recently the country's general devolution policy, codified in the 1992 Constitution, was vague about natural resources management. In October 1996, the Local Community Management of Renewable Natural Resources Act was adopted by the Malagasy legislature. It provided an important new legal basis for localities to assume responsibility and share in the benefits of governing and managing their natural resources. CIFOR's research helped to shape the new law, and is presently helping to find a process for its implementation for protected forest environments.

A focus of CIFOR's effort is to help negotiate community-based forest management agreements through a process of "Resource Use Negotiation" – with interactions between researchers and key stakeholders, and then participatory evaluation of the processes and outcomes by the persons affected. The method is being applied in the ICDPs associated with the Ranomafana National Park, established in 1991, and the proposed Masoala National Park, both designated to protect unique and essentially intact tracts of eastern rainforest. The effort is helping to elaborate principles, guidelines and procedures for negotiating forest



Lalaina Rakotoson (left) with leaders of a Tanala village adjoining Ranomafana National Park discusses customary forest law (photo: Louise Buck)

protection and sustainable use agreements among stakeholders. The process originates from community perspectives on livelihood, tenure and governance issues that affect local people's behaviour towards protected forests.

Studies in strategically selected buffer zone communities have shown how people depend on protected forest resources for their security and well-being, how various complementary and competing rules of access affect the use of these resources, and the roles of communities in deciding how and by whom resources may be exploited, including sanctions for offenders. Information is generated with communities through participatory methods. The studies reveal how the standing forest can become more valuable to communities if they are allowed to make non-degrading use of the protected forest, whereas exclusion and prohibition strip the forest of all value other than a one-time fertiliser application to rice fields. In Ranomafana NTFPs have been the basis for negotiating resource use and management agreements among communities. In Masoala where the timber value of forest resources is much

higher than in Ranomafana, this is the negotiable resource of principal interest to communities. A timber-based community management agreement is being negotiated, based on certification of the wood resources by Woodmark for export to "green markets" in Europe.

These activities are only part of the ICDP strategies to preserve the Ranomafana and Masoala rainforests. Intensification of lowland rice systems, the development of more permanent tree-management systems in the upland areas, and improved returns from tourism are also being pursued to create alternative livelihood options. As relationships between park protection agents and communities improve due to these developments, devolved forest management agreements should become part of the local institutions and culture.

CIFOR's partners in this consortium include the Department of Environmental Law and Management of the University of Fianarantsoa (Jean Rakotoarison), and the Departments of Forestry (Bruno Ramamonjisoa) and Agro-Management (Maminiaina Razafindrabe) in the Graduate School of Agronomy at the University of Antananarivo, their research assistants and students. The research is led by Louise Buck and locally co-ordinated by Lalaina Rakotoson, an environmental lawyer who specialises in protected area issues. The interdisciplinary research team collaborates with the national agency for protected area management (ANGAP) and the national Forest Department. The operators of the respective ICDPs are also research partners, State University of New York - Stony Brook and Cornell University in Ranomafana, CARE and the Wildlife Conservation Society in Masoala. This research is financially and logistically supported by USAID.

Louise Buck

Effects of Human Disturbance on Genetic Diversity in Tropical Forests

Harvesting timber from forests contributes significantly to the GNP of many countries. However, many more people depend on the forest in less lucrative but more intimate ways, deriving part or most of their livelihoods from harvesting non-timber forest products, or using the forest for livestock grazing and other activities. This is especially true in the tropics.

Tropical forests are estimated to contain more than 50 per cent of all terrestrial biodiversity. The way these are used therefore has very significant implications for global biodiversity. As the forests are so critical for the survival and welfare of so many people in the tropics, conservation of biodiversity must be compatible with continued economic benefits being derived from these forests. It is necessary to achieve a balance between these potentially conflicting demands to ensure that all facets of sustainability – ecological, economic and social – are met. Such a balance requires an understanding of the impacts of harvesting on the genetic resources of tropical forests. CIFOR is currently studying these relationships.

Human activities in forests modify the size and age structure of the tree species, and potentially alter genetic structure and levels of genetic diversity. Disturbance usually involves harvesting a variety of products from the forest: wood, fruit and other foods, medicinal plants, construction materials, and many more. “Disturbance” is used here to mean the impact of human activities on forests, as distinct from “natural perturbations” caused by wind, water or natural fire. Commercial harvesting of timber through logging is a major form of disturbance in many areas, and CIFOR is investigating the impacts of commercial logging in Asia, Africa and Central America.

However, the results presented here come from studies focusing on other forms of disturbance, such as extraction of NTFPs, fire, or the cutting of wood for local consumption.

As use increases, genetic diversity of many species will be affected, with those species unable to tolerate disturbance becoming locally extinct. In order to encourage conservation of biodiversity, it may be necessary to offer financial compensation to those who adapt their harvesting practices to favour biodiversity.

Harvesting products from the forest may affect genetic diversity directly or indirectly. Gathering NTFPs can affect selection, migration and mating systems. For example, harvesting of reproductive structures (fruits, nuts) can affect migration by reducing seed dispersal, modifying the mating system, and may also impose a selection pressure.

The impacts of harvesting will vary according to the “life history strategies” of the species and the type of product harvested, as is demonstrated by research in Thailand and India. CIFOR research partnerships are sampling 6-8 species under different levels of disturbance on two sites.



*Pollination of Aren palm
(photo: Alain Compost)*



Dayak collecting fruits which have medicinal properties, West Kalimantan, Indonesia (photo: Alain Compost)

In Thailand the major study site is a Wildlife Sanctuary and World Heritage Site at Huay Kha Khaeng. The research includes two species of dipterocarp, *Shorea siamensis* and *Dipterocarpus obtusifolius*, that are contrasting, both in terms of ecology and economic uses. *Shorea siamensis* is cut by local people for construction timber. It is predominantly pollinated by a species of weak-flying bee. As disturbance increases (see figure opposite) the density of mature trees falls by a factor of 10. At the same time, the density of flowers per tree increases dramatically. There appears to be a threshold point where the distance between adjacent flowering trees exceeds the distance normally covered by the pollinating bee. Consequently, reproductive success and outcrossing rates decline rapidly, with a related

decline in genetic diversity, both among the embryos and in mature individuals.

In contrast, outcrossing rates for *Dipterocarpus obtusifolius* do not decline at disturbed sites. The effective control of fires within the wildlife sanctuary may increase the loss of flowers and fruit to insects and other pests, thus reducing outcrossing. It would seem that *Dipterocarpus obtusifolius* is a truly fire-adapted species. The consequences of controlling fires and illegal cutting within the wildlife sanctuary therefore seem to favour *Shorea siamensis* at the expense of *Dipterocarpus obtusifolius*.

The most disruptive influence of harvesting is likely to be removal of reproductive structures (flowers, fruit and seeds). In southern India, fruits of *Phyllanthus emblica* are harvested for food and as the base for many traditional medicines.

The villagers in Thailand are best described as forest-margin dwellers. However in India, research has focused on the activities of true forest dwellers – an indigenous tribal group, the Soligas. Research has shown that the Soligas rely on NTFPs for more than 60 per cent of their income. Previously, when living a semi-nomadic existence, their use of NTFPs was probably sustainable. Since being obliged to settle in permanent villages, the collection activities have been concentrated in fewer areas within which the genetic diversity of valuable species has been significantly affected. Reproduction of some of these species has been prevented due to over-harvesting of fruit and seeds. Although other factors may have contributed to these changes, it does seem that the policy-driven change in social activities has adversely affected the resource, at least near villages. As older trees die, the economic viability of the Soligas will also be severely affected as they are so dependent on forest resources.

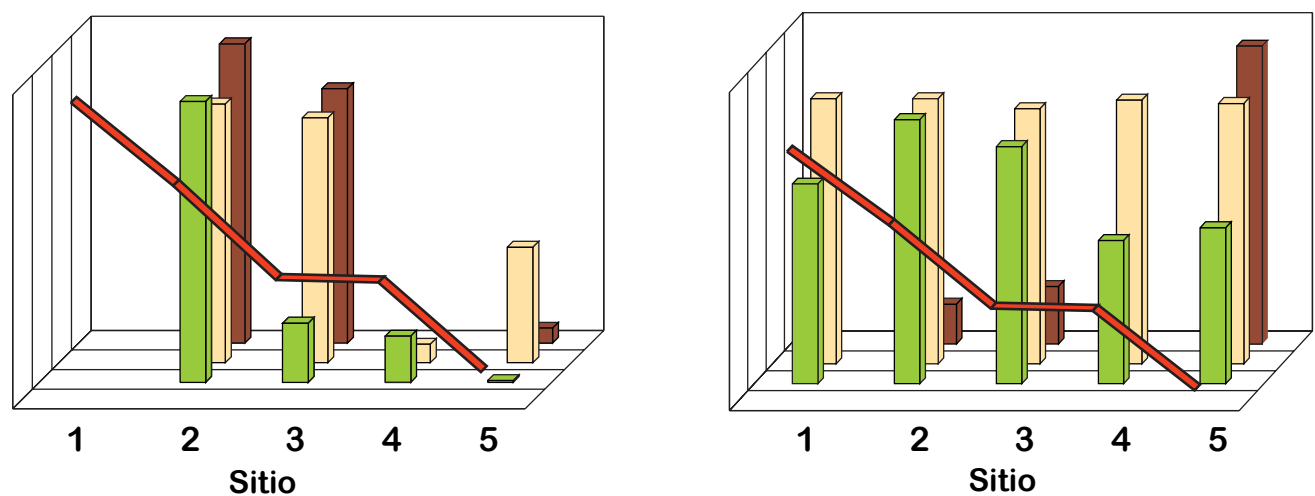
Samples collected from two areas were subjected to three different intensities of collection and separated by only a few kilometres. They show distinct differences in characteristics such as germination percentage, seedling vigour and seed predation. The samples collected from the most disturbed site had the lowest germination percentage and vigour and the highest rates of seed predation. A Principal Component Analysis of seedling phenotypes shows clear differences between the seedlings at the three levels of disturbance. This may simply be due to physical isolation, but the way *Phyllanthus emblica* reproduces (wind pollination and animal seed dispersal) means this is unlikely.

Many integrated conservation projects in areas of high biodiversity have failed because the link between economic activities and resource conservation has

not been understood. The impacts of disturbance are not easily predicted, and will depend on a variety of factors. These include intensity, harvesting cycles and the life history characteristics of the species affected. Harvesting of most products, if carefully regulated, can be undertaken without significant long-term impacts on genetic diversity. Harvesting of reproductive structures for food or medicine is likely to have the most significant impact on genetic diversity, due to the direct consequences of removal of fruits or seeds, and the difficulties in regulating the harvest. Research on these genetic processes can help achieve a balance between the needs of the forest-dependent people and the genetic integrity of the resource.

Timothy Boyle

Effects of disturbance on genetic and demographic factors in Thailand (*Shorea siamensis* left, *Dipterocarpus obtusifolius* right).



Leyenda: La línea muestra el índice de alteraciones para cada sitio (alteración baja = índice alto)

Tasa de reproducción
 Heterocigosidad esperada
 Éxito de la fructificación



What is Sustainable Forest Management?

Sustainability can mean different things to different people. It is not a fixed steady-state situation but changes with societies' needs and so varies over space and time

Since the UNCED92 Rio conference on the environment, several important international initiatives have sought to identify standards (criteria and indicators) for sustainable forest management. These initiatives have moved the global community closer to a consensus on what constitutes sustainable forest management. However, research to develop criteria and indicators, or standards, by which to judge forest management is still needed.

CIFOR has tested criteria and indicators using inter-disciplinary teams of foresters, social scientists and ecologists with inputs from local stakeholders. The tests took place within operating forest management units in Germany, Indonesia, Côte d'Ivoire, Brazil, Austria and Cameroon. These tests revealed that two of the most contentious issues requiring further research are the social criteria and indicators, and the impacts of disturbance on genetic diversity.

Social Criteria and Indicators

Most reliable methods of assessing the social criteria and indicators are too time consuming and the quick ones are too "dirty". The project has attempted to develop and test relevant social science methods which are simple, quick and reliable. The methods were tested in areas familiar to CIFOR staff or collaborators so that results could be compared with knowledge from long-term research. Subsequent testing will be carried out in Cameroon and East Kalimantan initially.

Three priority issues for the social component were:

- Definition of relevant stakeholders in forest management;
- Inter-generational access to resources;
- Participation in forest management.

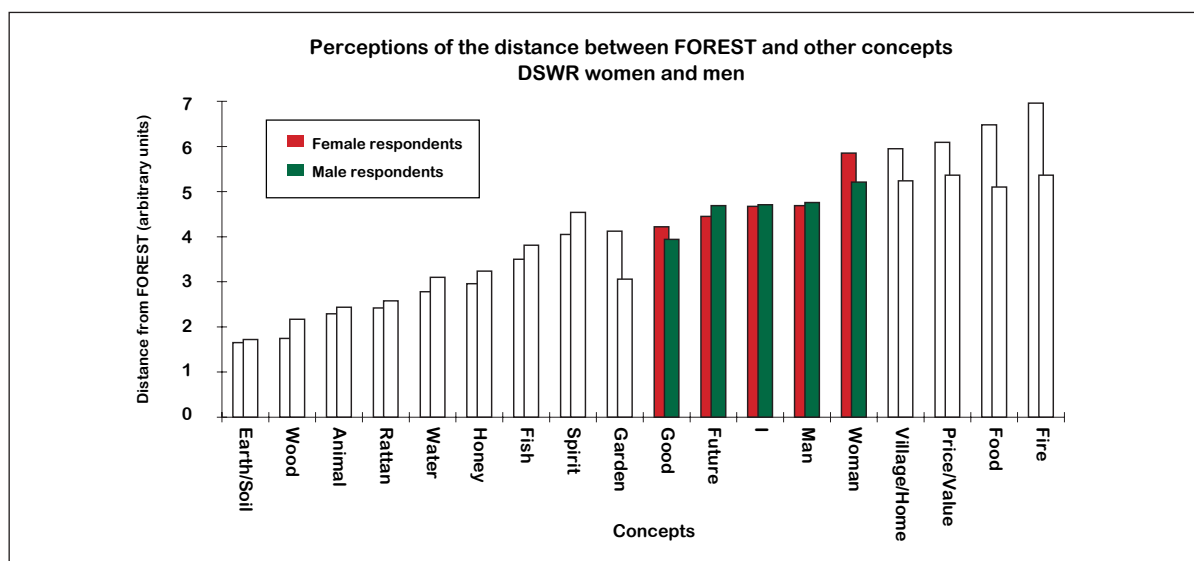
The social criteria and indicators developed were pre-tested in and around the Danau Sentarum Wildlife Reserve (DSWR) in West Kalimantan, Indonesia, and in Cameroon (near Kribi and Mbalmayo). In West Kalimantan, local people do not just "participate" in the management plans of others. In reality, day-to-day management is primarily in their hands, with timber companies or the state playing an ephemeral or supporting role.

The existence of a "conservation ethic" among local people is important in determining who counts in sustainable forest management. While not easily defined, there are observable differences in people's feelings of affinity for the forest (e.g., Borneo's indigenous Dayaks *vis-à-vis* transmigrant farmers from Java; the Amazon's long resident *ribeirão's* vs the settlers who come there from southern Brazil). Understanding the forest-culture link and being able to assess it easily is important in our attempt to define relevant stakeholders and perhaps to assess sustainability more generally.

The figure opposite presents some of our survey findings from women and men in Danau Sentarum about their perceptions of the forest and important related

CIFOR anthropologist Carol Colfer interviews women from Tanab Merah, East Kalimantan (photo: Alain Compost)





concepts. In assessing a “conservation ethic”, we expected the “forest” to be particularly close to such concepts as “me”, “good”, “future” and “spirit”. Instead, the comparatively great distances of “forest” from those concepts are intriguing, considering that these people reside in a sustainably managed forest area.

The similarities between men’s and women’s views on forest issues, in and around the Danau Sentarum Wildlife Reserve, are consistent with their easy communication and the comparatively egalitarian attitudes of these communities about gender. In Cameroon where sustainability profiles are quite different, we anticipate different results about the links between the people and the forest.

During 1997, CIFOR will test new methods in four areas of Cameroon in collaboration with: Avenir des Peuples des Forêts Tropicales and Comité Diocésain des Activités Socio-Caritatives near the Dja Reserve; IITA-Humid Forest Systems and Dr. John Mope Simo near Mbalmayo; Mt. Cameroon Project near Limbe; and Tropenbos Foundation near Kribi. In East Kalimantan partners include Mulawarman University, Kehati Foundation, Asia Forestry Network and the Ministry of Forestry’s Center for

Research and Development on Forests and Nature Conservation.



People from Tanab Merab, East Kalimantan point out the incursions of industrial plantations on their lands (photo: Alain Compost)

Impacts on Genetic diversity

Genetic variation is required for species to survive and reproduce in the array of conditions they face. Genetic conservation is also a necessary pre-condition for the future evolution and adaptability of local populations and of entire species. However, genetic variation is difficult to measure directly and hence its loss is easy to ignore – until it is too late. Genetic erosion can ultimately lead to species extinctions and ecosystem loss, and thus restrict development options.

The conservation of evolutionary processes is a necessary biological criterion by which the sustainability of forests can be judged. Genetic indicators of those processes can reflect the sustainability of the evolutionary processes. Four genetic indicators are necessary for sustainability (see table below).

To use these indicators effectively, a preliminary screening of susceptible species is necessary, followed by a risk assessment based on the indicators. This can identify species at risk under a given management system. Since no common standard exists, assessment must be made on reference populations as well as the affected populations. Sampling and analysis must ensure that temporal differences are detected and that factors, such as location, generation, age and density, are disaggregated.

A system of three levels of sustainability can be devised to indicate the potential damage to a species of a particular management action: levels of genetic variation may be so low that demographic recovery is unlikely; prospects for adaptation may be so poor that future adaptation is constrained; and

migration may be so restricted that colonisation does not occur. If the mating system cannot regenerate genetic variation, then little can be done to sustain the system – a case of unconditional non-sustainability. On the other hand, if all indicators are that the system can renew itself regardless of future events, then little can be done to improve sustainability and an unconditional acceptability of risk may exist. However, if some of the indicators are at indeterminant levels, then a conditional acceptability could be declared and interventions warranted.

The use of standards (or criteria and indicators) to decide whether a forest management system is sustainable or not must take account of not only the silvicultural aspects of tree growing but also the social and biodiversity implications. Field assessment of these indicators as well as recognition of varying social environments in which actions take place require that those most closely affected by forests be involved in their management.

*Ravindra Prabhu, Carol Pierce Colfer
& Timothy Boyle*

Four indicators of genetic diversity and their relationship to common forest operations. An "X" indicates that forest operation is likely to have an impact on the relevant indicator

Modes of Utilisation	INDICATORS			
	Levels of genetic diversity are maintained	No directional change in genic/genotypic frequencies	No changes in the mating system	Changes in gene migration
Logging - Commercial Species	X	X	X	
Logging - Non-commercial Species	X	X	X	
Grazing		X		
Fire			X	X
NTFPs - Reproductive		X	X	X
NTFPs - Non-reproductive		X	X	X
NTFPs - Whole Individuals		X		
Forest Conversion	X	X	X	X

Extractive Reserves in the Brazilian Amazon: Prospects for the Future

The Brazilian Extractive Reserves are collective long-term land-use rights given by the government to whole communities of forest-based people. They were proposed by the Conselho Nacional de Seringueiros (Rubber Tappers National Council or CNS) in 1985 as a way to defend their rights against logging and cattle-ranching pressures. This approach to combining land reform with conservation gained international momentum after the murder of Chico Mendes, leader of the CNS.

The first extractive reserve created in Brazil was Alto Jurua (REAJ), in the west of the State of Acre. With half a million hectares and around 5,500 inhabitants, REAJ has been a pioneer in social organisation, design and implementation of forest management.

At the end of 1995, CIFOR began support of a long-term research effort led by Professor Mauro Almeida of Campinas University, where fifteen years of detailed information had accumulated. With CIFOR's support, Professor Almeida's team is preparing a database that will be used to better understand the dynamic processes and their causal relationships, and to develop models to explore possible future scenarios. The provisional findings of the team already reveal the great resilience of the rubber tapper communities which have stayed on in Alto Jurua despite a four-fold decline between 1982 and 1992 in the price paid for their rubber.

This resilience is reinforced by large movements of people inside the Reserve, who are abandoning the headwaters (which are rich in rubber trees) to settle near the main rivers. They have achieved survival by changing their mix of activities and drastically reducing the production of rubber in response to low

prices. Rubber is thus becoming more marginal in the economy of the REAJ. It has been overtaken by small-scale agriculture, and by income from salaries earned as teachers, health assistants or state administrators or from pensions. Rubber tappers and farmers now tend to accumulate a few head of cattle. These new trends in the REAJ are affecting its conservation status, with pressure now concentrated on the river banks. The population density of some heavily hunted species is also increasing in the hinterlands as fewer people go there for rubber-tapping. The deforestation rate is still very low, estimated at 3 per cent for the whole REAJ, which is well below the upper limit of 5 per cent foreseen in the management plan.

This process of change will probably lead to re-evaluation and re-formulation of the role and potential of extractive reserves in Brazil. CIFOR expects to help decision makers reconcile development and conservation objectives by contributing to the better understanding of these changes and modelling the likely results.

*Manuel Ruiz Pérez
& Mauro Almeida*



Typical rubber tappers house in Alto Jurua Extractive Reserve, Acre, Brazil (photo: Manuel Ruiz Pérez)



Buying Carbon to Promote Reduced-Impact Logging



*Taking forest inventory
(photo: Michael Ibach)*

Environmentally sound forest harvesting and transport operations are essential components of sustainable forestry. For the most part, technologies for harvesting industrial timber in environmentally sustainable ways are well understood and have been mandated in the forests of industrialised countries for many years. In spite of this, such technologies have not been widely adopted in tropical countries. Logging operators in the tropics argue that they cannot find workers and supervisory personnel with the necessary skills to utilise such technologies, and that reduced-impact logging is more costly than “conventional” logging and would thus put them at an economic disadvantage compared to competitors.

To successfully promote reduced-impact logging (RIL) for tropical forests four key questions require answers:

- Is it possible to develop simplified procedures that can be readily understood and applied by less-skilled personnel while retaining most of the benefits associated with environmentally sound logging systems?
- Can reduced-impact logging technologies be applied in ways that reduce overall logging costs (or at least minimise the increase in costs) compared to conventional logging?
- Can policies or other instruments be developed which would provide economic incentives sufficient to encourage loggers to adopt reduced-impact logging technologies?
- To what degree do factors external to the forest sector influence the selection and application of logging technologies?

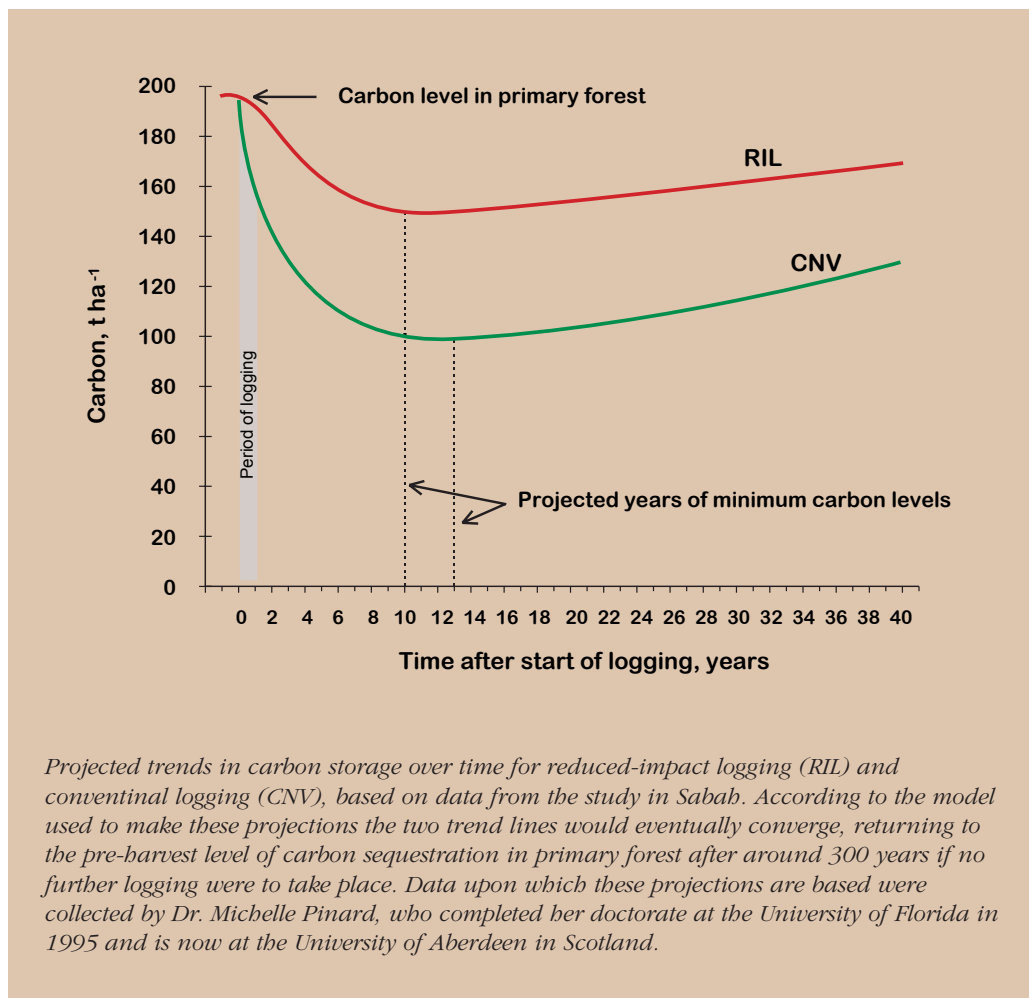
To answer these questions, CIFOR research partnerships in seven countries are collaborating in inter-related studies. One study, which has been under way in Sabah, Malaysia, since 1993, investigates the potential for using carbon-sequestration payments to promote the adoption of reduced-impact logging. Other studies (one in Cameroon and two in Brazil) began in 1996. The remaining three (one in Bolivia, one in Indonesia at the Bulungan Research Forest, and one involving field work in both Tanzania and Zambia) are expected to start in 1997 or 1998.

In Sabah CIFOR is collaborating with Rakyat Berjaya Sdn. Bhd. (RBJ), an industrial subsidiary of the Sabah Foundation, whose contract logging crews do the field work. The New England Power Company of Massachusetts, USA, funds these activities as a carbon-sequestration project. In the United States, such projects are used by power companies to pay for the sequestration of carbon in forests as an offset to the carbon released into the atmosphere through the burning of fossil fuels to generate electricity. In this particular case, New England Power pays RBJ for the increase in sequestered carbon resulting from RBJ's use of reduced-impact logging techniques. These techniques leave behind significantly more living trees and other vegetation (and therefore sequestered carbon) than does conventional logging.

CIFOR teams (including scientists from the University of Florida) measure the difference in carbon sequestration from reduced-impact logging as compared to conventional logging. They are using field assistance from foresters and technicians at RBJ with policy-level involvement by the Sabah Forestry Department. The Forest Research Institute of Malaysia and the Rainforest Alliance, a non-governmental organisation based in New York City, help carry out annual environmental audits of the logging operations.

Harvesting with reduced-impact logging techniques does increase significantly the quantity of carbon stored in living biomass compared with areas harvested using conventional logging techniques.

One year after harvesting, the RIL area in this study held about 100 tons/ha more total living biomass and 42 tons/ha more carbon than the conventionally logged area (see figure below). This difference will increase dramatically during the first 10-15 years after logging because of the large number of trees severely damaged by logging (and expected to die) in the conventionally logged area. Reduced-impact logging retains significantly more carbon in living plants and in the soil than does conventional logging. It reduces damage to residual trees and other vegetation during the harvesting operation, and limits the amount of soil disturbance resulting from the operation. In this study, 41 per cent of the unharvested trees smaller than 60 cm in diameter at breast height were severely



damaged by conventional logging. In the RIL operation only 15 per cent of these trees were similarly damaged.

In addition, 17 per cent of the conventionally logged area was covered by roads, skidtrails and landings as compared to only 6 per cent on the RIL area. Furthermore, skidtrails in the RIL area were less severely disturbed than those in the conventionally logged area. The proportion of skidtrails with subsoil disturbance in the RIL area was less than half that in the conventionally logged area. The guidelines for RIL techniques have been revised based on experiences in the field with loggers. The most difficult aspects are related to the construction and maintenance of skidtrails and roads.

The study in Sabah demonstrates clearly that reduced-impact logging can substantially increase the quantity of carbon sequestered over time in managed natural forests. Carbon-offset

projects thus provide one potential way to pay any additional costs associated with the application of reduced-impact logging in tropical forests. CIFOR is currently involved in negotiations within Indonesia to undertake a similar study to further investigate potential methods for paying any additional costs at the scale of a full timber concession. Detailed economic analysis will be necessary to estimate the minimum contribution needed (through carbon offsets or any other type of incentive) to encourage the adoption of reduced-impact techniques.

CIFOR has a key role to play in promoting the use of RIL in those countries with forests of high biodiversity, and where people rely significantly on forest resources for their welfare. Preservation of a maximum level of undisturbed forest cover while maintaining commercial use of the timber can satisfy a broad range of demands extending from the local to the international arenas.

Dennis Dykstra

Land preparation in a forest farm, Cameroon (photo: Andy Gillison)



Rehabilitation of Degraded Tropical Forest Ecosystems

Almost 17 million hectares of tropical forests are cleared for agriculture annually, while a further 5 million hectares become secondary forests after timber harvesting. Detailed knowledge of the long-term impacts of tree harvesting on forest ecosystems, especially changes in vegetation, soil and productivity, is still lacking. Assessing the impacts of logging and burning through long-term monitoring over a range of conditions (e.g., the time and methods of logging, transport, species removed, soil characteristics, topography and rainfall), will provide the scientific basis for minimising site damage and facilitating ecological restoration.

Rehabilitation of degraded forests and lands is urgent. In logged-over forests, where former ecosystems remain more or less intact, methods to accelerate natural regeneration are needed. Where ecosystem functioning has been disturbed, plantations provide an option. However, the success of regeneration or reforestation depends on accurate evaluation of site conditions after logging. Analyses of biological and physiological characteristics of regenerated or newly planted trees – and of the processes influencing productivity – are necessary if rehabilitation and reforestation activities are to succeed.

Short-rotation plantations cause changes in nutrient storage and cycling processes due to changes in erosion, leaching and patterns of organic matter turnover. All of these affect the sustainability of plantations, but opportunities exist to manipulate them through silvicultural practices. The challenge for researchers is to provide the scientific information to devise silvicultural systems which enhance soil properties important to sustainable production, and minimise deleterious effects. These practices must

not only be technically feasible and economically viable but also socially acceptable.

In consultation with scientists at the Forestry and Forest Products Research Institute at Tsukuba, Japan, a framework for research has been prepared. During 1995-96, research partners were identified and a set of inter-related research activities developed. The research is being managed by Dr Shigeo Kobayashi, based in Bogor, and conducted in collaboration with a network of scientists in Indonesia and Peru. Additional work is taken place in Malaysia, Papua New Guinea, Brazil, Thailand and Argentina. This research complements and reinforces other CIFOR research on the sustainable management of natural forests and plantations, and conservation of genetic resources and the environment by addressing:

- Evaluation of the impacts of forest harvesting on forest ecosystem functions;
- Development of methods to rehabilitate logged-over forests and degraded forest lands; and
- Development of silvicultural techniques on degraded forest lands (site management and productivity in tropical forest plantations).

This collaborative research is generously supported by the Ministry of Foreign Affairs through the Ministry of Agriculture, Forestry and Fisheries, Japan.



Shigeo Kobayashi with DG Jeffrey Sayer

Shigeo Kobayashi



TROPIS: Tree Growth and Permanent Plot Information System

TROPIS is the acronym for the Tree Growth and Permanent Plot Information System sponsored by CIFOR to promote more effective use of existing data and knowledge about tree growth.

TROPIS is concerned primarily with information about permanent plots and tree growth in both planted and natural forests throughout the world. It has five components:

- a network of people willing to share permanent plot data and tree growth information;
- an index to people and institutions with permanent plots;
- a database management system to promote more efficient data management;
- a method to find comparable sites elsewhere, so that observations can be supplemented or contrasted with other data; and
- an inference system to allow growth estimates to be made in the absence of empirical data.

TROPIS is about people and information. The core of TROPIS is an index to people and their plots maintained in a relational database. The database is designed to fulfil two primary needs:

- to provide for efficient cross-checking, error-checking and updating; and
- to facilitate searches for plots matching a wide range of specified criteria, including (but not limited to) location, forest type, taxa, plot area, measurement history.

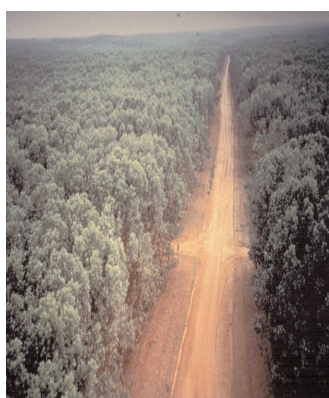
The database is essentially hierarchical: the key element of the database is the informant. Each informant may contribute information on many plot series, each of which has consistent objectives. In turn, each series may comprise many plots, each of which may have a different location or different size. Each plot may contain many species. A series may be a thinning or spacing experiment, some species or provenance trials, a continuous forest inventory system, or any other aggregation of plots convenient to the informant. Plots need not be current. Abandoned plots may be included provided that the location is known and the plot data remain accessible. In addition to details of the informant, we try to record details of additional contact people associated with plots, to maintain continuity when people transfer or retire. Thus the relational structure may appear complex, but ensures data integrity.

At present, searches are possible only via mail, fax or email requests to the TROPIS co-ordinator at CIFOR. Self-service on-line searching will also be available in 1997. Clients may search for plots with specified taxa, locations, silvicultural treatment, or other specified criteria and combinations. TROPIS currently contains references to over 10,000 plots with over 2,000 species contributed by 100 individuals world-wide.

This database will help CIFOR as well as other users to make more efficient use of existing information, and to develop appropriate and effective techniques and policies for sustainable forest management world-wide.

TROPIS is supported by the Government of Japan.

Jerry Vanclay



*Three and half year old
Acacia mangium in PT Musti
Hutan Persada plantations,
Subanserisi, Sumatra
(photo: Christian Cossalter)*



RESEARCH PROGRESS



Underlying Causes of Deforestation, Forest Degradation and Poverty in Forest Margins

Principal Collaborators:

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During 1996, this project focused on three medium-term comparative studies:

- how policies, market trends and changes in population affect tropical forests in Bolivia, Cameroon and Indonesia;
- the impact of policies on household livelihood strategies in the miombo forests of southern Africa; and
- forestry policies in Central America.

The study of extra-sectoral influences in Bolivia, Cameroon and Indonesia involves CIFOR staff and national researchers from each country. It began with an international workshop of study participants in Puncak, Indonesia, in March 1996. There it was decided to initially concentrate on: general trends regarding deforestation and forest degradation and the livelihoods of forest-dependent people in each country; and how these have been influenced by macro-economic, agricultural and forestry policies, and by population growth and migration.

Specific products resulting from this research so far include: published papers on why deforestation rates have historically been low in lowland Bolivia, and on the impact of structural adjustment on deforestation and forest degradation there; a CIFOR Occasional Paper on the rates and causes of deforestation in Indonesia (in English and Indonesian); a draft report on the impact of macro-economic and agricultural policies on deforestation in Cameroon; and discussion papers on the relationship between population growth

and migration and deforestation in Cameroon and Indonesia.

The southern Africa study began in mid-1996, and currently involves four institutions and thirteen researchers from Zimbabwe, Tanzania and Malawi. In each country three sites have been selected which will be monitored to evaluate the impact of macro-economic and other policies on the livelihoods of miombo woodland-dependent communities. This should make it possible to design policies to improve these livelihoods in the future. During the year, the conceptual framework and key hypotheses for the study were developed, research sites were selected in each country, participatory rapid rural appraisals conducted, and survey questionnaires designed and tested. Background papers on macro-economic and sectoral policies were also prepared.

The Central American forestry policy study is a joint initiative with the CCAB, FAO, GTZ and the IICA. In its first phase in 1996, teams from Central American universities and NGOs conducted national case studies on the policy constraints hindering the forestry sectors of each of the seven countries in the Central American isthmus. A regional seminar was held to discuss the results in Panama City in May 1996.

All these activities will continue through the coming year. This project has benefited from additional financial support from USAID.

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Forest Ecosystem Management

Forests do not occur in isolation from other elements in the landscape. Many plant and animal species that occupy forests also make their homes in surrounding savannas, wetlands and land-use mosaics. The development of options for sustainable forest management must take into account the many factors that determine the behaviour of forest elements within the surrounding landscape. Forest Ecosystem Management (FEM) seeks improved understanding of these factors, including



CIFOR research assistant Nining Liswanti measuring plant functional attributes, Indonesia (photo: Andy Gillison)

the interactions between the socio-economic and biophysical variables. Understanding the very complex interactions between people and forests is vital if effective management and policy options are to be developed. FEM is therefore concerned with integrating knowledge about representative areas of the tropics, to predict the outcomes of different management options.

This year saw the development of spatially referenced databases in eco-regional transects located in the western Amazon, Indonesia (Sumatra and East Kalimantan) and Cameroon in humid west tropical Africa. The most intensive of these is in the Jambi Province of Central Sumatra. There, the broad-ranging transect covers about 2000 square kilometres, ranging from montane forest at about 3800 metres above sea level to widespread, coastal wetlands that include rainforest on peatlands as well as tidal mangroves. The people who occupy the area range from nomadic forest dwellers (Kubu) to urban industrialists. The Jambi transect offers an enormous variety of socio-economic and biophysical characteristics relevant to much of the world's tropical forested lands. Data recorded so far include topography, climate, soils, geology, stream and road networks, land-tenure patterns, logging concession and national park boundaries, demographic and other socio-economic data.

CIFOR's growing multi-variate database can support a wide range of multi-disciplinary research interests – from modelling forest ecosystem behaviour to examining linkages between forests and climate.

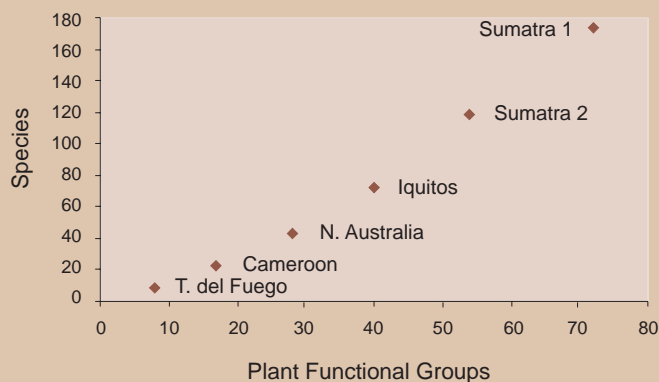
The Jambi benchmark site was the focus this year for an intensive ground-truthing operation involving remotely sensed radar (the INDREX project). For that study, a team of about thirty field staff from Indonesia and overseas were trained in rapid survey methods. These methods were developed by CIFOR, to locate and record vegetation data in a way that may identify useful correlates between plant-based characteristics and cloud-piercing, radar imagery. The study will help improve the capacity of managers and planners to evaluate

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Extraordinary Species Richness in Central Sumatra

Analysis of a late-1995 baseline study of biodiversity patterns in Central Sumatra on the borders of the Kerinci Seblat National Park revealed extraordinarily high levels of richness in vascular plant species and in butterflies and moths. For plants, the record still stands at 169 species per 200m² plot. While this cannot be readily extrapolated per hectare, many plots averaged about 120 species. The best record to date from the lowland forests of the Peruvian Amazon basin, widely regarded as containing some of the world's richest forests, is only 70 species. The figure illustrates species levels of the richest plots so far recorded using the rapid survey technique in a number of different countries. More recent data from lowland Jambi Province in Central Sumatra continue to give consistently high records, with a staggering 62 woody plant species recorded from one 5x5m quadrant in a semi-natural durian forest. Although these values are the highest recorded anywhere in the world so far, including other areas of Indomalesia, there is no immediate explanation for this phenomenon. As well as species, the plots are also very high in plant functional types. Global baseline studies of this kind illustrate CIFOR's comparative advantage in establishing a much-needed, global context for biodiversity assessment.



natural resources using more cost-effective imagery than that obtained via LANDSAT and SPOT satellite techniques that are often hampered by cloud layers.

Geo-referenced data for the other FEM benchmark sites in East Kalimantan, the western Amazon basin and Cameroon are progressing. In association with the

ICRAF Alternatives to Slash and Burn (ASB) project, FEM will co-develop the databases needed to construct geographic information systems and testable models of options for management of forests and agroforests.

To improve methods of forest assessment, CIFOR has been testing use of a minimum set of plant functional attributes (PFAs) to make ecological comparisons between sites, where physical, environmental and adaptive responses may be similar but where the plant species differ. In an intensive biodiversity baseline study in two logging concessions in the Kerinci Seblat National Park buffer zone, an international team recorded data on birds, small and large mammals, insects and vascular plant species as a way of identifying logging impacts.

Preliminary analyses of the data indicate this area of central Sumatra may be outstandingly rich in biodiversity of certain insect and plant taxa. When compared with plant data collected using the same techniques in the western Amazon basin, the upland forest sites recorded at least twice the number of vascular plant species (see box). This is the highest level of species richness so far recorded anywhere in the world using these survey techniques. An analysis of global data has also shown a surprisingly close correlation between the total number of plant species per plot and the total number of unique plant functional types (PFTs). Forest managers and biodiversity surveyors in many tropical forests may be able to reliably estimate species richness from readily recordable PFTs using a simple statistical formula.

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Multiple Resource Management of Natural Forests

Each of three major research activities expanded significantly this year.

The main focus for the Reduced-impact Logging (RIL) field research was again in Sabah, Malaysia, where carbon-sequestration payments have encouraged the adoption of reduced-impact logging since 1993 (see pages 24-26). The results of a pilot study on the impacts of RIL on methane emissions suggest that these impacts are not important at this time. During the field assessments, it became clear that in the long term bridge abutments and culverts create serious problems when not properly constructed and maintained. Stream sediment rates may decline, on average, within a few years after even destructive logging. However, major storms may result in significant pulses of sediments when bridge abutments and culverts fail, an unavoidable event when they are constructed from untreated wood. Two

Stand of old teaks at Bosonegoro, East Java (photo: Christian Cossalter)



papers based on the research in Sabah were published this year. CIFOR is currently negotiating to undertake a similar study at timber concession scale in Indonesia. Other studies in Cameroon and at two sites in Brazil began in 1996, and another is planned for Bolivia in 1997.

A workshop on research methods for studies on RIL was organised jointly with USAID, the USDA Forest Service and FAO in Bogor and East Kalimantan, Indonesia. Seventeen participants from Asia, Africa and Latin America attended. A second workshop, mainly for Latin Americans, is being planned next year in Bolivia.

Research to synthesise and help transfer previous research results on the management of lowland rainforests of humid Africa (known as FORAFRI) started in January 1996. In the first five months, collaborative links were established with the different potential partners in five countries: Cameroon, Congo, Central African Republic, Côte d'Ivoire and Gabon. This "initiation" phase concluded with a workshop in Bangui (Central Africa Republic) of about forty representatives from the full range of project "clients": NARS, private sector, NGOs, and training institutions. In December 1996, FORAFRI jointly organised a workshop on the definition of research programmes for natural forest management with the Congolese Ministry of Research and CIRAD-Congo. Output of this workshop will serve as the basis for defining priority forestry research in the region.

As part of the review and synthesis work under way on natural forest silviculture in the American tropics, a seminar-workshop was held in Pucallpa, Peru. It was attended by sixty Latin American researchers and practitioners, to exchange experiences on silvicultural

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practice in the region's natural forests and identify priorities for research. (The proceedings of the meeting will be jointly published early in 1997 in Spanish by CIFOR and CATIE.) An annotated bibliography on natural forest management in the American tropics was completed for publication by CATIE and CIFOR in early 1997.

CIFOR and CATIE in 1996 conducted collaborative research on the management of secondary forests in the American tropics. The main aim is to improve resource management options by integrating production from secondary forests into the wider context of land use, especially for resource-poor people on the forest margins. Secondary forests are the woody vegetation which develops on land abandoned after its original vegetation was destroyed by

human activities. The research will be initially conducted at two sites in the Amazon region of Brazil (Zona Bragantina, Para State) and Peru (Pucallpa), and one in the Atlantic lowlands of Nicaragua (Rio San Juan).

A planning workshop with collaborating institutions was held in Pucallpa in June, and a second project meeting focusing on research methodologies for the biophysical and socio-economic components in October at CATIE, Costa Rica. This first phase is funded by the Inter-American Development Bank.

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The upper Jurua River meanders through forest in West Acre, Brazil (photo: Manuel Ruiz Pérez)



Assessing the Sustainability of Forest Management: Testing Criteria and Indicators

International interest in developing criteria and indicators (C&I) reached new heights in 1996 as a result of their inclusion in the agenda of the Intergovernmental Panel on Forests of the United Nations Commission on Sustainable Development.

The results of the first phase of field tests (in Germany, Indonesia, Côte d'Ivoire, Brazil and Austria) revealed that more than half the criteria and indicators proposed as relevant for the policy and legal framework, ecological and production aspects were common to all test sites. There was however a marked and sharp divergence regarding the social aspects of forest management. The tests also revealed that considerable work is still needed to make the conceptual framework of principles, criteria, indicators and verifiers more consistent and operational. Based on the identification of gaps in existing knowledge, additional work also commenced on management impacts on biodiversity, social aspects, and on the sustainability of forests managed by local communities for multiple purposes (see pages 20-22).

A pre-test of eight social science methods in and around the Danau Sentarum Wildlife Reserve in West Kalimantan, Indonesia, was completed and evaluated. A participatory card sorting technique was revised and adopted as very useful in determining the roles of relevant local stakeholders. In this method, people ranked stakeholders by importance in forest management and by frequency of interaction. Accurate assessments of sustainably managed forests must ensure that the real managers of forests, not just the "official" managers, have been

included.

Improved criteria and indicators to assess the impacts of forest management on biodiversity were developed through a series of workshops, the first of these dealing with genetic criteria and indicators. Led by Gene Namkoong of the University of British Columbia, a team of six eminent geneticists concluded that relevant, scientifically valid criteria and indicators should be based on the processes that maintain genetic diversity. However, since forest managers cannot be expected to understand how these complex processes work, a system was designed to allow managers to determine which genetic criteria and indicators may be important to assess, based on a description of activities going on in the forest.



Two women come home from their fields in a degraded forest area, near Bossematié, Côte d'Ivoire (photo: Carol Colfer)

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Germany: Institute of World Forestry, Initiative Tropenwald;
France: CIRAD-Forêt;
UK: Soil Association;
Netherlands: Directorate General for International Cooperation (DGIS), TROPENBOS Foundation, Both Ends;
USA: USDA Forest Service, Rainforest Alliance;
International: FAO, ITTO, Forest Stewardship Council (FSC), International Forest Genetics Research Associates.



Young logger accompanies C&I research team in the forest, Cameroon (photo: Carol Colfer)

These proposals were subsequently field tested in Kribi, Cameroon. A Cameroonian forest ecologist, Oscar Eyog-Matig assisted the team. The indicators originally proposed were found to be acceptable with a few minor modifications. The researchers also discussed several approaches to combining data from the nominated indicators to give an overall assessment of genetic sustainability and the potential to restore or improve sustainability where necessary. Research continues on this complex issue.

A sixth test of criteria and indicators for sustainable forest management was conducted in Cameroon, the most complicated test so far. It involved six (three-person) inter-disciplinary teams evaluating sets of C&I from the African Timber Organisation, the Dutch Working Group and CIFOR. In all, eighteen experts (half of them from Cameroon) participated in the evaluations supported by eight additional scientists, including four from CIFOR headquarters.

Data analysis is still under way, but a few results have emerged, especially regarding the methods used. A minimum of two weeks in the field plus preparation time must be provided to teams for the evaluation of criteria and

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indicators. Shared experience and shared values improve the ability of teams to work under time pressures (although this did not always result in improved quality of output). Preliminary Cameroon results appear consistent with the common features obtained in Indonesia, Côte d'Ivoire, Brazil and Austria (Prabhu *et al.*, 1996. *Testing Criteria and Indicators for the Sustainable Management of Forests: Phase 1. Final Report*). However this conclusion must await further investigation. A full report on the Cameroon test will be available by March 1997.

This research has been supported by the European Union, GTZ (Germany), DGIS (Netherlands) and USAID.

Logs of Acacia mangium at a sawmill established on plantation site, Kuala Lumpur region, Malaysia (photo: Christian Cossalter)



Plantation Forestry on Degraded and Low-potential Sites

Alternative socio-economic approaches to reclaiming degraded lands in China are being applied to the joint problems of poverty and land degradation. The Chinese Academy of Forestry has produced several technological solutions for degraded lands, but now seeks appropriate socio-economic structures to efficiently achieve their wide-scale application. Degraded lands in mountainous and hilly regions account for 60 per cent of China's total land area and their populations have very low incomes. All levels of government in China aim to encourage productive use of degraded lands through popular participation in forestry: new rights and responsibilities on land given to State farm employees or free enterprise on lands re-allocated to farmers. Smallholder tree planting may offer solutions but there are concerns about the ecological, economic and social sustainability of tree planting on such lands.

Socio-economic surveys to evaluate existing production systems have been completed at five selected sites. Research at two other sites investigated the processes resulting in site deterioration and productivity decline (part of a CIFOR network of research sites in Asia and Africa).

West Kalimantan, Indonesia, is inhabited by farmers who practise shifting cultivation in forest margins and so contribute to the expansion of *Imperata* grasslands. One option to make these lands economically viable again is to cultivate crops which withstand low-input farming practices (fertilisation and tending). As a pioneer species on *Imperata* land, *Vitex pubescens* can be expected to grow in plantations, but cultivation methods and growth capacity of the species are largely unknown. CIFOR is testing *Vitex pubescens* tolerance



Four year old eucalyptus plantation in Pointe Noire, Congo (photo: Christian Cossalter)

for low-input cultivation practices, the economic returns to be expected from producing high-quality charcoal, and whether such tree plantations will be acceptable to smallholders.

Research on the catalytic effect of tree planting on the rehabilitation of forest biodiversity on degraded tropical lands is investigating: whether tree plantations can enhance biodiversity of indigenous and naturalised plant species; how management intensity and species selection affect re-colonisation by indigenous species within plantations; if tree plantations can restore faunal biodiversity; and how land-use practices, proximity to natural forest and degree of site degradation influence biodiversity within plantations. Field studies have been carried out in the Congo and South Africa. The former included observations on litter and soils, bird and mammal populations, and changes in soil fauna

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South Africa: Institute for Commercial Forestry Research;

Thailand: International Board for Soil Research and Management (IBSRAM), Royal Forestry Department;

UK: International Mycological Institute, Royal Botanic Garden Kew;

USA: USDA Forest Service, Southern Forest Experiment Station (Pineville), University of Massachusetts, Yale University.

and micro-fauna. CIFOR's collaborators presented their work at a IUFRO-World Bank-USDA Forest Service workshop.

Site management and productivity in tropical forest plantations and the long-term impact on site productivity must be well understood and monitored if plantations as a land-use technology are to be sustainable. Do the changes in soil characteristics induced by intensive plantation management lead necessarily to site degradation? How can changes in soil characteristics be influenced by silvicultural and harvesting practices? Can successive, equally productive crops of trees be harvested from a site in perpetuity? A network of partnerships in Indonesia, Malaysia, Australia, Congo, China, India and South Africa is using a multi-site approach with a set of treatments common at all locations. Additional treatments are tailored to each site to maximise the value from this research to each specific region.

Dipterocarps are the most important family of tropical trees in Asia but most knowledge remains fragmented. The potential benefits of this family of trees have not been fully recognised. Thirteen leading scientists have contributed to an overview of the state of knowledge on Dipterocarps which identifies the main questions still to be answered. The book will be published in 1997.

Another multi-authored book produced in collaboration with CSIRO Division of Forestry and Forest Products will be published by ACIAR in early 1997. It will improve understanding of the role of nutrients and water, and their interaction, in problems of tree growing and of sustaining forest production in tropical and sub-tropical environments.

In the Amazonian forests 41.5 million hectares have been converted to other uses, 17.5 million hectares to pastures. About half of this area has become unproductive only a few years after establishment and is now abandoned land. In many instances, reforestation is

the only way to restore these wastelands. Soils in these areas have been severely disturbed – low levels of organic matter and nutrients have become limiting factors. Tree species which could adapt to this new environment need to be found. Developing new tools to enhance species/site matching capabilities and to streamline the species and provenance testing process is a priority. In the Amazonian region, EMBRAPA and CIFOR are jointly adapting and testing a model, **PLANTGRO**, which predicts tree performance on untested sites using notional relationships between trees and site conditions, and soil and climate variables. A course was held for fifteen Brazilian collaborators (Manaus, June 1996) and data files were prepared for 25 plantation species (20 native and 5 exotic).

Tropical acacias are important for reforestation in South and South-east Asia where over one million hectares have already been planted. Recent reports suggest that productivity of some important species may be affected by fungal pathogens including leaf spot, shoot blight, stem canker, heart rot and gall rust. A series of disease surveys was undertaken in native Australian stands and trials, social forestry planting and large-scale industrial plantations in India, Indonesia, Malaysia and Thailand, to assess fungal pathogens as a potential threat to tropical acacia growth and productivity, and the relative importance of individual fungal pathogens. CIFOR's collaborators presented their results at a workshop in May 1996 at an Indonesian reforestation company in Sumatra. Following publication in 1997 of this benchmark in current knowledge of the pathology of the four most important acacia species currently grown in the region, CIFOR will undertake a second phase with support from ACIAR.

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Conservation of Biodiversity and Genetic Resources



Morning light on Cigenter River, Ujung Kulon National Park, Indonesia (photo: Alain Compost)

During 1996, CIFOR pioneered the development of a set of criteria and indicators (C&I) to assess sustainability of forest management operations in terms of conservation of genetic diversity. In collaboration with Dr. Gene Namkoong of the University of British Columbia, who leads International Forest Genetics Research Associates, a workshop was held in Indonesia in March to propose an appropriate set of C&I (see pages 35-36). This was followed by a field trial in October in Cameroon, in which the initial ideas were tested and inputs sought from international experts not involved in the original workshop. As a result of this, a system of one criterion and five indicators was proposed to assess genetic diversity.

A number of new research activities were initiated including assessment of the impacts of logging in Indonesia, Costa Rica and Cameroon, and habitat fragmentation in Indonesia and Costa Rica.

For all three countries surveyed (Malaysia, Thailand and India) in research on the impacts of disturbance, the laboratory analyses have been completed or are close to completion. Some very interesting results are being produced, demonstrating impacts in various situations. For example, research on *Shorea siamensis* in Thailand has demonstrated a threshold density below which reproductive success declines very rapidly, leading to an absence of successful regeneration (see pages 17-19). The combination of the genetics and entomology work in Thailand has been particularly fruitful, with both data sets generating mutually reinforcing conclusions. The socio-economic components of the research began in 1996

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Canada: University of Alberta;

USA: Harvard University, Massachusetts University, USDA Forest Service;

International: IPGRI, FAO.



Dr. Stephen Harris of Oxford University (right) discussing molecular genetics technology with trainees supported with funding from CIFOR (photo: OFI)

and is already well advanced in Thailand, with good progress also in India. Work on impacts of logging commenced in 1996. The Indonesian and international research partners collected nearly 800 vegetative samples and extracted DNA for further analysis. Preliminary analyses at LIPI demonstrated high levels of genetic variation.

Much stronger links were also forged this year with the Institut Pertanian Bogor (Bogor Agricultural Institute) in several areas including student participation in field work and assistance to students to attend courses and workshops.

In collaboration with the University of Alberta, CIFOR released its first in-house software package in 1996. POPGENE is a user-friendly, Windows[®]-driven package that analyses population genetics data. In contrast with previous commercial packages, POPGENE can accept data in a variety of formats, and can analyse both dominant and co-dominant genetic markers with equal ease. Most importantly, a wide range of analyses can be selected simply by clicking on desired options in a dialogue window. The same data set can therefore be analysed in a variety of ways very quickly, without the need for re-formatting data or writing program code required in other packages. POPGENE has been designed

to analyse genetic data from any organism and, although just released a few months ago, is already being utilised in many laboratories around the world. POPGENE is supplied free to non-profit research laboratories in developing countries.

CIFOR played a large role in the execution of the INDREX project, which is jointly led by the Indonesian Ministry of Forestry and Wageningen Agricultural University (Netherlands). INDREX is examining the potential for airborne radar for forest assessment and monitoring, including the monitoring of biodiversity. Data collected during July from several areas in Jambi Province, Sumatra, are now being analysed.

Research on physiological testing and molecular markers has been completed. Proposed work on mangroves was delayed and will now commence in 1997. CIFOR also helped to organise a new course on Forest Conservation Genetics offered at the Australian National University.

*Mountain Blue Swallowtail
(Papilio Ulyse)
(photo: Alain Compost)*



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Local Livelihoods, Community-Based Forest Management and Devolution

A world-wide trend to promote systems of local management, both through the devolution of centralised structures of control and by strengthening so-called “traditional” forest management systems, has stimulated CIFOR’s research on local people’s well-being and role in forest management. Amidst growing interest and experience in local management over the last two decades, several issues regularly surface in debates about the development of effective local forest



Field burning in East Kalimantan is normally a prelude to rice cultivation by the Dayaks (photo: Lini Wollenberg)

Women in Krui (Lam pung) are paid to carry damar from the forest to their village (photo: Lini Wollenberg)



management. How can multiple interests or objectives be accommodated in decision making about forests, especially when some of those interests are less powerful? What is the role of policy, including land-tenure policy, in supporting local management? How do economic incentives influence local people’s management of the forest?

CIFOR’s research has sought to inform and sharpen understanding about these debates in ways that also have practical implications for improving local people’s well-being. With the overall objective of improved understanding of the relationship between the forms of local forest management and its impacts, research activities have examined the question, “how do incentive structures, institutional arrangements and policies affect household well-being and local forest sustainability?” This is addressed in such diverse contexts as protected forests and production forests, private and government forest lands, natural forests and agroforest plantations. Emphasis has been given to protected areas where forest conservation and economic development goals are jointly pursued and where the compatibility of people’s needs and forest management objectives are often most at odds. The research has been supported by models of local people’s decision making.

Four clusters of research took place in 1996. Activities in collaboration with CIIFAD at Cornell University have concentrated on models for collaborative management in protected areas in Madagascar. This 18-month project is expected to be completed by mid-1997 (see pages 14-16).

Principal Collaborators:

Indonesia: WWF-Indonesia Programme, University of Indonesia, Lembaga Alam Tropika Indonesia (LATIN), Keluarga Pecinta Alam dan Lingkungan Hidup (WATALA);
Madagascar: CARE International Madagascar, Department of Water and Forestry and Dept of Agro-Management - Atananarivo University; University of Fianarantsoa Dept. of Environmental Law and Management, Association Nationale Pour La Gestion des Aires Protegees (ANGAP), Ramanofana National Park Project;
Eastern & Southern Africa: University of Zimbabwe, Sokoine University of Agriculture and University of Dar-es-Salaam, Tanzania, University of Malawi;
UK: ODA;
USA: Cornell University, University of Florida, University of Indiana, The East-West Center;
International: ORSTOM, ICRAF, Ford Foundation.

Also in Africa, a synthesis of available scientific knowledge on the management of miombo woodlands was completed in 1996 with the publication of *The Miombo in Transition: Woodlands and Welfare in Africa*. We have worked closely with partners from Zimbabwe, Tanzania, Mozambique and Malawi to design a four-year project on Management of Miombo Woodlands, examining how different policies influence people-woodland interactions and to provide new information to guide sustainable management of the woodlands.

Research continued on household economic strategies and incentives for conservation in the planted *Shorea javanica* (damar) forests of Krui, Sumatra, and the natural dipterocarp forests of the Kayan Mentarang National Park in East Kalimantan, Indonesia. During 1996, surveys of over 400 households were conducted to assess forest dependence, changing trends in livelihood strategies, and the possible economic basis for why people manage the forests in the way they do. CIFOR also co-sponsored a workshop in May with the IUCN-Laos and the South and South-east Asia NTFP Network to discuss methods for improving the incomes of

CIFOR Project Team:

Lini Wollenberg, Jerry Vanclay, Godwin Kowero, Susie Hussey, Louise Buck, Bruce Campbell

people living in forest areas based on NTFP conservation and development. (An edited volume of papers from this meeting will be available in 1997.)

A quantitative, predictive model of land-use decisions made by rural people at the forest frontier is being developed. Tentatively titled the People-Forest Interface Model, it aims to integrate results from several projects into a concise and explicit form amenable to empirical testing. The model will be spatially explicit, predicting land use within each of the land units in the area under consideration. This has already stimulated discussions amongst CIFOR staff about the causal forces at work at the forest frontier. It will provide an empirical test-bed for ideas and hypotheses arising from CIFOR's work, and provide a quantitative basis for exploring future scenarios and their implications. Later versions of the model should be useful for land-use planning and simulation of policy options.

During 1997, the Project is planning to expand work in Africa and Latin America. A new research activity will investigate the influence of economic development and policy trends on institutions for local forest management. It will also develop a series of future scenarios to better inform decision makers, to enhance the well-being of those people who live near and depend most on forests.

The additional financial support of USAID for this research is gratefully acknowledged.

Sue Ellen Johnson (IITA) conducts a women's meeting on the role of small livestock in a forest farming system, Awai, Cameroon (photo: Carol Colfer)



Sustainable Use and Development of Non-timber Forest Products



*Kayapo Indian Chief Utey's medicinal plant trail, Garotire, Brazil
(photo: WWF- Mauri Rautkari)*

The project consolidated a team of people, at headquarters and outside, with complementary professional backgrounds. It also initiated activities in four new locations (Bolivia, Zimbabwe, Indonesia and Peru) while advancing a long-term commitment in some of the earlier sites (China, Cameroon and Brazil). The collaborative network of research partners is being continually extended and strengthened.

Research has gained focus, concentrating on the socio-economic importance and development potential of forests in people's livelihoods, using NTFPs as a convenient entry point. Household and community strategies related to the development potential of NTFPs are being studied in Brazil, Bolivia, Zimbabwe and China. Market studies continued in Cameroon. Preparatory field work was conducted in Indonesia on the modifications in household forest-

exploitation strategies in response to logging, or new large-scale agricultural development projects. In Peru, collaboration aims to assist the National Natural Resource Institute with the development of policy guidelines for the exploitation and trade of several medicinal plants that sustain a growing national and international industry.

The methodological approaches applied include the explanation of cases, as well as the development of scenario-based models. The scenario-based models aim to link mathematical and spatial modelling techniques that, if successful, could be used as a management tool by communities and forest institutions. Both case study explanations and scenario models offer opportunities for testing the validity of some of the prevailing assumptions about people-forest interactions, or the development of new concepts.

Principal Collaborators:

Brazil: State University of Campinas;

Bolivia: El Centro de Investigacion y Manejo de Recursos Naturales Renovables (CIMAR-Santa Cruz);

Central Coastal Africa: IITA-Cameroon;

China: Research Institute for Subtropical Forestry, National Forestry Economics and Development Research Center;

Germany: Institute for World Forestry, Federal Research Centre for Forestry and Forest Products, Institute for Forest Policy, University of Freiburg;

India: University of Agricultural Sciences - Bangalore;

Indonesia: Forestry Research and Development Agency (FORDA);

Netherlands: Wageningen Agricultural University, Department of Vegetation Ecology-University of Utrecht, Tropenbos Foundation;

Zimbabwe: Institute for Environmental Studies-University of Zimbabwe;

International: ICRAF, IFPRI, International Network for Bamboo and Rattan (INBAR), IUCN.



A Punan boy carrying a deer head in rattan baskets (photo: Esther Katz)

Field work was undertaken in Karnataka and Kerala (India), Alto Jurua Extractive Reserve in Acre (Brazil), Hangzhou, Sichuan and Hunan Provinces (China), Kalimantan, Sumatra and Java (Indonesia), Riberalta (Bolivia), Lima, Pucallpa and Iquitos (Peru), and Mashvingo Province (Zimbabwe).

Vegetal leather processing adds value to the natural rubber being extracted by rubber tappers in Alto Jurua Extractive Reserve, Brazil (photo: Manuel Ruiz Pérez)



The project maintained the strategy, initiated in earlier activities in Sri Lanka and China, of inviting research partners to CIFOR's headquarters to carry out data analysis and general research progress discussions. In 1996 we enjoyed the presence of Professor Fu Maoyi (Chinese Academy of Forestry), Brian Belcher (INBAR) and Professor Mauro Almeida (Campinas University, Brazil). The latter presented the concept of Extractive Reserves (see page 23) to different Indonesian institutions, including to the Minister of Forests and his staff.

One of the highlights for 1996 was the completion and publication of an overview book, *Current Issues in Non-Timber Forest Products Research*, which synthesises much of the existing knowledge on this theme and charts a compelling course for future research.

In addition to core funding, the project continued to enjoy financial support from BMZ-GTZ (Germany) and ODA (United Kingdom).

CIFOR Project Team:

Manuel Ruiz Pérez, Wil de Jong, Neil Byron, Esther Katz, Ousseynou Ndoeye, Susie Hussey, Mike Arnold, Bruce Campbell

Research Impact, Information and Capacity Building

Many forestry research institutes still have weak research capacity, poor access to information, and lack means for the efficient dissemination of research findings. These combine to reduce their research impact. This project addresses these problems with partners in Africa, Asia and Latin America.

A major activity relates to research evaluation and impact assessment. Comprehensive understanding and detailed documentation of the intended impact is necessary for planning and conducting impact assessments. During the year, information was collated on intended impact, both on the immediate “targets” for research outputs and the ultimate beneficiaries for each research activity. CIFOR’s Management Information System (MIS) includes logical frameworks at activity and project levels, and documentation of progress against specific “milestones”. The MIS will simplify assessment of CIFOR’s efficiency and effectiveness whilst promoting accountability and transparency in the way our research is selected, prioritised and managed. Formal procedures for the evaluation of new research proposals (or for the continuation of existing research activities) were finalised and implemented during the year.

Links with impact assessment activities within the CGIAR system and the Impact Assessment Evaluation Group (IAEG) were developed further. Project staff attended an inter-centre workshop held at ISNAR for impact assessment scientists from all CGIAR Centers. They discussed

appropriate methodologies and analyses for priority setting and impact assessment, and provided guidance on the IAEG workplan. Impact assessment of natural resources research is still regarded as a discipline in its infancy.

This project helps provide access to information for national research systems, and efficient dissemination of research results using the latest electronic technologies. CIFOR organised a regional “discussion forum” for forestry information scientists from twelve Asia-Pacific countries, and representatives from CABI, FAO and FORSPA. The forum participants identified common problems and constraints faced by forestry information scientists and outlined mechanisms and strategies for their amelioration. The rate of uptake of the new electronic information technologies in the Asia-Pacific has been rapid and continues to accelerate. A network of information scientists in the region was also launched.

CIFOR continued to provide training to partners and collaborators. As outlined in *CIFOR’s Strategy for Collaborative Research*, training is conducted only where CIFOR has a distinct comparative advantage. During 1996, activities included a computer modelling training workshop for research partners and CIFOR staff.

A study to assess forestry-related research capacity in the Southern Africa Development Community (SADC) was presented at a regional consultation convened by CIFOR in South Africa (see page 8). Plans were also developed for further forestry research capacity assessment in 1997, to be undertaken in West and Central Africa involving CORAF, FAO and many national partners.



NARs trainees at OFI, Oxford
(photo: OFI)

Principal Collaborators:

China: Chinese Academy of Forestry, Nanjing Forestry University;

India: Centre of Minor Forest Products, YS Parmar University, Kerala Forest Research Institute;

Indonesia: Forestry Research and Development Agency (FORDA),

Institut Pertanian Bogor;

Malaysia: Forest Research Institute Malaysia;

UK: Oxford Forestry Institute;

USA: USDA Forest Service;

Regional: Forestry Research Support Programme for Asia Pacific

(FORSPA), ASEAN Institute for Forest Management,

ASEAN Forest Tree Seed Centre, Centro

Agronomico Tropical de Investigacion y Ensenanza

(CATIE), European

Tropical Forestry Research Network, Asia Pacific

Association of Forestry Research Institutes

(APAFRI);

International: CAB International, FAO, IUFRO.

CIFOR Project Team:

Michael Spilsbury, John Turnbull,
Research Support Division

Policies, Technologies and Global Changes

Principal Collaborators:

World Conservation Monitoring Centre, FAO, World Bank, European Forestry Institute, Finnish Forest Research Institute, IUCN, World Wide Fund for Nature.

The three key words of this Project are Strategy, Futures and Communications. Both for internal priority setting and for external communications, CIFOR needs credible analyses of the likely future developments that affect the fate of forests and the people whose livelihoods are forest-based.

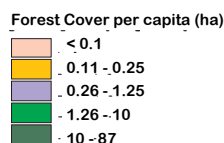
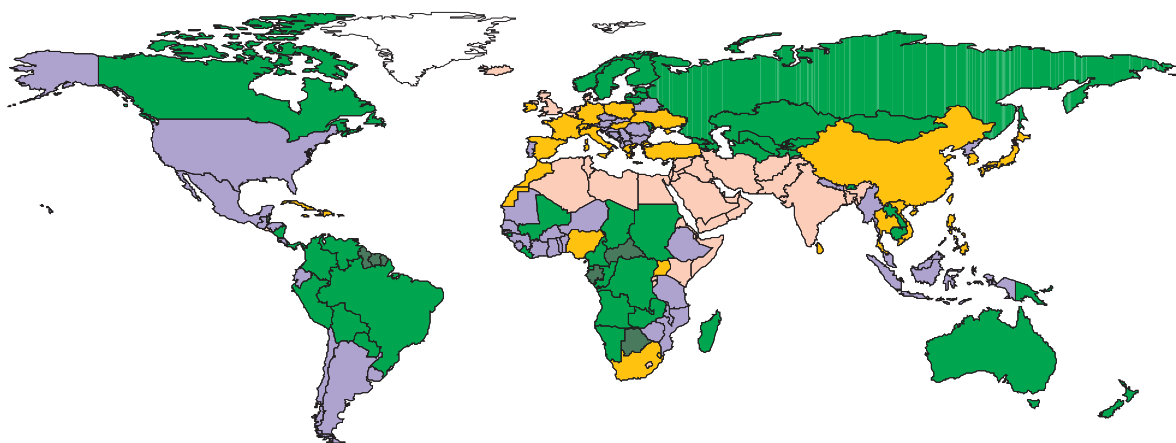
Identification and interpretation of “mega-trends” is crucial, e.g., discerning how changes in demographics, in the global economy or in bio-technology, interact to shape the future of forests. CIFOR maintains a comprehensive overview (both quantitative and qualitative) of the state of the world’s tropical forests. We analyse major global trends in the patterns and structure of international supply and demand (in the broadest sense, including all goods and services that societies derive from forests), to assess the implications of such changes for forest policies and technologies. Such analyses and

interpretations not only determine CIFOR’s research agenda but also influence how other institutions and researchers think about possible future roles and contributions of forests. They help establish CIFOR’s international profile.

CIFOR has extended other institutions’ reviews e.g., FAO’s “State of the World’s Tropical Forests” and the World Conservation and Monitoring Centre (WCMC) Biodiversity Map Library as well as CIFOR’s own research:

- to actively contribute to the international policy debates on tropical forests, through the scientific literature and in the major international policy fora (such as IPF), the independent World Commission on Forests and Sustainable Development (WCFSD), and the Conference of the Parties to the Convention on Biological Diversity (CBD); and

Forest Cover Per Capita (ha)



- to provide the global context (and especially the policy environment) within which CIFOR's more specific thematic research is undertaken. It also provides a basis for both determining research priorities, and for the monitoring and assessment of the impacts of CIFOR research, and of policy reforms.

This Project helps consolidate the outputs of CIFOR's other Projects, and provides another vehicle for contributing to forest conservation and management, through direct communication with key opinion leaders; policy makers involved in forest conservation and management; multi-lateral and donor agencies; international and national environmental NGOs; and multi-national forestry corporations.

Major research undertakings during 1996 included:

- Analysis of patterns, processes and underlying forces affecting global transitions in supplies and demands, and the possible social and economic implications of such trends. Specifically we have collaborated with FAO and WCMC on long-term scenarios for the future of the forestry sector in the Asia-Pacific region;
- Synthesis of CIFOR's collective understanding of the causes of deforestation and forest degradation (and therefore potential policy interventions on a global scale), an international workshop in Indonesia in January with the Finnish Forest Research Institute, and contributions to a World Bank monograph on the subject;



Teak, Tectona grandis, Central Java, Indonesia (photo: Francis Ng)

- Analysis of the advantages and disadvantages of a legally binding Global Forests Convention with the European Forestry Institute and the IUCN Environmental Law Center; and
- Analysis of the role of forests in the well-being and quality of life of forest-dependent communities.

A number of publications have resulted from this work, independently and in collaboration with the numerous research partners. It is proposed to expand our in-house capacity to analyse both global change and institutions for the governance of forests through recruitment of post-doctoral fellows. Also, leading thinkers on these issues will be invited as short-term Visiting Scholars at CIFOR to prepare research reports analysing causes and consequences of forest changes on a pan-tropical scale.

We acknowledge UK-ODA's support for the collaboration with WCMC.



CIFOR Project Team:

Neil Byron, Manuel Ruiz Pérez,
Susan Iremonger, Mike Arnold, Jerry Vanclay

Research Support Division



CIFOR information services assistant Dina Satrio

The Research Support Division has been operating at near-full capacity during 1996. The Division provides a broad range of support for research including computing, publications, information and GIS services. In addition to having most of the requisite skills in-house or readily available by out-sourcing, we have found that good teamwork is crucial. Achievements for this year include the launching of our first CD-ROM publication and the implementation of the Management Information System (MIS). Both have demonstrated the ability of the research support team to operate effectively in, and take advantage of, the new information era. The creation of a CIFOR homepage on the world-wide web has increased our capacity to make information available more quickly, efficiently and to a wider audience.

The CD-ROM publishing initiative began with a substantial investment in software, hardware and training in 1995. Our first experimental CD-ROM publication, *The Manual of Forest Fruits, Seeds and Seedlings*, was produced during the year. Various techniques to convert text and graphics into digital form were tested in order to achieve the finest possible resolution.

After a year of preparation, we began implementing the Management Information System this year. This MIS is a system focused on project- and task-related data and will eventually be linked with the Financial Information System (FIS). It is designed to be transparent to all CIFOR staff, enhancing the accessibility to information without neglecting the need for financial and personnel confidentiality.

The CIFOR library continues to distribute our publications to almost 400 forestry and related libraries and information

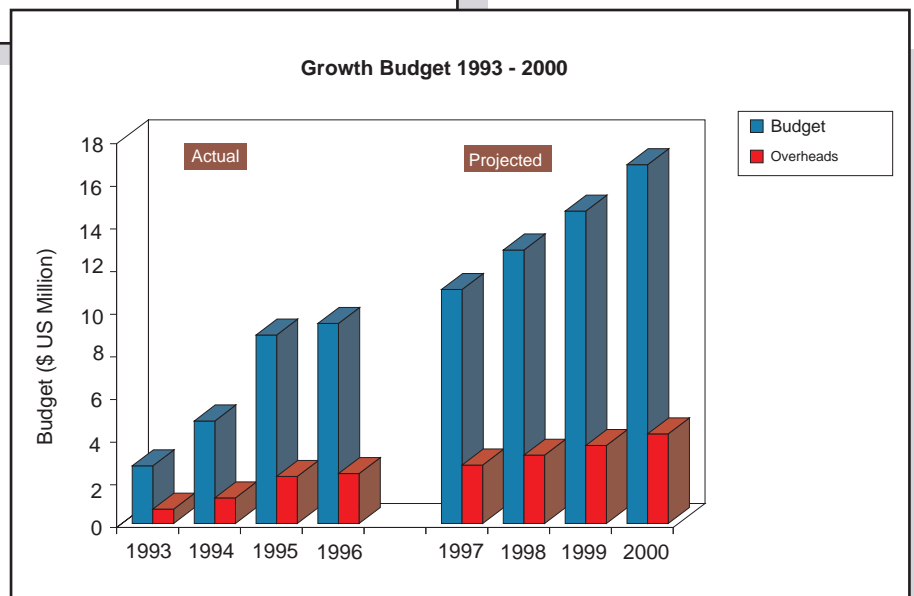
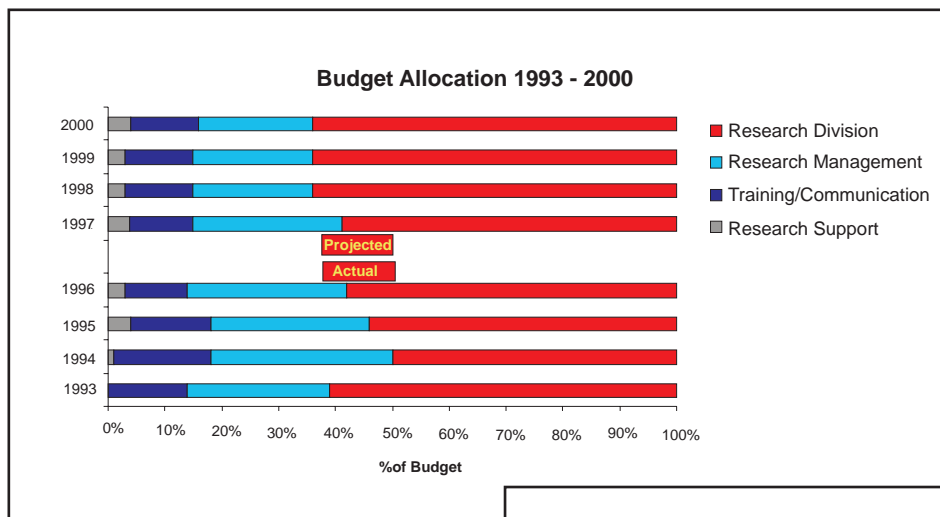
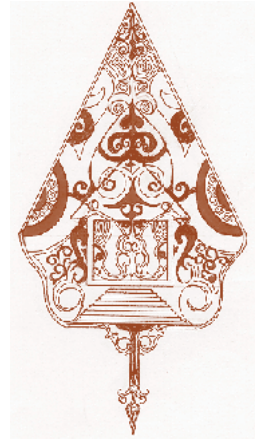
services all over the world. Many of these maintain a publications exchange arrangement with CIFOR. During 1996, eighteen forestry libraries in Asia and the Pacific received free subscriptions to TREE-CD and CAB International document delivery services coupons to obtain copies of articles. Along with other CGIAR institutions, CIFOR became a member of FAO's research database on agriculture (AGRIS) in 1996. Our library will input details of CIFOR publications to the AGRIS database for world-wide access.

The number of publications resulting from CIFOR's work in 1996 grew substantially (see Appendices 1 and 2). Two monographs, five occasional papers, six working papers and a number of ad hoc publications were produced. The quarterly *CIFOR News* was distributed to over 5,000 individuals and institutions world-wide. The publication of CIFOR's *Strategy for Collaborative Forestry Research* and numerous collaborative works have raised the profile of CIFOR with our partners. All Occasional Papers, as well as the *CIFOR News*, are progressively being made available on the webpage. In addition, all CIFOR publications to date will soon be published on one CD with annual updates.

CIFOR GIS specialist Atie Puntodewo explaining the GIS system



FINANCE AND ADMINISTRATION



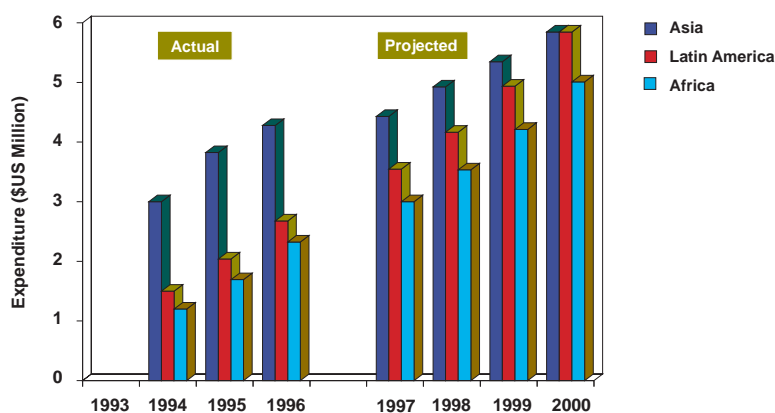
Statements of Financial Position
As at 31 December 1996 and 1995
(US \$000)

	<u>1996</u>	<u>1995</u>
ASSETS		
Current Assets		
Cash on hand and in banks	6,936	7,361
Accounts receivable:		
Donors	2,418	961
Employees	94	112
Others	384	304
Prepaid expenses	376	387
Funds in trust	–	21
Total current assets	<u>10,208</u>	<u>9,146</u>
Fixed Assets		
Property, plant and equipment	1,969	1,257
Less: Accumulated depreciation	(877)	(469)
Total fixed assets - net	<u>1,092</u>	<u>788</u>
TOTAL ASSETS	<u>11,300</u>	<u>9,934</u>
LIABILITIES AND NET ASSETS		
Current Liabilities		
Accounts payable:		
Donors	1,815	779
Others	53	42
Accruals and provisions	1,802	1,418
Funds in trust	115	–
Total current liabilities	<u>3,785</u>	<u>2,239</u>
Net Assets		
Capital invested in fixed assets	1,092	788
Capital fund	1,911	2,215
Operating fund	4,512	4,692
Total net assets	<u>7,515</u>	<u>7,695</u>
TOTAL LIABILITIES AND NET ASSETS	<u>11,300</u>	<u>9,934</u>

Statements of Activities and Operating Fund
For the years ended 31 December 1996 and 1995
(US \$000)

	1996				1995
	<u>Agreed Research Agenda</u>				<u>Total</u>
	<u>Unrestricted</u>	<u>Restricted</u>	<u>Complementary</u>	<u>Total</u>	
Revenue					
Grants	6,995	1,717	273	8,985	9,022
Other revenues	409	–	–	409	369
Total revenue	<u>7,404</u>	<u>1,717</u>	<u>273</u>	<u>9,394</u>	<u>9,391</u>
Operating expenses					
Research programmes	3,678	1,641	118	5,437	4,637
Research support	1,279	76	155	1,510	2,018
General administration	<u>2,627</u>	–	–	<u>2,627</u>	<u>2,187</u>
Total operating expenses	<u>7,584</u>	<u>1,717</u>	<u>273</u>	<u>9,574</u>	<u>8,842</u>
Excess of expenditure over revenue	<u>(180)</u>	–	–	<u>(180)</u>	<u>549</u>
Operating fund - beginning	4,692	–	–	4,692	4,143
Excess of revenue over expenditure	(180)	–	–	(180)	549
Operating fund - ending	<u>4,512</u>	–	–	<u>4,512</u>	<u>4,692</u>
Operating expenses represent:					
Personnel costs	3,501	554	–	4,055	3,724
Supplies and services	3,180	1,042	271	4,493	4,161
Operational travel	488	121	2	611	645
Depreciation of fixed assets	415	–	–	415	312
Total operating expenses	<u>7,584</u>	<u>1,717</u>	<u>273</u>	<u>9,574</u>	<u>8,842</u>

**Distribution of Expenditure
by Regions 1993 - 2000**



Schedule of Grant Revenue
For the years ended 31 December 1996 and 1995
(US \$000)

<u>Donors</u>	<u>1996</u>	<u>1995</u>
Agreed Research Agenda		
Unrestricted		
Australia	334	336
Austria	80	80
Canada	240	245
Denmark	135	–
European Union	750	323
Finland	377	421
France	134	104
Germany	332	349
Indonesia	500	75
Japan	1,624	1,635
Netherlands	592	617
Norway	216	222
Philippines	26	–
Spain	30	25
Sweden	370	191
Switzerland	255	257
USA	400	350
World Bank	600	2,070
Sub total	<u>6,995</u>	<u>7,300</u>
Agreed Research Agenda		
Restricted		
Australian Centre for International Agricultural Research	–	49
Brazil (EMBRAPA)	20	–
UN Environment Programme	–	253
Germany (GTZ/BMZ)	408	285
European Union	254	404
Ford Foundation	–	21
Japan	165	1
Netherlands	213	–
United Kingdom	275	317
USA	382	–
Sub total	<u>1,717</u>	<u>1,330</u>
Total Agreed Research Agenda	<u>8,712</u>	<u>8,630</u>
Complementary		
United States Department of Agriculture Forest Service	37	43
United Kingdom	236	349
Sub-total	<u>273</u>	<u>392</u>
Total Grants	<u>8,985</u>	<u>9,022</u>



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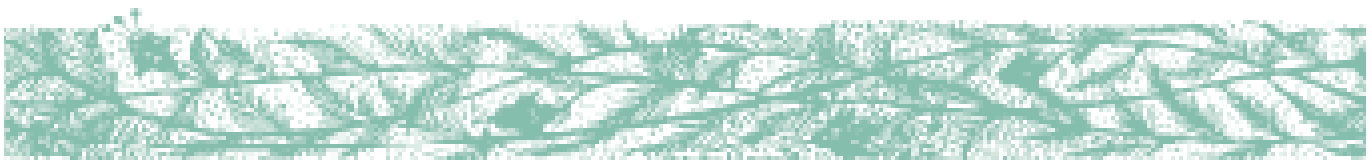
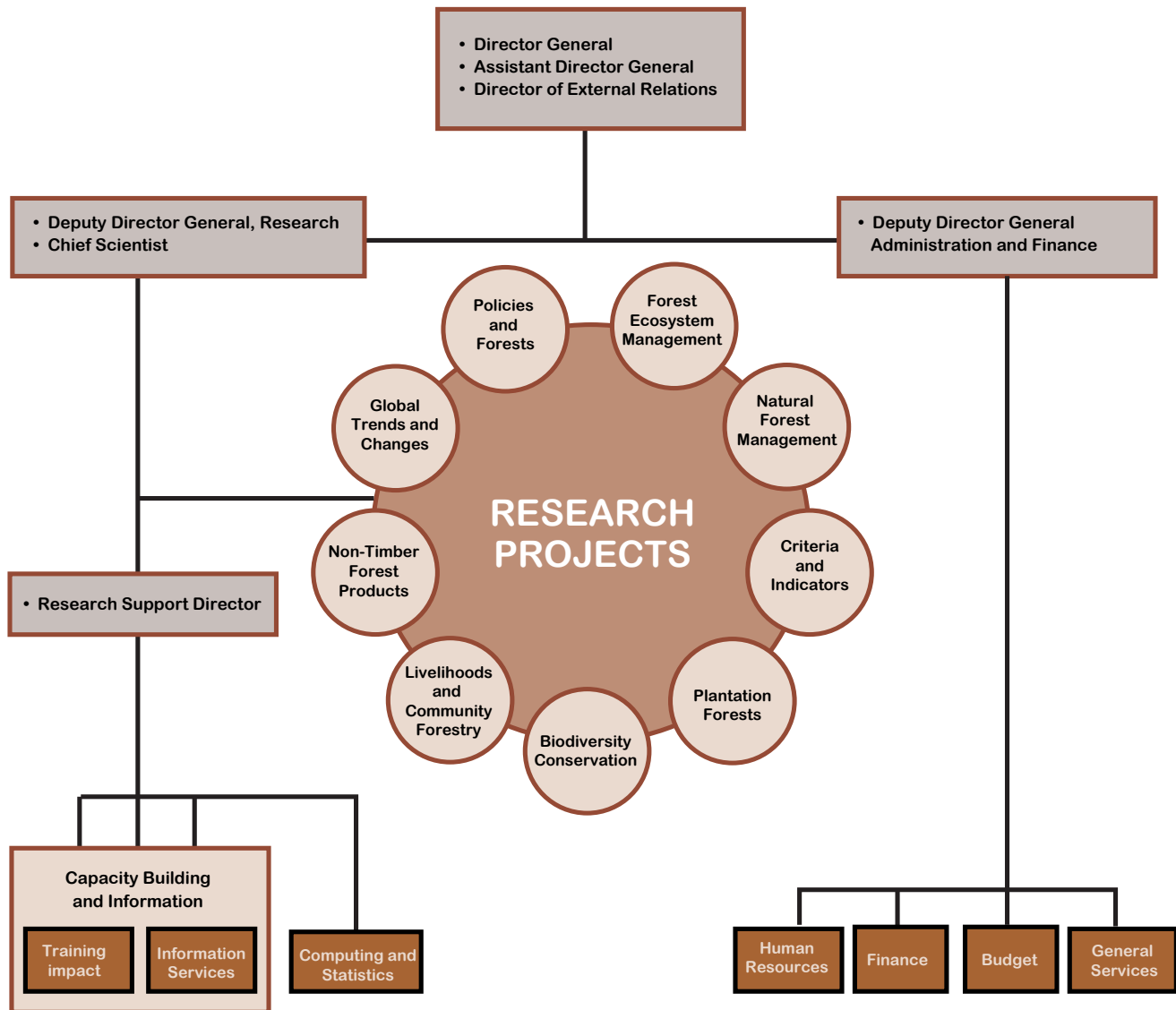
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- Ata Sukanta
- Iie Suwarna

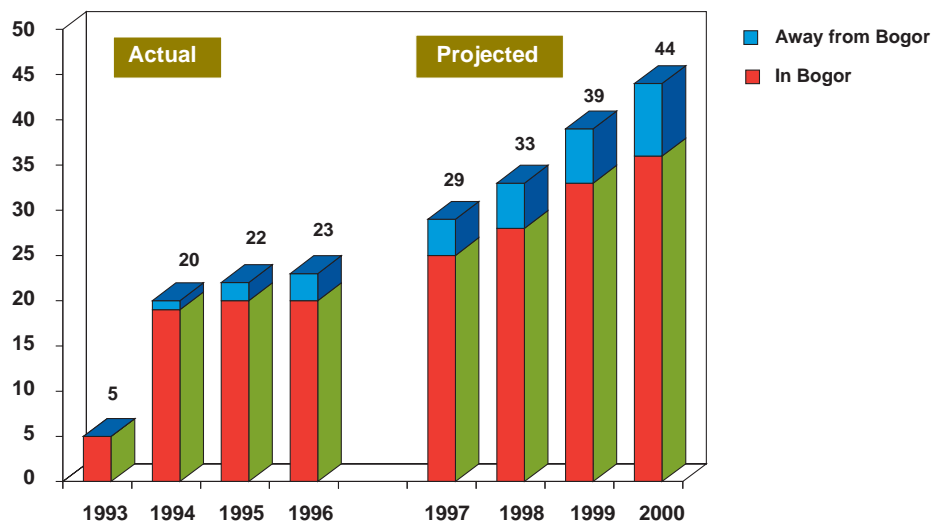
OFFICE ASSISTANTS*

- Ukat Sanusi
- Pendi
- Supandi
- Atang Sanjaya

OTHERS*

- Endang Kosasih
- Ani Tentrem
- Tina Turtinawati
- Ali Bin Maud
- Siti Nadhiroh
- Komar
- Suhendar

Number of International Staff



* Indonesian nationality



Appendix 1: CIFOR Publications during 1996

CIFOR News (in English, French and Spanish).

Numbers 10 (March), 11 (July), 12 (September), 13 (December).

CIFOR Annual Report 1995

CIFOR's Strategy for Collaborative Forestry Research

Monographs

Bruce Campbell (editor). *The Miombo in Transition: Woodlands and Welfare in Africa*.

Manuel Ruiz Pérez and J.E. Michael Arnold (editors). *Current Issues in Non-timber Forest Products Research*.

Proceedings of the workshop "Research on NTFP". Hot Springs, Zimbabwe, 28 August - 2 September 1995.

CD - ROM Publication

No. 1: Francis S. Ng. *Manual of Forest Fruits, Seeds and Seedlings*, Version 1.0.

Jonathan Rhind and Susan Iremonger *Tropical Moist Forests and Protected Areas: the digital files*. CD ROM published jointly by WCMC and CIFOR

Occasional Paper Series

No. 6, January: Shen Zhaobang. Production and Standards for Chemical Non-wood Forest Products in China.

No. 7(S), March: Sunderlin, William D. and Juan A. Rodriguez. Ganaderia, Bosques Latifoliados y Ley de Modernización Agrícola en Honduras: El Caso de Olancho.

No. 7(E), March: Sunderlin, William D., Juan A. Rodriguez. Cattle, Broadleaf Forests and the Agricultural Modernization Law of Honduras: The Case of Olancho.

No. 8, November: Francis S. Ng. High Quality Planting Stock - Has Research made a Difference?

No. 9, December: William D. Sunderlin and Ida Aju Pradnja Resosudarmo. Rates and Causes of Deforestation in Indonesia: Towards a Resolution of the Ambiguities.

Working Paper Series

No. 9, March: Timothy J.B. Boyle. CIFOR's Research Programme on Conservation of Tropical Forest Genetic Resources.

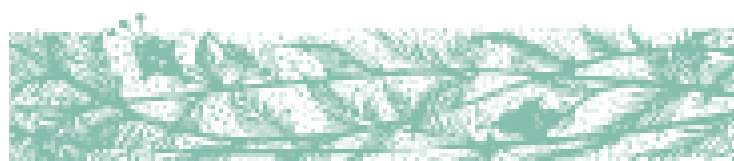
No. 10, July: Gene Namkoong, Timothy Boyle, Hans-Rolf Gregorius, Helene Joly, Outi Savolainen, Wickneswari Ratnam and Andrew Young. Testing Criteria and Indicators for Assessing the Sustainability of Forest Management: Genetic Criteria and Indicators.

No. 11, September: Jerome K. Vanclay. Estimating Sustainable Timber Production from Tropical Forests. 1996.

No. 12, September: Carol J. Pierce Colfer and Reed L. Wadley. Assessing "Participation" in Forest Management: Workable Methods and Unworkable Assumptions.

No. 13, October: Carol J. Pierce Colfer, Joseph Woelfel, Reed L. Wadley and Emily Harwell. Assessing People's Perceptions of Forests in Danau Sentarum Wildlife Reserve.

No. 14, December: Andy Gillison, Nining Liswanti and I. Arief Rachman. Rapid Ecological Assessment Kerinci Seblat National Park Buffer Zone: Report on Plant Ecology.



Ad Hoc Publications

- Andrew P. Vayda. *Methods and Explanations in the Study of Human Actions and their Environmental Effects*. Joint CIFOR/WWF Publication.
- Lay Cheng Tan, Manuel Ruiz Pérez and Michael Ibach. *Non-timber Forest Product Databases*.
- Lay-Cheng Tan. (editor). *Initiatives on Assessing Sustainability: Status and Future Directions*. Summary of the Open Session of the Third International Project Advisory Panel (IPAP) meeting on Testing Criteria and Indicators for Sustainable Management of Forests, Turrialba, Costa Rica, February 29 - March 1, 1996.
- Ravi Prabhu, Carol J.P. Colfer, P. Venkateswarlu, Lay Cheng Tan, Rinekso Soekmadi and Eva Wollenberg. *Testing Criteria and Indicators for the Sustainable Management of Forests: Phase 1. Final Report*.
- David Kaimowitz. *Livestock and Deforestation in Central America in the 1980s and 1990s: A Policy Perspective*.
- Andrew P. Vayda and Ahmad Sahur. *Bugis Settlers in East Kalimantan's Kutai National Park: Their Past and Present and Some Possibilities for their Future*. Joint CIFOR/UNDP/ UNEP publication.

Other Publications in collaboration with partners

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- Francis E. Putz, Elias, P. Sist, Dennis P. Dykstra and R. Heinrich (eds). *Research Methods for Reduced-impact Logging: Workshop Results*. A Report on the International Training Seminar on Reduced-impact Timber Harvesting and Natural Forest Management.
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Papers published by partners, arising from CIFOR research

Assessing the Sustainability of Forest Management: Testing Criteria and Indicators

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Plantation Forestry on Degraded or Low-potential Sites

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Memed Gunawan, Sri Hery Susilawati and Gelar Satya Budhi. *Smallholder Tree Growing on Erosion Prone Marginal Upland: A Case Study in Sumedang, West Java*. IPP1996/1.

Nelson, R., P. Grist, K. Menz, E. Paningbatan and M. Mamicpic. *A Cost-benefit Analysis of Hedgerow Intercropping in the Philippine Uplands using SCUAF*. IPP96/2.

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Sustainable Use and Development of Non-timber Forest Products

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Appendix 3: Memoranda of Understanding with partners (in place or nearing signature)

AFOCEL (Association Forêt Cellulose) France
CATIE (Tropical Agriculture Research and Higher Education Center) Costa Rica
CIIFAD (The Cornell International Institute for Food, Agriculture and Development) USA
CIRAD-Forêt (Département Forestier du Centre de coopération Internationale en Recherche Agronomique pour la Développement) France
DRN (The National Research Council) Indonesia
EFI (The European Forest Institute) Finland
EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária) Brazil
GAMA, Faculty of Forestry (University of Gajah Mada) Indonesia
IIAP (The Peruvian Research Institute for the Amazon) Peru
IICA (The Inter-American Institute for Cooperation on Agriculture) Costa Rica
IITA (The International Institute of Tropical Agriculture) Nigeria
IPB (Bogor Agricultural University) Indonesia
IPEF (Instituto de Pesquisas e Estudos Florestais) Brazil
Kayu Mas & BPK Samarinda Indonesia
MOF (Ministry of Forestry) Indonesia
ODA (Overseas Development Administration) UK
PBC (Prince Bernhard Centre for International Nature Conservation, University of Utrecht) The Netherlands
PCARRD (The Philippine Council for Agriculture, Forestry and Natural Resources Research and Development) The Philippines
PFA (The Central American Agricultural Frontier Program) Panama
SACCAR (The Southern African Centre for Cooperation in Agricultural and Natural Resources Research and Training) Botswana
SADC-FSTCU (The Southern African Development Community Forestry Sector Technical Co-ordination Unit) Malawi
SEAMEO BIOTROP (Southeast Asian Regional Centre for Tropical Biology) Indonesia
SUA (Sokoine University of Agriculture) Tanzania
TAFORI (Tanzania Forestry Research Institute) Tanzania
TROPENBOS (The Tropenbos Foundation) The Netherlands
USDA Forest Service (United States Department of Agriculture) USA
UZIM (University of Zimbabwe) Zimbabwe
Wetlands International Indonesia
WWF-IP (The World Wide Fund for Nature - Indonesia Program) Indonesia



Appendix 4: Common Acronyms and Abbreviations

ACIAR	Australian Centre for International Agricultural Research, Australia
ASB	Alternatives to Slash and Burn Programme of ICRAF
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit, Germany
CABI	Centre for Agriculture and Bioscience International, UK
CARE	Cooperative for American Relief Everywhere, USA
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza, Costa Rica
CGIAR	Consultative Group on International Agricultural Research, Washington DC
CIIFAD	Cornell International Institute for Food, Agriculture and Development, New York
CIRAD-Forêt	Forestry division of Centre de Coopération Internationale en Recherche Agronomique pour le Développement, France
CORAF	Conférence des Responsables de (la) Recherche Agronomique Africains, Sénégal
CSIR	Council for Scientific and Industrial Research, South Africa
CSIRO	Commonwealth Scientific and Industrial Research Organization, Australia
FAO	Food and Agriculture Organization of the United Nations
FEM	Forest Ecosystem Management
FORDA	Forestry Research and Development Agency, Indonesia
FORESTEK	Division of Science and Technology of CSIR, South Africa
FORSPA	Forestry Research Support Programme for Asia and the Pacific, Thailand
FRIM	Forestry Research Institute Malaysia
GIS	geographic information system
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit, Germany
IBSRAM	International Board for Soil Research and Management, Thailand
ICDP	integrated conservation and development project
ICRAF	International Centre for Research in Agroforestry, Nairobi
IDRC	International Development Research Centre, Canada
IFPRI	International Food Policy Research Institute, Washington DC
IICA	Instituto Interamericano de Cooperación para la Agricultura, Costa Rica
IIED	International Institute for Environment and Development, UK
IITA	International Institute for Tropical Agriculture, Nigeria
INRA	Institut National de la Recherche Agronomique
IPB	Institut Pertanian Bogor (Bogor Agricultural University), Indonesia
IPF	Inter-governmental Panel on Forests
IPGRI	International Plant Genetic Resources Institute, Italy
ISNAR	International Service for National Agricultural Research, The Netherlands
ITTO	International Tropical Timber Organization, Japan
IUCN	The World Conservation Union, Switzerland
IUFRO	International Union of Forest Research Organizations, Austria
NARS	National Agricultural Research Service/System(s)
NGO	non-governmental organisation
NTFP	non-timber forest product
ODA	Overseas Development Administration, UK
ORSTOM	Office de la Recherche Scientifique et Technique Outre-Mer, France
RIL	reduced-impact logging
SACCAR	Southern African Centre for Cooperation in Agricultural and Natural Resources Research and Training, Botswana
SADC	Southern Africa Development Community, Malawi
SEAMEO	South East Asian Ministers of Education Organization, Thailand
TREE-CD	Forestry on CD-ROM – Abstracts
TROPIS	Tree Growth Potential Information System (CIFOR database)
UNCED92	United Nations Conference on Environment and Development, Rio de Janeiro, Brazil, 1-12 June 1992
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USDA Forest Service	United States Department of Agriculture Forest Service
WCMC	World Conservation Monitoring Centre, UK
WWF	Worldwide Fund for Nature

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SMT Grafika Desa Putera is a graphic training centre established by the Budi Mulia Foundation, Jakarta. The original Desa Putera work began in 1947 in the aftermath of World War II. An elementary school was established by Catholic Brothers to care for and educate orphans and those in need. Desa Putera, literally meaning "boys town", has since developed to incorporate a secondary school and a health centre, as well as the graphic training centre.

The facilities of SMT Grafika are among the most advanced of such training schools in Indonesia and provide an excellent environment for training students in the printing industry. There are approximately 240 students who receive both theory and practical training. Income from the printing activities supports the graphic school and other social activities of the Budi Mulia Foundation.

Photos:

Cover: Isu fishing port along the Ndian River
Korup National Park, Cameroon
(WWF-Mauri Rautkari)

Pines, *Pinus massoniana*, Vietnam
(Christian Cossalter)

Waterfall near Bandung, Indonesia
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Genetic reserve, Dourado, Brazil
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