**Economic Models of
Tropical Deforestation
A Review**

David Kammerer and André Angelsen

Research Abstracts 1998

Research Abstracts 1998

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Cover photos by
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Center for International Forestry Research
Bogor, Indonesia

August 1999

The 1998 Research Abstracts is a collection of in-house and external publications by CIFOR scientists and collaborators. Also included are abstracts of workshop and conference papers presented in 1998 but not published.

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1. **A review of dipterocarps: taxonomy, ecology and silviculture.**

Appanah, S. and Turnbull, J.M. (eds.).

Dipterocarps are one of the best known and commercially important groups of tropical trees. They preside over some of the most magnificent forest formations in the world. Exploitation of dipterocarp-dominated tropical rain forests has expanded rapidly in the past 20 years. Efforts to develop and implement sustainable management practices are being intensified and there is a pressing need for high quality information on which to base management decisions and reorient research. This book is a critical compilation of the results of research spanning 150 years on the taxonomy, ecology, silviculture and non-timber forest products of these trees. The 13 authors are internationally recognised as specialists in their fields, and the 10 chapters provide comprehensive digests of information and identification of priority research needs.

CIFOR, Bogor. 220p. ISBN 979-8764-20-X

2. **The role of non-timber forest products in conservation and development.**

Arnold, J.E.M. and Ruiz-Pérez, M.

This paper discusses the assumptions underlying non-timber forest product (NTFP)-based approaches. The authors examine conservation dimensions, highlighting the differences in perceptions among different stakeholder groups about what should be conserved, and development issues, including the role of NTFPs in meeting cultural and subsistence, and in enabling people to deal with increasing integration into market systems. This is followed by an examination of the institutional frameworks that influence pursuit of both conservation and development objectives. It is suggested that more attention should be given to understanding the limitations on NTFP conservation and development, including the effects of market fluctuations and the tendency for many NTFPs to encounter boom-bust cycles. The evaluation of income generation options for forest dwellers should consider not only NTFPs but also other products, enterprises or employment opportunities. It concludes that there is a need to analyse NTFP initiatives on a case-by-case basis because of the variable conservation or development potential associated with non-timber forest products.

In: Wollenberg, E. and Ingles, A (eds.)

Incomes from the forest: methods for the development and conservation of forest products for local communities, 17-41. CIFOR, Bogor.

3. **A production-to-consumption systems approach: lessons from the bamboo and rattan sectors in Asia.**

Belcher, B.

Common approaches to analysing market and processing structures such as market chain and subsector analysis are reviewed. Additional information necessary to diagnose interventions is identified. This includes understanding horizontal linkages among actors in a market chain, (for example, farmers' cooperatives or industry associations that affect power relations and mobilisation of resources), vertical linkages, (for example, mechanisms such as contracts between buyers and sellers that influence people's motivations to participate in the chain), and intensity of use of labour or capital in each stage of production, which has direct implications for forest conservation. The methods are discussed in the context of action research conducted by the International Network for Bamboo and Rattan.

In: Wollenberg, E. and Ingles, A (eds.)

Incomes from the forest: methods for the development and conservation of forest products for local communities, 17-41. CIFOR, Bogor.

4. **STREK project objectives and methodology.**

Bertault, J.G., Sist, P. and Nguyen-The, N.

The project for the Development of Silvicultural Techniques for Regeneration of Logged-over Rain Forests in East Kalimantan (STREK) aims to develop, through improved knowledge of the dynamics of the stand, management rules leading to sustained forest productivity in East Kalimantan, the main supplier of the wood industry in Indonesia. For many species, there are numerous uncertainties about growth rates, mortality ratios and the regeneration mechanisms governing the sustainability of these stands. The STREK project covered the period 1989-1996. In the Berau PT Inhutani I concession, two 1 000 ha sites were selected. On the first site, logged in 1978-1979, six plots of 4 ha each were set up where two different silvicultural treatments were tested, with two control plots. On the second site, covered by primary forest until 1991, 12 plots of 4 ha each were set up with three control plots having three replicated logging treatments. In these plots, all trees with dbh ≥ 10 cm were measured, numbered and mapped on a scale of 1:200, topography and soil assessed, botanical samples collected for each unidentified tree and crown position recorded for each tree according to Dawkin's codes at

each bi-annual measurement. Forty 100 m² subplots plot were established for a regeneration study focused on the sapling stage. The management of a database comprising 40 000 trees needs strong organisation with a constant regard to data accuracy monitoring. This database organisation and processing, including the procedures developed by STREK as prerequisites to carry out further growth and yield studies, are given.

In: Bertault, J.G. and Kadir, K. (eds.)

Silvicultural research in a lowland mixed dipterocarp forest of East Kalimantan: the contribution of STREK project, 29-49.
CIRAD- Forêt, Montpellier.

5. Indonesia's fire problems require long term solutions.

Byron, R.N. and Shepherd, G.

The 1997-98 El Niño is among the strongest recorded and low rainfall in Indonesia set the conditions for widespread fires. At the same time, it is clearer during this particular El Niño than it has been in the past that many fires are being deliberately set. They must be understood in the context of competing land-claims from government and private companies on the one hand and local people with customary rights to land on the other. The 1997 El Niño is the first in which the resources of Land Satellite imagery and the Internet have been harnessed to demonstrate quite clearly where the fires are taking place, and why.

Natural Resource Perspective 28, ODI, London. 4p.

6. New arrangements for forest science to meet the needs of sustainable forest management.

Byron, R.N. and Turnbull, J.W.

This paper reviews the type of research which sustainable forest management will need. It asks which institutions are best equipped and most likely to provide it, especially integrative policy, social and environmental research. It concludes changes are occurring rapidly in how forests are managed, by whom and for what purposes. The need for changes in the way forest science is organised, funded and practised is highlighted. Research findings must be more effectively communicated to policy makers and forest managers and the role of participatory research involving researchers and clients to improve the likelihood of adoption and application of research results is discussed.

It is recommended: (i) recognition of the need for a greater and qualitatively different forest research agenda; (ii) strengthening of mechanisms to communicate researchable problems to research communities, to facilitate the research process and report back to clients; and (iii) dismantling financial and institutional impediments to effective cooperation in research at local, national and international levels.

*In: Enters, T., Nair, C.T.S. and Kaosa-ard, A. (eds.)
Emerging institutional arrangements for forestry research,
345-358. FAO FORSPA, Bangkok.*

7. Statistical methods for estimating species richness of woody regeneration in primary and secondary rain forests of northeastern Costa Rica.

Chazdon R.L., Colwell, R.K., Denslow, J.S. and Guariguata, M.R.

If robust and accurate statistical estimators of species richness can be found, they serve to provide a quantitative basis for identifying conservation priorities, for comparative biogeographic or regional studies, and for assessing long-term changes in species richness. The performance of several statistical approaches in estimating species richness of young woody regeneration in six tropical sites is analysed. Comparison was made, focussing specifically on two size classes of woody regeneration, on the performance of various estimation techniques within individual sites as well as across a range of sites differing in successional status and in woody species abundance and spatial distribution. The results suggest that non-parametric statistical approaches offer great promise in estimating species richness of seedling, sapling and shrub communities within tropical rain forests. Yet, idiosyncratic differences among sites or among different size classes within a site may suggest a shifting preference of one estimator over another. The analysis did provide some guidelines for the selection and use of species-richness estimators, however. Further evaluation of these promising techniques is needed, particularly for data sets in which complete censuses of delimited areas have been undertaken.

*In: Dallmeier, F. and Comiskey, J.A. (eds.)
Forest biodiversity research, monitoring and modeling: conceptual
background and old world case studies, 285-309.
Man and the Biosphere Series, vol. 20.
UNESCO and Parthenon Paris, New York, Carnforth, UK.*

8. **Pemanfaatan hutan oleh masyarakat Kenyah di Kalimantan Timur: reaksi terhadap adanya El Niño, transmigrasi dan HTI. [Kenyah forest use in East Kalimantan: responses to El Niño, transmigration and HTI.]**
Colfer, C.J.P. and Salim, A.

This paper gives the results of a household survey in Long Segar, East Kalimantan, covering the period 1991-1997. Its aim was to assess changes in land use since the development of industrial timber plantations near Long Segar and it is a follow-up of surveys conducted in 1980 (1962-1980) and 1991 (1981-1991). During the study period, there were two El Niño events. There are fewer significant changes than expected. Cutting of old growth forest for rice fields has diminished and old secondary forest is now the dominant forest type used for swiddens. Yields have fallen and individual field size has increased while household land/forest use remains the same. Use of low-lying areas increased, probably in response to recent, recurrent drought conditions. Long Segar households had an unprecedented four-year period of poor yields and drought. Recourse to wage labour increased in response to agricultural failures but standard of living did not fall. Women's traditional dominant role is still in rice production but there are slightly more agriculturally active men per household. The Long Segar community is coping but the dramatic reductions in natural forest cover, precipitated by transmigration, logging and industrial timber plantations, may be having an impact on Long Segar's micro-climate with potentially long term and disastrous effects.

Manusia dan Lingkungan 5(15): 3-22. (Paper in Bahasa Indonesia)

9. **Turning ideas into action: planning for non-timber forest product development and conservation.**
de Jong, W. and Utama, R.

Effective planning for non-timber forest product (NTFP) development and conservation will ensure the most effective use of scarce resources and maximise the likelihood that the objective will be obtained. NTFP development and conservation is usually a long-term activity and involves the collaboration of a number of different, quite independent parties. This has implications for the kind of planning that needs to be undertaken. Issues confronting the manager planning a NTFP initiative are discussed, highlighting three essential elements: the involvement of stakeholders, the need for good information and the need for biological monitoring. Consideration is given to the problems and

opportunities in applying these planning principles to forest-based income activities in a GTZ supported Social Forestry Development Project in Indonesia. Ways are suggested to undertake projects in a step-wise fashion in order to match decisions with information as it becomes available. The point is made that in some cases NTFPs may not be the most appropriate products for development. However, the interests of funders often inappropriately constrain the possibilities for working with agricultural products with greater potential.

In: Wollenberg, E. and Ingles, A (eds.)

Incomes from the forest: methods for the development and conservation of forest products for local communities, 43-55. CIFOR, Bogor.

10. Appropriateness of *Vitex pubescens* production for swidden agriculturists.

de Jong, W., Utama, R., Rantan, D., Budhi, S., Kusmina, S. and Sriwardani F.

Vitex pubescens is a pioneer tree species that invades grasslands dominated by *Imperata cylindrica*. It was observed in West Kalimantan that *V. pubescens* recovers on burning *imperata* grasslands and that its wood yields excellent charcoal. For these reasons the Yayasan Dian Tama, the Center for International Forestry Research and Tanjungpura University began investigating the possibilities of *V. pubescens* tree planting technology, especially for smallholder farmers. In this paper it is explained why *V. pubescens* is a promising technology and worthy of further research. *V. pubescens* tree planting technology research is still in its early phase but the species is appropriate to be grown by swidden farmers in West Kalimantan because of its wood and yield qualities, and its fire resistance. Also, it is appropriate for the swidden agriculturists' culture and economics. There is a wide scope for this technology as there are an estimated 35 million ha of *imperata* grasslands in Asia.

Forest, Farm and Community Tree Research Reports 3: 62-65.

11. Fishermen, farmers, forest change and fire.

Dennis, R., Puntadewo, A. and Colfer, C.J.P.

Uncontrolled fires have a significant impact on vegetation, fauna and climate as well as peoples' health and livelihood. In many cases, fires also have long-term effects on the economy of the country concerned and its neighbours. In order to minimise the negative effects of fires, it

is important to know the location and likely behaviour of the fires. In 1997, due to remote sensing, the spatial distribution of fire hot spots was well monitored. However, identifying and understanding the process and factors that lead to fires and deforestation is less easily achieved. In the Danau Sentarum Wildlife Reserve in West Kalimantan remote sensing and GIS were used to assess forest cover change between 1973 and 1994, in relation to forest management systems. Analyses were carried out in three villages within the reserve. Results show that integration of remote sensing and GIS can add significantly to sustainability assessment. Integrating socio-economic and ethnographic data with the forest cover classifications facilitate conclusions about some of the mechanisms behind burning. The work also highlights the complexity of deforestation processes and shows the need to examine conditions historically.

GIS Asia Pacific February/March: 26-30.

12. L'analyse de cernes: applications aux études de croissance de quelques essences en peuplements naturels de forêt dense africaine.

Detienne, P., Oyono, F., Durrieu de Madron, L., Demarquez, B., and Nasi, R.

Knowledge of wood production, and particularly of diameter increment of trees, is central to forest management. This is one of the parameters contributing to determination of the length of the felling cycle as well as the maximum allowable cut without impoverishment of forest stands. Two techniques can be used to assess diameter increment of trees: analysis of growth rings and periodical measurements of circumference over a given period. The results obtained with several designs, in which trees have been periodically measured for more than ten years (Mopi, Irobo and La Téné in Cote de Ivoire, Mbaiki in Central African Republic and Oyane in Gabon), provide increments for each species. In the same way, several growth ring counts were carried out for species with visible annual growth rings, especially in Cameroon, Central African Republic and Gabon. This report describes the methodology used for growth ring analysis, the application of such analysis for each tree species, as well as a synthesis of the results obtained for the main species exploited in Central and West Africa. The following species are included: Ayous/Samba (*Triplochiton sideroxylon*), Sapelli (*Entandrophragma cylindricum*), Limba/Fraké (*Terminalia superba*), Sipo (*Entandrophragma utile*), Tali (*Erythrophloeum ivorense*), Tiama

(*Entandrophragma angolensis*), Kosipo (*Entandrophragma candollei*), Okoumé (*Aucoumea klaineana*) and Moabi (*Baillonella toxisperma*). It appears that the mean diameter increment of Meliaceae (Sapelli, Sipo, Kosipo and Tiama – *Entandrophragma* spp.) and Iroko (*Milicia excelsa*) is 4-5 mm/year. The increment is 2-3 mm/year for slow-growing species, such as Bossé clair (*Guarea cedrata*) and Kotibé (*Nesogordonia papaverifera*), while mean annual increment of Okoumé (*Aucoumea klaineana*) is slightly under 10 mm/year for trees with diameters from 20 to 100 cm.

Série FORAFRI 1998 Document, no. 15.
CIRAD-Forêt, France. 39p. (Paper in French)

13. Temporal and spatial dynamics in the extraction of non-timber forest products in the Northern Bolivia Amazon.

Dijkman, W., Stoian, D., Henkesmans, A.B., Assies, W. and Boot. R.G.A.

For more than a century, northern Bolivia has had a tradition of commercial forest exploitation. For several decades into the twentieth century, the extraction of rubber and Brazil nuts was combined with subsistence agriculture, resulting in an agro-extractive cycle that fostered a sedentary lifestyle of forest dwellers. The extraction of rubber and Brazil nuts used to be organised in a debt-peonage system, often leaving extractivists in debt to the patron. The decline of the Bolivian rubber market during the 1980s induced the breakdown of the agro-extractive cycle. Most people left the patron-controlled extraction areas (barracas), and either established themselves as farmers in independent communities close to urban areas or migrated to the cities where the processing of forest products had increased job opportunities. About half the Brazil nut collectors are now seasonal migrants, mainly from the cities. Depending on access to land, forest resources and markets, extraction-based income can contribute to more than 50% of the overall household income, especially in the more remote forest settlements. Some processing plants gain direct access to the Brazil nut resource base through vertical integration, thereby increasing their control of the production process. These large enterprises partly take over the role of the former patrons (e.g. on making advance payments to the Brazil nut collectors). The increasing demand for Brazil nuts and the increased in-country processing in Bolivia has benefited all participants in the production process, including the collectors. Especially, the collectors from independent communities manage to obtain a higher price for the nuts they collect. Even so, an unequal exchange continues to be characteristic of many

non-timber-forest-products-based production systems. In addition, more recent extractive activities (e.g. logging and palm-heart extraction) are threatened by depletion of the resource area. None of the extractive activities thus fulfills all the criteria of sustainable development.

In: Seminar proceedings. Research in tropical rain forests: its challenges for the future, 25-26 November 1997, 149-158. Tropenbos, Wageningen, Netherlands.

14. Gestion des écosystèmes forestiers denses d'Afrique tropicale humide: 1. Gabon.

Dupuy, B., Gerard, C., Maitre, H-F., Marti, A. and Nasi, R.

This publication compiles and synthesises information on forest ecosystems with a view to transferring this knowledge to professionals and institutions involved in research and training. The chosen references provide an up-to-date picture of achievements in sustainable management of forest resources in Gabon. There is particular concern in this region of French-speaking Africa about problems linked to sustainable management of forest resources. Programmes dealing with the sustainable management of tropical forests must take into account environment, (soils, climate as well as biodiversity), economics, sociology, interaction with wild fauna, etc. The vegetation and flora of this area, ecology, environmental problems, and pilot management programmes have given rise to an array of research aimed at better knowledge and rational utilisation of the potential of forest resources. This research includes such aspects as transport of timber, non-timber forest products and the wild fauna. This review of the literature does not aim to be exhaustive, especially in the field of silviculture and forest management. This mass of information provides a base for further work, and brings to the attention of all actors work published in specialised journals, proceedings of international fora and selected reports in grey literature. The chosen references include real experiences or reflections directly derived from the field and mission reports describing the situation over a limited period in a particular geographical area. Other documents deal with field research carried out by students, consulting firms, research centres, financing institutions, and are in the form of unpublished papers, reports of activity, synthesis, etc. For example, documents prepared by the Gabon component of ECOPAC Project are included in the review. This is a regional project supported by European Union, aiming at conservation and sustainable use of forest ecosystems in Central Africa. Research on wood technology and

processing was not included, as this will be published elsewhere and little attention was given to industrial forest plantations.

Les Bibliographies du CIRAD no. 9.
CIRAD-Forêt, Montpellier, France. 207p.
ISBN 2-87614-305-4 (Book in French)

15. Aprovechamiento de impacto reducido: convirtendolos resultados de la investigación en practicas de campo.

Dykstra, D.P.

In the four years since the United Nations Conference on Environment and Development (UNCED) in 1992, an important shift has taken place in the attitudes towards tropical forest management. During the UNCED meeting urged a global initiative to reduce the impact of logging operations and to develop an 'International Code for Forest Exploitation Practices'. At the same time, several development agencies as well as international non-governmental organisations began promoting reduced impact logging as a strategy for sustainable management of tropical forest. If extensive adoption of reduced impact logging and other sustainable forest management techniques does not result, confrontations with environmental groups will occur, as before. As a contribution to the debate on tropical forest sustainable management, the Food and Agriculture Organization of the United Nations (FAO) recently published the Code for Forest Exploitation Practices. The Code, designed as a general reference to be used in FAO member countries, will require some modification to adapt some of the proposed specific practices to variability of local conditions existing in the tropics. The function of a publication like the FAO Code will be to outline the general criteria for environmentally sound forest exploitation and to promote exploitation practices in accordance with these criteria.

In: BOLFOR, CIFOR, IUFRO.

Memoria del Simposio Internacional sobre Posibilidades de Manejo Foresta; Sostenible en America Tropical,

Santa Cruz de la Sierra, Bolivia, 15-20 de Julio de 1997, 183-189.

Proyecto de Manejo Forestal Sostenible (BOLFOR),
Santa Cruz. (Paper in Spanish)

16. Reduced impact logging: putting research results into practice.

Dykstra, D.P.

This paper aims to communicate the idea that both timber and non-timber resource values can be sustained in the forests of Southeast

Asia by putting into practice the reduced-impact logging techniques that have been established through research and experience. For the most part these techniques require only minor modifications of current practices, and in general can be implemented with little or no overall increase in operating costs. To ensure that these practices are adopted widely, however, government policies must be revised to improve timber concession agreements, provide incentives for sustainable practices through taxation and other fiscal measures, have greater control over logging operations, and ensure that trained foresters are involved in decision-making on forest operations. Governments must then have the political will to enforce such policies, and foresters and the forest industry endeavour to utilise tropical forests to best achieve development goals and maximise the value of forest assets.

In: Proceedings of the Seminar on Harvesting Technologies and Standards for Sustainable Forest Management in Sabah, 18-22 March 1996, 63-72 Sabah Forestry Department, Sabah, Malaysia.

17. Wood harvesting.

Dykstra, D.P. and Poschen, P.

Wood harvesting is the preparation of logs in a forest or tree plantation according to the requirements of a user, and delivery of logs to a consumer. It includes the cutting of trees, their conversion into logs, extraction and long distance transport to a consumer or processing plant. This article describes the sequence of wood harvesting operations, common methods, equipment and hazards, including felling and extraction preparation, extraction and log making and loading, and standards and regulations.

*In: Stelman, J.M. (ed.)
Encyclopaedia of occupational health and safety,
vol. 3, 68.6-68.11. 4th ed. International Labour Organization,
Geneva, Switzerland. (Also on CD-ROM).*

18. Cameroon's logging industry: structure, economic importance and effects of devaluation.

Eba'a Atyi, R.

This study was conducted in Cameroon from July 1996 to June 1997. It aimed to describe the structure of the Cameroon logging industry, assess its importance within Cameroon's economy, and analyse recent developments experienced by the industry since the devaluation of the

CFA franc in January 1994. Study methods consisted of carrying out a structural survey of logging enterprises based on a trialled, written questionnaire, reviewing existing documentation within the forestry administration and timber exporting organisations, and conducting an elementary statistical analysis of the information gathered.

Occasional Paper No. 14. CIFOR, Bogor.

19. Dynamique et croissance de l'Okoumé en zone côtière du Gabon
Fuhr, M., Deleguè, M-A., Nasi, R. and Minkoué, J-M.

Monitoring permanent plots established in pure natural stands of Okoumé (*Aucoumea klaineana*) in the coastal zone of Gabon from 1987 to 1997 allows reconstitution of the development pattern of such stands from their establishment to the so-called exploitable stage (around 60 years), and assessment of the impact of selective thinning from above (killing of standing trees) and traditional logging on the dynamics of such stands. Even-aged stands derive from recolonisation of agricultural clearings, and were identified from aerial photographs. They are distinguished from Okoumé-rich stands by the strong dominance of the species, which makes up at least 60% of the standing trees and 80% of the basal area in 20-60 year-old stands. Three successional stages are identified by the evolution of floristic composition through which pioneer species accompanying Okoumé in young stands are gradually replaced by species characteristic of the surrounding forest. From the age of 5-10 years, young stands show a growth differential between Okoumé and all other species to the advantage of Okoumé, in both height increment (>1 m/year) and diameter increment (>1.5 m/year). At an age of about 15-20 years, the stands are vertically structured (overstorey and understorey). The evolution of their density is mainly due to natural mortality of understorey trees. Some equilibrium is reached at about 45 years, when some 100 dominant Okoumé trees per hectare make up 68% of the stands' total basal area (45 m^2). The diameter growth of dominant Okoumé trees reaches a maximum between 5 and 15 years (>1.5 cm/year), and remains steady for at least 60 years (0.7 cm/year). Thinning carried out in 1989 removed an average of 36% of the basal area in young stands (15-30 years), and 21% in older stands (35-50 years). Over 80% of the volume removed was surplus overstorey Okoumé trees. Eight years later, both stands show a positive response. Stimulation of the diameter growth of individual Okoumé trees is quicker and marked in younger stands and the individual trees are

smaller. However, the response of overstorey Okoumé trees is at present too limited to make up for loss of standing timber due to removal of trees, and appropriateness of the operation is being discussed. It is too soon to assess the impact of the logging operations on the growth of the stands, although preliminary results show that, despite an exceptionally high thinning intensity (15-20 trees/ha, representing a marketable volume of up to 100 m³/ha), a high number of overstorey and promising understorey trees are left standing. Post-logging regeneration, for the time being, only appears favourable to Okoumé in the most intensively logged plot.

Série FORAFRI 1998 Document, no. 16.
CIRAD-Forêt, France. 78p. (Paper in French)

20. Les peuplements d'Okoumes éclaircis au Gabon.

Fuhr M., Nasi, R. and Minkoué, J-M.

The continuous monitoring from 1988 to 1995 of thinned and control Okoumé stands in the coastal forest of Gabon helps to evaluate the relevance of silvicultural treatment with regard to sustainable management. The stands, almost even-aged, are grouped according to their ages. The homogeneity of structural features between future thinned and control stands is verified. The thinning, carried out in 1989, is a selective thinning in the upper storey. The average removal of basal area is 36% in young stands (15 to 30 years old) and 21% in older ones (37 to 50 years old). More than 80% comes from supernumerary dominant Okoumé trees (average volume at 7 cm diameter removed in older stands: 145 m³/ha). Six years after thinning, young and old stands have reacted favourably. The dominant population is not significantly weakened. The gain on average current diameter annual increment of Okoumé trees stabilised at 0.2 to 0.3 cm/yr. Related to the increment before thinning, this gain is substantial for dominated and small dominant trees but minor for big dominant trees. At stand level, the better growth of remaining trees does not offset the loss of basal area due to thinning. In stands where the Okoumé accounts for more than 80% of total basal area, the removal of large usable trees is too sizeable for thinning after 35 years to be relevant. This may not be the case in more mixed forests where the Okoumé represents only 30-80% of total basal area, and the relevance of thinning in such stands is arguable.

Bois et Forêts des Tropiques No. 256: 5-20. (Paper in French)

21. Disturbance-induced density-dependent seed set in *Shorea siamensis* (Dipterocarpaceae), a tropical forest tree.

Ghazoul, J., Liston, K.A. and Boyle, T.J.B.

The reproductive output of *Shorea siamensis*, a widespread dipterocarp tree, was assessed in relation to disturbance and tree density at three sites in western Thailand during the 1996 and 1997 flowering seasons. The locations were similar except in disturbance history, which was reflected in decreasing tree density from undisturbed via moderately disturbed to disturbed sites. Hand pollination experiments showed *S. siamensis* to be partially self-incompatible due to differential pollen tube growth and abortion of inbred fruit. Although more than 90% of flowers from trees at all sites were pollinated, pollen tubes developed in only a small proportion of these flowers. Both pollen tube development and initial fruit production were highest at the undisturbed site. Many fruit, presumably selfed, were aborted during development at all sites, but significantly more fruit were aborted at the disturbed site, resulting in lowered production of mature fruit. *S. siamensis* was pollinated by small *Trigona* bees, which exhibited significant declines in intertree movements with increasing distance between flowering trees. As resource availability did not differ between sites, differences in mature fruit set were considered to be mediated by changes in pollinator foraging behaviour at different tree densities. Variation in seed set was negatively correlated with distance to nearest conspecific both within and between sites. At the two least disturbed sites observed seed set values corresponded with those expected by calculation. However, seed set at the disturbed site was significantly lower than expected. The results suggest that high reproductive success of *S. siamensis* is dependent upon cross-pollination, which, through pollinator behaviour, is a function of tree isolation. This species may thus be subject to the Allee effect, where population viability is reduced disproportionately with a decline in population size or population density. The implications of these results for population recovery and genetic structure following disturbance are discussed.

Journal of Ecology 86: 462-473.

22. Mechanism to identify, define and prioritize interdisciplinary forest research themes at national, regional and global levels.

Gluck, P. and Byron, N.

This paper describes how two sets of factors – the economic characteristics of the benefits of research, and the policy network of

diverse actors and their interests – determine not only the priorities for (interdisciplinary) forest research themes but also the choice of mechanisms for the decision-making process itself. The paper extends the literature in organisation theory and political science, to propose a theoretical framework to guide the identification, definition and prioritisation of interdisciplinary forest research themes at the global level. Such a framework seems necessary if proposals before the Intergovernmental Forum on Forests for supporting and coordinating international forestry research are to succeed. The paper leads to the conclusion that international deliberations on forests would benefit substantially from a new kind of formal arrangement for providing scientific input. For example, a scientific advisory body could help bridge the gap between the information needs of negotiators and policy makers and the scientific and research community.

In: Proceedings of International Consultation on Research and Information Systems in Forestry: an Austrian and Indonesian initiative in support of the programme of work of the Intergovernmental Forum on Forests, Gmunden, Austria, September 11-17, 1998, 33-52.
Federal Ministry of Agriculture and Forestry, Vienna, Austria.

23. Senteurs de miel et d'encens: le benjoin a Java centre.
Goloubinoff, M.

Sumatra benzoin (*Styrax* spp.) is a fragrant resin that has been traded overseas for many centuries. However, more than 70% of the production is sent from Sumatra to Java where it is used as an ingredient in traditional cigarettes and as incense in rituals. In Southern Central Java several small factories specialise in 'klembak menyan' cigarettes which are made from tobacco, Chinese rhubarb (*Rheum officinale*) and benzoin. This hand rolled cigarette was popular until the late 70s when the kretek cigarette became a serious competitor. However, the product still has customers among transmigrants, Central Java countrymen and low-income workers. The incense market, as a benzoin outlet, is far more important. Javanese people still use incense in many rituals, despite changing life habits and fundamental Islam influence. Several factories manufacture incense by mixing benzoin with other raw materials. Java remains the main place for incense use although some is exported or sent to other Indonesian islands such as Bali.

In: Guillot, C. (ed.) Histoire de barus: le site de Lobu Tua.
Etudes et documents, I, 265-280.
Association Archipel, Paris. (Paper in French)

24. **Forestry for sustainable development: making it happen.**

Gregersen, H., Lundgren, A. and Byron, R.N.

Sustainable development is a process of meeting the continuing, evolving needs of people while protecting and enhancing the resource base on which all production of goods and environmental services depends. Good forest management is an essential part of the sustainable development process. Given the need to share the benefits from forests, and given the uncertainty we face concerning the future, a participatory adaptive management approach is needed, one that lets us most easily adapt if we find in the future that we are on a path of sustainable development.

Journal of Forestry 96(3): 6-10.

25. **Modified BEAM rubber agroforestry models: RRYIELD and RRECON.**

Grist, P., Menz, K. and Thomas.

This paper details changes to the BEAM models, RRYIELD and RRECON, which are two of a series of bioeconomic models developed by the Bioeconomic Agroforestry Modelling (BEAM) project. The RRYIELD model deals with the biophysical components of a rubber-based agroforestry system. It focuses on the changes in output (latex, wood and intercropped annual and perennial crops) in response to a number of bioclimatic, topographic and silvicultural variables. Outputs are measured annually over the life of the plantation. The RRYIELD model is linked to an economic model RRECON used to determine the economic returns from a rubber plantation. The two models are used in combination as an extension and research tool to supply farmers or researchers with information on the viability of alternative rubber intercropping systems. The original model was developed for large estates and government plantations. The changes outlined in this report aimed to make the model more applicable to smallholders in *Imperata* infested areas of Southeast Asia, particularly Indonesia. These modifications were made progressively and were documented in a series of five papers. They are now presented here together in a single paper.

ACIAR Technical Report Series, 42.
ACIAR, Canberra, Australia. 43p. ISBN 1-86320-225-0

26. Response of forest tree samplings to experimental mechanical damage in lowland Panama.

Guariguata, M.R.

Physical damage to saplings is considered an important factor that affects tree population dynamics in tropical forests, but interspecific differences in post-damage vegetative recovery and survival have been rarely quantified. Over 4 years, the vegetative and demographic responses to experimental mechanical damage were monitored in naturally-growing saplings of four coexisting tree species, under comparable overhead illumination conditions, in a lowland moist forest in Central Panama. Inflicted damage mimicked both crown loss and stem breakage ('snapped') and stem pinning by fallen debris ('bent') in individuals (1.0-2.5 m tall) of *Alseis blackiana* (Rubiaceae), *Protium panamense*, *P. tenuifolium* and *Tetragastris panamensis* (all Burseraceae). For all species combined, 4-year percent mortality was significantly different between bent (21%), snapped (13%), and undamaged controls (6%). Species differed in their capacity to survive damage. Saplings of *A. blackiana* showed the highest resilience, expressed as a high ability to regain pre-damage height in snapped individuals, production of adventitious roots in bent individuals, and very high survival. A previous classification of the study species fits them into a large 'generalist' guild, having no obvious illumination preferences for their juvenile growth and survival at the study site. In contrast, this study suggests that tree vegetative behaviour should be incorporated in tropical forest research attempting to detect species differentiation in regeneration potential at the sapling phase.

Forest Ecology and Management 102(2/3): 103-111.

27. Curso-Taller sobre Metodologías de Investigación en Bosques Secundarios.

Guariguata, M.R.

This document summarises participants' reports based on field-oriented problems aimed at testing research methodologies from both the biophysical and socioeconomic components of secondary forest management. This 10-day workshop was held in Eastern Amazonia (Pucallpa, Perú) with the participation of professionals from Perú, Nicaragua, Brazil, and Bolivia.

Memorias. Curso-Taller sobre Metodologías de Investigación en Bosques Secundarios. 10-20 de febrero de 1998, Pucallpa, Perú. CIFOR, CATIE, INIA, Turrialba, Costa Rica 1998. 46p. (Paper in Spanish).

28. Ecology and management of tropical secondary forest: science, people and policy.

Guariguata M.R. and Finegan, B. (eds.)

The disturbance and destruction of the old-growth forests of the tropics continue to monopolize attention in international fora and the popular media, but a steadily growing land area is covered by secondary forest developing on sites which have been deforested and then abandoned by their erstwhile owners. The natural process of secondary forest succession offers hope that the unique combination of goods and services provided by the original old-growth forests may be at least partially recovered.

An enormous number of questions concerning secondary tropical forests and their potential role in sustainable land management and biodiversity conservation remain to be answered, however. Many of these questions are biological and ecological: What are the factors that bring about successional change in vegetation? How does biodiversity change during succession, does its similarity to the biodiversity of old-growth forests increase over time and why, or why not? How might secondary forests be manipulated to optimize their value for a given set of management objectives? Many more questions nevertheless concern people and their actions: what factors bring about land abandonment? How are secondary forests perceived and utilized by rural people? What market or policy changes may contribute to a more profitable and sustainable use of secondary forests?

This volume contains 16 paper presented at a conference which brought together researchers concerned with biological, ecological, social/organizational, financial/economic and political aspects of secondary forests and their management with a strictly neo tropical focus. Although the biophysical side of secondary forest research dominated this conference, it is becoming clear that sound management of this resource will depend on interdisciplinary approaches.

Proceedings of a conference held at CATIE, Costa Rica, November 10-12, 1997. Serie Técnica. Reuniones Técnicas/CATIE, No. 4. Turrialba, Cota Rica, CATIE, IUFRO, CIFOR, WWF, GTZ. 233p.

29. Ecological knowledge of regeneration from seed in neotropical forest trees: implications for natural forest management.

Guariguata, M.R. and Pinard, M.A.

This paper discusses the main ecological factors that influence tree recruitment in neotropical moist- and wet forests within the context of timber management based on selective logging. It is proposed that

setting aside protection areas in managed forests as a way to preserve ecological processes may not be sufficient to ensure sustainable levels of tree regeneration, and that a thorough understanding and application of tree seed ecology can help to refine management prescriptions. We review relevant aspects of tree reproductive biology, seed production and dispersal, spatial and temporal constraints on seed availability, disperser behavior, and the potential consequences of hunting and forest fragmentation on tree regeneration, and discuss their implications for biological sustainability in managed forests. Tree seed production can be influenced by the selective removal of neighbors of the same species (due to insufficient pollen transfer), flowering asynchrony, and attributes of the species' sexual system. The extent to which an area is supplied by seed can be affected by dispersal mechanism, spatio-temporal limitations to seed dispersal, and tree size-dependent levels of seed production at the species level. Studies of vertebrate-disperser behavior and tree seed deposition in logged forests are scarce and warrant further attention in order to refine our understanding of the dependency of sustained timber production on vertebrate fauna. Although much remains to be learned about tree seed ecology in neotropical logged forests, the baseline information presented here may offer a starting point for developing ecological criteria for seed tree retention. Furthermore, it may contribute to improving ecologically-based management prescriptions in order to enhance or at least maintain sufficient levels of natural regeneration without the need to rely on artificial regeneration.

Forest Ecology and Management 112(1-2): 87-99.

[A Spanish version is: Guariguata, M.R. 1998. Consideraciones ecológicas sobre la regeneración natural aplicada al manejo forestal. Serie Técnica. Informe Técnico no. 304/Colección Manejo Diversificado de Bosques Naturales no. 14. CATIE, Turrialba, Costa Rica. 27p.]

30. Mobilizing expert knowledge of tree growth with the PLANTGRO and INFER systems.

Hackett, C. and Vanclay, J.K.

PLANTGRO can provide estimates of plant and tree growth under a wide range of conditions by evaluating responses to some 20 environmental variables ranging from day length to soil pH and determining the limiting factor. Although intended only to indicate the suitability of a given site-species combination, empirical trials suggest that the suitability index provides a reasonable indication of growth potential, offering correlations with height growth as high as 80%. PLANTGRO can be calibrated for new situations by providing

appropriate soil, climate and species files. These can be compiled from plot-based data, casual observations, or expert knowledge. INFER is an expert system that complements PLANTGRO by providing an objective framework to elucidate plant growth details from casual observations. Together, INFER and PLANTGRO offer an effective way to provide initial growth estimates for species-site combinations not covered by plot data or other models. PLANTGRO is available from C.Hackett, and INFER and many PLANTGRO files for forest trees may be accessed on the internet at <http://www.cgiar.org/cifor/research/tropis/PLANTGRO.html>.

Ecological Modelling 106: 233-246.

31. Development of criteria and indicators for sustainable management of tropical plantation forests.

Hopmans, P., Prabhu, R., Brand, D., Nambiar, E.K.S. and Cossalter, C.

This paper examines the need to develop criteria and indicators (C&I) to assess the sustainability of tropical timber plantations. It does this in the light of expectations that such plantations are going to play an increasing role in meeting the demand for forest products, environmental services and social benefits. There is a need for sustainable management of these plantations in accordance with clearly defined objectives and values. It outlines a framework for sustainability in tropical forest plantations, the key issues involved in the development of appropriate C&I and concludes by sketching a role for CIFOR and its collaborators in developing such C&I.

In: Chinese Academy of Forestry (ed.) Forestry towards the 21st century: forestry science and technology under the global strategy of sustainable development. Proceedings of the workshop for the 40th anniversary of Chinese Academy of Forestry. Beijing, P.R. China, October 26 - 31, 1998, 51-59. China Agricultural Sciencetech Press, P.R. China
[A shorter version is in: Tropical Forest Update 8(3): 8-9, 18.]

32. La gestion local de recursos forestales: la experiencia Boliviana 94-98.

Kaimowitz, D.

This brief paper presents basic background information on decentralization in Bolivia and the role of municipal governments in forest management. Then it provides some possible lessons from the Bolivian experience for Central America. It concludes that decentralization opens new opportunities for local participation but

does not guarantee that participation will occur or that benefits will be shared more equitably. Informal power relations can be more important than formal changes in laws. Decentralisation's impact on the conservation of natural resources remains uncertain, with conflicting tendencies operating in both directions.

In: Manejo descentralizado y colaborativo del medio ambiente en Centroamerica. Workshop Memoria del encuentro realizado del 20 al 22 de abril de 1998 en San Jose, Costa Rica, 24-28. PFA/UNDP Capacity 21/FUNDEMUCA/FUDEU, San Jose. (Book in Spanish)

33. Social pressure for environmental reform in Latin America.

Kaimowitz, D. 1998.

-Abstract is not available-

In: Carter, M.R., Cason, J., Zimmerman, F. (eds). Development at a crossroads, uncertain path to sustainability after the neo-liberal revolution, 178-98. Global Studies Program, University of Wisconsin, Madison, USA.

34. Economic models of tropical deforestation: a review.

Kaimowitz, D. and Angelsen, A. 1998.

As international concern over tropical deforestation has grown over the last ten years, researchers have sought to understand the causes of deforestation and possible solutions using quantitative economic models. This book reviews the results and methodology of over 150 of these models and synthesises the main lessons that can be learned from them. Higher agricultural prices, lower wages, less off-farm employment, and more roads generally lead to more deforestation. Major doubts remain on the impact of technological change, agricultural input prices, household incomes, and tenure security. The role of macro level factors such as population growth and foreign debt is still largely uncertain. While the boom in deforestation modelling has yielded new insights, many model results should be regarded with caution because of poor data quality and methodological weaknesses. In particular, this book finds most multi-country regression models to be of limited value and recommends a shift in future research towards household and regional level studies, instead of the current emphasis on national and multi-country studies.

CIFOR, Bogor. 139p. ISBN: 949-8764-17-X.

35. Riberalta: extractivistas bajo una elite tradicional.

Kaimowitz, D. and Bojanic, A.

This chapter looks at the municipal government of Riberalta, Bolivia and its role in forest management. Riberalta is located in the northern Bolivian Amazon and depends heavily on Brazil nuts harvesting and processing, as well as logging and agriculture. The traditional local elite has maintained control over the municipal government. Since passage of the 1996 forestry law the municipal government has attempted to create a municipal forest reserve and a local protected area but has fought strongly against government titling of indigenous territories.

*In: Pacheco, P. and Kaimowitz, D. (eds.). **Municipios y gestion forestal en el tropico Boliviano**, 137-178. Serie Bosques y Sociedad, No. 3. Center for International Forestry Research, Centro de Estudios para el Desarrollo Laboral y Agrario, Taller de Iniciativas en Estudios Rurales y Reforma Agraria, Bolivia Sustainable Forest Management project, La Paz. (Book in Spanish)*

36. Reseña histórica de la investigación sobre políticas en Centro América.

Kaimowitz, D. and Murrar, A.

This chapter reviews Central America's experience with regional collaborative policy research efforts focusing on rural issues, with particular emphasis on natural resources issues. It first presents a historical description of these efforts. Regional rural policy research began with the institutions developed around the Central American Common Market in the 1960s and 1970s, then became heavily tainted by the region's military conflicts in the 1980s, and came under the predominant influence of CGIAR centres and international agencies in the 1990s. Some specific issues are examined, including the need for greater Central American control over the research agenda, stakeholder participation, the role of regional research coordinators, the quality of the research being conducted, the balance between primary and secondary research, and coordination between different regional initiatives.

*In: Scherr, S., Miranda, B. and Neidecker-Gonzales, O. (eds.) **Investigaciones sobre políticas para el desarrollo sostenible en las laderas mesoamericanas**, 255-275. IFPRI/IICA/CIMMYT/Zamorano San Salvador. (Book in Spanish)*

37. Public policies to reduce inappropriate tropical deforestation.
Kaimowitz, D., Byron, R.N. and Sunderlin, W.

This paper explains the ways in which, and the extent to which, public policy measures might be used to reduce inappropriate tropical deforestation. Inappropriate deforestation is a significant problem: 1. deforestation generally causes negative externalities that generate cost to society not reflected in exiting prices and has long term consequences that individual producers rarely consider. 2. The relative importance of the negative externalities tends to grow over time if an increasing proportion of deforestation occurs in areas that have only marginal value for agriculture but that sequester large amount of carbon, have fragile soils, or are high in biodiversity. The process of deforestation must be analysed at two levels: agents and causes. How certain causes can be manipulated to influence the behaviour of agents, so as to lessen the rate of inappropriate deforestation is discussed.

In: Lutz, E., Binswanger, H., Hazell, P., and McCalla, A. (eds.) **Agriculture and the environment: perspectives on sustainable rural development**, 302-322. World Bank, Washington, D.C.

38. Considering the impact of structural adjustment policies on forests in Bolivia, Cameroon and Indonesia.
Kaimowitz, D., Erwidodo, Ndoye, O., Pacheco, P. and Sunderlin, W.

A preliminary insight into how structural adjustment policies (SAPs) may have affected deforestation and forest degradation in the lowland tropical forests of Bolivia, Cameroon and Indonesia. It presents tentative hypotheses on how changes in prices, costs, incomes and government services associated with SAPs affect forests. The indirect effects of SAPs on forests resulting from changes in overall economic growth, inflation rates, employment and consumption are difficult to measure and predict. The experience of Cameroon and Indonesia indicate that SAPs that succeed in creating new off-farm employment opportunities probably reduce deforestation, while those that do not succeed have the opposite effect, but this is still inconclusive. There is little evidence that government spending restrictions associated with SAPs diminished governments' ability to promote sustainable forest management or control deforestation, largely because there was minimal capacity in the first place. It remains to be seen whether SAPs will favour or hinder the development of such capacity in the future.

Unasylva 49(194): 57-64.

39. Municipal governments and forest management in lowland Bolivia.

Kaimowitz, D., Vallejos, C., Pacheco, P.B. and Lopez, R.

Recent decentralisation and forestry laws in Bolivia give municipal governments a strong role in forest management. This article analyses the impact of those laws on local government activities related to logging, protected areas, indigenous territories, and land-use planning. It concludes that the laws have created new opportunities for indigenous people, small farmers, and small-scale timber producers to gain access to forest resources and influence forest policy, although they are not always able to take advantage of those opportunities. The article identifies both positive and negative trends with regard to the laws' impact on resource management, although it is premature to draw firm conclusions.

Journal of Environment and Development 7: 45-59.

40. L'exploitation du benjoin dans les hautes terres Batak: situation actuelle.

Katz, E.

The article describes the present situation of exploitation, trade and uses of Sumatra benzoin (*Styrax* spp.) as well as its historical perspective. North Sumatran Batak people exploit this fragrant resin. They use it for medicine, burn it in rituals and tell myths about it. They trade it at the local level, then hand it to ethnic Chinese who trade and transform it in Sumatra, Central Java and Singapore, which is now its main international trading point. Producers and traders have been going through a difficult phase for the last decades. Nevertheless this international trade has been conducted for at least a thousand years and benzoin continues to be used all over the world as incense, flavouring agent, medicine and perfume.

In: Guillaut, C. (ed.) Histoire de barus: le site de Lobu Tua. Etudes et documents, I, 243-264. Cahier d'Archipel no. 30. Association Archipel, Paris. (Paper in French)

41. Las plantas exogenas en la taxonomia mixteca (Mexico).

Katz, E.

After the Spanish conquest of Mexico, many plants were introduced in the Mixtec Highlands as in the whole country. In this article, the names given to introduced plants in local Spanish and Mixtec are analysed

from an ethnoscience point of view: How do new plants fit into indigenous classification? What do they reveal about social representations?

In: Hernández Bermejo, J. E. et al. (eds.). Etnobotánica 92. Actas I, 53-58.. Ayuntamiento de Córdoba/Jardín Botánico de Córdoba/Universidad de Córdoba, Córdoba (Espagne). (Paper in Spanish)

42. **Plantes américaines au Sud Congo.**

Katz, E.

Most plants presently cultivated in the Congo, including the main food crops, have been introduced from the American continent. Starting from present-day observation, the author attempts to reconstruct their process of introduction, adoption and substitution for African species. The main crops were introduced on the Atlantic coast by the Portuguese between the end of the 16th century and the 18th century and slowly made their way into the interior, as indicated in travellers' descriptions. They happened to be more resistant and productive than local plants. People progressively added them to their diet and even invented new preparation techniques. Fruit trees and potential commercial crops were more or less successfully introduced in colonial times.

*In: Chastanet, M. (ed.)
Plantes et paysages d'Afrique: une histoire à explorer, 283-322.
Karthala, Paris. (Paper in French)*

43. **'El Niño visto por las ciencias sociales: propuestas de investigación', climatic and hydrological effects of El Niño Southern Oscillation (ENSO) events at regional and local scales.**

Katz, E., Goloubinoff, M. and Lammel, A.

Until now, the El Niño has mainly been studied by natural scientists. From their experiences in the study of the relationship between societies and their climatic environment, the authors propose that social scientists be included in future research projects on this theme. They show different aspects in which these scientists could complement and enrich other scientific approaches often giving a global view of the ENSO from the physical perspectives of the sky, the sea or the earth. Focused on human beings, the social sciences tend to approach the problem at a local level. Firstly, research could be

conducted on the local history of floods and drought through oral tradition, archives and archaeology. Secondly, in most societies people have developed a good indigenous knowledge of the local climate, its variations, seasons, meteorological phenomena, climate change and weather forecasting. Anthropologists, for instance, can interpret the logic of this knowledge beyond its symbolic elements, to enhance the understanding of indigenous knowledge by other scientists. How populations affected by El Niño perceive the phenomenon is also of interest. Understanding how these populations interpret news on El Niño, as conveyed by the mass media, would bring the problem a step forward and allow the media to relay better data and forecasting to the affected people. Thirdly, the environmental and social consequences of the El Niño phenomenon should be recognised, as well as the role of human responsibility in the consequences, as was recently shown in the case of forest fires in Indonesia.

In: Cadier, E., Galarraga, R. and Gomez, G. (eds.)

Consecuencias climáticas e hidrologicas del evento

El Niño a escala regional y local: incidencia en America del Sur,

INAMHI-ORSTOM Conference, Quito, 26-29 November 1997.

Bulletin de l'IFEA 27 (3). (Paper in Spanish)

[Also published on UNESCO Montivideo web pages
(<http://unesco.org.uy/phi/libros/enso/indice.html>)]

44. Experiences in benzoin resin production in Sumatra, Indonesia.

Katz, E., Goloubinoff, M., Ruiz Perez, M. and Michon, G..

This paper presents preliminary results of research on benzoin in North Sumatra, Indonesia. Benzoin was studied because of its interesting management, and very little data available on present exploitation. Benzoin is the resin of various species of *Styrax* trees (Styracaceae) and is chiefly used for incense, perfume and medicine. It was thought that benzoin in North Sumatra had become a very minor product, yet it is still produced in 14 sub-districts, distributed over two districts, Dairi and North Tapanuli, where it is either the main source of income or secondary to commercial agriculture. Thousands of farmers, small farmers and small local traders still live from this resource. Present trading channels follow very old trading routes. Indonesian consumption, which is possibly now the highest in the world, will most likely decrease as the use of benzoin in rituals is now perceived as backward. Its use as a component of kretek cigarettes could also decrease markedly in the future. Research is still needed to more accurately define the present marketing channels and the future potential of this product. It is recommended that quality standards be

set up, the product labelled to distinguish between pure benzoin resin and adulterated blocks and that customs offices change their categories, so that import-export figures of 'minor' products, such as benzoin, can appear separately.

In: Mugah, J.O., Chikamai, B.N., Mbiru, S.S. and Casadei, E. (eds.)
Conservation, management and utilisation of plant gums, resins and essential oils: proceedings of a regional conference for Africa,
 Nairobi, Kenya 6-10 October 1997, 56-66.
 FAO Forestry Department, Rome.

45. CIFOR/Japan Research Project on 'Rehabilitation of Degraded Tropical Forest Ecosystems'.

Kobayashi, S.

Tropical forests are decreasing at the rate of 16.9 million hectares per year due mainly to clearing for agriculture and shifting cultivation. Moreover, timber harvesting results in more than 5 million hectares of tropical forest becoming secondary forests every year. CIFOR has a mission to contribute to the sustained well-being of people in developing countries, through collaborative strategic and applied research. CIFOR's research on 'Rehabilitation of Degraded Tropical Forest Ecosystems' projects started in 1996. Seven institutions, including UNMUL-Indonesia, FCFUM-Argentina, PNGFRI-Papua New Guinea, INIA-Peru, UPM-Malaysia, KUFF-Thailand, and EMBRAPA-Brazil are collaborating in research on: (i) evaluation of forest harvesting impacts on the forest ecosystems, (ii) development of methods to rehabilitate logged-over forests and degraded forest lands, and (iii) development of silvicultural techniques on degraded forest lands.

Tropical Forestry 41: 22-33. (Paper in Japanese)

46. Forest structures and regeneration process of peat swamp Alan Forests (*Shorea albida*) in Brunei Darussalam.

Kobayashi, S.

Tropical peat lands constitute one of the most important areas for land utilisation in insular Asia. There are 18.2 million ha of peat in insular Asia with 90 884 ha peat swamp forests in Brunei Darussalam. These forests are dominated by pure *Shorea albida* (Alan) stands classified into three forest types; Alan Batu, Alan Bunga and Alan Padang. In this study there is an attempt to clarify the Alan forest structures and regeneration processes on different sites. Different forest types were

observed; mixed swamp forest dominated by *Drybalanops rappa*, Alan Batu, Alan Bunga, Alan Padang and Padan Paya. Alan forests occupied a wide area and *S. albida* is very distinctive due to its phenological characteristics and its occurrence as a monoculture in peat swamps of the tropical rain forests. Alan forest types are characterised by their heights and ground water levels. *S. albida* flowered in February 1986 in Brunei and Sarawak but two years later the seedling population had almost disappeared from the forest floor. The main factors of mortality were the low light intensity and soil conditions that dry on days with no rainfall and flood after continual rainfall. The energy allocation to root weight of *S. angustifolia* was less than 20%, lower than *S. laxa* and *S. angustifolia*. The effect of *S. albida*'s fragile forest ecosystem on its regeneration process must be taken into account in peat land utilisation.

In: Proceedings of the Second International Symposium on Asian Tropical Forest Management, 166-187. PUSREHUT Special Publication. PUSREHUT- UNMUL and JICA, Samarinda, Indonesia.

47. Effect of soil amendment on early growth of *Vitex pubescens* stumps.

Kusmina, S., Budhi, S., Sriwardani, F., Utama, R., Rantan, D. and de Jong, W.

Establishment of *Vitex pubescens* plantations must be realised through the production of planting stock in nurseries because direct sowing into imperata grasslands is unsatisfactory. Also, farmers need an appropriate, cost-effective, simple technique to produce seedlings. The use of fertiliser in producing planting stock ensures production of healthy seedlings, especially if suitable fertilisers are readily available. In this research in West Kalimantan, 'green charcoal', a mixture of charcoal and poultry manure, was applied to the nursery containers to determine the optimal dose of fertiliser. Charcoal increases soil porosity capacity and poultry manure adds important nutrients. The 'green charcoal' was added to the locally available soil, a red-yellow podzolic soil with both high acidity and low fertility, in three different proportions and tested on germinated seedlings of *V. pubescens*. There was one control plot. The study demonstrated that treatment with fertiliser, in the ratio of 1:5 of 'green charcoal' to soil, produces the best results for growing *V. pubescens* planting stock.

Forest, Farm, and Community Tree Research Reports 3: 70-73.

48. Mating system in *Pterocarpus macrocarpus* Kurz in Thailand.
Liengsiri, C., Boyle, T.J.B. and Yeh, F.C.

The mating system in 11 natural populations of *Pterocarpus macrocarpus* Kurz in Thailand was investigated based on the mixed mating model using 16 isozyme markers. Single-locus outcrossing rates (t_s) averaged from 0.620 to 0.931 among populations while multilocus outcrossing (t_m) ranged from 0.719 to 0.959. Both t_s and t_m revealed a geographic pattern with western populations exhibiting higher outcrossing than eastern populations. Low estimates of outcrossing rates in eastern populations could be attributed to habitat characteristic, degree of disturbance, density, and distribution of flowering mature trees. Individual tree outcrossing rates (t_{mi}) indicated that reduced population density associated with disturbance could result in low t_m in some eastern populations.

Journal of Heredity 89: 216-221.

49. Natural vegetation strips (NVS) and *Gmelina* cropping systems.
Mamnicpic, M.A.E., Tinsley, R.L. and Magcale-Macandog, D.

Recent rising demand for timber in Northern Mindanao, Philippines has driven smallholder farmers to plant fast-growing timber species, mostly *Gmelina arborea*, within their farms. The trees are commonly planted in portions of farms as block planting, along farm boundaries, or established along contour strips. Both natural vegetation strips (NVS) and tree cropping systems are examined here from biophysical and economic perspectives. In this paper, farmer surveys are reported with the aim of determining how livestock are raised in relation to the agricultural and tree components in both NVS and *Gmelina* block planting systems. The contribution of the animals to the productivity of each cropping system is established. Following the survey, the computer model, Soil Changes Under Agroforestry, is used to predict crop and tree yields for a number of years. These yields, in combination with the economic data collected, are input to a benefit-cost analysis that determines the long-term economic productivity of the cropping systems, with and without the animal component. The integration of livestock within both cropping systems was found to enhance economic productivity. The *Gmelina* system was the more profitable of the two systems but required a greater investment.

Imperata Project Paper, 1998/1. CRES, ANU, Canberra. 16p.

50. Are joint implementation and the clean development mechanism opportunities for forest sustainable management through carbon sequestration projects?

Mulongo, K.J., Smith, J., Alirol, P. and Witthoeft-Muehlmann, A.

This background paper summarises the issues raised by the Kyoto Protocol as background information for discussion aimed at assessing whether joint implementation (JI) and the clean development mechanism (CDM) are opportunities for forest sustainable management through carbon sequestration projects. A synthesis of the results of the discussions will be used: (i) to provide policy-makers with information that will enable them to elaborate the modalities of these instruments and take well-informed decisions whether they should engage into, or encourage, JI or CDM activities in the forestry sector; (ii) to identify gaps in knowledge and researchable issues that will permit a better understanding of the socio-economic, cultural, political, scientific, technical and environmental implications of carbon sequestration, taking into account national and global needs for sustainable development; and (iii) to enhance public awareness and facilitate the understanding whether JI or CDM are opportunities for carbon sequestration projects in the forestry sector. The first section lists a number of issues derived from Articles 6 and 1 of the Kyoto Protocol, with some emphasis on forestry sector issues. These issues are then discussed in subsequent sections under: (i) methodological issues including measurement, verification and certification of climate benefits in the forestry sector; (ii) eligibility criteria for JI and CDM projects; (iii) environmental and financial additionality; and (iv) incentives for participating in JI or CDM projects including sustainable development achievement and cost-effectiveness in implementing emissions reductions. Finally, the paper provides some guidance on broad issues that will be considered at the Policy Dialogue.

CC98/PD01/04, International Academy of the Environment, Geneva.

51. Roles of global and regional networks and consortia in strengthening forestry research.

Nair C.T.S. and Dykstra, D.P.

Collaborative institutional arrangements such as networks and consortia are becoming significant in the provision of goods and services in situations where such collaborations can improve the overall comparative advantage of the alliance. Economic globalisation, rapid development of communication technologies and

increasing problem complexity have enhanced the relevance of these networks. While networks and strategic alliances are playing an increasingly important role in national and international agricultural research they have been less widely used in forestry for collaborative research. Forestry research networks foster the exchange of information among scientists and to a lesser extent, users and beneficiaries of forestry research. Recent developments in forestry suggest that by broadening the scope of their activities, these networks could contribute much more to forestry research. Many research problems could be handled more effectively through networking than by individual research institutes. In this paper a selection of issues relating to collaboration in forestry research through networks and consortia at the regional and global levels is examined. It is not a comprehensive overview of the subject but rather an attempt to catalogue the many existing forestry research networks and collaborative arrangements. The aim is to raise issues for discussion.

In: Proceedings of International Consultation on Research and Information Systems in Forestry, 7-10 September 1998, Gmunden, Austria. An Austrian and Indonesian initiative in support of the programme of work of the Intergovernmental Forum on Forests, 63-82. Federal Ministry of Agriculture and Forestry, Vienna, Austria.

52. Growth and mortality patterns before and after logging.

Nguyen-The, N., Favrichon, V., Sist, P., Houde, L., Bertault, J.G. and Fauvet, N.

In the frame work of the STREK project, growth and mortality rates were analysed in both primary forest and after interventions such as logging or liberation thinning in logged-over forest. Dipterocarps, the dominant family in the upper storey and the major commercial species, were the particular focus. Before logging, the annual increment is a few millimetres per year and depends on the diameter class, linked to the social status in the stand. Dipterocarps grow faster than many other species and the stand density influences growth. The denser the stand, the higher the proportion of trees with negative or nil growth with an associated high probability of dying. After logging, growth and mortality were clearly influenced by the degree of canopy opening related to logging intensity. The data analysis therefore took into account different levels of logging intensity. A spatial approach using GIS showed that only a part of the stand suffered any harvesting impact. Two years after logging, the balance between growth, recruitment and mortality, showed no significant difference to the control plots. This suggests that the forest is not yet in a reconstitution

phase but in a recovery process. Overall, the growth enhancement induced by canopy opening is balanced by a higher mortality. In the logged over areas, growth, after the silvicultural treatments, was enhanced by an average of 50%. The long-term effect of these treatments will have to be assessed over an extended period.

In: Bertault, J.G. and Kadir, K. (eds.) **Silvicultural research in a lowland mixed dipterocarp forest of East Kalimantan: the contribution of STREK project**, 181-216. CIRAD-Forêt, Montpellier.

53. Phenology of some dipterocarps.

Nguyen-The, N. and Sist, P.

Phenological observations have been carried out on all the dipterocarps (except the genera *Vatica* and *Hopea*) recorded on 20 ha of mixed lowland dipterocarp forest in the Berau district (Kalimantan Timur, Indonesia). More particularly, a fruiting peak was observed at the end of January 1995. Although fruiting trees were observed in all diameter classes from 10 cm dbh, it turned out that the proportion of fertile trees was maximum and stable only above 50 cm dbh, which could be considered as a limit of maturity for dipterocarps. Considering only the trees above 50 cm dbh, the proportion of fruiting individuals was 66%, which is defined as a 'mast fruiting' in the literature. Nevertheless, this fertility varied between genera. The genus *Dipterocarpus* participated at 82.3% while the genus *Shorea* participated at 54.5%. Within one genus, differences between species were also observed.

In: Bertault J.G. and Kadir, K. (eds).
Silvicultural research in a lowland mixed dipterocarp forest of East Kalimantan: the contribution of STREK project, 95-110.
CIRAD-Forêt, Montpellier.

54. Estilos de desarrollo, deforestación y degradación de los bosques de las tierras bajas de Bolivia.

Pacheco, P.

This book looks at the history of lowland forest in Bolivia from the beginning of the century to the present time. It allows us to understand why the rate of deforestation in Bolivia has increased so dramatically and the minor use of just forestry or environmental base actions compared to the influence of other actors. The causes of deforestation and forest degradation are not in the forest but have their origins in policies, macro-economic, international and domestic markets,

migrations and social changes. This research is included in a CIFOR initiative to study the relation between society and forests in Bolivia, Cameroon and Indonesia.

Serie Bosques y Sociedad, 2.
Center for International Forestry Research, Centro de Estudios para el Desarrollo Laboral y Agrario, Taller de Iniciativas en Estudios Rurales y Reforma Agraria. (Book in Spanish)

55. Municipios y gestion forestal en el tropico boliviano.

Pacheco, P. and Kaimowitz, D. (eds.).

This book looks at the role of municipal governments in lowland Bolivia in forest management since passage of a popular participation law in 1994 and a new forestry law in 1996. It covers issues related to logging, protected area management, land use planning, indigenous territories, and non-timber forest products. Most of the book consists of nine case studies of specific municipalities or groups of municipalities. The book concludes that decentralisation has opened new opportunities for more equitable access to forest resources and their benefits, but that local people's capacity to take advantage of these opportunities varies. Initial indications point to both positive and negative effects on natural resource management, but it remains too early to determine whether the net impact of decentralisation on forests will be positive or negative.

Serie Bosques y Sociedad, No. 3. Center for International Forestry Research, Centro de Estudios para el Desarrollo Laboral y Agrario, Taller de Iniciativas en Estudios Rurales y Reforma Agraria, Bolivia Sustainable Forest Management Project, La Paz. 489p.
(Book in Spanish)

56. The role of grazing animals in the natural regeneration of *Samanea saman* in degraded pasture areas in the Philippines.

Pasicolan, P.N., Ramos, M.T. and Menz, K. 1998.

The bioecological basis for the symbiotic relationship between grazing animals and *Samanea* is analysed. The contributory factors enhancing such relationships are examined, with the aim of evolving a successful reforestation model that builds on the natural process of regeneration on degraded grasslands. The study site was in the Province of Cagayan, Luzon Philippines. The methodology consisted of a series of bioecological experiments, plus a socioeconomic survey. The bioecological experiments addressed seed germination, seed

digestibility and forage preference by grazing animals. A socioeconomic component is included to determine the income gains to the farmer from *Samanea*.

Imperata Project Paper, 1998/2. CRES, ANU, Canberra. 11p.

57. El proceso social de formulacion de la ley forestal de Bolivia de 1996.

Pavez, I. and Bojanic, A.

This work presents, for first time, an opportunity of knowing the process of the formulation of the new Forestry Law in Bolivia, approved in July 1996. The formulation of this law was a long and difficult social process, full of conflicts between the different actors involved and delays. The book shows the politics as it is, with all its alliances of convenience, small tragedies and surprises and the powerful interests behind it, but it also demonstrates that democracy can work and that there are still possibilities to conciliate all these interests in the forestry sector. This study is included in a CIFOR initiative to look at the process of formulation of new forestry laws in Bolivia, Cameron, Costa Rica and Indonesia.

Serie Bosques y Sociedad, 1. Center for International Forestry Research, Centro de Estudios para el Desarrollo Laboral y Agrario.

58. From industrial forestry to natural resources management - lessons learnt in forestry assistance.

Persson, R.

The report summarises some Swedish experiences in assistance to forestry. Sweden's development from forestry mining in the last century to sustainable forestry is discussed as is the impact of assistance to Swedish forestry during 150 years. Forestry assistance has gone through a number of phases (Industrial forestry, Social forestry, 'Environmental' forestry and Sustainable management of renewable natural resources). The report does not detail the forestry problems giving cause for assistance in developing countries but concentrates on analysing the role of donor organisations. There are too many problems in the administrative system and improved forestry assistance requires changes in the donor-organisations.

Publications on Forestry, 1/1998. Department for Natural Resources and the Environment, Swedish International Development Cooperation Agency (SIDA), Stockholm, Sweden. 21p.

59. Skogsforstorelsen fran Adam till Clinton.*Persson, R.*

The article describes deforestation from early man to our time. During the last 8 000 years forests (very widely defined) may have decreased by about 40%. Deforestation began in West Asia, China, India and the Mediterranean followed by Europe and somewhat later by North America. It has now moved to the tropics at the same time as forest areas are actually increasing in temperate and boreal zones. In a historical perspective forest development can be described as going through several phases. As expected, there was a long phase with little deforestation, then usually a phase or phases with rapid deforestation, a phase of stabilisation and then, in developed countries, an increase in forest area. In Europe, for example, deforestation and recovery has oscillated with for example an increase in forest area during the period of the Black Death. Wars and powerless governments can result in both deforestation and recovery. Rapid deforestation on one period has often been connected to some kind of industry (e.g., mining). Not all forests in the Mediterranean were cleared in classical times as is often described. Forests were left in inaccessible areas and some forests recovered after the decline of the Romans. Much of the deforestation in West Asia and North Africa has taken place in this century.

Skogshistorisk Tidskrift No. 8: 71-82. (Paper in Swedish)

60. Tree planting in Indonesia: trends, impacts and directions.*Potter, L. and Lee, J.*

This report details the results of a consultancy that aimed to: (i) identify tree planting activities currently prominent in Indonesia; (ii) seek reasons for their ascendancy; (iii) monitor perceptions of local and transmigrant populations regarding the opportunities and constraints associated with tree planting options; and (iv) briefly examine the environmental impacts of dominant tree planting activities. Oil palm is seen to emerge as the winner on all counts, just as the IMF has endorsed further development of tree-based cash crops. Forestry is in retreat. Fires have further undermined some of the best Kalimantan forests, which now face increased pressures from the demands of the large firms operating logging concessions, plantation forests and oil palm estates. Newly impoverished populations are also turning in increased numbers to the extraction of forest resources. Indonesia is the world's cheapest producer of palm oil products, largely because of low labour costs. Future plantations are likely to

want to cut costs further, especially those estate companies being attracted from Malaysia. Huge markets for palm oil products, both local and international, will ensure the industry's future growth. Replacing much of Indonesia's biodiverse tropical forest and cultivations of small-holders by oil palm monocultures, is not an environmentally happy prospect. It is, however, a prospect embraced with equanimity, even eagerness, by local administrations. While the pulpwood monocultures will also engage in the battle for land, the demise of many is likely, except in specific areas where they can attract small-holder growers. Big questions remain on the continuity and sustainability of all these tree crops, together with uncertainty surrounding the continued role of the small-holder as an independent grower and producer of a variety of tree crops.

CIFOR Occasional Paper No 18. CIFOR, Bogor. 75p.

61. Criteria and indicators for sustainable forest management: new findings from CIFOR's forest management unit level research.

Prabhu, R., Colfer, C.J.P. and Shepherd, G.

This paper traces the growing interest in the development of Criteria and Indicators(C&I) for sustainable forests since the declaration of the 'Forest Principles' at the Rio Conference 1992. Several processes are underway in different regions of the world to define sets of C&I that can be used to assess the social, economic, and ecological sustainability of forest management. Some have focused more at national level, while others have emphasised information needs at the forest management unit level. In an attempt to produce a generic 'master set', the Center for International Forestry Research (CIFOR) has carried out several tests to compare the different sets of C&I in existence. At the forest level, ecological criteria are much easier to apply than social ones as the latter often require an in-depth understanding of areas beyond the intermediate boundaries of the forest management unit. To help people in different areas adapt the generic hierarchy of C&I to their own conditions, CIFOR is developing a computer programme (CIMAT) which allows the addition of local knowledge and iterative development of locally-specific C&I. Further work is needed but the importance of defining a comprehensive but practical set of C&I is that such a measurable and comparable methodology would build public confidence in forest sustainability.

Rural Development Forestry Network Paper/ODI, 23a,
Summer 1998. 20p.

62. Testing and developing criteria and indicators for sustainable forest management in Cameroon: the Kribi test: final report.

Prabhu, R., Maynard, W., Eba'a Atyi, R., Colfer, C.J.P., Shepherd, G., Venkateswarlu, P. and Tiayon, F.

This is the report of the Center for International Forestry Research (CIFOR) sixth test of criteria and indicators for sustainable forest management. The test took place in October and November 1996 in and around Kribi, Cameroon. Unlike previous criteria and indicators (C&I) tests, the Kribi test placed emphasis on testing methods for developing the C&I. Eighteen experts in forestry, ecology and social science from Cameroon and other countries were involved in testing C&I developed by ATO, a Dutch working group, and a set collated from several sources. As a result of the test a set of C&I deemed appropriate for the Kribi region was compiled and valuable feedback on the CIFOR method for iterative testing and development of C&I gained. This report will be useful for people interested in the process of developing C&I and for those interested in obtaining a model set of C&I for Central African conditions.

CIFOR, Bogor. 122p. ISBN: 949-8764-18-8

63. El manejo de los bosques tropicales: retos, deficiencias y oportunidades.

Putz, F.E.

Despite the challenges and deficiencies tropical forest research faces, it has never had so much power as now. Foresters rely on new approaches to stimulate a change in the way forest is used for a more sustainable management system. In addition, new legislation and international agreements on forests will help if there is political willingness to apply the laws and postpone economic benefits. However, before there is any possibility of change from the culture of forest exploitation to the culture of forest management, it is necessary to address some issues. Some lumbermen, forest concessionaires and forest owners do not see any reason to change the present exploitation practices; they argue that they have no access to the information for implementation of reduced impact logging techniques and other forest management practices; and additionally forest management is less profitable in the short-term. There is a need to respond to these issues, to accept the challenges and to overcome the deficiencies in the

research programmes to stop destructive forest exploitation practices and preserve the forest.

In: BOLFOR, CIFOR, IUFRO. Memoria del Simposio Internacional sobre Posibilidades de Manejo Forestal Sostenible en America Tropical, Santa Cruz de la Sierra, Bolivia 15-20 de Julio de 1997, 1-4. Proyecto de Manejo Forestal Sostenible (BOLFOR), Santa Cruz. (Paper in Spanish)

64. Methods for non-timber forest products research: the Tropenbos experience.

Ros-Tonen, M.A.F., van Andel, T., Assies, W., van Dijk, J.F.W., Duivenvoorden, J.F., van der Hammen, M.C., de Jong, W., Reinders, M., Rodriguez Fernandez, C.A. and Van Valkenburg, J.L.C.H.

Several studies on non-timber forest products (NTFPs) have been and are being carried out under the umbrella of the Tropenbos programme. To bring more coherence in these studies, a research strategy was formulated, providing an analytical framework for site-specific studies. The strategy aims at identifying the key conditions for successful and sustainable commercial NTFP extraction, to bring these together in a checklist, and to develop a methodology to apply this checklist in land-use planning and community development. Among the key elements of sustainable commercial NTFP extraction are the availability of natural resources, the sustainability of harvesting levels, the compatibility of extractive activities with people's livelihood strategies, access to markets, and participatory planning. Several methodologies have been applied to gain more insight into these elements. The methodology to assess the availability of natural resources is determined firstly by the study's aim and scale. The land-ecological approach gives a first impression of plant resource availability at the level of land units. To determine the availability of NTFP resources at a more detailed level, the nested sampling method is often preferred. In cases where only primary forest is studied and where smaller plants are hardly exploited for NTFPs, a standard vegetation analysis can be carried out. Market surveys are part of most NTFP studies in the Tropenbos programme. Several participatory methods have been applied in the Tropenbos programme, such as participatory personal interviews and community workshops. The overview methodologies make it clear that the specific objectives and context of the studies generate their own methodologies choices. It is the overall research strategy that provides the framework for the integration of site-specific results.

Tropenbos Document, 14. Tropenbos, Wageningen, Netherlands. 31p.

65. Rational exploitations: economic criteria and indicators for sustainable management of tropical forests.

Ruitenbeek, J. and Cartier, C.

The objective of this paper is to develop economic criteria and indicators that relate to the sustainable management of tropical forests. Existing criteria and indicators (C&I) do not always reflect the breadth of experience that exists in the broader economic literature. This paper aims to synthesise some of this 'non-C&I literature' to distil some key lessons relevant to C&I design within the forestry sector. The topics covered range from economic history and the role that 'rationality' has played in economic decision-making, to modern procedures of resource valuation, to issues of uncertainty, taxation and wealth distribution. It is argued that economic criteria and indicators of sustainable forest management should reflect the dimensions of efficiency, equity and sustainability, and need to look beyond the forest stand to institutional and policy issues. If such criteria inform our decisions, exploitation of the forests may yet occur. It would, however, be rational exploitation; rational exploitation reflecting an enlightened self-interest that captures the broader global needs of current and future generations.

Occasional Paper No. 17. CIFOR, Bogor.

66. Planes de manejo forestal y necesidades de informacion para el manejo operacional.

Sabogal, C.

The main aim of this paper is to present some thoughts about natural forest management, management plans, information needs in management planning, and how to overcome some of the technical deficiencies existing. Emphasis is placed on management of hardwood neo-tropical natural forest exploitation and on information aspects as well as on the biophysical and silvicultural research needed for the planning, implementation and assessment of management techniques. There is a need to systematise and disseminate in a broader context the research findings and the practical experiences. Current biological, ecological and silvicultural knowledge relevant to management is not accessible enough for those involved in planning and/or in the forest management decision-making process.

In: BOLFRO, CIFOR, IUFRO. Memoria del Simposio Internacional sobre Posibilidades de Manejo Forestal Sostenible en America Tropical, Santa Cruz de la Sierra, Bolivia 15-20 de Julio de 1997, 135-147. Proyecto de Manejo Forestal Sostenible (BOLFRO), Santa Cruz. (Paper in Spanish)

67. Forest composition, structure, and regeneration in a dry forest of the Nicaraguan Pacific coast.

Sabogal, C. and Valerio, L.

This paper presents the results of nearly five years of research in one of the least disturbed dry forests in Nicaragua, the country with the largest proportion of dry forest areas in Central America. Floristic, structural and dynamic aspects of dry deciduous and gallery forest stands are presented. The study has international implications because knowledge of tropical dry forest ecology is scarce at the same time that local demands on such forests around the world are intense.

In: Proceedings SI/MAB International Symposium on Measuring and Monitoring Forest Biological Diversity, Washington, DC, May 1995, 187-212. Kluwer Academic, Dordrecht, Netherlands.

68. Changing roles in forest research.

Sayer, J.A.

The globalisation of economies and the emergence of a powerful multi-national corporate sector will result in significant shifts in the geographic locations, types and intensities of forest use. Governments will increasingly need to apply their resources to creating the optimal policy environment. New types of forest research institutions and a new culture of forest research are required: science that operates at the scale of landscapes allowing the optimisation of many products, and that treats forests in their social context; and management that can adapt quickly to changing social and economic conditions. Tropenbos' special contribution may be to develop the capacity to predict the response of these systems to a variety of management interventions. CIFOR's contribution lies in drawing on the information produced by Tropenbos and other upstream science to generate options for institutional and policy interventions to achieve sustainable forestry. Future research should give increased emphasis and resources to achieving greater integration to research management within each site. Optimal utility of the residual forests will come from an appropriate balance between management for environmental functions and for the variety of products whose harvesting is consistent with the maintenance of these environmental functions. The future role of public forest research institutes should be to provide the scientific underpinnings for multiple use forest management with a heavy emphasis on environmental public goods and the equitable distribution of costs and benefits.

In: Seminar proceedings 'Research in Tropical Rain Forests: Its Challenges for the Future, 25-26 November 1997, 59-63. Tropenbos Foundation, Wageningen, Netherlands.

69. Research and information for sustainable forests.

Sayer, J.A.

Forestry is no longer just about ensuring sustained supplies of timber, non-timber products and wildlife, today a much wider range of local, regional and global values influence decisions on how to manage forests. Forests are central to debate on climatic change, water management and biodiversity conservation. Progress in information technology allowing manipulation of complete data sets, computer-based models and remote sensing capabilities are all contributing to providing the information which is now needed to manage forests. As economics are liberalised and trade barriers reduced forests are becoming more and more a global resource. Decisions formerly made by government forest agencies are increasingly being made by corporate investors. The implications for research are that the private sector will dominate areas such as tree improvement, plantation technology and wood processing but will not find it attractive to invest in research about the public-good values of forests. It will be important for the public sector to engage in research, which provides the ability to assess a variety of forest conditions, monitor changes and develop standards against which to evaluate forest management practices. The paper poses questions on the provision of scientific advice to the Intergovernmental Forum on Forests; what form an international consultative mechanism for forest research should take, identification of new collaborative initiatives and the way forward for initiatives for global forest information systems.

In: Proceedings of International Consultation on Research and Information Systems in Forestry, 7-10 September 1998, Gmunden, Austria, An Austrian and Indonesian initiative in support of the programme of work of the Intergovernmental Forum on Forests, 11-17. Federal Ministry of Agriculture and Forestry, Vienna.

70. Changing patterns of research funding: threat or opportunity for research on forests.

Sayer, J.A. and Hunter, I.

A lower percentage of product value is invested in research in the forest sector than in many other sectors of the economy. Moreover, while it has been possible to reach a stable funding environment for research in some parts of the sector - notably in forest products - other aspects of forestry research are increasingly unattractive to funding agencies. The funding environment for forestry research is changing. Increasingly, state funding for commercial or proprietary research is being withdrawn in the expectation that such research will be taken up

by the private sector. State funding is being applied to the issues that governments rate as important, either as a result of perceived public concern or as a result of international agreements. Competitive bidding is increasingly being used as a mechanism to allocate funds. This process has tended to favour small disciplinary teams doing component research at the expense of multi-disciplinary teams working at the systems level. In the Developed World the task is to improve the perceived value of forestry research; to adapt smoothly to the new research agenda created by changed demands placed upon forests and to maintain a balanced and progressive programme. In the Developing World the task is to build a research-capacity, an essential component of soundly-based, locally adapted development solutions, where often none exists. Given that state funding for many aspects of forestry research is not likely to increase and may decline, new sources of funding must be found. It is proposed that the role of Foundations, the GEF, Climate Change mitigation funds, the private sector and the commercial exploitation of research products be reviewed.

In: Proceedings of International Consultation on Research and Information Systems in Forestry, 7-10 September 1998, Gmunden, Austria, An Austrian and Indonesian initiative in support of the programme of work of the Intergovernmental Forum on Forests, 101-112. Federal Ministry of Agriculture and Forestry, Vienna.

**71. Development of RAPD protocol for *Shorea laevis*.
Siregar, U.J., Sudarmonowati, E. and Sri Hartati, N.**

To study genetic diversity of *Shorea laevis* using RAPD, it is necessary to optimise the method for good resolution. Two PCR conditions, using 109 random primers of Kit B, C, E, F, G and H from Operon Technology Ltd., were tested on *S. laevis* DNA, extracted by CTAB miniprep method. The PCR condition II was the most suitable for *S. laevis*, requiring more PCR cycles, compounding with higher MgCl₂ concentration and using more DNA samples and primers. Further surveys, using two primers on 110 individuals from natural habitat, revealed considerable genetic variation in *S. laevis*.

Annales Bogorienses 5: 85-92.

**72. Liberation thinnings in logged-over forests.
Sist, P. and Abdurachman.**

One of the objectives of the STREK project was to propose silvicultural methods able to increase forest production, especially in

logged-over areas, The area RKL 1 which was logged 15 years ago was the most suitable zone to implement those trials. This study aims to describe the silvicultural treatments undertaken in RKL 1. Two different treatments were applied in addition to the control: the first treatment was a liberation thinning carried out systematically in the plot with a removal of 30% of the basal area involving the non-commercial species with $\text{dbh} \geq 20$ cm. The second silvicultural treatment was a two-fold intervention: (i) a liberation thinning focused around selected potential crop trees (PCT) characterised by an extraction of non-commercial species with $\text{dbh} \geq 20$ cm located within a circle of a constant 10 m diameter centred on the PCT; and (ii) an extraction of the same non-commercial species group with $\text{dbh} \geq 40$ cm outside the 10 m circles. The efficiency of the arboricide on the trees three years after treatment is given.

In: Bertault, J.G. and Kadir, K. (eds.) **Silvicultural research in a lowland mixed dipterocarp forest of East Kalimantan: the contribution of STREK project**, 171-180. CIRAD-Forêt, Montpellier.

73. Reduced impact logging experiments: impact of harvesting intensities and logging techniques on stand damage.

Sist, P. and Bertault, J.G.

Timber harvesting was investigated both in terms of commercial timber volume extracted and impact on residual stand. Conventional and Reduced Impact Logging (RIL) techniques were compared on the basis of pre- and post-harvesting stand inventories. Timber volume extracted averaged $87 \text{ m}^3 \text{ ha}^{-1}$ and the resulting commercial volume was $46 \text{ m}^3 \text{ ha}^{-1}$ (i.e. 53.8% of the felled volume). On average, logging damage affected 40% of the residual trees ($\text{dbh} > 10$ cm): injured and dead trees were recorded in equivalent proportions (21% and 19% respectively). Generally, felling operations caused injury to trees, crown damage being most common, whereas skidding caused death to trees, essentially by uprooting. Tree injury and death from RIL, in contrast, was substantially lower (30.5%) than from conventional methods (48.1%). This study demonstrated that the impact of logging on trees can be substantially reduced by strict supervision and planning of logging operations and limit of harvesting intensity, which should not exceed $80 \text{ m}^3 \text{ ha}^{-1}$. If these technical recommendations are followed, it is possible to reduce the damage by 20% which is equivalent to about $100 \text{ stems ha}^{-1}$ ($\text{dbh} > 10$ cm).

In: Bertault, J.G. and Kadir, K. (eds.) **Silvicultural research in a lowland mixed dipterocarp forest of East Kalimantan: the contribution of STREK project**, 139-161. CIRAD-Forêt, Montpellier.

74. Description of the primary lowland forest of Berau.

Sist, P. and Saridan, A.

The structure and species composition of the primary lowland dipterocarp forest in Berau is presented. This study mainly focuses on the primary forest based on 3 control plots of 4 ha each, totalling 12 ha, where 93% of the trees (dbh (10cm) were identified at the taxa level. Tree identification led to a collection of herbarium samples and to development of a herbarium reference which now contains more than 3 000 samples representing 45 families, 129 genera and 579 species or taxa. In primary forest, the average figures for density, basal area and standing volume are 530.7 trees 31.5 ha⁻¹, and 402 m³ ha⁻¹, respectively. In the study area dipterocarps represented 25% of the tree population, 50% of the basal area and 60% of the standing volume. In the three control plots of primary forest (12 ha), 538 different taxa were recognised representing a mean of 182 trees per ha. The families Dipterocarpaceae and Euphorbiaceae were the most important taxa in both density and number of species (61 species each). Two dipterocarp species, namely *Shorea leptoderma* Meijer ex Wood and *Shorea symingtonii* Wood were recorded for the very first time in Indonesia. The structure of the forest of Berau is very similar to that of Sabah or other parts of northern Borneo. The main characteristic of this forest is its remarkable richness in dipterocarps which is exhibited in a mean of 29 species per ha. The forests of Sabah are mainly dominated by light-demanding dipterocarp species such as *Parashorea* spp. and *Dryobalanops* spp. This could result from important canopy disturbance caused by climatic events like cyclones or long periods of drought. The high species richness of the Berau forest may be linked to a longer-term stability and a relative constancy of the climate in the region.

In: Bertault, J.G. and Kadir, K. (eds.) Silvicultural research in a lowland mixed dipterocarp forest of East Kalimantan: the contribution of STREK project, 51-94. CIRAD-Forêt, Montpellier.

75. Reduced impact logging guidelines for lowland and hill dipterocarp forest in Indonesia.

Sist, P., Dykstra, D.P. and Fimbel, R.

These guidelines form the basis for defining the initial set of activities to be classified as Reduced-Impact Logging (RIL). They have been adapted to and will be tested in the local conditions that occur in the lowland and hill dipterocarp forest of the Bulungan Model Forest project in East Kalimantan, Indonesia. It is anticipated that through the implementation and supervision of the RIL practices described in this

document, the timber concession operators (INHUTANI II) can expect to: reduce disturbances to soil and residual vegetation by at least 50% in comparison to conventional logging operations where these guidelines are not applied; limit overall direct impacts to the forest <25%; conserve wildlife and other forest resources, including non-timber forest products, threatened and endangered species, keystone plant resources, and water; diminish direct logging costs by at least 15%; and protect the long-term integrity and value of the permanent forest estate.

Occasional Paper No 15. Bulungan Research Report Series No. 1,
CIFOR, Bogor.

76. Harvesting intensity versus sustainability in Indonesia.

Sist, P., Nolan, T., Bertault, J.G. and Dysktra, D.P.

In East Kalimantan (Indonesia), impacts of conventional and reduced-impact logging (RIL) on forest ecosystems were compared on the basis of pre- and post-harvesting stand inventories. There was a positive and significant correlation between the proportion of trees damaged by felling and the density of trees felled. Logging intensity ranged from 1 to 17 trees ha⁻¹ (9--247 m³ ha⁻¹) and averaged 9 trees ha⁻¹ (86.9 m³ ha⁻¹). The study has shown that with RIL techniques, logging damage on the original stand can be significantly reduced by 50% compared with conventional logging. However, this 50% reduction in logging damage, was dependent on the felling intensity. With a felling intensity of 8 stems ha⁻¹ or less, RIL techniques only damaged 25% of the original tree population whereas 48% were damaged with conventional techniques. Above this felling intensity (i.e. 8 stems ha⁻¹), the effectiveness of RIL in limiting forest damage was significantly reduced, mainly because of the increasing felling damage. Moreover, the removal of all harvestable timber trees, leaving only few potential crop trees, will result in a seriously depleted residual stand. Because of the high damage involved by high felling intensity, leaving few potential crop trees, and the yield capacity of the remaining stand, acceptable harvesting volume will not be reached within the felling rotation of 35 years. It is concluded that silvicultural system based on diameter limit alone, as is the Indonesian system (TPTI), cannot be compatible with sustainability and more sophisticated harvested-selection rules are needed.

77. Accuracy and precision of two laser dendrometers.

Skovsgaard, J.P., Johannsen, V.K. and Vancly, J.K.

Two commercial laser dendrometers were tested under controlled and field conditions, and contrasted with alternative instruments. Testing focused on height measurement, but also considered distance and remote diameter measurements. Both laser instruments gave very precise estimates, but showed some bias. Users of these and other 'high-tech' instruments are reminded that precision is not synonymous with accuracy. Users should not become complacent about the submillimetre readout, but should calibrate instruments to examine if users' accuracy requirements are satisfied. Instruments may need to be re-calibrated each measurement season and after any mishandling.

Forestry 71: 131-139.

78. Dynamics of the agricultural frontier in the Amazon and savannas of Brazil: analyzing the impact of policy and technology.

Smith, J., Winograd, M., Gallopin, G. and Pachico, D.

The last 25 years have seen a rapid and uncontrolled expansion of the agricultural frontier in two vast, sparsely populated areas of Brazil: the Amazon tropical moist forest and the savanna (Cerrado). This paper analyses the impact of policy and technology on land use changes in these ecosystems up to the year 2020. The driving forces behind past land use change are examined to identify future scenarios depicting plausible changes in the driving forces. A land use model is then used to analyse the impact of these changes and derive implications for policy and technology development. While many government policies stimulating deforestation have been reversed, private sector lobbies for uncontrolled logging and soybean export corridors threaten the Amazon. Under a favourable scenario (macroeconomic stabilisation, controlled logging and road building, sustainable technologies, global environmental markets) reconversion of natural habitat could be 30% lower than under unfavourable policies and technologies, without sacrificing production.

Environmental Modeling and Assessment 3: 31-46.

79. Database management for forestry literature in the Asia-Pacific region.

Soeripto, S.W.

Databases for forestry literature in the Asia Pacific Region have not been fully developed. The need for establishing a good database is not well understood by all levels of management at many forestry

organisations. Aspects affecting database management include management support, organisational structure, information technology, data collection, and information delivery. A short list of forestry-related CD-ROM databases and web sites is included at the end of this paper.

In: Enriquez, G.L., Wasrin, U.R. and Murdiyarso, D. (eds.) **Proceedings of Seminar on Tropical Forest Dynamics**, Bogor, Indonesia, 10-11 December 1996, 231-238. SEAMEO BIOTROP, Bogor.

80. Effect of moisturizing treatments on germination of *Vitex pubescens* seeds.

Sriwardini, F., Budhi, S., Kusmina, S., Utama, R., Rantan, D. and de Jong, W.

In producing *Vitex pubescens* planting stock, the seeds need to be germinated as quickly and as uniformly as possible. Under natural conditions, *V. pubescens* seed has a dormancy of up to four months. Techniques to reduce this dormancy, so that seeds will germinate faster, will allow more efficient planting stock production. Two seed treatments were tested: (i) soaking seeds in room-temperature water for 24 hours, and (ii) soaking seeds in boiling water for 15 seconds. Both are techniques that could be easily used by small holder farmers. These treatments significantly increase the success rate of germination and the speed with which seeds germinate. However, the treatment of soaking seeds for 15 seconds in boiling water is slightly more effective.

Forest, Farm and Community Tree Research Reports 3: 66-73.

81. Site management and productivity in tropical forest plantations.

Tiarks, A., Nambiar, E.K.S. and Cossalter, C.

Tropical countries are expanding plantation forestry to develop sustainable wood production systems. Much of this is based on short rotations of exotic species. These systems require large capital investments, represent intensive land use and increase the demands on the soil. To develop options for maintaining or increasing productivity, a partner-project was initiated by Center for International Forestry Research with three objectives: 1) evaluate the impact of soil and site management practices on the productivity of successive rotations of plantations, 2) develop management options for maintaining or increasing productivity, and 3) where it is appropriate strengthen local institutional capacity to respond to new problems and opportunities. The project focuses on the critical inter-rotational phase of

management: harvesting, site preparation, and early stand development. A core set of treatments selected to create a range of impacts on organic matter and nutrients supply intensities will be included at all locations. Optional treatments tailored to each site will be added as required by local management, and soil and stand considerations. Each location will carry out a self-contained experiment that will produce scientifically valid results on its own merit. All experiments are networked to integrate the information so underlying processes can be understood and options for science based management developed. All sites are expected to be valuable reference sites for long-term investigations.

Occasional Paper No. 16. CIFOR, Bogor.

82. Resource management domains in forestry research.

Turnbull, J.W. and Booth, T.H.

To manage tree plantations or natural forests effectively requires close attention to interactive aspects of environmental, economic social and management factors. Extrapolation of results is crucial to the adoption of research findings and it is important to estimate the extent to which results from specific research sites can be applied to other areas. Resource management domains (RMDs), defined as relatively homogenous tracts of land with inherent suitability for specific uses, can assist in these and other tasks. This paper reviews the use of both intuitive and computerised analyses to define RMDs. Computerised analyses have increased the speed and ease with which alternative options can be examined and evaluated. Climatic mapping programs such as WORLD can be used to assist in the selection of tree species for growing in plantations and GROWEST to provide better agro-ecological patterns using more realistic conditions experienced by plants. A major limitation to the development of environmental domains has been the difficulty in incorporating soils data at the high resolutions often required for GIS analysis. The DOMAIN package that is linked to a GIS and a digital elevation model is well suited to applications where the site locations or environmental data are limited. It is not sensitive to highly covariate data such as climatic data and is potentially a useful tool for determining RMDs. The land system mapping by CSIRO in Australia is an example of intuitive integration of environmental and biological variables into easily defined land units. Other intuitive analyses in Brazil, Canada, South Africa and by FAO are described. The paper concludes that the concept of RMDs and their application to forestry and forestry research is well established

but to maximise their value they need to be highly flexible and tailor-made for specific applications.

In: Syers, J.K. and Bouma, J. (eds.) **International Workshop on Resource Management Domains: proceedings of the International Workshop**, Kuala Lumpur, Malaysia, 26-29 August 1996, 105-117. IBSRAM Proceedings, no.16. IBSRAM, Bangkok.

83. CIFOR's experience with research partnership: responding to the new research challenges.

Turnbull, J.W. and Byron, R.N.

The Center for International Forestry Research (CIFOR) has adopted an interdisciplinary, complex-systems approach to address both scientific and capacity-building challenges in forestry. Its strategic research agenda on tropical forests is implemented primarily through collaborative partnerships. The differences between 'collaboration', 'cooperation' and 'coordination' is stressed with the latter generally describing lower levels of interactions between scientists and are often the precursors of collaboration. The nature and duration of the research partnerships reflect the specific research problems being addressed but include scientists from government forestry agencies, universities, non-government organisations and the private sector in both developed and developing countries. The benefits and inhibitors of collaborative research arrangements compared with competitive forestry research are discussed. CIFOR's partnership arrangements are categorised according to the degree of involvement of the CIFOR scientists and the extent of financial contributions made to partners. Examples of each of the four partnership models are given. The capacity building aspects of CIFOR's collaborative partnerships are discussed, particularly the 'learning by doing', which is the main vehicle by which training is conducted.

In: Enters, T., Nair, C.T.S. and Kaosa-ard, A. **Emerging institutional arrangements for forestry research**, 277-290. FORSPA Publication no. 20. FAO FORSPA, Bangkok.

84. Recent developments in acacia planting: proceedings of an international workshop held in Hanoi, Vietnam, 27-30 October 1997.

Turnbull, J.W., Crompton, H.R. and Pinyopusarerk, K. (eds.).

The 1 300 species of the genus *Acacia* extend around the globe, from Australia through Asia to Africa and the Americas. These nitrogen-fixing trees and shrubs grow in a range of environments and fill an

important niche in natural ecosystems. They have also been planted as exotics in over 70 countries for land rehabilitation, shade and shelter, and to produce a range of wood and non-wood products including firewood, charcoal, building poles, tannins and fodder. In recent years extensive plantations have been established in Asia to provide wood pulp for paper and textile manufacture. This book contains 52 papers and 7 short communications on recent developments in planting tropical and subtropical acacias presented at a workshop held in Hanoi, Vietnam, 27-30 October 1997. It brings together the research results and experiences of scientists involved in developing new technologies for acacia planting in Asia and Australia and forest managers facing practical problems growing acacias in the region. Many papers refer to well-known species, such as *Acacia auriculiformis*, *A. mangium* and *A. mearnsii*, but others report the results of testing lesser-known species in a range of environments. The 57 participants at the workshop reviewed the major issues arising from the meeting, identified gaps in knowledge and made recommendations for future research. The key areas were: genetic resources and tree improvement, silviculture and site management, pests and diseases, physiology (including soil symbionts), social, economic and utilisation issues, and mechanisms to foster future collaboration.

ACIAR Proceedings, 82. ACIAR, Canberra. 383p.

85. Tropical acacias planted in Asia: an overview.

Turnbull, J.W., Midgley, S.J. and Cossalter, C.

Australian acacias are planted in over 70 countries and cover about 2 million ha. This area is dominated by *Acacia mearnsii*, *A. saligna* and *A. mangium*. In the past five years there has been a massive increase in the area of *A. mangium* plantations in Indonesia for pulpwood, and modest increases in China, India, Malaysia and Vietnam. The area now totals 600 000 ha. Recent development of plantations of tropical acacias is related to the profitability of growing acacia plantations due to the decreasing availability and higher costs of wood from natural forests, the opportunity to increase productivity of degraded sites, and the suitability of fast-grown wood for paper and reconstituted boards. Furthermore, research in genetics and breeding has identified superior provenances, developed seed orchards, and cloned fast growing hybrids. Molecular biology techniques have enabled rapid characterisation of genotypes and the detection of genetic variation. Nutrition research has demonstrated the value of phosphorus fertilisation on most sites and the benefits of inoculation with selected

rhizobia and mycorrhizas. Surveys have identified potentially damaging pathogens and insects. All these have contributed greatly to reducing costs and increasing the potential returns from acacia plantations. There is an increased market acceptance of tropical acacia wood but research on wood properties and development of new products is a priority. As the large area of first-rotation plantations is harvested there is an increasing priority to develop management options to ensure minimal decline in site productivity and plantation yield in successive rotations.

In: Turnbull, J.W., Crompton, H.R. and Pinyopusarerk, K. (eds.) **Recent developments in acacia planting: proceedings of an international workshop**, Hanoi, Vietnam, 27-30 October 1997, 14-28. ACIAR Proceedings, no. 82. ACIAR, Canberra.

- 86. Income generation through rehabilitation of imperata grasslands: production of *Vitex pubescens* as a source of charcoal.**
Utama, R., Rantan, D. and de Jong, W.

A tree-planting technology using *Vitex pubescens*, a native tree species from Southeast Asia, is presented. It may allow reclaiming *Imperata cylindrica* grasslands that are difficult to use for other purposes and at the same time increase incomes for local swidden agriculturists in West Kalimantan. *V. pubescens* is grown as a raw material for charcoal production. It has a wood density of 0.8-0.95 kg/L and produces a high quality charcoal that is comparable and competitive with mangrove charcoal in international markets. It is expected that this technology may have wider application, beyond the location where the technology is being developed. The development of this technology allowed general conclusions on the domestication of tree species. Domestication of a tree species should be mostly concerned with providing the technology that allows the tree planting agents to successfully cultivate the tree species, meaning that the tree species can be reproduced successfully and lead to achieving an economic profit. Developing the technology has many facets. What these facets are depends on both on the characteristics of the tree species and the opportunities and constraints of the tree planting agent. Selection of certain genetic strains may be a facet of domestication but it is not always a necessary requirement.

Forest, Farm and Community Tree Research 3: 175-184.

87. Towards more rigorous assessment of biodiversity.

Vanclay, J.K.

Biodiversity is often ill-defined and subjectively surveyed, resulting in inefficient and ambiguous estimates. Strengths and deficiencies of prevailing survey techniques are appraised through a review of selected literature. Analogies with forest inventory are used to suggest options for more efficient and rigorous biodiversity assessment. Techniques such as variable-probability and model-based sampling, especially when used in conjunction with generalised linear modelling, offer efficient alternatives to more traditional assessment based on quadrats and nested plots. Bayesian methods offer scope to combine expert and local knowledge with formal samples, and warrant further investigation. Suggestions for further research are given.

*In: Bachmann, P., Köhl, M. and Päivinen, R. (eds.) **Assessment of biodiversity for improved forest planning: proceedings of the Conference on Assessment of Biodiversity for Improved Forest Planning**, 7-11 October 1996, Monte Verità, Switzerland, 211 - 232. Forestry Sciences Series 51. Kluwer, Dordrecht, Boston, London.*

88. TROPIS: Tree Growth and Permanent Plot Information System.

Vanclay, J.K.

TROPIS, the Tree Growth and Permanent Plot Information System, contains five elements: (1) a network of people willing to share permanent plot data and tree growth information, serviced by newsletters and information sources hosted at <http://www.cgnet.org/cifor/research/tropis.html> (or available from CIFOR), (2) an index of people and institutions holding permanent plot data, (3) a database management system to assist more efficient data management, (4) a system to facilitate site-matching by identifying comparable sites and allowing foreign data to be used when no local growth information exists, and (5) an inference system to allow growth estimates to be made in the absence of empirical data. The index or metadatabase contains references to 12,000 plots with 3,000 species provided by 100 contributors, and is growing at about 1,000 plots per month. Searches of the database are welcomed, and may be directed to the author.

Journal Forest Planning 4: 1-5.

89. Healthy forests: sound economics, social justice.*Vancley, J.K. and Prabhu, R.*

The paper outlines some of the key issues relating to the maintenance of 'healthy forests' in the tropics. It examines the concept of sustainable forestry and its corollary the destruction or degradation of forests, before moving on to discuss some of the challenges faced by the international community in trying to halt the destruction of tropical forests. The role of improved training and education, development of international standards for forest management and the reform of the forest management process and policy are discussed in this respect. The paper concludes that a more effective use of existing information is the first step and calls for immediate action on tropical forests.

Forum for Applied Research and Public Policy 13: 78-84.

90. A conceptual framework and typology for explaining the outcomes of local forest management.*Wollenberg, E.*

Few generalisations are currently possible about the effectiveness of local forest management owing to a lack of common terms and concepts with which to compare the wide range of practices employed. This paper proposes a conceptual framework and typology based on four dimensions which affect the motivation, resources and capacities of local people to undertake it: (a) the objectives underlying local people's use of the forest; (b) the potential of the forest resource to meet these objectives; (c) the nature of local social arrangements; and (d) macro-level economic and political factors.

Journal of World Forest Resource Management 9: 1-35.

91. Decision-making among diverse interests: the use of future scenarios in local forest management policy, a proposed methodology.*Wollenberg, E.*

The purpose of this concept paper is to propose a methodology for enhancing the policy-making process in local forest management (LFM). LFM is defined here as the involvement of people living near a forest in activities intended to maintain or enhance the forest and improve local people's well-being. As an umbrella concept, LFM included the rehabilitation of forests on degraded lands, management

of natural forest, intensification of agroforestry to reduce pressure for use of natural forest, logging by communities, the sharing of management responsibilities with the state (co-management), nurseries, hunting and gathering by so-called traditional populations and wage employment for local people planting trees. It covers both development interventions as well as indigenous practices. This paper explores the potential of a future scenario method for improving the policy-making process. The emphasis of the method is on the process of generating future scenarios through stakeholder consultations, more than on the product of the scenarios or models used to produce them. The justification, objectives and components of the method are outlined. Issues related to stakeholder analysis, elicitation of the future and construction of a model for producing future scenarios are discussed.

In: Victor, M., Lang, C. and Bornemeier, J. (eds.)

Community forestry at a crossroads: reflections and future directions in the development of community forestry: proceedings of an international seminar, Bangkok, Thailand 17-19 July 1997, 155-162. Regional Community Forestry Training Center (RECOFTC), Kasetsart University, Bangkok, Thailand.

92. Incomes from the forest; methods for the development and conservation of forest products for local communities.

Wollenberg, E. and Ingles, A. (eds.).

In the last two decades, there has been increasing interest in the potential of small-scale non-timber forest product collection and other low-impact uses of the forest for achieving forest conservation. Experience suggests however that such uses do not guarantee conservation and economic outcomes. This book documents and compares methods to assess options for forest-based livelihoods and their outcomes. The contributions are based on the premise that livelihood and conservation goals can be best achieved by improving information flows about changes in the environment, and the impacts of forest use. The 16 authors report on the strengths and weaknesses of methods that have been tried in the field. Their experiences and analysis should be of interest to practitioners everywhere concerned with developing livelihood options for people living in forests.

CIFOR, Bogor. 227p. ISBN 979-8764-19-6

93. Estimating the incomes of people who depend on forests.

Wollenberg, E. and Nawir, A.S.

Estimating the incomes of people whose livelihoods depend on the forests is a key to understanding their well being and the use of the forest. Yet there has been little agreement about the methods to undertake such assessment. This paper reviews the strengths and weaknesses of the methods available. The authors summarise the methodologies used in 10 case studies and use these cases, as well as insights from their own research in Indonesia, to suggest ways of overcoming the logistics of collecting income information related to possibly hundreds of products. Attention is also drawn to the difficulties of assigning values to forest products where such products are not sold. This review indicates some of the reasons why good information remains unavailable: expense of collecting information, weak application of methods and incomparable data. Also, some basic economic concepts do not fit very well the values, perceptions or conditions of forest dwellers. One conclusion is that the methods currently in use for accurately estimating incomes are costly and probably not possible or appropriate for many development efforts, especially where long-term monitoring is required.

In: Wollenberg, E. and Ingles, A. (eds.) **Incomes from the forest: methods for the development and conservation of forest products for local communities**, 157-187. CIFOR, Bogor.

94. SCUAF Version 4: a model to estimate soil changes under agriculture, agroforestry and forestry.

Young, A., Menz, K., Muraya, P. and Smith, C.

Soil Changes Under AgroForestry (SCUAF) is an easy-to-use computer model which predicts the effects of specific land use systems under given environmental conditions. It includes the distinctive features of agroforestry, namely land use systems which include both trees and crops. However, it can also be used to compare agroforestry systems with land use under agriculture or forestry, treating these as limiting cases of agroforestry. Hence, SCUAF can alternatively be construed to mean Soil Changes Under Agriculture, agroforestry and Forestry. SCUAF is a process-response model in which the user specifies the physical environment, land use system, initial soil conditions, initial rates of growth and rates of operation soil - plant processes. The model provides an annual simulation of changes in soil conditions and the effects of soil changes upon plant growth and harvest. It is primarily intended for simulation over periods of 10-20

years but can be applied to long-term simulation. This document describes the fourth version of the SCUAF model.

ACIAR Technical Report Series, 41. ACIAR, Canberra, Australia. 49p.
ISBN 1-86320-224-2

95. Effects of social economy and policies on production management systems: a case study of China's bamboo industries.

Zhong, M., Fu, M., Belcher, B. and Ruiz-Pérez, M.

Over recent years, since reform and liberalisation, there has been rapid development of the bamboo industry in China that has brought about a series of economic policies and regulations favourable to economic development. Between 1981 and 1993, the area covered by bamboo forests expanded at a rate higher than the growth rate in forest-covered areas of the country. By 1996, the annual production value of primary products from bamboo resources reached 0.9 billion USD. The export value of manufactured bamboo products was US\$ 35 million in 1995. Because 93% of bamboo forests in rural areas is collectively-owned and directly managed by farmers, the increase in yields and profits from bamboo forest products significantly improves incomes and living standards of rural people. Thus the bamboo industry has become an important means to reduce poverty among the rural population. The purpose of this study is to promote sustainable development of the bamboo sector by reviewing the development of bamboo industries in Anji County, Zhejiang Province. The review analyses industry fundamentals, approaches and potential weaknesses and explores the direction and methods for its further development.

Forestry Economics 3: 22-43.

Also published in Forestry Economics no.5:50-58, 1997 (Chinese).

Appendix: Workshop and Conference Papers in 1998 (unpublished)

This section includes papers presented at conferences, seminars and workshops whose proceedings have not yet been published, contributions to newsletters and unrefereed documents appearing on the World Wide Web.

96. Impacts of trade on growth, distribution and the environment in forest communities.

Angelsen, A.

This paper develops a microeconomic framework to assess how opening up for trade will affect the overall welfare and its distribution within a forest community, as well as the impact on the environment. Whereas trade will increase overall welfare, it will normally create both winners and losers. The increased scale of the activity caused by trade is likely to have a negative impact on the environment when viewed in isolation, but it may also shift resources from more destructive activities. The paper briefly presents some tentative conclusions based on fieldwork in Sumatra, Indonesia.

Paper presented at a workshop on Trade Impacts on Forest Communities. Aatvidaberg, Sweden, 18-20 January 1998. 13p.

97. Social criteria and indicators: assessing human well being in and around industrial timber enterprises.

Colfer, C. J. P., Salim, A., Tchikangwa, B., Tiani, A. M., Mustofa Agung Sardjono and Prabhu, R.

This paper provides a brief historical background to CIFOR's project on Assessing Sustainable Forest Management: Testing Criteria and Indicators (C&I). It gives the social C&I considered to be 'Best Bets' by a series of interdisciplinary teams who tested them in a number of countries. Sample analyses, comparing results from 'forest rich' and 'forest poor' contexts in Cameroon and Indonesia, are made. One set of results pertains to the assessment of benefit sharing among stakeholders; the other, to local perceptions of rights to manage locally relevant forest resources. The most outstanding commonalities among the data sets are the general agreement that (i) most financial resources go to timber companies and governments and most other resources (non-timber forest products, wildlife, medicinal plants) go to local

people; and (ii) local people consider they have a strong voice in forest management, even in areas where timber companies have strong legal rights. JMT 15/4.

Paper presented at the International Congress on Anthropological and Ethnological Sciences, 26 July-1 August 1998, Williamsburg, Virginia, USA. 32p.

98. Toward social criteria and indicators for protected areas: one cut on adaptive co-management.

Colfer, C.J.P., Prabhu, R., Wollenberg, E., McDougal, C., Edmunds, D. and Kowero, G.

CIFOR has developed a rigorously tested process for establishing criteria and indicators (C&I) for sustainable forest management. Its concern with alleviating poverty and improving human welfare within an environmentally friendly context has generated particular interest in social criteria for evaluating the conditions in forests. Both the process and product of the social C&I offer strategic insight, approaches and tools for operationalising the concept of adaptive co-management in and around protected areas. In this paper, demonstrated and potential roles of social C&I in adaptive co-management of such areas is examined. CIFOR's social C&I, developed within the context of industrial timber exploitation, are also examined as 'templates' or 'base sets' for possible use in conservation use. They may be used in monitoring human and environmental conditions as well as the efficacy of agreements or policies that may form the basis of collaborative management decisions. Methods are identified to advance understanding of the potential and effectiveness of adaptive co-management approaches in managing protected area forests through the development and application of social C&I. The paper concludes with suggestions on practical ways to use these C&I, adapted to both protected areas and local conditions, as part of the process of creating the conditions (or criteria) specified as important for sustainability in the real world.

Paper presented at the Cornell Symposium on Adaptive Collaborative Management in Protected Areas, September 1998, Ithaca, New York.

99. Whose forest is this, anyway?: C&I on access to resources.

Colfer, C.J.P., Salim, A., Tiani, A.M., Tchikangwa, B., Sardjojo, M.A. and Prabhu, R.

This paper provides a brief history of the social component of the Center for International Forestry Research project, Assessing Sustainable Forest Management: Testing Criteria and Indicators, with special reference to the issue of security of access to resources (SIAR).

There is an overview of the literature assessing SIAR; then the social C&I 'Best Bets' and some methods for assessing them. There are tentative findings relating to the possible causal links between sustainable forest management and sharing of forest benefits (a SIAR element), and plans and recommendations for future research.

Paper presented at the IUFRO/FAO/CIFOR International Conference on Indicators for Sustainable Forest Management, August 24-28, 1998, Melbourne, Australia. 32p.

100. L'Indonésie et ses feux de forêt.

Cossalter, C. and Cauvin, B.

The disastrous forest fires in Indonesia are not necessarily the result of climatic influences. Certainly the drought engendered by El Niño is to be taken into account but it has not been the only factor in transforming an ordinary situation into a crisis situation. Every year, on the islands where forest is still a reserve of arable soil, forests burn. The causes of these fires are multiple and most often cumulative. They are especially frequent on the 'pioneer fronts' where the pressure on the land is at a maximum by large agro-industrial groups and migrants, mostly from Java. Indeed, Indonesian government policies encourage development of concessions (notably rubber and palm oil) and export of agricultural and forest products and the corollary of this is the conquest of new agricultural land by fires, the least costly and most practical means of clearing the forest. On several previous occasions, these large fires have alerted international public opinion. Today they bring to light the contradictions and uncertainties that impinge upon the future of Indonesia's forest cover. One can speculate if there is a real political wish to maintain a forest estate in the order of 10 million hectares taking into account the government's intentions of increasing agricultural production. The reserves of arable land earmarked for agricultural production are officially estimated at 30 million hectares. This is mostly land now covered in dense forest.

Informations - Forêt 1, Fiche no. 566. 6p. (Paper in French)

101. El potencial de manejo de especies maderables de rapido crecimiento en regeneración natural, sistemas agroforestales y plantaciones puras: estudios de caso en Brasil, Per' y Costa Rica. *Current, D., Rossi, L.M.B., Sabogal, C. y Nalvarte, W.*

This paper presents three case studies of natural regeneration of species that because of their biophysical characteristics have a market: *Guazuma crinita* in Peru, *Schizolobium amazonicum* in Brazil and

Cordia alliodora in Costa Rica. As a result of the interest in these species and based on their natural regeneration they have been integrated in agroforestry systems, as well as in plantations. In the past, the producers have mainly used agroforestry systems, and to a lesser extent the passive management of natural stands. With incentives to establish plantations, more farmers are selecting this option. The costs of management of natural regeneration and of agroforestry systems are less than for plantations. Although agroforestry systems are a source of cash and benefits for the farmers they must wait for the trees to reach commercial size.

Paper presented to 'Primer Congreso Latinoamericano', IUFRO, Valdivia, Chile 1998. 14p. (Paper in Spanish)

102. Tropical forests, carbon and people: a revisionist philosophy for the new millenium.

Dykstra, D.P.

A 'revisionist philosophy' is one that advocates revision of doctrines or policies, generally through evolutionary rather than revolutionary means. In this light, the future of tropical forests is an important issue. This paper discusses three closely interlinked topics relating to tropical forests: (i) tropical deforestation outlining the extent of and trends in estimated deforestation rates, the major causes established by recent research and a set of myths and truths; (ii) forest carbon including climate change, carbon sequestration by tropical forests and the role of forests in mitigating climate change; and (iii) sustainable utilisation of tropical forests arguing whether tropical forests should be preserved untouched, used a non-timber forest product reserves, treated with reduced-impact logging, designated for sustainable forest management, and logged and then locked away. Pressures on tropical forests from population growth, poverty, and land hunger are severe and will increase but sustainable forest management will be part of any solution that addresses the needs of people in developing countries as well as the global need for reduced deforestation and mitigation of climate change.

Presented at the College of Forestry, Oregon State University,
5 November 1998 for the 1998 Starker Lecture Series,
Different Philosophies and the Impacts of these Philosophies on the
World's Natural Resources.

103. Information for forest sector policy.

Janz, K. and Persson, R.

Information for forest resources management, conservation and development at national/state level is often insufficient. At the same time existing forest resources information is poorly used. This is particularly true of developing countries. There are several reasons for this: institutions formulating and implementing forest sector policies are weak; dialogue between information producers and users is insufficient or absent; and information gathering is seen as a mere technical problem. Thus the mechanism to formulate the questions to be answered in the political process are often absent and inventory findings not used. It is proposed that increased emphasis is needed on interaction between policy development and implementation on one hand and information gathering on the other. An analysis function is needed to organise existing information from various sources, recognise data sources and quality, and have a capability to undertake ad hoc studies on request. This function should also serve as a link between data collection and data use. It acquires knowledge of emerging and current information needs of the users (both public and private) when it interacts with them to provide data. It can then transfer this knowledge to data collecting organisations and assist in identifying gaps in their activities. Analysis of consequences of political action or non-action is presented as an example high-quality, forest sector information use. Obstacles to relevant information gathering and smooth interaction, including the attitude of governments and of various stakeholders to consider information as a potentially dangerous instrument of power, are discussed.

Paper presented at North American Symposium, Toward a Unified Framework for Inventorying and Monitoring Forest Ecosystem Resources, Guadalajara, Mexico. November 1-6, 1998.

104. Site management strategy on the forest harvesting and short/long term rotation of plantations.

Kobayashi, S.

The following research activities are proposed as the parts of a project 'Rehabilitation of Degraded Tropical Forest Ecosystems': (i) development of species-site matching methods, identification of critical silvicultural characteristics and establishment techniques for lesser-known indigenous species, (ii) site management options for sustained productivity of plantations, and (iii) social and economic acceptability of management options. Two activities have begun: (i) ecological impacts of teak (*Tectona grandis*) plantation thinning and

its effect on intercropping (Kasetsart University, Thailand), and (ii) soil mechanical induced compaction: effects on *Eucalyptus* spp. Changes of site conditions were clarified after forest harvesting and during the rotation of plantations. The paper documents site management and sustained productivity. One of the most important aspects is social and economic acceptability for the management options. Effective site management through the development of silvicultural techniques is crucial for long term sustainability of plantations. (JMT 27/4)

Paper presented at 2nd Workshop on Site Management and Productivity in Tropical Plantations: Impact on Soils and Options for Management over Successive Rotations, 16-20 February 1998, Pietermaritzburg, South Africa. 14p.

105. Manejo sostenible y recuperación de bosques degradados: resultados preliminares de experiencias de una red Internacional.
Montagnini, F., Eibl, B., McDonagh, P. and Kobayashi, S.

In Misiones, Argentina, natural regeneration was examined in forests thinned by minimum diameters (MD) and uniform spacing (US). Three years after harvesting, 22 300 seedlings/ha were found in the forest cut by MD, 54 300 seedlings/ha in the forest cut by US, and 33 000 seedlings/ha in undisturbed forest. The degree of canopy closure and understorey composition were also examined. Forest harvesting methods with reduced impact techniques can help maintain high levels of plant diversity and habitat heterogeneity. In enrichment trials for the rehabilitation of over-exploited forests, the most successful species were *Bastardiopsis densiflora*, *Ocotea puberula*, *Enterolobium contortisiliquum*, *Cordia trichotoma* and *Peltophorum dubium*. The use of non-timber species investment provides returns and makes this practice profitable. These trials are part of a CIFOR research network including Latin America and SE Asia.

Paper presented at Primer Simposio Argentino-Canadiense - Primer Congreso Argentino de Protección Forestal, 13 y 14 de Abril de 1998. Organizado por la Universidad Nacional del Comahue en la Facultad de Agronomía Universidad de Buenos Aires. 14p.

106. No forest without management.
Poore, D. et al.

Sustainable development is unattainable without the sustainable management of forests and sustainable forest management is important for everyone, but especially for the very poor. Sustainable forest management is of great significance for the long-term prosperity

of humanity and it is possible with full commitment and collaborative endeavour. Forests can be managed to produce the conservation, production and other benefits that societies will increasingly demand for the alleviation of poverty, sustainable development and the prevention of the irreversible damage or loss of forest ecosystems. There are three essential planning elements for environmentally sound and socially acceptable forest management: (i) areas of forest should be set in a wider, national or bioregional, land use context which provides adequately for all uses in suitable locations; (ii) forests should be available to meet the various needs of society; and (iii) each area of forest is carefully managed for the purpose for which it is suited and intended.

Tropical Forest Update 8(4): 10-12.

107. Between voodoo science and adaptive management: the role and research needs for indicators of sustainable forest management.

Prabhu, R., Ruitenbeek, H.J., Boyle, T.J.B. and Colfer, C.J.P.

There is a pressing need for a monitoring arrangement that delivers comprehensive, relevant, scientifically sound and cost-effective information regarding the sustainability of forest management. The development of indicators of sustainable forest management is attracting considerable interest, as information tools for forest managers, although some controversy still exists regarding their utility. The 'wrong' indicators can lead to negative, destructive effects on systems and attention must be paid to their proper selection, development and use. The indicators' utility as information tools has three conditions: a) relevance to the assessment or monitoring goal; b) sufficiency to deliver meaningful information about trends; and c) adequacy of understanding non-linear and compensatory effects between indicators. This paper examines how these conditions can be met. It concludes that, while indicators suffer from limitations in providing broad but not deep insights and imprecise information, their advantages as effective information tools outweigh these limitations. They offer a transparent and understandable means of gathering information and their scope is limited only by the extent of our knowledge of the underlying systems and the translation of that knowledge into effective indicators.

Paper presented at the IUFRO/FAO/CIFOR International Conference on Indicators for Sustainable Forest Management, August 24-28, 1998 Melbourne, Australia. 23p.

108. The world heritage convention as a mechanism for tropical forest conservation.

Sayer, J., Ishwaran N., Iremonger, S. and Thorsell, J.

This paper makes a plea for greater use to be made of the World Heritage Convention in conserving the world's forests. Whilst we fully endorse the current international processes and the eventual aim to bring all forests under sustainable management, we believe that the international conservation community may be fiddling while Rome burns. Significant action is urgent within the next decade to ensure that the building blocks for sustainable forest management in the future are still available to our descendants. The World Heritage Convention provides an existing mechanism that has international legitimacy and that could rapidly be geared-up to intervene operationally on the ground. It is unique amongst the existing forest conservation initiatives in that results of investments in the system could be measured. A monitoring system could quite easily be put into place. A small operations centre would be required with a capacity to maintain updated scientific information on each site. A fund would be needed to intervene in support of urgent action in threatened sites. It is likely that technical and operational support would be required to confront the problems of some sites. This support could come from the personnel of other sites in the network. Thus, the network of World Heritage forest sites might be supported globally with those sites where management capacity is strongest supporting those where it is weaker. A global support programme with a relatively modest budget could maintain the integrity of 50 sites strategically located in the tropical forests of the world. This would provide the most cost-effective option to conserve a large proportion of the worlds tropical forest biodiversity.

Paper presented at Workshop on the Role of Local Communities in the Management of World Natural Heritage in Asia and the Pacific, Huay Kha Khaeng, Thailand, 19-23 January 1998. 14p.

109. Between danger and opportunity: Indonesia's forests in an era of economic crisis and political change.

Sunderlin, W.D.

Indonesia has been experiencing economic shocks, policy reform, and political transformation on a scale that would have been unimaginable as recently as early 1997. These changes will undoubtedly have a profound influence on the forest sector and on land use in general. This paper documents some of the changes and speculates about possible consequences for forest conservation and management, drawing

largely on media reports and general knowledge about the effects of macroeconomic change in developing countries. The observations are preliminary, superficial and tentative because as yet there are few data and research results available on the effects of the changes. This is the fourth iteration of this paper, and the first since President Suharto stepped down from power in late May 1998. The paper will be revised and updated approximately every four months. The paper comprises three sections: (i) background of the economic crisis and policy and national leadership changes; (ii) discussion on nine different effects of these changes on the forest sector. These include direct effects on the forest sector, indirect effects through the agricultural sector, transmigration, poverty and spontaneous migration, mining, and road construction; the joint effects of the drought, fires, and the crisis; policy changes; and the implications of national leadership change and the dawning of the 'reform era'; and (iii) summary of the implications of these nine effects on the conservation and management of Indonesia's forests.

[http:// www.cgiar.org/cifor/Research/projects/project1/crisis1.html](http://www.cgiar.org/cifor/Research/projects/project1/crisis1.html)
(23 September 1998)

110. Codes of forest practice and related research needs.

Turnbull, J.W., and Vanclay, J.K.

This paper aims to set codes of forest practice in the framework of the evolving debate on sustainable forest management. Codes of forest practice are sets of regulations or guidelines developed by governments or other organisations to assist forest managers select practices to be followed when carrying out forest management and utilisation operations. These practices, when correctly applied, should meet standards for sustainable forest management. A code of practice is also a form of forest policy typically used to promote certain environmental benefits and the codes are regarded as important measures in moving towards sustainable forest management. They are based on the best knowledge available to ensure forests are well managed. In many countries the pressures from environmental activists to improve forest management practices began in the 1970s. In Australia, CSIRO published environmental guidelines for forest harvesting in 1979 and throughout the 1980s most Australian States developed codes of forest practices, principally directed at logging or harvesting forests. In the United States many forestry authorities published guidelines and best management practices from 1988 onwards, but Oregon developed the first comprehensive forestry practices Act in 1971. In the tropics, buoyant world timber markets and

weak forest regulatory authorities led to deteriorating standards of timber harvesting and utilisation, and the gap, is widening between the principles of sustainable forest management and forest management practices. ITTO produced general guidelines for management of natural forests, planted forests and conservation of biological diversity in tropical forests. Regional codes of practice for the South Pacific and Asia-Pacific have and are being developed. The paper concludes that sustainability continues to be the single most important principle to guide forest management and management will need to continuously challenge and evaluate its own codes of forest practices. (JMT 1/5)

Paper presented to Hermon Slade Workshop on
Sustainable Forest Management, Melbourne,
30 November-4 December 1998. 8p.

111. FLORES: for exploring land use options in forested landscapes.
Vanclay, J.K.

Incentives intended to stimulate better land use practices often don't work as intended, and can have undesirable side effects that were not foreseen. How can we better equip policy makers and their advisors to envisage fully the efficacy and consequences of initiatives? One way is to provide a decision support system. The formulation and construction of such a system offers other benefits: it would make existing information more accessible, facilitate hypotheses testing, and foster collaboration between researchers working on these issues. FLORES is such a system being developed through a partnership coordinated by the Center for International Forestry Research.

Agroforestry Forum 9: 47-52.

TESTING CRITERIA AND INDICATORS FOR THE SUSTAINABLE MANAGEMENT OF FORESTS: PHASE I FINAL REPORT

Ravi Prabhu, Carol J.P. Colfer, P. Venkateswarlu, Lin Chen, Lin, Winkens Notemeyer and Eva Witzelsberger

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