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TECHNICAL INFORMATION ON TROPICAL FORESTS IV

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TECHNICAL INFORMATION
ON
TROPICAL FORESTS
IV

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READERS' GUIDE

1. Geographic coverage of information.

This paper covers mainly the Puerto Rico (USA), Brazil and Paraguay in the Latin America.

2. Titles.

Titles are given in the original language.

3. What an abstract contains.

¹Sofwan Bustomi & Komar Soemarna

²Regeneration and standing stock study on logged-over area in Laban forest complex, Forest District of Berau, East Kalimantan

³Buletin Penelitian Hutan (Forest Research Bulletin), Indonesia

⁴No. 479, ⁵1-16, ⁶1986, ⁷Indonesian

⁸The system linear sampling with several sampling intensity have been tried as the initial study on natural regeneration and standing stock on logged-over areas at the Forest District of Berau, West Kalimantan.

The recording units were used as a line plot with 5 m width for saplings, 10 m for poles and continuous strips unit of 20 m width for standing stock of the remain stand. All tree species are grouped into commercial species that consist of Dipterocarps and non-Dipterocarps, non commercial and the total of all species.

Key words: Natural regeneration, logged-over area, Forest type, Stand condition

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| 1) Author | 5) Page numbers |
| 2) Title | 6) Year of publication |
| 3) Journal/Book title | 7) Language of text |
| 4) Volume | 8) Abstract |

1. FOREST ENVIRONMENT

- climate, ecology, forest resources, etc.-

PETER L. WEAVER

An ecological comparison of canopy trees in the montane rain forest of Puerto Rico's Luquillo Mountains
Caribbean Journal of Science, Puerto Rico, Vol. 28(1-2), 62-69,
1992, English

Twenty tree species that reach canopy size in some part of the colorado forest, Luquillo Mountains, Puerto Rico, were compared in terms of density of seedlings and understory stems, wood specific gravity and seed size. The tree species were ranked, based on these characteristics, from most secondary to most primary in ecological type.

Keyword: Ecosystem, Tropical forest, Tree density, Seed, Wood quality

JOHN K. FRANCIS

The roots of plantation cottonwood: their characteristics and properties
Research Note, USDA, Forest Service, Southern Forest Experiment Station, USA,
S0-314, 4, 1985, English

The root biomass and its distribution and the growth rate of roots of pulpwood-size cottonwood (*Populus deltoides*) in plantations were estimated by excavation and sampling. About 27 percent of the total biomass was in root tissue. Equations for predicting stump-taproot dry weight from d.b.h. and top dry weight were derived. Lateral roots in two plantations increased in length until dicback, and regrowth produced a lateral root of semistable average length to a little more than half the distance between trees.

Keyword: Root system, Biomass, Growth, Plantation

JOHN A. PARROTTA

Assisted recovery of degraded tropical lands: plantation forests and ecosystem stability
Soil Biota, Nutrient Cycling, and Farming Systems, Lewis Publishers, USA,
169-182, 1993, English

Plantation of multipurpose tree species can play a critical role in restoring productivity, ecosystem stability, and biological diversity to degraded tropical lands. The present study, conducted at a coastal pasture site in Puerto Rico, compares 4.5-year-old *Albizia lebbek* (L.) Benth. plantation stands and adjacent control areas. The comparison is concerned with understory species diversity and nutrient storage patterns within vegetation, forest floor organic matter, and mineral soil compartments.

Mineral soil (0 to 20 cm depth), organic carbon (OC), and total nitrogen (TN) were both significantly higher in plantation plots (1.70% OC, 0.095% TN) than in control plots (1.44% OC, 0.074% TN). Standing crop mass of herbaceous plants, forest floor organic matter, and fine (<2 mm) roots averaged 160, 349, and 362 g/m² in the plantation plots and 420, 311, and 105 g/m² in the control plots. Nitrogen concentrations within each of these biomass components were, however, consistently higher in the plantation plots. Plantation understory species appear to be efficient "scavengers" of biologically fixed nitrogen and appear to help buffer the system against leaching losses.

Keyword: Plantation, Multipurpose trees, tree species, Biomass, Undergrowth

ARIEL E. LUGO & SANDRA BROWN

Management of tropical soils as sinks or sources of atmospheric carbon
Plant and Soil, Netherlands, 149: 27-41, 1993, English

The prevailing paradigm for anticipating changes in soil organic carbon (SOC) with changes in land use postulates reductions in SOC in managed systems (agriculture and tree plantations) relative to mature tropical forests. Variations of this notion are used in carbon models to predict the role of tropical soils in the global carbon cycle. Invariably these models show tropical soils as sources of atmospheric carbon. We present data from a variety of studies that show that SOC in managed systems can be lower, the same as, or greater than mature tropical forests and that SOC can increase rapidly after the abandonment of agricultural fields. History of land use affects the comparison of SOC in managed and natural ecosystems. Our review of the literature also highlights the need for greater precautions when comparing SOC in mature tropical forests with that of managed ecosystems. Information on previous land use, bulk density, and consistency in sampling depth are some of the most common omissions in published studies. From comparable SOC data from a variety of tropical land uses we estimate that tropical soils can accumulate between 168 and 553 Tg C/yr. The greatest potential for carbon sequestration in tropical soils is in the forest fallows which cover some 250 million hectares. Increased attention to SOC by land managers can result in greater rates of carbon sequestration than predicted by current SOC models.

Keyword: Land-use, Carbon cycle, Soil, Tropic, Global forest management

ERNESTO MEDINA, ELVIRA CUEVAS et al.

Mineral content of leaves from trees growing on serpentine soils under contrasting rainfall regimes in Puerto Rico
Plant and Soil, Netherlands, 158: 13-21, 1994, English

The interactions between water and soil nutrient availability in determining leaf nutritional composition and structural features were investigated in forests on serpentine in Maricao and Susua (Puerto Rico). These forests grow under contrasting rainfall regimes: Maricao is a wet forest located at altitudes above 500 m and receiving more than 2500 mm rainfall, while Susua is a humid forest located well below 500 m, with less than 1500 mm rainfall and a well defined dry season. Dominant tree species and soils were analysed for N, P, K, Ca, Mg and Ni. Soils can be differentiated according to their K content (higher in Maricao) and P contents (higher in Susua). Mature leaves of both forests have sclerophyllous characteristics as judged from the Specific Leaf Areas ($<80 \text{ m}^2 \text{ g}^{-1}$) and low P contents. Leaf area development is strongly correlated with leaf N and P contents in both forests, but Maricao samples appear to be more limited by P availability. In concordance with soil values, the Susua leaf sample set has significantly higher contents of P, but lower contents of K when compared with the Maricao sample set. Analyses of soluble K, Ca, and Mg reveal strong physiological selectivity in the absorption of these cations. K/Ca and Ca/Mg ratios are markedly higher in the soluble leaf extracts than in the soil extracts. It seems that restriction to vegetation development in the serpentine areas investigated are more related to nutritional deficiencies and not to high contents of either Mg or Ni in the upper soil layers. Only two strong Ni accumulators were found, *Cassine xylocarpa* ($1.2 \mu\text{mol Ni g}^{-1}$ dry mass or $70 \mu\text{g g}^{-1}$) from Susua, and *Chionanthus domingensis* ($12.2 \mu\text{mol g}^{-1}$, or about $700 \mu\text{g g}^{-1}$) from Maricao. These species are not restricted to serpentine areas in Puerto Rico.

Keyword: Leaf, Soil nutrient

ELBERT L. LITTLE, JR. & FRANK H. WADSWORTH

Common trees of Puerto Rico and the Virgin Islands
Agriculture Handbook No. 249, Forest Service, USDA, Washington, D.C., USA, 556, 1964, English

For the Commonwealth of Puerto Rico and the Virgin Islands, both United States and British, 250 common tree species are described and illustrated by line drawings on large facing pages. Besides native forest trees, many species introduced from other tropical lands for forestry, shade, ornament, and fruits are included. Noted for each species are main distinguishing characters, size, appearance, leaves, flowers, fruit, wood, uses, and distribution. One hundred species maps show distribution by municipalities within Puerto Rico. Other common names from various countries and languages are compiled and indexed. Special Lists group species according to a distinctive character, feature, or use. There are keys to families and species, and other native species in each genus are noted. One chapter with three maps is devoted to Forests and Forestry.

Keyword: Tree species, Tropic, Tropical forest, Ecosystem

ELBERT L. LITTLE, JR. & FRANK H. WADSWORTH et al.
Trees of Puerto Rico and the Virgin Islands (second volume)
Agriculture Handbook No. 449, Forest Service, USDA, Washington, D.C.,
USA, 1,024, 1974, English

The trees of Puerto Rico and the Virgin Islands, both United States and British, are described and illustrated in two volumes, of which this is the second (volume 2). "Common Tree of Puerto Rico and the Virgin Islands" by Little and Wadsworth, the first, is cited here as volume 1. The first volume contains on facing pages the descriptions and drawings of 250 common tree species, both native and introduced. This second volume similarly treats 460 additional species and briefly describes 40 others, a total of 500. Thus, the two volumes together contain the text of 750 species and illustrations for 710 of them. The aim is to include all native species attaining tree size, even rarely, also the common and many uncommon trees introduced for various purposes. Information from the Introduction to volume 1 is repeated or revised here. Each volume can be used independently, and the second volume mentions in keys all species of the first.

Keyword: Tree species, Tropic, Tropical forest, Ecosystem

ROBERT B. WAIDE & ARIEL E. LUGO
A research perspective on disturbance and recovery of a tropical montane forest
Tropical Forests in Transition, Birkhäuser Verlag Basel, Switzerland
173-190, 1992, English

Studies of disturbance in tropical forest ecosystems have been important in developing the new paradigm that views these ecosystems as dynamic in structure and function rather than constant. Long-term investigations in the Luquillo Experimental Forest in Puerto Rico are designed to evaluate the relative importance of the four principal types of disturbance within the forest and to analyze the importance of the biota in restoring the ecosystem after disturbance.

Research is driven by the concept that the response of an ecosystem to disturbance is a function of the type, intensity, periodicity, and extent of the disturbance. Recovery is influenced by a complex interaction among the soil, biota, hydrosphere, and atmosphere, but we hypothesize that the biota plays a key role in conditioning the return to the previous level of productivity after disturbance. With increasing severity of disturbance, the role of the biota becomes more important.

A patch dynamics model is being used to guide research on disturbance and regeneration at the ecosystem level. Results from this work are being linked to the landscape level of organization through simulation models generalized to each cell of a geographic information system covering the forest.

Keyword: Ecology, Biosphere, Flora, Succession

P.A. STEUDLER, J.M. MELILLO, R.D. BOWDEN et al.
The effects of natural and human disturbances on soil nitrogen dynamics
and trace gas fluxes in a Puerto Rican Wet Forest
BIOTROPICA, 23 (4a), 356-363, 1991, English

We examined the effects of two disturbances (Hurricane Hugo and forest clearcutting) on soil nitrogen dynamics and on the exchanges of N_2O , CO_2 , and CH_4 between soils and the atmosphere of a subtropical wet forest in Puerto Rico. The disturbances resulted in prolonged increases in ammonium pools and short-term increases in rates of net N-mineralization and net nitrification. Nitrous oxide emissions increased following both disturbances. The most dramatic increase was observed 4 mo after clearcutting; N_2O emissions ($109.49 \mu g N/m^2-hr$) from the cut plot were about two orders of magnitude higher than emissions from the reference plot ($1.71 \mu g N/m^2-hr$). Carbon dioxide emissions from both disturbed plots (mean $102.47 mg C/m^2-hr$) were about 30 percent lower than the reference (mean $151.28 mg C/m^2-hr$). Soils at all sites were generally sinks for CH_4 . Methane uptake, however, was suppressed by both disturbances. This suppression may be related to disturbance-induced changes in the nitrogen cycle, as we have previously observed in temperate zone forests.

Keyword: Wind, Wind damage, Soil texture, Forest damage

ARIEL E. LUGO & SANDRA BROWN
Tropical forests as sinks of atmospheric carbon
Forest Ecology and Management, Elsevier, Netherlands
Vol. 54 (1-4), 239-255, 1992, English

Changes in land use and rates of carbon accumulation by land use including mature, logged, and fallow tropical forests, and degraded tropical lands are used to estimate the role that the tropical landscape serves as sinks of atmospheric carbon. Results indicate that in 1980 tropical lands may remove between 1.5 and 3.2 Pg C from the atmosphere. We excluded from the analysis some 900 million ha of open tropical forests that could also be removing carbon from the atmosphere and an additional 0.5-0.6 Pg C year⁻¹ sink associated with carbon export by rivers and in wood products. Our analysis challenges assumptions about the steady-state condition of the carbon budget of mature tropical forests and suggests that large areas of the tropical landscape are recovering from disturbance and act as atmospheric carbon sinks. We focus attention on sinks of atmospheric carbon only. In 1980, the estimated accumulation of carbon in the recovering landscape was equal to the net carbon flux due to tropical deforestation.

Keyword: Carbon cycle, Deforestation, Land-use, Tropical forest

ANDREW F. HOWARD
A linear programming model for predicting the sustainable yield of
timber from a community forest on the Osa Peninsula of Costa Rica
Forest Ecology and Management, Elsevier, Netherlands, Vol. 61 (1-2)
29-43, 1993, English

The establishment of cooperative or 'community' forests in buffer zones surrounding national parks in developing countries is a popular means for protecting the parks. The success of such endeavours depends, in part, on a sustainable supply of timber. Consequently, comprehensive forest management planning and, specifically, the determination of annual timber harvests must be made an integral part of management activities of project staff and supporting organizations. The regulation of a community forest on the Osa Peninsula was achieved by specifying and simulating polycyclic silvicultural prescriptions to generate the required periodic timber yields. The long-term scheduling of harvests was formulated as a classic 'Model I' linear programming problem, modified for polycyclic systems. First period harvest was maximized subject to area, cutting cycle, and volume control constraints. The model was used in a case study of a 1200 ha community forest comprised of 15 landowners. The results suggest that the cooperative will have difficulty supplying a proposed portable sawmill, particularly once the conversion of the forest from the unmanaged to managed state is complete.

Keyword: Forest conservation, Environmental conservation, Buffer zone, Sustainable management of forest

RICHARD CONDIT, STEPHEN P. HUBBELL & ROBIN B. FOSTER
Mortality and growth of a commercial hardwood 'el cativo',
***Prioria copaifera*, in Panama**
Forest Ecology and Management, Elsevier, Netherlands, Vol. 62 (1-4)
107-122, 1993, English

The demography of a valuable timber tree, *Prioria copaifera*, was studied in undisturbed forest on Barro Colorado Island (BCI) in central Panama using data from a permanent, 50 ha census plot. All individuals above 10 mm diameter at breast height (dbh) in the plot were mapped and dbh measures taken in 1982, 1985, and 1990. Although *Prioria* is mainly known from swamp forest, it was abundant in the upland forest of BCI, with a mean density of 27-29 stems ha⁻¹ of 10 mm dbh or more. Mortality rates of *Prioria* were 0.5 and 0.6% year⁻¹ during the two census intervals and did not depend on dbh. Mean growth of saplings was slow, less than 1 mm year⁻¹, but larger trees grew rapidly, at 8-16 mm year⁻¹. Growth rates of medium and large trees were higher during 1982-1985 than during 1985-1990, probably because a severe drought in 1983 increased forest-wide mortality rates and opened the forest canopy, allowing more light to penetrate the forest. During both census intervals, growth was extremely variable, ranging from 0 to 40 mm year⁻¹ in different individuals. The range of variability changed little with size: across dbh values from 100 to 1000 mm, maximum growth rates were

20–40 mm year⁻¹. Unlike absolute growth rates, however, relative growth declined with size, from about 5% year⁻¹ in saplings to 1% year⁻¹ in large trees, and was much more variable among small stems than among larger.

Keyword: Natural forest, Mortality, Forest inventory, Growth, Diameter increment/growth

S.N. TRIVEDI & COLIN PRICE

The incidence of illicit felling in afforestation project appraisal: some models illustrated for Eucalyptus plantations in India
Journal of World Forest Resource Management, UK, Vol 3 (2), 129–140, 1988, English

Apart from its adverse biological consequences, illicit felling raises problems in the appraisal of plantations. Expected value of plantations depends on how losses occur. For a given proportionate loss of volume, losses may be concentrated by area, or scattered through the plantation, with or without consequent loss of increment. Different assumptions about how losses occur may have different consequences for management. Modelling of *Eucalyptus* plantations in India showed that losses concentrated by area were more serious and shortened optimal rotations more than scattered losses which removed the same proportion of crop volume. Losses affecting increment shortened rotations more than those which did not. Conventional financial models of risk appraisal were unsatisfactory. Further study of the pattern of losses is needed to decide the most appropriate model.

Keyword: Forest management, Cutting/felling, Evaluation, Eucalypt, Man-made forest, Degradation

ALAN GRAINGER

Future supplies of high-grade tropical hardwoods from intensive plantations
Journal of World Forest Resource Management, UK, Vol. 3 (1) 15–29, 1988, English

Projections were made of future production of high-grade tropical hardwoods from intensive forest plantations for 30 countries in the humid tropics for the period 1981 to 2026. High grade hardwood plantations covered an area of 1,380 ha.10³ in 1980 but accounted for less than one fifth of the total area of tropical forest plantations. Production will not be significant until 1996 when it will reach 3.5 m³.10⁶.a⁻¹, but even by the year 2001 will still be less than 3% of all tropical hardwood removals from natural forests in 1980. Production will grow to exceed 12.0 m³.10⁶.a⁻¹ by 2021 but this follows a sharp fall to less than 3.0 m³.10⁶.a⁻¹ between 2011 and 2020 because of the previous planting schedule and consequent dates of maturity. An alternative scenario was tested in which production from half of all plantations of *Gmelina arborea* was diverted to high value uses. This increased total plantation production by about 1.5 m³.10⁶.a⁻¹ after the turn of the century and helped to compensate somewhat for the decline between 2011 and 2020. However, in the foreseeable future, these projections indicate that plantations will supplement, but not replace, removals from natural tropical moist forests.

Keyword: Forest resources, Plantation, Wood utilization, Natural forest

JÜRGEN BLASER & MARLEN CAMACHO

Estructura, composición y aspectos silviculturales de un bosque de roble (*Quercus* spp.) del piso montano en Costa Rica
Serie Técnica Informe Técnico No. 185, CATIE, Costa Rica 68, 1991, Spanish

The objective of the work was to obtain initial information on the composition, structure and dynamics of high mountain oak forests. In Costa Rica these forests occur between approximately 1,800 masl and 3,200 masl, mainly in the Talamanca mountain range.

The study site is located in the northwestern part of the Talamanca mountain range between latitude 9° 37' north and longitude 83° 30' west. 12.35 ha of forest were subdivided in 247 plots of 500 m² each, in which the following research was carried out:

- characterization of the different soil types present;
- sampling of stands of bamboo (*Chusquea*);
- inventory of all trees, shrubs and tree ferns with $d \geq 5$ cm;
- survey of structure, by compartments, for all plants taller than 50 cm;
- inventory of all dead trees with $d \geq 50$ cm.

Through the soil analysis two principle soil units could be defined: Dystrandept and Placandept. A strong relationship between the type of bamboo and soil units was revealed. Two forest types were defined:

- The Mixed Encino Forest (BME) which occurs on Placandept where the bamboo *Chusquea talamencensis* grows. Characteristic tree species are *Quercus costaricensis*, *Grammadenia myricoides*, *Prunus cornifolia* and *Vaccinium consanguineum*.
- The White Oak Forest (BRB) which occurs on Dystrandept where the bamboo *Chusquea tomentosa* grows. The characteristic species of this community is *Ardisia glandulosa-marginata*.

Silvicultural management objectives are given for both forest types. For the BME a high forest with multilayer structure, mixed in time and in space, is recommended in order to produce high value commercial timber. Management should be based on natural regeneration. For the BRB a high-volume intermediate forest is recommended, achieved by management of natural regeneration by seedlings and sprouting, with an all-aged upper layer of *Quercus copeyensis* (in order to produce commercial timber) and an even-aged inferior layer of oaks and other species (in order to produce firewood and charcoal). In both forest types, refinement cuts are recommended as silvicultural treatments eliminating trees with badly developed crowns and/or trunks. Stands improved by these treatments will then be considered as "departure stands".

Keyword: Forest inventory, Ecology, Forest type, Stand condition, Soil

LORENA OROZCO VILCHEZ

Estudio ecologico y de estructura horizontal de seis comunidades boscosas en la cordillera de Talamanca, Costa Rica
 Serie Técnica Informe Técnico No. 176, CATIE, Costa Rica
 34, 1991, Spanish

A study on ecology and structure of six forest communities was carried out at the northwestern part of the Talamanca Mountain Range in Costa Rica. The objectives were: 1) to characterize the six communities in terms of floristics and structure. 2) to provide ecological and silvicultural information in order to guide future research on regeneration process and management options.

Results of an inventory of all trees with diameter on breast height (d) greater than 10 cm within plots of two hectares are presented. The study sites are División-Montecarmelo (2 050 masl), Macho Mora-Salitre (2 550 masl), Macho Gaff-Salsipuedes (2 600 masl), Villa Mills 1 (2 700 masl), Villa Mills 2 (2 700 masl) and Asunción-Encierro (2 850 masl). The first site belongs to the Tropical Lower Montane Rain Forest zone, while the others are located in the Tropical Montane Rain Forest zone, according to Holdridge's Life Zone System.

Considering the floristic homogeneity, high values for number of trees, basal area and volume, forest management of these communities seems to be promising. However, because of steep slopes, high rainfall and soils prone to erosion, these ecosystems tend to be fragile. Forest management must be based on a sound knowledge of ecology and structure, and will require advanced and appropriate technologies for extraction and stand treatment which will have to be developed or introduced into the country.

Keyword: Ecology, Plant community, Ecosystem, Forest management

JOSÉ NATALINO MALEDO SILVA & JOSÉ DO CARMO ALVES LOPES

Inventário florestal contínuo em florestas tropicais: a metodologia utilizada pela EMBRAPA-CPATU na Amazônia Brasileira
 EMBRAPA-CPATU, Belém, Brasil, 36, 1984, Portuguese

This paper deals with the application of continuous forest inventory in tropical forests, emphasizing its importance as a basic tool for the execution of management plans. The different types of sampling in several occasions are briefly discussed and with more details the permanent plot procedures used by the Humid Tropic Research Center - CPATU in the Brazilian Amazon region.

Keyword: Forest inventory, Forest inventory method

**JOSÉ DO CARMO ALVES LOPES, JOÃO OLEGÁRIO PEREIRA
DE CARVALHO et al.**

**Composição florística de uma floresta secundária três anos após o
corte raso da floresta primária**

**Boletim de pesquisa No. 100, EMBRAPA-CPATU, Belém, Brasil
25, 1989, Portuguese**

The floral composition of a 400 ha secondary forest, approximately three years after clear cutting of the primary forest, is analysed. The study area is located in Morro do Felipe on the property of Companhia Florestal Monte Dourado, in the state of Amapá. A total of 154 species were found, representing 97 genera and 47 botanical families, notably the following: *Amonaceae*, *Araliaceae*, *Burseraceae*, *Caesalpinaceae*, *Fabaceae*, *Lauraceae*, *Lecythydaceae*, *Malpighiaceae*, *Melastomataceae*, *Mimosaceae*, *Moraceae*, *Myrtaceae*, *Rubiaceae*, *Sapotaceae*, *Simarubaceae* and *Tiliaceae*. Within these families at least one species from each size class is represented (size class I: plants of at least 30 cm in height to 2.49 cm D.B.H.; size class II: plants from 2.5 cm to 4.9 cm D.B.H.; and size class III: plants equal to or greater than 5 cm D.B.H.). The species *Cecropia sciadophylla*, *Cecropia obtusa* and *Cecropia* sp., had the largest distribution and abundance in the study area. The specie *Goupia glabra*, occurred in size class I and II, being the most important in size class I, due to the fact that it was both most abundant and the only specie with 100% distribution. All of these species are characteristic of secondary forest, having high rates of occurrence in this successional stage.

Keyword: Plant community, Vegetation, Vegetation survey

W.J. JUNK & H.K. BIANCHI

**Studies on human impact on forests and floodplains in the tropics:
summaries of lectures and posters presented at 1st SHIFT-Workshop
German/Brazilian Cooperation in Environmental Research and Technology,
Brazil, 202, 1993, English**

A growing preoccupation about the destruction of ecosystems and the deterioration of the environment in a worldwide scale led Brazilian and German politicians and scientists during the annual meeting of the Mixed Commission in 1989 to discuss possibilities for a more intensive bilateral cooperation in the field of ecology. In order to concentrate efforts and funds, both sides agreed in concentrating the studies on a few geographic regions and research objects. The following geographic regions were selected:

- the forests and floodplains of the Amazon basin
- the forests of coastal region (Mata atlantica) and its inland waters
- The floodplain of the upper Paraguay River (Pantanal) and its catchment area.

Later on, the following title was selected for the program:

Studies of Human Impact on Forests and Floodplains in the Tropics (SHIFT).

From the early beginning, SHIFT has been planed as a program of applied science, to elaborate concrete answers for the solution of existing environmental problems. However, we always should be aware of the fact, that we are dealing with very complex problems, which include scientific, political, socio-economic, organizational, administrative and many other aspects. We should not expect immediate and easy solutions, but the first workshop has shown that the SHIFT-projects are on a good way to make important contributions for a better understanding of structure and function of the studied ecosystems, their sustainable use and their protection.

This publication is summaries of presentations at 1st SHIFT-workshop in Belém, March 8-13, 1993.

Keyword: Ecology, Environmental conservation, Watershed conservation, Research and development

RAFAEL HERRERA, CARL F JORDAN et al.

**How human activities disturb the nutrient cycles of a tropical
rainforest in Amazonia**

**AMBIO a journal of the human environment research and management
Vol. 10 (2-3), 109-114, 1981, English**

The functioning of tropical rain forests with limited soil nutrients depends largely on input by rain and the ability of the forest plants to use this source of nutrition. The forest shows very well developed mechanisms for efficient recycling of the nutrients stored in its biomass so that losses are minimal. These mechanisms are of high adaptative value and can be identified both at the structural and physiological levels. The forest trees are able to exist on reduced nutrient budgets compared with forests growing on more fertile locations. It is considered more pertinent to compare forests growing under "oligotrophy" versus those growing under "eutrophy" than the more usual contrast of tropical versus temperate ecosystems.

The nutrient-conserving mechanisms are very fragile and when the forest is disturbed they cease to function. The soil, with its low retention capacity, is impoverished after a brief period of fertilization due to the sudden release of nutrients in the biomass. This brief period of fertility is used by shifting cultivators to produce crops. But even this system, which was developed by the native populations in close contact with the environment, can induce severe losses if forced to fit a market-oriented economy or to feed large populations.

Keyword: Biomass, Tropical rain forest, Soil nutrient, Shifting cultivation, Fallow

KUNIO SUZUKI

**The process of ecological change and rehabilitation of tropical forest:
lessons from Southeast Asia**

**Conference on Environmentally Sound Socio-economic Development in
Humid Tropics, 13-19 June 1992, Manaus, Brazil**

The forests that support the humid tropics of Asia, Africa and America are actual treasuries of biomass, biological diversity, environmental resources and cultural heritage. But, considering global levels, it's possible to say that the richest ecosystem, which is composed by the humid tropical forests, has not most of its structure and functions clearly identified scientifically.

Strategies to provide the rehabilitation of tropical forests, which lately have been destroyed rapidly, have been provided by Japan to the Southeast Asian countries and now, wider, to the world. It is the strategy of the native forest rehabilitation through the use of endemic species.

With the experience obtained in Japan, we are working in plant plans in Southeastern Asian countries since 1990. The environmental forestation or rehabilitation of native forest is to develop an endemic forest with endemic plant species of the locality. A dense, multi-layer Grove, as commonly seen in natural forests, can be developed. The forest, composed by native plants and their ecosystem with high effect for environmental conservation, can be developed both quickly and economically. The forest obtained by planting endemic trees in the region will, gradually, recover its endemic life.

Keyword: Tropical forest, Indigenous species, Ecology, Afforestation, Regeneration

JOSÉ NATALINO MACEDO SILVA & CHRISTOPHER VHL

**Forest management for timber production: a sustainable use of
the Brazilian Amazon**

An. Acad. Bras. Ci., (1992) 64, 89-95, 1992, English

Logging in Amazonia is a source of wealth but also a cause of concern because of destructive harvest practices. Logging is practiced in both the upland and floodplain forests of Amazonia. The number of species cut varies from very few in the selective logging of floodplain forests to more than a hundred in the intensive logging of upland forests. Intensive logging in both upland and floodplain forests can cause severe damage, modifying, sometimes drastically, forest structure and composition.

Roundwood production in Amazonia rose from 6.7 to 24.6 million cubic meters in the period from 1976-1988, and presently represents more than half of Brazil's total. Logging is lucrative: a typical sawmill, engaged in both logging and wood processing, realizes a net profit of more than \$200,000 per year. Forestry and wood processing activities could create about one job per 200 hectares of forest—more than twice the employment generated by cattle ranching on an aerial basis.

World concern with the future of tropical forests has grown recently and has motivated environmental groups to contemplate campaigns to boycott tropical wood from non-sustainable sources. Meanwhile, there has been almost no effort to manage the Amazon forest sustainably, nor has there been much progress in the establishment of mixed-species plantations of native species on degraded Amazonian lands. However, there are

no serious technological barriers to the practice of sustainable forestry. The scientific knowledge exists for the management of natural forests as well as the establishment of mixed-species plantations of native species. What is lacking is the political will to apply this knowledge.

Agro-ecological zoning of Brazilian Amazonia is the necessary starting point for the implementation of a wise forestry policy. It is imperative to create forest reserves of sufficient size to guarantee the preservation of the principle forest ecosystems of Amazonia, as well as to demarcate areas for production forestry. Alternatives are presented for the sustainable use of Amazonia's forest, together with suggestions for how ranchers, farmers, and forest dwellers can integrate forest management and tree planting in their production systems.

Keyword: Forest management, Land-use, Ecology, Forest conservation, Forest policy, Tropical forest

RAYMOND A. YOUNG & RONALD L. GIESE (editors)
Introduction to forest science – second edition
John Wiley & Sons, New York, USA, 586, 1990, English

This book is intended to provide beginning and intermediate students with a comprehensive introduction to important aspects of the field of forestry. The book represents a collective effort by a number of authors to present a broad view of the field. The authors give general coverage of their specialized fields within forestry and emphasize how decisions made by forest managers affect the forest ecosystem. References to other works that explore certain aspects of forest science are provided for the student interested in greater depth.

In the book an attempt is made to maintain a flow from the basic cell and individual trees to the forest stand, followed by management of the forest stand, and finally the acquisition of goods and services from the forest. To this end, the book is arranged in four major parts. In the two chapters of the Introduction (Part 1), the development of American forest policy and the location and composition of forests around the world are described.

Part 2, Forest Biology, contains information on factors affecting individual tree growth through growth of the forest stand.

The management of forest stands for multiple uses is treated in Part 3, Forest Management.

Part 4, Forest Products, deals with the conversion of forests to usable commodities. The structure and properties of wood are described, and the methods for conversion to lumber, reconstituted products such as particleboard, paper, chemicals, and energy are illustrated.

Keyword: Forest, Forest management, Forest utilization, Wood utilization, Extension work

STEPHEN J. PYNE
Introduction to wildland fire: fire management in the United States
A Wiley-Interscience Publication, John Wiley & Sons,
New York, USA, 455, 1984, English

Fire is a synthetic subject and fire management is a synthetic art. Fire research must combine knowledge from many fields into a unique pattern. It intersects chemistry, in the form of combustion; physics, with fire behavior mechanisms; biology, with the interdependence of fire and ecosystems; meteorology, with the interaction of fire and atmosphere; culture, in the relationship between fire and human history. Even as fire, wildland fire shows unique characteristics compared to other forms of combustion. Because it integrates so many probabilistic processes and because not all of its important relationships are known, wildland fire remains a largely local and particularized phenomenon. There are, of course, general principles of combustion, fire behavior, fire weather, fire ecology, and fire practices by humans. But wildland fire – not physics, chemistry, or biology – must remain the object of attention. Fire uniquely integrates the many subjects it touches on. The point of intersection, moreover, tends to be local.

Consequently, this volume tries to reconcile the general and the particular by first explaining concepts and then illustrating those principles with particular examples.

Keyword: Forest fire, Fire prevention

R. LAL

Tropical ecology and physical edaphology
A Wiley-Interscience Publication, John Wiley & Sons,
New York, USA, 732, 1987, English

Given proper management and necessary inputs, the soils and environment of the tropics can produce high and sustained yields of many crops. This book is a state-of-the-art review of the properties, potential and constraints of some major agro-ecological regions of the tropics. Particular emphasis is placed upon soil physical properties under natural conditions, effects of vegetation and soil fauna, and alterations by man's intervention. Although soils and environments of the tropics are called fragile, there is still a great deal to learn about factors and processes responsible for their fragility and how to manage them.

This book is arbitrarily divided into four parts: (1) Tropical Ecology; (b) Ecological Factors and Soil Physical Properties; (c) Man as an Ecological Factor; and (d) Towards Improvements in Tropical Agriculture. The title of the volume has been carefully chosen to reflect the contents and highlight the importance of ecological environments in relation to soil physical properties and crop production in the tropics. Although scientific bases of technologies described are transferable to other regions, it will be oversimplification to expect the universalities of technological packages discussed.

Keyword: Tropic, Ecology, Soil conservation, Food production, Soil improvement, Environmental conservation

HENNING RODHE & RAFAEL HERRERA (editors)

Acidification in tropical countries SCOPE 36
John Wiley & Sons, New York, USA, 405, 1988, English

There are very good reasons to consider acidification as one of the most serious environmental problems facing industrialized countries today. A natural question to ask is whether acidification is also a serious problem in other parts of the world. Even if this is not the case, it is important to know what the prospects are for the future: how susceptible are tropical ecosystems, for example, to future emissions of sulfur and nitrogen pollutants?

In 1984 the SCOPE Executive Committee decided to launch a project to answer some of these questions. In preparation for the workshop held outside Caracas in April 1986, case studies were initiated in late 1984 to describe the current situation in relation to acidification and other regional air pollution problems in seven countries: Australia, Bangladesh, Brazil, China, India, Nigeria and Venezuela. These case studies were presented at the Caracas workshop together with several background papers prepared by scientists experienced with acidification problems in Europe and North America.

During the year following the Caracas workshop the case study reports were reviewed, expanded and improved.

The contributions in this book reflect our current understanding of the potential for acidification in five countries. The data used in this assessment are generally sparse and thus may not be representative of all parts of the tropics. The book should therefore not be regarded as a final assessment. It is rather a beginning that needs to be completed by much additional data.

The book includes a synthesis chapter, which summarizes the most important findings of the project.

Keyword: Meteorology, Global forest management, Ecology, Environmental conservation

GEORGE W. LAWSON (editor)

Plant ecology in west Africa, systems and processes
John Wiley & Sons, New York, USA, 357, 1986, English

The plant life of tropical Africa, though broadly similar to that of other tropical regions, has a very marked character of its own. Not only are there very many plants and animals peculiar to Africa, but also, curiously, there are some groups of plants, such as palms, which are very numerous in other parts of the tropics, but poorly represented in Africa. As I once wrote, Africa is in many respects the 'odd man out', the flora of tropical America and tropical Asia being more alike than either is to Africa. Yet, in spite of its great interest, African plant ecology has in recent years received much less attention than that of other parts of the tropics.

For this reason, a book like this one, in which acknowledged experts give up-to-date accounts of some of the major aspects of West African plant ecology, is much to be welcomed.

A special feature of this volume is three chapters on aquatic, coastal and marine vegetation, which in earlier accounts of West African vegetation have usually received no more than cursory treatment. This is primarily a book by scientists for scientists, but there is much in it to interest and instruct the less expert. Some chapters, notably Professor Gillet's on the desert and Sahel, Dr. Hedberg's on land-use and conservation, and the editor's on ecology and development, are on topics of urgent practical importance.

Keyword: Vegetation, Land-use, Arid region, Soil conservation

ALAN GRAINGER

Controlling tropical deforestation

Earthscan Publications Ltd., London, UK, 310, 1993, English

The deforestation of tropical rain forests has been a source of world-wide concern for more than twenty years. This book sets out to give a concise but comprehensive introduction to the causes, scale and possible consequences of the problem and to suggest how it might be tackled. It is intended to satisfy the needs of general readers and students on introductory courses who want to gain a quick overview of tropical deforestation, and to provide some new ideas and inspiration to politicians, planners, agronomists, foresters, conservationists and development workers keen to grapple with the major policy and technical challenges that tropical deforestation presents to them. It is important to stress that deforestation is also happening elsewhere in the tropics, particularly in dry areas, but this merits separate treatment.

There are no easy or quick solutions to tropical deforestation. To think otherwise would be counterproductive. This book argues that if we wish to bring the deforestation of tropical rain forests under control we must take an *integrated* approach to land use that encompasses agriculture, forestry, the management of other resources and conservation, rather than the more partial solutions proposed previously.

Keyword: Deforestation, Tropical rain forest, Forest conservation, Forest policy, Forest management

ENVIRONMENTAL MANAGEMENT COMMITTEE (IDB)

Third conference on the environment: proceedings of the third consultative meeting with public agencies and nongovernmental organizations concerned with environmental protection and the conservation of natural resources, 1991

Inter-American Development Bank, Washington D.C., USA

278, 1991, English

The Inter-American Development Bank, in collaboration with the Government of the Republic of Venezuela, held its Third Consultative Meeting from June 17 to 19, 1991 in Caracas with public agencies and nongovernmental organizations engaged in environmental protection and natural resource conservation in Latin America and the Caribbean. These proceedings contain the addresses delivered at the inaugural and closing sessions, the four basic documents presented and discussed at the plenary sessions, the five working documents, and summaries of all the sessions.

The main objective of the Third Consultative Meeting was to discuss the region's major environmental problems and a possible strategy for addressing them, in preparation for the United Nations Conference on Environment and Development to be held in Brazil in June 1992. The basis for discussion was *Our Own Agenda*, a document prepared under the guidance of the Latin American and Caribbean Commission on Development and Environment. The document describes the process of reflection, analysis, and discussion that has taken place in recent decades on environmental problems in the region. The Meeting also made it possible to provide information on the Bank's activities of the past two years in relation to natural resources and the environment, and to review liaison and collaboration between the Bank and nongovernmental organizations devoted to environmental matters in its borrowing member countries.

Keyword: Natural resources, Environmental conservation, Environmental protection

N. MARK COLLINS, JEFFREY A. SAYER & TIMOTHY C. WHITMORE (editors)

The conservation atlas of tropical forests, Asia and the Pacific
Simon & Schuster A. Paramount Communications Company
256, 1991, English

People through the world have been increasingly aware of tropical forest conservation as one of the major environmental issues of our time. The debate is now firmly established in the public arena and tropical forests have become a significant political issue in countries as far apart as Australia, Brazil and Thailand. In both the developed and developing worlds the media have given extensive coverage to the plight of tropical forest people in places such as Sarawak, to species conservation in Madagascar, and to the possible impact on world climate of deforestation in Indonesia and Brazil.

This atlas introduces more objective and carefully researched information to the debate. It is the first of a series of three volumes, covering all the main tropical regions. It presents the *best available* information on the tropical forest resources of Asia and the Pacific.

The chapters on the critical issues confronting forest conservation attempt to present a balanced view of knowledge. But often they illustrate just how complex the issues are and how intractable the solutions appear to be. The chapter on natural rain forest management, for example, shows the sustained yield management is technically possible, while acknowledging the general failure to achieve this goal in practice.

Keyword: Tropical forest, Sustainable management of forest, forest management, Global forest management, Forest conservation

S.D. RICHARDSON

Forests and forestry in China

Island Press, Washington, D.C., USA, 352, 1990, English

The People's Republic of China covers an area of 9.6 million square kilometers spanning 50 degrees of latitude (including the islands within Chinese territorial waters) and 62 degrees of longitude. This vast section of the Eurasian landmass amounts to one-fourteenth of the total land area of the globe and supports nearly one-quarter of the world's population. It is characterized by immense variation in topography, climate, soils, ecology, and ethnic features. China's flora is among the richest in the world, including more than 5000 woody species in almost 700 genera; the vegetation pattern is unique in Eurasia in that natural forest extends in an unbroken sequence of communities from tropical rain forest in the south to montane-boreal coniferous forest in the northeast.

The forest regions are vast and diverse – from the northern coniferous forests to the tropical rain forests of the east, the steppes and desert forests of the north, and the mountain and plateau forests of the west and southwest. This book details the socio-political effects of recent decades and forestry's importance to China's future. Included is a comprehensive look at harvesting, sawmilling, tariffs and foreign exchange, pulp and paper production, seed collection, urban forestry, and soil erosion. This up-to-date assessment of present-day forestry shows how the Chinese people are attempting to solve their problems and become self-sufficient in areas of industrial timber and fuelwood. The book also reviews both the successes and failures of these initial policy directions and provides the first comprehensive discussion of the social and political forces shaping forestry and natural resource management in modern China."

Keyword: Forest resources, Forest policy, Forest management, Forestry

JAMES K. AGEE

Fire ecology of pacific northwest forest

Island Press, Washington, D.C., USA, 493, 1993, English

The structure of most virgin forests in the American West today reflects a past disturbance history that includes fire. Although media reports of the 1988 Yellowstone fires treated the scene as an ecological catastrophe, these forests were born of fire in the 1700s and are now being reborn in the 1990s. Knowledge of the natural and often inevitable disturbances likely to affect forests, including fire, is essential to any forest management plan, whether the objective is timber production, wildlife conservation, or wilderness management.

Creating desirable forest stand structures in the future for these objectives may not require simulation of past fire activity.

The geographical coverage of this volume is applicable to much of the western United States, although the focus is on forest types found in Oregon, northern California, and Washington. Where those types occur in adjacent regions, information on them has been included. The author chose to exclude those forest types endemic only to other areas of the West, such as giant sequoia forests. Nonforest vegetation is included where it is transitional to forest, as in oak and juniper woodlands or subalpine environments. The author did not attempt to provide detailed discussion of fire weather and fire behavior. Although the book features natural history, political events at the regional and national level have influenced the use of fire in our forests, and a cultural history of fire is included to place the information in context.

The author hopes that this book stimulates more research and progress reports on the fascinating and complex subject of fire ecology.

Keyword: Forest fire, Ecology, Succession, Forest type

GREGORY H. APLET, NELS JOHNSON et al. (editors)

Defining sustainable forestry

Island Press, Washington D.C., USA, 328, 1993, English

This book captures the essence of the workshop through the rearticulation of oral remarks made by the authors at the workshop. All of the authors, with the exception of Michael Toman, actively participated in this gathering. The chapters that follow are organized into three sections. Part I briefly describes the challenge of sustainable forestry and considers some of the issues inherent in deciding what should be sustained and for whom. Part II describes many of the ecological and silvicultural aspects of a sustainable forest management system. Part III addresses some of the economic, social, political, and institutional factors that are equally critical in a truly sustainable system. It was not our intent to provide the last word on defining sustainable forestry. Indeed, at this early stage in the evolution toward managing forests as diverse, naturally functioning ecosystems, we sought only to begin the dialogue, knowing that many others would follow to fill out the framework that has been set up here.

Keyword: Sustainable management of forestry, Forest management, Forest policy

JULIO C. FIGUEROA COLÓN (editor)

**Management of the forests of Tropical America: prospects and technologies
- proceedings of a conference**

**Institute of Tropical Forestry, USDA Forest Service, USA
469, 1987, English**

Forest management has proven a primary challenge throughout the Tropics. Faced with widespread forest destruction, those charged with forest conservation and management are further faced with physical constraints such as: unpredictable weather, relegation to lands either too poor for other crops or degraded by unsustainable agricultural practices, forest ecosystems fraught with complex, fragile and incompletely understood interdependencies, limiting water and/or nutrient budgets, and a high diversity with many species of not only limited marketability but also of slow growth.

In light of these circumstances, the major objectives that inspired the organization of this conference were to assess, and consolidate through expert presentation and discussion, a summary of experiences in the management of forests in the American Tropics. Contributors representing most of the major institutions involved with this problem in the region made presentations concerning seven different aspects affecting the management of forests in Tropical America: (1) the forest management outlook, (2) the current management scene, (3) the management of natural forests, (4) plantations, (5) social forestry, (6) communication outreach, and (7) future markets.

The thirty-two papers contained here present an assortment of experiences in forest management.

Keyword: Forest management, Ecology, Forest policy

P.N. BRADLEY & K. MCNAMARA (editors)
Living with trees: policies for forestry management in Zimbabwe
World Bank Technical Paper, The World Bank, Washington, D.C.,
USA, No. 210, 329, 1993, English

"Living with Trees" is an account of the results of a joint World Bank and Zimbabwe Forestry Commission study, in which the status, use and future of Zimbabwe's forest, woodland and tree resources are reviewed. The first chapter is, in effect, an executive summary, capturing the major themes of the review and presenting them within a framework which targets the key policy issues affecting forestry in Zimbabwe.

The second chapter is a national overview and deals with land, agriculture and economic structural adjustments, which are key policy concerns in Zimbabwe. Within this national context, chapter 2 also reflects on the form and role of the Forestry Commission.

The last two chapters focus on industrial forestry and forestry research. The major concern for industrial foresters is the dual role played by the Forestry Commission, as producer and processor of timber, and the market implications of this integration. A full review of all forestry-related research in Zimbabwe is presented, with suggestions for the future.

A map of Zimbabwe's woody cover is included which is based on interpreted satellite imagery from the mid-1980s combined with local sources.

Keyword: Forest resources, Forest policy, Forestry, Forest utilization

EMMANUEL D'SILVA & S. APPANAH
Forestry management for sustainable development
An EDI Policy Seminar Report, The World Bank, Washington, D.C.,
USA, No. 32, 46, 1993, English

Forests in the developing world are in crisis. Nowhere is this more acute than in Asia: though one-third of the land mass is covered with forests, this ratio is shrinking rapidly at the rate of 2 million hectares per year. By current trends, half of the original 725 million hectares will disappear by the year 2000. The dramatic declines will occur in India, Nepal, Philippines, Sri Lanka and Thailand.

The three immediate causes of deforestation are: clearing the forest land for farming, demand for firewood and fodder, and excessive commercial logging. Fire - intentional and natural - can also contribute to deforestation. These factors are aggravated by population growth and infrastructure and industrial development. All of these are expected to continue through this century. Asian forests are unique in their proximity to centers of rapid economic and population growth, which makes them particularly vulnerable to excessive exploitation.

Behind the crisis in Asian forestry - i.e., the forests, people, and institutions - lie three major failures. These failures are associated with: economic policy, institutional change, and technological improvement. These three sets of issues were the focus of the regional seminar on "Forestry Management for Sustainable Development" held January 27 - February 1, 1992 in Genting Highlands, Malaysia. This report is based in part on the papers prepared for, and the discussions that took place at, the seminar organized by the Economic Development Institute of the World Bank and the Forest Research Institute Malaysia.

Keyword: Deforestation, Forest conservation, Sustainable management of forestry, degradation

RIDLEY NELSON
Dryland management: the "desertification" problem
World Bank Technical Paper, The World Bank, Washington, D.C.,
USA, No. 116, 39, 1990, English

This paper argues that the problem of desertification has been poorly characterized in several ways by public statements, books, magazines and sometimes scientific articles. First, the impression has been conveyed that the extent of the problem of desertification is well known, when in fact the evidence is extraordinarily scanty. Second, the degree to which there is professional agreement among scientists and practitioners on the extent, causes and solutions has been overestimated. Third, the extent of desertification as an irreversible state has probably been exaggerated, although it is correct to classify it as a serious problem. Fourth, the image

created has too often been of inexorably advancing sands, as opposed to more subtle, more complex, pulsating deteriorations, sometimes with reversals, but at least, with substantial periodic remissions, radiating out from centers of excessive population pressure. Fifth, the availability of profitable technologies to combat the problem has been overestimated because the gap between what is socially profitable and what is perceived as privately profitable has been underestimated.

The paper offers a number of strategy priorities which respond to this somewhat different characterization of the problem.

Keyword: Arid region, Desertification, Soil conservation

FRANÇOIS FALLOUX & ALEKI MUKENDI (editors)

Desertification control and renewable resource management in the Sahelian and Sudanian Zones of West Africa

World Bank Technical Paper, The World Bank, Washington, D.C., USA, No. 119, 1990, English

This volume is a compendium of papers presented at the "Workshop on Desertification Control and Renewable Resource Management" held in Oslo, Norway in June 1986. The main objective of the workshop was to develop workable guidelines for addressing the problem of resource depletion in the Sahelian and Sudanian zones of West Africa.

Major policy areas covered include land tenure, water management, household energy use, production systems and migration. The contributors have attempted to describe how existing control and incentive schemes can be modified to encourage the establishment of sustainable resource management in those areas, and to define the political, institutional and economic responsibilities involved. Recommendations concerning water management institution building, the use of appropriate technology, and the development of human capital. Traditional production systems are discussed from sociological and economic standpoints, with emphasis on more autonomous local organizations (such as pastoral associations). The migration strategy outlined attempts to strike a balance between spontaneous, but badly organized, migration and slow and costly state-sponsored migration schemes. The compromise would channel, train and support migrants, combining incentives for, and control over, land use practices with the development of sustainable and viable production systems.

A recurring theme is that smaller organizational units (e.g., village or pastoral associations), for which a tradition exists in Africa, are better equipped – psychologically, physically and legally – to manage their own resources. This belief is shared by all the authors and underlies the strategies for improving production systems and land use.

Keyword: Environmental conservation, Sustainable management of forest, Arid region

LUCINDA A. MCDADE, KAMALJIT S. BAWA et al. (editors)

La Selva: ecology and natural history of a neotropical rain forest

The University of Chicago Press, USA, 486, 1994, English

La Selva, a nature reserve and field station in Costa Rica, is one of the most intensively studied and best-understood tropical field sites in the world. For over thirty years, La Selva has been a major focus of research on rain forest ecology, flora, and fauna. This volume provides the first comprehensive review of this research, covering La Selva's climate, soils, and physical setting, its plant and animal life, and agricultural development and land use in nearby areas.

Drawing together a wealth of information never before available in a single volume, *La Selva* is a substantive treatment of the ecology of a rain forest. Part 1 summarizes research on the physical setting and environment of the rain forest, as well as the history of the research station.

Part 2 synthesizes what is known about the plant community. Part 3 covers the animal community, summarizing information on butterflies, fishes, amphibians, reptiles, birds, and mammals. This part includes an overview of faunal studies at La Selva. Part 4 addresses interactions between plants and animals, focusing on herbivory and frugivory. Part 5 considers the impact of land use and agricultural development on La Selva and other areas of Costa Rica. A final chapter synthesizes and highlights some of the book's findings and considers prospects for comparing La Selva's tropical forests to those in other regions.

This book provides not only an introduction to tropical ecology for students and researchers at La Selva,

but also a major source of comparative information for biologists working in other tropical areas. It offers a valuable resource for everyone concerned with tropical conservation.

Keyword: Biosphere, Tropical forest, Ecosystem, Biodiversity

BOARD ON AGRICULTURE NATIONAL RESEARCH COUNCIL

Managing global genetic resources: forest trees
National Academy Press, Washington, D.C., USA
228, 1991, English

Chapter 1 of this report presents data on the current status of the world's forests and highlights the critical need for conserving and managing the remaining diversity of tree genetic resources, especially in tropical areas of the world. Chapter 2 describes the benefits derived from trees globally and identifies the current and future importance of tree genetic variation in land-use systems and breeding programs. Chapter 3 profiles the current understanding of the biological factors that determine the structure of genetic variation of managed and unmanaged forest tree populations and points out how this knowledge is important to efforts to create, monitor, conserve, and manage reserves for tree species. Chapter 4 defines the methods and technology available for the management of trees through complementary in situ and ex situ conservation activities, and outlines the importance of greater emphasis on developing long-term in situ conservation programs. Chapter 5 describes the activities of the national, regional, and international organizations that are involved with the management and conservation of three genetic resources. Chapter 6 presents the committee's recommendation on how to implement rapidly a much needed global strategy for conserving the managing forest tree genetic resources.

Keyword: Forest conservation, Biodiversity, Environmental conservation

FRANCISCO DALLMEIER, ROBIN FOSTER & JAMES COMISKEY

User's guide to the manu biosphere reserve biodiversity plots
Peru Zones 01 and 02
The Smithsonian Institution/MAB Biodiversity Program,
Washington, D.C., USA, 15, 1993, English

Data in the guide have been gathered over the past six years at the Manu Biosphere Reserve plots. The information provides a foundation for comparative analysis of the plot's vegetation. The Appendices, which include a complete set of maps for each 20 x 20 meter quadrat, data spreadsheets, and full-size maps of each hectare, provide the most complete and condensed information for the plot to date.

The guide is the product of many meetings and discussions with scientists and collaborators. It incorporates numerous changes and suggestions made by these experts.

The material provided in this SI/MAB User's Guide is both interesting and fundamentally useful to those engaged in the study of biological diversity. Its application should prove rewarding in the future.

Keyword: Biodiversity, Forest conservation, Ecology

FRANCISCO DALLMEIER, ROBIN FOSTER & JAMES COMISKEY

User's guide to the manu biosphere reserve biodiversity plots
Peru Zones 03 and 04
The Smithsonian Institution/MAB Biodiversity Program,
Washington, D.C., USA, 15, 1993, English

Increasingly, scientists and others around the world are improving their understanding of biological diversity, protecting it better, and collecting the data needed to do both. More attention must be paid to comparative monitoring of species over time in a network of protected areas. Such monitoring programs are indispensable to in-depth analyses of biological diversity and forest dynamics that provide the scientific basis for managing forest resources in a sustainable fashion. This User's Guide and its complementary Field Guide constitute a practical step toward these goals.

This guide is one of a series that the Smithsonian Institution/Man and the Biosphere Program (SI/MAB) is preparing for researchers, educators, and students interested in undertaking long-term biological diversity

studies. This particular guide is based on study sites established by SI/MAB in cooperation with other agencies (see below) in the Manu Biosphere Reserve of Peru.

This document first provides a detailed description of the site ecology and gives a brief overview of the Manu Biosphere Reserve's climate, topography, soils, vegetation and history. Next, it discusses the methods for establishing a permanent plot to assist researchers who plan to use the same methods in other areas.

Keyword: Biodiversity, Ecosystem, Forest conservation

JAMES COMISKEY, FRANCISCO DALLMEIER et al.
Biodiversity survey of Kwakwani, Guyana
The Smithsonian Institution/MAB Biodiversity Program,
Washington, D.C., USA, 36, 1993, English

Guyana is a small country of 215,000 square kilometers, about the size of Idaho in the United States. It is located on the northeastern coast of South America. In Guyana, SI/MAB aims to provide information about forest conditions, along the Berbice River, that will 1) aid in restoring areas where the mining of bauxite is taking place, and 2) could serve as a model for forest restoration and sustainable development in other areas around the world. As the first leg of a projected three year project, our initial research provided data on vegetation and ecosystem functions from a site that will shortly be mined. We expect to establish a control site in 1994. Detailed site descriptions from the 1993 research are provided below.

SI/MAB, with the full cooperation of Aroaima Mining Company, conducted the field work at the Aroaima site, and analysed the data in conjunction with the University of Guyana.

The findings of the analysis are summarized in the document.

Keyword: Forest conservation, Sustainable management of forest, Ecosystem

FRANCISCO DALLMEIER
Tracking biodiversity for practical applications
Canadian Museum of Nature, Global Biodiversity
3 (1), 24-27, English

Since 1986, The Smithsonian Institution/Man and the Biosphere (SI/MAB) program has been developing biodiversity monitoring projects in protected forested areas of several Latin American countries and the southeastern United States. The focus is on gathering information about tropical and temperate zone forest species and communities, and thus, gaining knowledge about changes in the ecosystems.

Why monitor? Collecting baseline and repetitive data allows us to define the natural patterns of change in the composition and abundance of species in communities and ecosystems. Once these patterns are documented, they can become warning signs, which are useful in detecting further changes in biodiversity.

Despite our accumulated knowledge about species and ecosystems, we lack comprehensive programs for recording forest diversity over time and for predicting a forest's ecological patterns (Dallmeier and Devlin 1993). SI/MAB's biodiversity monitoring program is designed to fill these gaps.

Keyword: Biodiversity, Ecosystem, Environmental conservation

FRANCISCO DALLMEIER, JAMES COMISKEY ET AL.
User's guide to the virgin islands biosphere reserve biodiversity
plots 01 U.S. virgin islands
The Smithsonian Institution/MAB Biodiversity Program,
Washington, D.C., USA, 11, 1993, English

Increasingly, scientists and others around the world are improving their understanding of biological diversity, protecting it better, and collecting the data needed to do both. More attention must be paid to comparative monitoring of species over time in a network of protected areas. Such monitoring programs are indispensable to in-depth analyses of biological diversity and forest dynamics that provide the scientific basis for managing forest resources in a sustainable fashion. This User's Guide and its complementary Field Guide constitute a practical step toward these goals.

The guide is one of a series that the Smithsonian Institution/Man and the Biosphere Program (SI/MAB) is preparing for researchers, educators, and students interested in undertaking long-term biological diversity studies. This particular guide is based on study sites established by SI/MAB in the St. John Biosphere Reserve of the U.S. Virgin Islands. The guide is, of course, especially useful to those conducting research and training at the St. John sites. But it is also helpful as a model of permanent plot methods, which are the foundation for long term biological diversity research programs in other forest ecosystems.

This document first provides a detailed description of the site ecology and gives a brief overview of the St. John Biosphere Reserve's climate, topography, soils, vegetation and history. Next, it discusses the methods for establishing a permanent plot to assist researchers who plan to use the same methods in other areas.

Keyword: Biodiversity, Ecology, Ecosystem, Biosphere

JICA PROJECT

Concepto general forestal

MAG-SFN-JICA, Proyecto Capiibary, Paraguay, 41, Spanish

This publication was compiled as textbook for training carried out by Paraguay/JICA Project, Capiibary, Paraguay. The training was conducted with purpose to disseminate silvicultural technique developed by the Project.

The topics discussed here are general explanation of forest ecology and forestry activities.

Keyword: Ecology, Forest operation, Forestry

JUAN ALBERTO LOPEZ, ELBERT L. LITTLE, JR. et al.

Arboles comunes del Paraguay

Cuerpo de Paz, Colección e Intercambio de Información, USA

425, 1987, Spanish

This book on the common trees of Paraguay describes and illustrates 156 species not only from the eastern region but also from the western part including the Gran Chaco. The introduction contains notes on the plan of the book, a summary of the species, relationships of the trees, and other references. Forest formations of Paraguay are also described with lists of trees. The species, classified in 124 general and 49 plant families, are arranged in alphabetical order by family and scientific name, with text and drawing on facing pages. The Leguminosae family is the largest, represented by 40 species. Four species of palms, three tree cacti, and a bamboo are included.

The text of each species has a summary of the tree, for recognition and describes form, bark, leaves, flowers and fruits. Ecological and silvical observations are added, and geographic distribution outside the country is summarized. Uses of wood and other uses are mentioned. Other common names in Paraguay and other countries and languages are compiled. In the appendices are the glossary of technical terms, Guarani names of the trees and their meaning, authors of scientific names, and the bibliography. The indexes of scientific and common names include synonyms and other common names.

Keyword: Tree species, Distribution

HARRI LORENZI

Árvores brasileiras: manual de identificação e cultivo de plantas arbóreas nativas do Brasil

Editora Plantarum Ltda, Brasil

352, 1992, Portuguese

This publication is an illustrated book of native trees in Brazil. The work by the author is the result of numerous travels, observations and diligent and continuous researches, and localizing and photographing with details. The book deals with natural distribution and manual of identification and cultivation of native tree species in Brazil, and also presents pictures of tree form, flowers, fruits, seeds, bark and wood specimens.

Keyword: Tree species, Seed, Flowering and fruiting, Bark, Wood

INSTITUTO FLORESTAL

2° congresso nacional sobre essências nativas - Parte 4

Revista do Instituto Florestal, São Paulo, Brazil

983-1257, 1992, Portuguese

In the year in which Brazil is holding the 2nd Conference of the United Nations on the Environment and Development, the State of São Paulo, through the Forestal Institute, undertook with great success, the 2nd National Congress on the Native Essences, whose works are included in these Annals.

Having as a main theme the "Conservation of Biodiversity", the 2nd Congress has gathered approximately one thousand participants, among researchers from Brazil and from overseas, entrepreneurs, politicians, environmental militants, governmental authorities.

The works included herein show the real meaning of what represented the 2nd National Congress on Native Essences in the technical/scientific ambients. This publication will be undoubtedly a necessary instrument for consultation for any person who in any ways would be interested in the problems of environment.

This publication is Part 4 of the proceedings of the congress.

Keyword: Biodiversity, Environmental conservation, Research and development, Ecosystem

INSTITUTO FLORESTAL

2° congresso nacional sobre essências nativas - Parte 3

Revista do Instituto Florestal, São Paulo, Brazil

649-979, 1992, Portuguese

In the year in which Brazil is holding the 2nd Conference of the United Nations on the Environment and Development, the State of São Paulo, through the Forestal Institute, undertook with great success, the 2nd National Congress on the Native Essences, whose works are included in these Annals.

Having as a main theme the "Conservation of Biodiversity", the 2nd Congress has gathered approximately one thousand participants, among researchers from Brazil and from overseas, entrepreneurs, politicians, environmental militants, governmental authorities.

The works included herein show the real meaning of what represented the 2nd National Congress on Native Essences in the technical/scientific ambients. This publication will be undoubtedly a necessary instrument for consultation for any person who in any ways would be interested in the problems of environment.

This publication is Part 3 of the proceedings of the congress.

Keyword: Biodiversity, Environmental conservation, Research and development, Ecosystem

INSTITUTO FLORESTAL

2° congresso nacional sobre essências nativas - Parte 2

Revista do Instituto Florestal, São Paulo, Brazil

339-645, 1992, Portuguese

In the year in which Brazil is holding the 2nd Conference of the United Nations on the Environment and Development, the State of São Paulo, through the Forestal Institute, undertook with great success, the 2nd National Congress on the Native Essences, whose works are included in these Annals.

Having as a main theme the "Conservation of Biodiversity", the 2nd Congress has gathered approximately one thousand participants, among researchers from Brazil and from overseas, entrepreneurs, politicians, environmental militants, governmental authorities.

The works included herein show the real meaning of what represented the 2nd National Congress on Native Essences in the technical/scientific ambients. This publication will be undoubtedly a necessary instrument for consultation for any person who in any ways would be interested in the problems of environment.

This publication is Part 2 of the proceedings of the congress.

Keyword: Biodiversity, Environmental conservation, Research and development, Ecosystem

INSTITUTO FLORESTAL

2º congresso nacional sobre essências nativas – Parte 1

Revista do Instituto Florestal, São Paulo, Brazil

1-338, 1992, Portuguese

In the year in which Brazil is holding the 2nd Conference of the United Nations on the Environment and Development, the State of São Paulo, through the Forestal Institute, undertook with great success, the 2nd National Congress on the Native Essences, whose works are included in these Annals.

Having as a main theme the "Conservation of Biodiversity", the 2nd Congress has gathered approximately one thousand participants, among researchers from Brazil and from overseas, entrepreneurs, politicians, environmental militants, governmental authorities.

The works included herein show the real meaning of what represented the 2nd National Congress on Native Essences in the technical/scientific ambients. This publication will be undoubtedly a necessary instrument for consultation for any person who in any ways would be interested in the problems of environment.

This publication is Part 1 of the proceedings of the congress.

Keyword: Biodiversity, Environmental conservation, Research and development, Ecosystem

JOÃO OLEGÁRIO PEREIRA DE CARVALHO

Distribuição diamétrica de espécies comerciais e potenciais
em floresta tropical úmida natural na Amazônia

Boletim de Pesquisa No. 23, EMBRAPA-CPATU, Belém, Brazil

34, 1981, Portuguese

This book presents the study of frequency of trees, volume and composition of species in various classes of diameter, in the area of unexploited humid tropical forest in the National Forest of Tapajós.

Approximately 140 species belonging to 32 families have been taken into consideration. All the trees from 15 cm of diameter have been measured and distributed in fifteen diametrical classes. Some species are encountered in as far as ten distinct diametrical classes, while the others are however encountered only in one class. The "Matomatá" [*Eschweilera* spp] was more frequent, with 11.21%, followed by "Abiurana" [*Sapotaceae*], with 10.07% and by "Andiroba" [*Carapa gualanensis* Aubl.], with 9.90%. It has been concluded that there are variations in the diametrical frequency of the trees in different species, that the species with longer life-span are encountered with high frequency in all the classes, that the volume is related with a frequency of trees per specie, and that the general form of distribution of the diametrical classes of the trees of Amazon rain-forest, presents likely a distribution that is nearly balanced, occurring with major frequency in the minor classes.

Keyword: Forest inventory, Stand density, Stand composition, Diameter grade, Stand condition

K.A. LONGMAN & J. JENIK

Tropical forest and its environment, 2nd edition

Longman Scientific & Technical, published by John Wiley & Sons,

New York, USA, 347, 1987, English

The aim of this book is to summarise available biological information on the nature of tropical forests and how they function, and to indicate some of the practical implications for anyone using or managing tropical forest land. Emphasis is placed on plant ecology and whole-plant physiology, although other botanical and zoological aspects are briefly touched on. In building up a picture of what the forests are like, questions are asked about the interactions of forest structure, composition and dynamics with differences in climatic, soil and biotic factors, and about the responses of trees to experimentally applied treatments. In considering how the natural ecosystems are likely to be affected by various management options, the key information is seen to concern the ways in which tropical forests change, and yet maintain and repair themselves, and the factors which set the limits to production and resilience.

In these circumstances, a fully revised edition of our concise book was needed, not merely to reflect the great flow of new information, but in order to emphasise for all those who wish to manage such land the relevance of the botanical knowledge about how the different tropical forest ecosystems function. The authors have been able to draw on their experience in West and East Africa, South-East Asia (including the island of

Borneo), South America, the Caribbean and the Galápagos Islands, to provide a broader geographical setting and many new illustrations.

Keyword: Tropical forest, Ecosystem, Succession, Stand composition, Stand condition

ANNIKA NILSSON

Greenhouse earth

John Wiley & Sons, New York, USA, 219, 1992, English

Climate change has become one of the major issues on the international environmental agenda. Predictions of a rising sea and devastating droughts have alerted politicians worldwide to the risks of continued increases in the emission of carbon dioxide and other greenhouse gases.

But to change the direction of development is not an easy process. A myriad of political decisions have to be made on a national as well as international level. Those decisions need to be based on facts. The question is then how big a problem climate change really is. How much do the scientists know about what is in store?

Since the greenhouse effect and climate warming were first brought up on the international agenda of environmental problems, many efforts have been made to critically evaluate the scientific base for the predictions about climate change.

This book is an attempt to capture the messages in those reports to give the non-scientific reader a picture of the different factors that scientists consider in their scenarios of the future. The decisions called for in a global climate convention have to be made by policy makers worldwide, but the basis for those decisions is the picture painted by scientists.

Keyword: Global forest management, Temperature, Deforestation, Carbon cycle

CHRIS C. PARK

Tropical rainforests

Routledge, London and New York, 188, 1992, English

Tropical Rainforests presents the most up-to-date and wide-ranging review of the problems and prospects of the world's most complex and abundant ecosystem. The book examines where and how fast rainforests are being cleared, drawing on examples from all major forest areas. The consequences of clearance are examined at local, regional and global scales.

The author achieves a balanced overview of the current state of the world's rainforests, discussing both the consequences of clearance (for ecology, environments and peoples) and the possible solutions (such as conservation and protection, reforestation, sustainable management, changing tropical timber trade and international investment programmes).

Well illustrated with maps, figures and photographs and with a comprehensive bibliography, the book provides an essential introduction for students of geography, Ecology and the environment, teachers, environmentalists, development practitioners and the general public.

Keyword: Ecosystem, Tropical rainforest, Environmental conservation, Sustainable management of forest

JAMES O. LUKEN

Directing ecological succession

Chapman and Hall, New York, USA, 251, 1990, English

This book is a manual for the practicing natural resource manager who commonly works with plant communities. It begins by developing a general model of succession management that is applicable to any ecosystem that supports plant life (Chapter 1). Implementation of this model relies on the establishment of working relationships between ecologists and resource managers, a subject treated in Chapter 2. Chapter 3 provides a few population biology concepts that are relevant to succession management. Chapters 4-7 deal with specific methods of managing succession as well as the effects of these management activities on succession. Examples are taken from plant communities around the world, but the reader may note a certain bias towards North American plant communities. The importance of scale in resource management problems is treated in

Chapter 8 by taking a landscape perspective. The author hopes that attempts to manage succession in the future do not overlook this important and rapidly developing field. Lastly, Chapter 9 examines some information systems that can be used to make decisions about succession management.

Keyword: Plant community, Natural resources, Succession, Ecosystem

RICHARD L. WYMAN (editor)

Global climate change and life on earth

Routledge, Chapman and Hall, New York and London

282, 1991, English

This book is based on presentations given by the authors at the conference entitled "Global Climate Change and Life on Earth: Evidence, Predictions, and Policy" held at the New York State Museum, in Albany, on April 24 and 25, 1989. The goal in organizing that conference and in editing this book is to inform as many people as possible about what we are doing to our planet. It is written to be comprehensible to the general audience and to college and university students alike, whether they are science majors or not. The main theme is the consequence for life of the greenhouse effect and global climate change. We integrate information on climate change with information on overpopulation, air pollution, ozone depletion, species extinction, and habitat destruction. The result is a comprehensive treatment of perhaps the greatest threat facing life on earth since the extinction of the dinosaurs.

There are three kinds of environmental problems we face today that may be distinguished by scale: acid rain, ozone depletion, and global climate change. Acid rain (more precisely acid deposition) is a local, waste disposal problem that with good will and scientific effort can be solved locally. Ozone depletion is a global problem but with a narrow cause. Again, scientists and politicians should be able to solve the problem with local solutions. Climate change, however, is a global problem with global dimensions and requires a global response.

The first set of chapters presents descriptions of what global climate change is and what may result from environmental changes that may be associated with climate change.

The second set of chapters uses information provided by the general circulation models (GCMs) to predict what the consequences may be for life on earth.

The last set of chapters deals with the direct impacts of climate change on human beings and on policy responses that are needed to stabilize the concentration of greenhouse gases in the atmosphere.

Keyword: Global forest management, Meteorology, Environmental conservation, Forest policy

D.J. MABBERLEY

Tropical rain forest ecology, second edition

Tertiary Level Biology, Blackie and Son, published by

Chapman and Hall, New York, USA, 300, 1992, English

Since the first edition of this book was written, public awareness of tropical rain forests has become so great that issues involving their exploitation are the stuff of daily newspapers, radio and television. The plight of forest-living peoples has become an international issue; concerns over the greenhouse effect and other climatic changes are often linked to rain forest destruction. At the same time, there has been an unparalleled scientific interest in the workings of the rain forest and an increasing concern by economists as to its potential in balancing the books of many developing countries. The need for an advanced yet concise and up-to-date synthesis of recent studies and a key to the increasingly voluminous literature on rain forests is even greater than it was in 1983.

This book is written for advanced undergraduate and postgraduate ecologists, botanists, forest economists and geographers. The contents are as followings.

The tropical rain forest. The changing physical setting. Soils and nutrients. The changing biological framework. The components of diversity and their dynamics. Coexistence and coevolution. Species richness. Traditional rain-forest use. The changing forest today. Postscript. Further reading. references. Index.

Keyword: Tropical rainforest, Ecology, Environmental protection, Biodiversity

F.A. McCLURE

The bamboos

Smithonian Institute Press, Washington, USA, 345, 1993, English

This book is a paperback edition. In the twenty-seven years since the original publication of F.A. McClure's landmark treatise, *The bamboos*, many valuable contributions to our knowledge of these unusual and versatile grasses have been made by researchers and enthusiasts around the world, but this book endures as an excellent, comprehensive account of the woody bamboos. What makes this book a classic for anyone interested in these plants is that it represents the accumulated knowledge of a dedicated scientist and scholar who worked with bamboos for nearly four decades in both Asia and America. *The Bamboos* rests upon three underlying themes: one, the importance of understanding the biology of organisms; two, continuing evaluation of facts, methods, and perspectives; and three, integration of the basic and applied facets of scientific research.

For those who are already bamboo enthusiasts, the availability of this popular book will be welcome. Those who are just beginning their odyssey into the world of bamboo will find a wealth of information on the structure of the bamboo plant, the propagation of bamboos, and a discussion of the most economically important species.

Keyword: Bamboo, Multipurpose trees, Propagation

KENTON MILLER & LAURA TANGLEY

Trees of life, saving tropical forests and their biological wealth

Beacon Press, Boston, USA, 218, 1991, English

Word of rapidly vanishing forests, particularly tropical forests, can't surprise anyone who reads newspapers or watches television. Widespread concern is deepening into conviction, even alarm, and with good reason. Half the world's tropical forests have already been cleared or degraded.

Trees of Life is the second WRI (World Resources Institute) *Guide to the Environment*. (*The Greenhouse Trap: What We're Doing to the Atmosphere and How We can Slow Global Warming* was the first.) This series was written for people who care about environmental problems and want to get a better grasp of them than the media can deliver but who lack the time or inclination to wade through a carton of technical books. Each guide provides an overview of causes and consequences, scientific findings and uncertainties, and solutions that are as simple as a given topic allows, but no simpler. The next in the series will be a provocative look at why and how transportation and energy use must change if we want to halt greenhouse warming, keep our air breathable, and save the forests and crops damaged by air pollution.

This series expect to help convert rekindled interest in the environment into personal commitment and public action.

Keyword: Global forest management, Environmental conservation, Deforestation

WILLIAM FARIONA ARIAS

**Regeneracion natural en tajas aprovechadas a tala rasa
en bosque tropical. valle de palcazu Peru**

Grant, WWF, No. 7545, 60, 1993, Spanish

The author, a young forestry engineer from University National of the center Peru, make a study about dynamics of natural regeneration of tree species, in two parcel of land harvested since five years ago, using the "strip shelterbelt system", they are located at Iscozacin, in the jungle of the department of Pasco, in central Peru. He makes a short referency about ecological characteristics and valley climatological, of the methodical using system and the first results the "Yanesha forestry cooperative" they are management the native community's natural forestry, the finished; the strip shelterbelt system is an alternative to the integrated utilization and sustained of the tropical forest.

Keyword: Natural regeneration, Forest management, Natural forest

GEORGE M. WOODWELL

Biotic effects on the concentration of atmospheric carbon dioxide:

A review and projection

**Report of the Carbon Dioxide Assessment Committee,
National Academy Press, USA, 216-241, 1983, English**

This report discusses the factors that affect the role of the biota in determining atmospheric CO₂ concentrations. These factors include the size and location of major reservoirs of carbon, the various transitions in metabolism that affect the reservoirs, and direct human effects, such as the clearing of forested land for agriculture.

Keyword: Biosphere, Deforestation, Carbon cycle

A WORLD BANK POLICY PAPER

The forest sector

The World Bank, Washington, D.C., USA, 98, 1991, English

Since the publication in 1978 of the Bank's policy paper Forestry, there has been a profound increase in the world's understanding of and concern about the forest sector of the developing world. All the problems and opportunities that drove the current policy are still important today.

The paper is organized as follows. Chapter 1 describes the two most important challenges in the sector—excessive deforestation and inadequate afforestation and reforestation—and highlights the extent and the causes of the problems. Drawing on the analysis of the causes of excessive deforestation and inadequate planting, chapter 2 discusses policies and programs directed toward overcoming those underlying causes. Finally, chapter 3 discusses the role of the World Bank in supporting governments' efforts to implement these policies and programs.

Keyword: Deforestation, Felling, Afforestation, Forest policy

AGRICULTURE AND NATURAL RESOURCES OPERATIONS DIVISION

Costa Rica forest sector review

**Document of The World Bank, Latin America and the
Caribbean Regional Office, The World Bank, USA**

No. 11516-CR, 55, 1994, English

Costa Rica's forest resources are extensive. In domestic terms, they generate a wide range of economic goods, though tourism and through extraction of logs, charcoal, sawnwood, and finished products. Forest also help maintain the value of national soil and water resources. In international terms, Costa Rica's forest are estimated to hold 5-7 percent of the world's biodiversity, are increasingly valuable for ecotourism, and are an important carbon sink.

Deforestation threatens forest resources. Though it has fallen from 50-60,000 ha per annum in 1950-1970 to 17,000 ha per annum in 1986-92, significant deforestation continue and natural forest may soon disappear completely. Almost all of the forest areas which sustain other land uses have already been cleared or significantly altered. Only about 250,000 ha of undisturbed forest remain outside strictly protected areas.

Keyword: Forest resources, Deforestation, Land-use, Forest policy

JOAN H. MILLAR & NORMAN JONES

China National afforestation project

**The World Bank Asia Technical Department Agriculture Division,
The World Bank, USA, No. 3, 18, 1992, English**

The national afforestation project in China is the largest forestry project ever financed through the World Bank. Its objective is to assist state and Collective Farms in establishing 985,000 ha of well established, well managed forest tree plantations. Predominant species are indigenous conifers—Chinese fir, larch and masson pine. Some valuable indigenous hardwoods are also planted, notably poplar, paulownia and elm. Certain sites

favor the exotic southern pines, eucalypts and black locust and these will be established on approximately 15% of the area. China has a long tradition of forest tree planting but, unfortunately, population pressures have resulted in quite severe deforestation and site degradation in many areas and the traditional practices were not providing adequate productivity.

Keyword: Plantation, Silvicultural technique, Afforestation

NELS JOHNSON & BRUCE CABARLE

Surviving the cut: natural forest management in the humid tropics

World Resources Institute, Washington, D.C., USA

71, 1993, English

Nels Johnson and Bruce Cabarle analyze past forest management failures and blaze a trail toward more productive, more sustainable, and more equitable practices. They argue that a narrow focus on sustained timber is all that counts, species diversity may plummet and watersheds may deteriorate all but unnoticed. To ensure a steady stream of valued forest products and services, they assert, the management goal must be maintaining the health of entire forest ecosystems and the well-being of local communities – whether in the Pacific Northwest or Southeast Asia.

Keyword: Forest management, Ecosystem

IRA RUBINOFF et al.

The center for tropical forest science

Smithsonian Tropical Research Institute, USA, 16, English

The mission of the Center is to promote programs of long-term interdisciplinary research in the natural and social sciences aimed toward understanding plant, animal, and human interactions in natural tropical forest and to translate this information into results relevant to forest management, conservation, and natural resources policy, and communicate these result in a timely fashion through publications, workshops, conferences, and datasharing networks.

Keyword: Biosphere, Ecosystem, Natural resources, Environmental protection, Extension work

MARTIN TEITEL

Rain forest in your kitchen

Island Press, USA, 112, 1992, English

The author has written an important book on one of the most critical issues facing our civilization and planet. Restoring biodiversity on the earth and restructuring the agricultural practices and eating habits of Americans are among the most politically important tasks of the coming decades. These are tasks that require not only a change in our personal dietary choices but also a change in our relationship to the natural world from which we draw our sustenance. While the author helps us to understand the ecology of genetic diversity and the politics of food, he argues that a change in eating habits must also be appreciation of the sacred value of the biological community of which we are a part.

Keyword: Biodiversity, Global forest management, Biosphere, Environmental conservation

J.J. EWELAND & J.L. WHITMORE

The ecological life zones of Puerto Rico and the U.S. virgin islands

Forest service research paper, USDA Forest Service, USA

ITF-18, 34, 1973, English

Most of the neotropical nations except Mexico and Brazil are mapped according to the Holdridge system of ecological life zones. In order to have comparability with these areas, Puerto Rico and the U.S. Virgin Islands were mapped and a discussion and a description of each life zone were written. The manuscript in English offers water balances, a description of the Holdridge theory of biotemperature, and greater detail in general.

Six life zones are present on these islands and also in South and Central America, representing large areas there. Research done on the islands will be directly applicable to those areas and conversely, successful practices done there will be applicable in corresponding life zones on the islands.

Keyword: Ecosystem, Biosphere, Flora

C.E. RUSSELL, C.F. JORDAN & R.M. NORTH

A lesson in tropical forest

IUFRO Symposium on forest site and continuous productivity,

USDA Forest Service, USA, 223-228, 1982, English

Jari: Florestal & Agropecuaria in the eastern Amazon is the world's largest tree farm with well documented sites at various stages of conversion from native forest to second-rotation pulpwood plantations. The standing stock of four nutrient elements in the native forest is being compared with those present in plantation forests of various ages. The entrance and exit of these elements was monitored by quarterly collections of rain from five weather stations and soil water from 37 zero-tension lysimeters.

Keyword: Forest management, Natural forest, Plantation, Soil nutrient

JOHANN G. GOLDAMMER

Wildfires and forest development in tropical and subtropical

Asia: Outlook for the year 2000

General Technical Report, USDA Forest Service, USA

164-176, 1987, English

It is estimated that each year wildfires affect more than 500 million hectares of forested land and about 600 million hectares of savanna and bush land within the tropical and subtropical regions of the world. An increasing tendency towards wildfire occurrence can be expected during the next decades. The collective scenario in the remaining noncommercial forest land will therefore be characterized by degraded and open formations, and the overall development of many forest communities will lead to an extended transformation into highly flammable fire climax savannas. Examples of this process are given by describing the development of the most prevailing forest types in tropical and subtropical Asia.

Keyword: Forest fire, Deforestation, Forest damage

CARLOS VÁZQUEZ-YANES & ALMA OROZCO-SEGOVIA

The rain forest in tropical America: forest dynamics,

reforestation, seed handling and problems of management

Tree Planters' Notes; USDA Forest Service, USA

Vol. 43 (4), 114-118, 1992, English

The high evergreen rain forests of tropical America are destroyed at overwhelming speed. There is still a considerable lack of basic knowledge about forest dynamics and proper management for this complex type of plant community. The understanding of the natural regeneration processes that take place after spontaneous gap formations in the mature forest is shedding light on this matter. The role of the fast-growing but short-living pioneer trees that first colonize light gaps in the reestablishment of the forest environment may be decisive in the development of management and reforestation techniques using native species.

Keyword: Deforestation, Succession, Silvicultural technique, Tropical rainforest

FRANK H. WADSWORTH

Management of a tropical forest

Social and Environmental Consequences of Natural Resources

Policies, Proceeding of International Seminar,

General Technical Report, USDA Forest Service, USA

RM-88, 50-51, 1980, English

We have been discussing biosphere reserves as if their only objectives were the preservation of germplasm, ecological research, and education. An equally important objective listed by MAB is the conservation of diversity. This does not mean only in the ecological sense. It involves the integration and management together of diverse land uses. This process of management is, of itself, complex and vital to the accomplishment of the other objectives that concern us.

Keyword: Biosphere, Ecosystem, Ecology, Biodiversity

WAN RAZALI BIN WANLMOHD & KRISHNA P. RUSTAGI

Development of a generalized growth model for mixed tropical forests of Peninsular Malaysia

Forest Growth Modelling and Prediction, Proceeding of the IUFRO Conference, General Technical Report, Forest Service, USDA, USA Vol. 1, 167-174, 1987, English

Models for predicting diameter growth and non-catastrophic mortality in the mixed tropical rain forests of Peninsular Malaysia by broad species groups are presented. In the absence of quantitative measures of site, density and/or inter-tree competition, the past rate of diameter growth was found to be the most significant predictor of future diameter growth in a weighted linear regression model. The logistic model for predicting tree mortality gave satisfactory results for only two of the four species groups.

Keyword: Succession, Mortality, Diameter increment, Growth

FREDERICK N. SCATENA

An introduction to the physiography and history of the Bisley experimental watersheds in the Luquillo mountains of Puerto Rico Southern Forest Experiment Station, General Technical Report, Forest Service, SO-72, 22, 1989, English

This paper summarizes the physiographic setting and historical uses of the Bisley experimental watersheds. These watersheds are the site of long-term watershed studies in the Luquillo Experiment at Forest of Pucrito Rico. Each of these watersheds drains deep, clayey soils that overlie a highly dissected terrain underlain by volcanoclastic sandstones. The drainages are covered by secondary tabonuco type forests and receive about 3,500 mm/yr of rainfall.

Keyword: Watershed, Succession, Experimental forest

BEDE N. OKIGRO

Development of multiple-use management for tropical forests through research in Africa

Forest Service General Technical Report, USDA Forest Service, USA WO-25, 26-37, 1980, English

Modeling and simulation offer opportunities for understanding and predicting effects of different management systems. Studies are to be located in selected sites representative at relevant ecosystems or benchmark areas within the forest zone at concern.

Keyword: Forest management, Ecosystem, Succession

RICHARD A. BIRDSEY & PETER L. WEAVER

Forest area trends in Puerto Rico

Research Note: USDA Forest Service, USA SO-331, 1-5, 1987, English

Forest area trends in Puerto Rico from 1980 to 1985 are included in this update of earlier studies. Total forest area has increased from 279,000 ha in 1980 to 300,000 ha in 1985. Most of the new forest is growing

on abandoned pasture. Secondary forest and abandoned coffee shade account for 76 percent of all forest land. Xeric scrub and active coffee shade account for 11 percent and 10 percent of all forest land, respectively.

Keyword: Forest resources, Tropical forest

R.V. SOARES

**Fire in some tropical and subtropical south American vegetation types:
An overview**

**Fire in the Tropical Biota, Springer-Verlag Berlin Heidelberg, German
63-81, 1990, English**

The objective of this chapter is to present a general review of the effects and influences of fire on the dominant vegetation types of South America. For the purpose of this presentation, the South American continent was divided into 11 main or dominant vegetation types. Besides these indigenous vegetation types, it is important to note the increasing importance of exotic forests planted on the continent, especially *Eucalyptus* spp. and *Pinus* spp. in Brazil, etc.

A general discussion on the influences of fire on these planted forests is presented.

Keyword: Forest fire, Vegetation, Succession, Ecosystem

FOREST SERVICE U.S.A.

**Fire related considerations and strategies in support of ecosystem management
Washington Office Fire and Aviation Management, USA
30, 1993, English**

This paper directs attention to short interval fire-adapted ecosystems because they are often the first indicator of a potentially larger problem. In these ecosystems, in the absence of periodic low-intensity surface fire, stands undergo relatively rapid changes in species composition and structure which, in turn, often become predisposing factors to epidemic insect and disease outbreak and severe stand replacement wildfire. In these ecosystems, under these conditions, managers are finding it difficult - if not impossible - to ensure sustainability. Sustainability is among the legislated mandates that direct Forest Service activities and is a key element of Ecosystem Management.

Keyword: Ecosystem, Forest fire, Succession, Forest management

EDWARD E. TERRELL et al.

**A checklist of names for 3,000 vascular plants of economic importance
United States Department of Agriculture: Agriculture handbook, USA
No. 505, 241, 1986, English**

This book was compiled to make available to both scientists and nonscientists a source of up-to-date plants scientific names. The total numbers of accepted scientific names are 1,241 genera and 3,296 species, subspecies, varieties, forms, and hybrids. In addition, 983 of the more frequently encountered synonyms are included, followed by their accepted scientific names.

The checklist includes mainly plants used for food, spices, medicine, drugs, forage, or fiber. Some plants used for lumber are also included.

Keyword: Vegetation, Flora, Biosphere

JOHN HEISSEN BUTTEL et al.

**Principles for sustainable management of global forests
The Global Forest Coordination and Cooperation Project
33, 1992, English**

By 1989, social and economic conditions were beginning to be recognized as being inextricably linked to environmental degradation. This frightening realization led the United Nations General Assembly to call on

national leaders to meet at a United Nations Conference on Environment and Development (UNCED). UNCED was to be held in Rio de Janeiro, Brazil, in 1992.

The UNCED charter called for drafting a document to outline ethical principles for sustainable lifestyles (which became known as the Rio Declaration) and a plan for sustainable development in the 21st century, Agenda 21. In addition two formal, legally binding conventions – climate change and biodiversity – were proposed to be signed at Rio.

Keyword: Environmental conservation, Sustainable management of forest, Global forest management, Biodiversity

WILLIAM L. McCLEESE et al.

Taking an ecological approach to management

Proceedings national workshop, Forest Service, USA

241, 1992, English

This publication records the proceedings of the National Workshop on "Taking an Ecological Approach to Management Using Integrated Resource Maps and Inventories" held April 27–30, 1992 in Salt Lake City.

Ecosystem management is defined as the skillful, integrated use of ecological knowledge at various scales to produce desired resource values, products, services, and conditions in ways that also sustains the diversity and productivity of ecosystems. The term "ecosystem management" may be new to many but the basic ideas and principles are not. With various levels of commitment, they have been working towards a similar or integrated approach to planning and management for some time. The difference today is that they have a better appreciation of the complexity or comprehensive nature of what is involved in ecosystem management.

Keyword: Ecosystem, Biodiversity, Environmental conservation, Forest management

FRANCIS E. PUTZ

**Considerations of the ecological foundation of natural forest management
in the American Tropics**

Center for Tropical Conservation, Duke University, USA

28, 1993, English

In this paper some of the strengths and weaknesses in the knowledge base for natural forest management in the American tropics are outlined, starting with flower production and pollination and ranging through seed and seedling biology, the growth, population biology, and harvesting problems. The carbon-offsetting potential of tropical forest management is presented as an example of how global concerns might provide incentives for improving management practices. Some reasons for the apparent weaknesses in the database for tropical forestry are then suggested. The paper concludes with a brief discussion of three very different approaches to natural forest management used in Mexico, Suriname and Peru.

Keyword: Natural forest, Carbon cycle, Phenology, Ecology, Forest management

DAUGLAS S. POWELL, JOANNE L. FAULKNER et al.

Forest resources of the United States, 1992

General Technical Report, USDA Forest Service, USA

RM-234, 132, 1993, English

This report updates information on the Nation's forest resources in USA, particularly the timber resource. It shows that the U.S. forest resources generally have continued to improve in condition and quality since before the 1960s. The area of forest cover has increased since 1987; and the quantity and quality of the forest resource also continued to improve.

Keyword: Forest resources, Wood utilization

KEVIN CLEAVER et al.
Conservation of West and Central African rainforests
World Bank Environment Paper, The World Bank, USA
No. 1, 354, 1992, English

This volume brings together selected papers presented and discussed at the Conference on Conservation of West and Central African Rainforests, held in Abidjan, November 5-9, 1990.

This conference had its origins in a fundamental disagreement between two opposing camps of experts who, although they share the objective of conserving the forests of Africa, disagree on how this can best be achieved. Simply stated, there are those who believe that the rapid economic development being promoted by the World Bank and other aid agencies is likely to lead to the opening-up of forest areas, the intensive agricultural use of forest land, and unsustainable industrial use of forest resources. The opposed view is that the generation of wealth and employment and the alleviation of poverty, which are the targets of development assistance, are essential if we are to create a social and economic climate in which forest conservation programs can have a chance of succeeding.

Keyword: Tropical forest, Forest resources, Forest development, Forest conservation

AJIT KUMAR BANERJEE
Shrubs in tropical forest ecosystems
World Bank Technical Paper, The World Bank, USA
No. 103, 132, 1989, English

Shrubs are a long-neglected life form in the forest ecosystem, playing many roles in the life not only of the forest itself but also of the human community that depends on the forest.

The planting of shrubs, separately and along with tree crops, should be encouraged in all afforestation programmes in tropical countries. If used correctly, shrubs can act as barriers to water run-off, increase in situ soil and moisture conservation, provide a continuous supply of biomass for use as fuel and fodder, particularly by the poor, and act as inexpensive live fences.

The first part of this paper concentrates on shrubs' presence in nature, their characteristics, their growth features and their usefulness. Examples, drawn from India, may be applied with appropriate modifications to all tropical forest lands. Propagation methods to multiply shrubs and shrub management are also dealt with in this part. In the second part, 81 shrubs are briefly described with respect to distribution, phenological characteristics, nursery and planting methods and appropriate locality factors.

Keyword: Shrub, Ecosystem, Water conservation, Soil conservation, Phenology, Silvicultural technique

SUSAN BRAATZ
Conserving biological diversity
World Bank Technical Paper, The World Bank, USA
No. 193, 66, 1992, English

This strategy paper accepts the position that setting up comprehensive and well-managed protected area system is likely to be the most practical way to preserve the greatest amount of the world's biological diversity and the ecological processes that define and mold it. For this reason, it suggests that initial efforts should help support the establishment and maintenance of protected area systems by promoting policy change, incorporating local people into protected area management, and mobilizing financial resources for conservation and protection.

This paper focuses on three elements that are critical to conservation programs. First element is improving the policy environment. Second element is integrating conservation and development. Third element is mobilizing financial resources.

Keyword: Biodiversity, Forest protection, Forest policy, Forest development

JANIS D. BERNSTEIN

**Land use considerations in urban environmental management
The Urban Management Programme, The World Bank, USA
99, 1994, English**

In rapidly growing developing cities, distorted land markets and ineffective urban land management often have resulted in the degradation of environmentally fragile land; occupation of hazard-prone areas; loss of cultural resources, open space, and prime agricultural land; and excessive urban sprawl. To prevent further degradation, governments should exert some degree of control over urban land use and development, but not unnecessarily constrain the supply of land for housing or discourage the private sector from providing affordable housing in safe locations. An important challenge is to achieve a balance between urban development and environmental protection, taking into account linkages among land use, poverty, and the environment.

Keyword: Land-use, Land conservation, Environmental protection

GARTER BRANDON & RAMESH RAMANKUTTY

**Toward an environmental strategy for Asia
A Summary of A World Bank Discussion Paper, The World Bank, USA
32, 1993, English**

This booklet summarized the findings and recommendations of a more detailed study that is being published by the World Bank as a separate Discussion Paper. The study was undertaken to address the need arising from both within and outside the World Bank for (a) an assessment of the trends and impacts of environmental problems in Asia, (b) a synthesis of the World Bank's experience in assisting Asian countries with environmental management, and (c) a clear statement on World Bank principles and priorities for environment-related assistance in the near future.

Keyword: Environmental conservation, Environmental protection

DENNIS J. MAHAR

**Government policies and deforestation in Brazil's Amazon region
A World Bank Publication, The World Bank, USA
56, 1989, English**

The purpose of this pamphlet is to shed further light on the subject by analyzing the effects of certain government policies on deforestation in the Brazilian Amazon. The emphasis is on policies which encourage economic activities that are detrimental to the environment and on those subregions that are now experiencing the most rapid deforestation. The equity aspects of these policies are also considered. The principal message is that attempts to reduce or stop tropical deforestation by fiat only – for example, through land-use zoning, legislation establishing national parks, or legal prohibitions of certain types of economic activity – are not likely to succeed if economic incentives encourage people to do the opposite.

Keyword: Deforestation, Forest conservation, Forest protection, Forest development

2. SILVICULTURE

2-1 Choice of Species

- trials of species, provenance trial, etc.-

JULIO C. FIGUEROA & JACOB L. WHITMORE

Three species of *Eucalyptus* tested in Puerto Rico:

five years after outplanting

Southern Journal of Applied Forestry, Vol. 4 (4), 169-174,

1980, English

As part of an international trial of provenances, three species of *Eucalyptus* were tested in Puerto Rico on two sites, one a combination of Tanama clay and Coloso silty clay loam, the other a Mayo sandy loam. Both sites represent large reforestable areas in Puerto Rico. Five provenances each of *E. deglupta* Blume and *E. urophylla* Blake and two provenances of *E. alba* Reinw. ex Blume were outplanted in 1971. Five years after outplanting, mean heights averaged from 10.3 m to 17.9 m, with the tallest tree over 26 m. D.b.h. averaged from 9.2 cm to 16.8 cm, and survival ranged from 23 to 92 percent. *E. deglupta* and *E. urophylla* grew quite well on both sites, with variation due both to site and to provenance. *E. alba* growth was less impressive.

Keyword: Eucalypt, Provenance test, Height increment, Diameter increment

JOHN K. FRANCIS

The Luquillo experimental forest arboretum

Research Note, USDA, Forest Service, Southern Forest Experiment Station,

USA, SO-358, 8, 1989, English

Since 1960, various tree species, mostly exotics with productive potential, have been planted in small blocks within a tract of subsistence farmland. The site, located on the lower western slope of the Luquillo Experimental Forest in Puerto Rico, has become a unique arboretum. The plantings were weeded and maintained for several years, but later were neglected. A complete inventory and measurements have been made now that some of the species have reached harvest size. Sixty-eight species, some represented by multiple subspecies or provenances, still survive. Fourteen species have died out completely. Promising species are identified for timber production or for ornamental use in high rainfall areas of Puerto Rico. Statistics given for plots of each species are: average height and diameter for trees on the plot, height and diameter of the tallest tree, percent survival, and seed and seedling production

Keyword: Tree species, Species trial, Tree growth, Mortality

ARIEL E. LUGO & FRANK H. WADSWORTH

***Dacryodes excelsa* Vahl tabanuco**

Silvics of North America. Hardwoods. Agric. Hand b., USDA, Washington, D.C.,

USA, Vol. 2, 284-287, English

Tabonuco (*Dacryodes excelsa*), also known as gommier and candlewood, is the dominant large tree of the native forests that formerly covered the northern lower and middle slopes of the mountains of Puerto Rico. It is distinguished by broad low buttresses, a columnar bole, smooth gray bark, and pinnately compound leaves with five to seven fragrant, dark-green leaflets. When wounded, the tree exudes a clear, fragrant inflammable resin that hardens and turns white on exposure.

Keyword: Afforestation, Tree species, Indigenous species/Native species

P.L. WEAVER

***Calophyllum calaba* L. MARIA, SANTA-MARIA**

Silvics of North America. Hardwoods. Agric. Hand b., USDA, Washington, D.C.,

USA, Vol. 2, 172-178, English

Maria (*Calophyllum calaba*) is a medium-sized tropical evergreen tree known also as santa-maría or false-mamey. It is frequently used for reforestation. Although it is easily established by direct seeding and grows well in almost all soils, its growth is generally slow. It tolerates salt spray and forms a dense crown with small fragrant flowers that make it popular as a shade tree or a protective hedge. The wood is used widely in the tropics where a strong, moderately durable timber and general utility wood is needed.

Keyword: Reforestation, Tree species, Direct sowing, Tolerant tree

SUSAN R. SILANDER & ARIEL E. LUGO

Cecropia peltata L. yagrumo hembra, trumpet-tree

Silvics of North America. Hardwoods. Agric. Hand b., USDA, Washington, D.C.,
USA, Vol. 2, 244-249, English

Yagrumo hembra (*Cecropia peltata*), also called trumpet-tree, is a rapidly growing neotropical tree, an important secondary species that is common in Puerto Rico. It is an early invader of forested areas subject to natural or human disturbances and is conspicuous due to its spreading crown and large peltate leaves 30 to 50 cm (12 to 20 in) in diameter, with silver-white lower surfaces.

Keyword: Tree species, Afforestation, Fast growing tree species

L.H. LIEGEL

Growth, form, and flowering of caribbean pine families in Puerto Rico
Commonwealth For. Rev., UK, 64 (1), 67-74, 1985, English

Mean annual increments at 11.6 years averaged ≥ 1.4 m for heights of eight families and ≥ 2.0 cm for diameters of seven families. Best height and diameter growth were for families selected from low elevations (<600 m) of Mt. Pine Ridge, Belize. Existing form was poor, with $\geq 81\%$ of all trees having twisted stems; foxtailing was $\geq 31\%$ for individuals in six families. Few individuals had fine branching and flat branch angle. Cone production was low, with only three families having a majority of individuals with ≥ 31 cones per tree. At 3.0 years, both male and female flowers were present, but at 11.6 years, female flowers predominated. At both assessments, flowering on trees in an eroded portion of the orchard was less than on trees in the non-eroded section.

Keyword: Provenance test, Growth, Pine, Flowering and fruiting

L.H. LIEGEL

Didymopanax morototoni (Aubl.) Decne. & Planch., yagrumo macho

Silvics of North America. Hardwoods. Agric. Hand b., USDA, Washington, D.C.,
USA, Vol. 2, 288-293, English

Yagrumo macho (*Didymopanax morototoni*) is a well-known pioneer species throughout the tropical Americas. In commerce, the common name is morototo or matchwood because the wood is used for match splints in several countries. The light weight wood is also substituted for certain grades of balsa.

Keyword: Tree species, Pioneer species

L.H. LIEGEL

Cordia alliodora (Ruiz & Pav) Oken, laurel, capá prieto

Silvics of North America. Hardwoods. Agric. Hand b., USDA, Washington, D.C.,
USA, Vol. 2, 270-277, English

Laurel (*Cordia alliodora*) is a tropical hardwood that grows from Mexico to Argentina. It is also known as capá prieto. The species frequently serves as shade for coffee trees and farm animals. The wood is easy to work and the dark colored heartwood is a favorite of woodworkers for fine carpentry.

Keyword: Tree species, Broad leaved tree, Nurse tree

L.H. LIEGEL

**Results of 5- to 6-year-old provenance trials of *Pinus oocarpa* Shiede on eight sites in Puerto Rico
Silvae Genetica, Germany, 33 (6), 223-230, 1984, English**

Four of fifteen *Pinus oocarpa* provenances, three from Nicaragua and one from Mt. Pine Ridge, Belize, outperformed all others in Puerto Rico at five and six years from planting. Mean annual height and diameter increments for the four were respectively 2.0 m and 2.7 cm, compared to 2.0 m and 2.6 cm for a fast-growing Alamicamba, Nicaragua *Pinus caribaea* var. *hondurensis* tester provenance. Survival averaged 70% for the top *P. oocarpa* provenances and 76% for the *P. caribaea* tester. Detailed form and volume assessments at one site showed that, compared to *P. caribaea* provenances in adjacent, similar-age trials, *P. oocarpa* provenances had finer branching, flatter branch angles, greater forking, higher overbark volumes, and less foxtailing.

All *P. oocarpa* provenances suffered wind or rain damage from two tropical storms in 1979. Highest blow-down mortality averaged 16 to 20% and included two of the top *P. oocarpa* performers. The *P. caribaea* tester had only 3% blow-down. All *P. oocarpa* provenances had inferior wind resistance to the *P. caribaea* tester, indicating potential problems in reforesting large wind-prone areas with *P. oocarpa*.

Keyword: Pine, Provenance test, Growth, Wind damage

A.E. LUGO & J.K. FRANCIS

**A comparison of 10 provenances of *Eucalyptus deglupta* and *E. urophylla* in Puerto Rico: growth and survival over 15 years
Commonwealth For. Rev., UK, 69 (2), 157-171, 1990, English**

Five provenances each of *Eucalyptus deglupta* and *E. urophylla* were studied through 15 years on two sites in Puerto Rico. A site at Rio Abajo was situated at 300 m above sea level in the subtropical wet forest life zone with an annual rainfall of about 2500 mm, a mean annual air temperature of about 25° C, and loamy soils with high nutrient content. The site at Yabucoa was located at 50 m elevation in the subtropical moist forest life zone with an annual rainfall of 2200 mm, a mean annual air temperature of about 26° C, and loamy soils (sandier than Rio Abajo) of low nutrient content. At Rio Abajo, and regardless of provenance, *E. deglupta* grew faster in diameter, height and stemwood volume than did *E. urophylla*. At Yabucoa *E. urophylla* outperformed *E. deglupta* numerically but not statistically. Observations of tree health and survival at 15 years followed the same pattern. Tree survival was greater in Yabucoa in spite of hurricane damage there. *Eucalyptus deglupta* is apparently better adapted to moist and nutrient-rich sites, whereas *E. urophylla* grows better on drier and sandier soils. Provenance performance was dictated by the elevation from which seeds were collected (over 50% of the growth variance could be explained by elevation). *Eucalyptus urophylla* from provenances of varying elevations responded more readily to new elevations than did those of *E. deglupta*. In general, those provenances from elevations >1,000 m performed poorly while provenances from elevations similar to those of the study sites showed better performance. Short-term, observations (2-5 yr) are suitable for assessing initial growth and survival of these species but not for determining which provenances are the best. Until age 8, growth projections from early observations could overestimate some provenances and underestimate others.

Keyword: Provenance test, Eucalypt, Growth, Soil type

LAURO MEDINA VIANA, JORGE ALBERTO GAZEL YARED et al.

**Teste de espécies/procedências de *Pinus* no planalto do Tapajós, Pará
Boletim de Pesquisa Número 105, EMBRAPA-CPATU, Belém, Brasil
21, 1990, Portuguese**

This paper deals with the results of five and half year old species/provenance trial of *Pinus*, in the Tapajós, Plateau, state of Pará, Brazil. The experimental design was one of random blocks with four replications. The following 16 provenances were tested: *P. caribaea* var. *hondurensis* (6), *P. oocarpa* (8), *P.*

caribaea var. *bahamensis* (1) and *P. kesya* (1). Each plot (216 m²) had 36 trees and only the 16 trees in the center were evaluated. The spacing was 3 × 2 m. Provenances of *P. caribaea* var. *hondurensis* had better performance than *P. oocarpa* and *P. caribaea* var. *bahamensis* in relation to plant height, diameter and volume growth. Yojoa, Honduras and Agudos, Brasil provenances of *P. caribaea* var. *hondurensis* were considered to be promising with an average annual increment in volume of 21.4 and 18.8 m³/ha/year, respectively. The provenance of *P. kesya* showed 100.0% of mortality.

Keyword: Provenance test, Pine, Growth

F.R. RUSKIN (editor)

Casuarinas: nitrogen-fixing trees for adverse sites

**Innovations in Tropical Reforestation, Report of an Ad Hoc Panel,
National Research Council, National Academy Press, Washington, D.C,
USA, 43, 1984, English**

This book highlights eighteen species of casuarina, a group of underexploited Australasian trees that could have exceptional potential in reforesting difficult terrain in many parts of the world. The idea for the study arose at a 1980 meeting of the Commission for the Application of Science to Agriculture, Forestry, and Aquaculture – a commission of the International Council of Scientific Unions – when Max Day was asked to propose a project in forestry for Third World countries, emphasizing trees for firewood, soil protection, and fodder production.

Dr. Day's suggestion for a joint study of casuarinas interested the U.S. National Research Council (NRC) because in 1980 it had briefly mentioned the promise of casuarinas in its report, *Firewood Crops: Shrub and Tree Species for Energy Production*.

It is not our purpose here to recommend casuarinas over all other possible reforestation species. No single species or group of species can provide the answer to the vast problem of tropical deforestation. Instead, we want to encourage broad consideration for increased planting of casuarinas.

Keyword: Tree species, Afforestation, Fodder tree

F.R. RUSKIN (editor)

Calliandra: a versatile small tree for the humid tropics

**Innovations in Tropical Reforestation, Report of an Ad Hoc Panel,
National Research Council, National Academy Press, Washington, D.C,
USA, 42, 1983, English**

This report describes a little-known tree legume, *Calliandra calothyrsus*. In 1936, foresters transported seed of this small Central American tree from Guatemala to Indonesia. They were interested in calliandra and other legumes as possible green manures or shade trees in coffee plantations. In particular, they wanted an alternative to leucaena,* notably for use at high altitudes, where leucaena did not perform well. The foresters planted test plots of calliandra in a few places in East Java. Villagers in East Java had spontaneously adopted calliandra and were cultivating it for their firewood needs. The villagers were so successful that in 1974 Perum Perhutani began encouraging the widespread testing and planting of calliandra. By 1981 the steadily expanding plantations, many planted by villagers themselves, covered almost 2,000 km² on Java. Today Javanese cultivate calliandra widely, often intercropping it with fruit trees and vegetables. The tree has become so popular in rural areas that "Kaliandra" is now a widely used name for children.

However, calliandra remains essentially unknown elsewhere, and the purpose of this report is to recount Java's experience in the hope that other countries will be encouraged to investigate calliandra's promise for themselves.

Keyword: Legume tree, Agro-forestry, Tree species, Multipurpose trees

MICHAEL D. READ & JAMES H. FRENCH (editors)

**Genetic improvement of neem: Strategies for the future, proceedings of
an international consultation held at Kasetsart University, Bangkok,
Thailand, 1993**

**Winrock International-Forestry/Fuelwood Research and Development
Project, Kasetsart University, Thailand, 194, 1993, English**

The importance of neem as a multipurpose tree species and lack of progress on its improvement prompted establishment of the International Neem Improvement Network. The network was formed to organize individuals working on neem into a cohesive association to exchange seed and information. It was to plan such an activity that the inaugural meeting of the International Neem Improvement Network was organized.

The objectives of this first meeting were 1) to exchange results of research related to genetic improvement, 2) discuss the status of neem research in Asia and Africa, 3) plan a set of international provenance trials and 4) identify priority supplemental studies which are needed. The first two goals were met by presentation and discussion of volunteered and invited papers. The second two were achieved by setting up working groups and asking the participants to develop a plan of work for seed exchange and to propose supplemental studies.

Section one of the proceedings consists of papers presented on neem improvement research in India. Neem is native to India and is highly revered there.

Section two consists of country reports presented by Asian participants and a summary of papers presented by African delegates.

Section three contains overview papers on the importance of neem to small-scale farmers, pests and diseases of neem, the influence of genotype and environment on chemical compounds in neem, vegetative propagation, and the role that networks can play in supporting national research programs.

Section five is arguably the meat of the conference. It starts out with an invited paper on neem provenance collection and seed handling prepared by specialists from DANIDA and FAO.

Keyword: Multipurpose trees, Tree species, Research system, Seed, Breeding

JOHN W. TURNBULL (editor)

**Advances in tropical *Acacia* research: proceedings of an international
workshop held in Bangkok, Thailand, 11-15 February 1991**

**Australian Center for International Agricultural Research (ACIAR),
Canberra, Australia, 234, 1991, English**

The genus *Acacia* has many native trees and shrubs with characteristics useful for industrial and community forestry. These nitrogen-fixing species grow in a variety of environments and produce a range of wood products, firewood, charcoal, building poles, tannins and fodder. In recent years fast-growing acacias have been used increasingly in the humid tropics to rehabilitate degraded grasslands and cutover rainforests. Extensive plantations have been established in Malaysia and Indonesia to provide timber and fibre for the pulp and paper industry.

ACIAR sponsored its first acacia workshop in Gympie, Queensland in 1986 to consolidate knowledge on the taxonomy, genetic resources, ecology, silviculture and utilisation of Australian acacias of interest to developing countries.

The aims of this second workshop were to provide a forum for scientists in ACIAR-supported projects to interact with other scientists currently researching tropical acacias, to share new technology, and to identify areas of research which should receive priority. The 60 participants came from Australia, People's Republic of China, India, Indonesia, Kenya, Laos, Malaysia, New Zealand, Pakistan, Sri Lanka, Thailand and Vietnam.

This book is based on the proceeds of that workshop.

Keyword: Nitrogen fixation, Tree species, Acacia, Research system

CARLOS M. NAVARRO P. & HECTOR A. MARTINEZ H.

**El Pochote *Bombacopsis quinatum* en Costa Rica guía silvicultural para
el establecimiento en plantaciones**

**Serie Técnica, Informe Técnico No.142, CATIE, Costa Rica, 41,
1992, Spanish**

MADELENA, a project for planting multipurpose tree species, took over the research developed of a project for firewood and alternative energy sources. The latter project sorted out 14 species to produce firewood through various tests on tree species and their selection. They represent 14 species to which priority should be

given in Central America along with three species well-known in this area. Pochote (*Bombacopsis quinatum* (Jacq) Dugand) is one of these species and important in Honduras, Nicaragua, Costa Rica, Panama and the northern part of South America, where this species is faced with a serious risk.

MADELENA has carried out a survey and study of Pochote in Costa Rica in recent years. This report traces the survey and study to date. It consists of four parts: the description of these species, silvicultural techniques, requirements for planting sites, and growth.

Keyword: Multipurpose trees, Tree species, Fuelwood tree species, Species trial, Silvicultural technique

**Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE)
Madero negro (Madreado, Madrecacao,..) *Gliricidia sepium* (Jacquin)
Kunth ex Walpers, especie de arbol de uso multiple en America Central
Serie Técnica, Informe Técnico No.180, CATIE-ROCAP (596-0117),
Costa Rica, 79, 1991, Spanish**

This is one of the handbooks on multipurpose tree species which have been published under a project MADELENA for planting such species in order to promote forestation.

This handbook provides accumulated data and information on the planting of *Gliricidia sepium* (Jacquin) Kunth ex Walpers in Central America. *G. sepium* is a medium-size leguminous species originating in Mexico and Central America. Many farmers use this species for agroforestry and other purposes. It is used because it propagates easily, whether from seeds or cuttings, saplings are available, and is excellent in fixing nitrogen. These characteristics make this species suitable for hedges and tree farming.

Keyword: Multipurpose trees, Legume tree, Agro-forestry

**MARTIN ALCALDE, ROBERTO CHIO et al.
Especies agrosilvopastoriles para la zona Altoandina
- revisión bibliográfica
ARBOLANDINO Proyecto, Pomata, Peru, 205, 1990, Spanish**

The living conditions of Altiplano farmers can be improved only through the conservation and improvement of the natural environment and the adoption of an efficient agricultural system.

From this point of view, this book summarizes accumulated knowledge and information on indigenous species as a basis for agroforestry activity, surveys and studies of the high Andes region. It introduces suitable crops, feed plants, shrubs and forest tree species for agroforestry in the area.

Keyword: Agro-forestry, Tree species, Shrub

**CARLOS REYNEL R. & JAIME LEÓN G.
Arboles y arbustos andinos para agroforesteria y conservacion de suelos
Proyecto FAO/Holanda/DGFF, Peru, 102, 1990, Spanish**

Much of Peru is in the Andes and there is only a small area of arable land, accounting for no more than 3% of the territory, and little natural vegetation. Combining crop cultivation with forestation for soil conservation is a critical problem for this country. Agroforestry will achieve a balance between soil conservation by planting trees and the life of local inhabitants, and is therefore very significant.

The FAO project/Holland/DGFF has promoted the introduction and practice of agroforestry in mountain areas (2,000 m to 4,500 m a.s.l) in Peru. Agroforestry is regarded as being extremely important for the development of agriculture and animal husbandry.

The above-mentioned project provides technical information in order to extend agroforestry. This book is also an example of such activities and introduces promising tree species and their applications and characteristics related to ecology and propagation.

Keyword: Tree species, Agro-forestry, Propagation

JOSE PRETELL CHICLOTE, DAVID OCAÑA VIDAL et al.
Apuntes sobre algunas especies forestales nativas de la Sierra Peruana
Proyecto FAO/Holanda/INFOR, Lima, Peru, 120, 1985, Spanish

Since 1860, *Eucalyptus globulus* has traditionally been used for afforesting or reforesting mountain areas in Peru. In recent years, *Pinus radiata* has also been introduced.

Forestation has generally been forced into marginal mountain areas by agricultural reforms launched in 1969 and the increasing pressure of population in such areas (expanded farmland). Many plantations have not produced good results due to having poor soil conditions. In particular, the problem of withering then death is serious in *Eucalyptus* plantations. Consequently indigenous species have begun to attract more attention.

This book compiles the existing information and cumulative experience about twelve tree species for forestation in mountain areas. These species were selected in view of utility, the possibility of growth in highlands and farmers' concerns. They are described under the five headings of Botanical Properties, Distribution and Ecological Data, Propagation, Planting, and Utilization.

Keyword: Tree species, Species trial, Propagation, Planting, Wood utilization

FRNCISCO MESÉN
Resultados de ensayos de procedencias en Costa Rica
Serie Técnica, Informe Técnico No. 156, CATIE/MDC/AID/ODA,
Costa Rica, 42, 1990, Spanish

CATIE's Forest Genetic Enhancement Project has been in progress since 1977 in the establishment of provenance tests for forest species with potential for the production of wood in Costa Rica. To 1989, almost 40 of this trials have been established in those ecological regions of the country that have most reforestation potential. This document consists of a progress report showing the results from some of these trials and briefly describing their implications in future research and reforestation programs in Costa Rica.

Keyword: Provenance test, Research and development, Tree species

P.L. WEAVER
Manilkara bidentata (A.D.C.) Chev.
Silvics of North America. Hardwoods. Agric. Hand b., USDA, Washington, D.C.,
USA, Vol. 2, 455-460, English

Ausubo (*Manilkara bidentata*), also known as balata, is a large evergreen forest tree that was probably the most important timber tree of Puerto Rico. It grows best in Puerto Rico on alluvial plains where it may reach the age of 400 years. Ausubo is extremely tolerant of shade. The strong and attractive wood makes it highly valued commercially and it is widely used in the tropics for many wood products. The tree is often tapped for its milky latex, the source of balata gum. Although growth is slow, ausubo is planted for shade and timber.

Keyword: Tree species, Commercial tree species

ANTONIO APARECIDO CARPANEZZI, MILTON KANASHIRO et al.
Informações sobre *Cordia alliodora* (R. & P.) Oken na Amazônia Brasileira
CPATU Documentos, 10, EMBRAPA-CPATU, Belém, Brazil
19, 1982, Portuguese

This book treats the botany, ecology, and silviculture of *Cordia alliodora* in the Brazilian Amazon. It presents informations regarding the distinction of other species of *Cordia*, geographic distribution (with map), climate and soils of *C. alliodora*; its natural regeneration, phenology and collecting of seeds; production of seedlings, silvicultural behavior in experimental planting and perspectives for its use, in artificial regeneration, at commercial scale, in the Brazilian Amazon.

Keyword: Tree species, Ecology, Silvicultural technique, Wood utilization

ANTONIO APARECIDO CARPANEZZI & MILTON KANASHIRO
Informações sobre a ecologia de freijó-cinza (*Cordia goeldiana* Huber)
CPATU Documentos, 14, EMBRAPA-CPATU, Belém, Brazil
13, 1982, Portuguese

The following characteristics of *Cordia goeldiana* Huber are described herein-after: the tree (tree height, crown, root system), natural occurrence (geographical distribution, soils, climate, density of population), ecological zoning for planting and natural regeneration.

Keyword: Tree species, Distribution, Ecology, Natural regeneration

BATISTA BENITO GABRIEL CALZAVARA
Fruticultura tropical: a fruta-pão (*Artocarpus altilis* (Park.) Fosberg)
EMBRAPA-CPATU, Belém, Brazil, 24, 1987, Portuguese

The bread-fruit is originating from the Indo-malaysian region, mainly from the Islands of Java and Sumatra, being cultivated in all the islands of the Asian archipelago and regions of all the world. In Polynesia its cultivation has an extraordinary value, to the extent that certain tribes cannot survive without such a tree.

According to Hill, quoted by Cavalcante (1976), it is one of the most important fruit of the world, constituting the basic food of the people of many islands in the Pacific, for which it is used under the most varied forms.

Its importance in Brazil is not so great, although it is common in all the humid tropical region, acclimatizing as well in Pará, where it becomes practically spontaneous.

Even in reduced number, it is also encountered in fruit-farms on the coastline of the States of Paraíba, Pernambuco, Alagoas, Sergipe and Bahia, where it is well appreciated. It is found in São Paulo at the extreme north of Brazil, growing best in the lower and rainy regions.

Keyword: Tree species, Fruit tree, Fruit

JORGE ALBERTO GAZEL YARED, MILTON KANASHIRO et al.
Espécies florestais nativas e exóticas: compartemento silvicultural no planalto do Tapajós - Pará
EMBRAPA-CPATU, Belém, Brazil, 29, 1988, Portuguese

A growing demand for tropical woods on the international market and within the own country leads in a higher pressure on the Amazon forestal resources, resulting thus in an intensive and extensive exploitation of the species having economical value.

The lack of silvicultural information regarding the native and/or introduced species, is normally mentioned, among other factors, as one of the obstacles to reforestation. With the aim of generate basic knowledges regarding this matter, various experiments are being undertaken in the Experimental Camp of Belterra, belonging to the Center of Agricultural Stock-Farming Research of Humid Tropics - CPATU.

This book has the aim to present the results of evaluation realized in 1986 with special reference to the silvicultural behavior of the tested species.

Keyword: Tree species, Afforestation, Silvicultural technique

L.T. CARRON & K.M. AKEN (editors)
Breeding technologies for tropical Acacias, proceedings of an
international workshop held in Tawau, Sabah, Malaysia, 1-4 July 1991
ACIAR No. 37, The Australian Center for International Agricultural Research
(ACIAR), Australia, 132, 1991, English

Fast-growing acacias are being used to reforest degraded grasslands and cutover rainforest in the humid tropics. *Acacia mangium* has been planted extensively in Malaysia and Indonesia in recent years to provide timber or raw material for the pulp and paper industry. *Acacia auriculiformis* has been an important exotic in many tropical countries for more than half a century. It is widely planted for fuelwood, erosion control, shade,

shelter and amenity, but with selection and breeding it has great potential to provide timber and other industrial wood products.

In 1989 the Government of Malaysia signed an agreement with the Australian Centre for International Agricultural Research (ACIAR) to undertake a collaborative research project entitled 'Hybridisation and Vegetative Propagation of Australian Tropical Acacias'. The project aimed to develop a thorough knowledge of the floral biology of *A. mangium* and *A. auriculiformis* as the basis for the manipulated production of hybrids between selected trees, and to evaluate the potential for hybrid seed production in orchards. It further sought to develop mass vegetative propagation techniques using both cuttings and micro-propagation so that selected hybrids can be multiplied rapidly.

The workshop was designed to provide a mechanism for the exchange of research methods and results among the project scientists and between the scientists and their clients. It was also a forum in which to discuss and formulate future research directions. The 52 participants and observers at the workshop came from Australia, People's Republic of China, France, Indonesia, Laos, Malaysia, Sri Lanka, Thailand, United Kingdom and Vietnam. The project results represent a very significant advance in developing breeding technologies for tropical acacias.

Keyword: Acacia, Breeding, Hybridization, Research system

F.W.G. BAKER (editor)

Rapid propagation of fast-growing woody species

CASAFE Report Series, CAB International, UK

No. 3, 125, 1992, English

Recent figures from FAO indicate that the rate of tropical deforestation has increased from 11.3 million hectares a year in 1980 to 17 million hectares a year in 1990. In addition to the efforts to conserve tropical and other forests efforts are being made to replant as much new forest as possible. The manual and mechanical problems of replanting tree seedlings over areas as large as 10 million hectares are compounded by the difficulties of obtaining or producing the millions of seedlings required for such a planting programme.

These difficulties stimulated CASAFE to organize a symposium on rapid and mass propagation of woody species at the secretariat of the International Council of Scientific Unions (ICSU) in late 1989. The symposium brought together a group of scientists with experience in the rapid and mass propagation of a number of tropical and temperate species including *Acacia*, *Casuarina*, *Eucalyptus*, *Musa*, *Paulownia*, *Populus*, *Salix* and bamboos. This third volume in the CASAFE Report Series gives the papers presented and the Recommendations.

Keyword: Deforestation, Fast growing tree species, Seedling, Propagation

NORMAN JONES & JOAN H. MILLER

***Jatropha curcas*: A multipurpose species for problematic sites**

The World Bank: Land resources series, USA, No. 1, 1-12, English

Jatropha curcas L. (Euphorbiaceae) or jatropha is a large shrub or tree native to the American tropics. *Jatropha* is a species widely utilized as a hedge yielding useful products, which may be established on a wide variety of sites with ease. Its ability to grow in hostile environments without suffering from pest attack while providing raw materials and medicines to local populations should easily earn the plant a reputation as a multipurpose species worthy of serious consideration. Furthermore, as a perennial plant, with relatively minimal moisture and nutrient requirement for growth, environmental impacts and capital investments are reduced. Along with such consideration, *jatropha* should be viewed with a mixture of optimism and prudence as well as suspicion and faith before embarking on a scheme of developing this underutilized plant.

Keyword: Shrub, Multipurpose trees, Tree species

T.F. GEARY, H. BARRES & R. YBARRA-CORONADO

Seed source variation in Puerto Rico and Virgin Islands grown mahoganies

Forest Service Research Paper, USDA Forest Service, USA

ITF-17, 8, 1973, English

Seeds were collected from natural stands of *Swietenia macrophylla* and *Swietenia humilis* in eighteen areas from Mexico through Panama and seedlings from the seeds were planted at thirteen locations in Puerto Rico and the Virgin Islands. *Swietenia mahogani* from naturalized stands in the Virgin Islands were included in plantings.

Differences exist to varying degrees in seed pods, seedling characteristics, survival after field planting, susceptibility to shoot borer attack, growth rate and leaf characteristics between species and among seed sources within species. Differences between species were more important than differences among seed sources in the important characteristic of adaptability as a timber species. Planting location was also very important.

S. macrophylla is recommended for plantations in most of the Subtropical Moist and Wet Ecological Life Zones, but only on a small scale because of shoot borer and weed problems. The data suggest that native areas with the shortest dry season may be the best source of seed for *S. macrophylla* plantation in Puerto Rico.

Keyword: Mahogany, Seed, Provenance test, Seed origin

T.F. GEARY & C.B. BRISCOE

**Tree species for plantations in the granitic uplands of Puerto Rico
Forest Service Research Paper, ITF-14, 1-8, 1972, English**

Thirty two tree species were tested for adaptability in Puerto Rico's humid, granitic uplands, a region of sandy, well drained, erosive soils. Based on adaptability and potential wood uses the following species are recommended for timber plantations.

These are honduras pine, mahoe, kadam and eucalyptus.

Keyword: Species trial, Tree species, Plantation

J.L. WHITMORE & GILBERTO HINOJOSA

**Mahogany (*Swietenia*) hybrids
Forest Service Research Paper, USDA Forest Service, USA
ITF-23, 8, 1977, English**

This study concludes that *Swietenia macrophylla* × *mahogani* is that same a *S. aubrevilleana* stehle & cousin and a hybrid worthy of widespread adaptability trials. Two new putative hybrids, *S. humilis* × *macrophylla* occurs naturally in northwestern Costa Rica and is intermediate between the parent species in height growth, survival on wet sites, leaf characteristics, and height diameter, and buttress height of mature trees. Seed weight, leaflet number, and dry site survival are greater than those of either parent. *S. humilis* × *mahogani* occurs where the two species are planted in proximity and is intermediate between the parent species in height growth, seed weight, length and width of simple leaves as well as later leaflets. This putative hybrid shows juvenile growth superior to that of *S. macrophylla* × *mahogani*.

Keyword: Mahogany, Hybridization, Useful species

KAMIS AWANG & DAVID A. TAYLOR (editors)

**Acacias for rural, industrial and environmental development
Winrock International Institute/FAO, USA, 258, 1993, English**

The first COGREDA (The Consultative Group for Research and Development of Acacias) meeting in June 1992 prioritized research needs for: species assessment and improvement; silviculture for industrial, agroforestry for rural development, and site reclamation purposes; utilization; and economic assessment. It also finalized tasks for producing a monograph on *Acacia mangium*, to be published by F/FRED in the coming months. F/FRED is also supporting several of the research proposals identified at the first meeting.

The group's second meeting, in Udom Thani, Thailand, February 15-18, 1993, examined more closely the contribution of acacias to the three broad areas of rural, industrial, and environmental development. Specifically, it reviewed the extent to which acacias are being used in the Asia-Pacific region for these purposes, identified relevant research needs, and planned for further synthesis of results on several of the most researched species. The meeting included greater representation of countries growing acacias in semi-arid and arid environments, and the group welcomed broader participation in the course of its growth.

Keyword: Acacia, Legume tree, Tree species, Fast growing tree species, Environmental conservation, Research system

KAMIS AWANG & DAVID TAYLOR (editors)

Acacia mangium growing and utilization

Winrock International and The Food and Agriculture Organization of United Nations, USA, 280, 1993, English

This monograph consolidates the knowledge on *A. mangium* from published literature, unpublished and studies, and observations by those familiar with the species. It clarifies where serious gaps remain in our knowledge of the species. For example, silviculture schedules and management of subsequent rotations are not yet well known. Priorities for further research are included in each topic chapter and summarized in the concluding chapter. The appendices list seed supply sources and researchers engaged in the study of *A. mangium*. This book is intended for forest managers, university students, and researchers who may benefit from its baseline of knowledge and who may help to fill the gaps in that knowledge.

Keyword: Acacia, Legume tree, Tree species, Fast growing tree species, Silvicultural technique, Research system

KAMIS AWANG & DAVID A. TAYLOR (editors)

Tropical Acacias in east Asia and the Pacific

Proceedings of the Consultative Group for Research and Development of Acacias, Winrock, USA, 1-106, 1992, English

Taking up a recommendation made by the MPTS Research Committee in 1991, the first meeting of the Consultative Group and Research and Development of Acacias (COGREDA) was convened June 1-3, 1992 in Phuket, Thailand. Eighteen experts currently working on acacias in the fields of tree biology, breeding and propagation, silviculture, pests, utilization, economics, and marketing attended.

The Group attempted to identify priorities for improving the contribution of acacias in community forestry, commercial use of forest products, and the rehabilitation of degraded lands. The meeting reviewed past work and experience, and recommended priority areas for future research as described in the next section.

Keyword: Acacia, Multipurpose trees, Legume tree, Research system, Tree species

DAVID A. TAYLOR & KENNETH G. MACDICKEN (editors)

Research on multipurpose tree species in Asia

Proceedings of an international workshop, Los Banos, Philippines 259, 1990, English

Multipurpose tree species (MPTS) are grown to provide several products, such as food, fodder, wood, fiber, fertilizer, and medicine. They may also be grown to control erosion, restore soil fertility, act as windbreaks, and provide shade and ornament.

This proceedings contain 29 papers presented at the workshop and illustrate the diversity of topics covered under the umbrella of research on MPTS. In working groups, the participants discussed the problems and constraints of their respective fields, the requirements for solving these problems, and potential applications for their findings. Conclusions, recommendations, and priorities for future research, as they were summarized by the working groups, are included here.

Keyword: Multipurpose trees, Tree species, Research system, Multiple purpose forestry

BANPOT NAPOMPETH (editor)

Leucaena psyllid: problems and management

Proceedings of an international workshop, Bagor, Indonesia 208, 1989, English

This workshop was an attempt to update and disseminate information on the *psyllid* and *psyllid* research. The leucaena psyllid, *Heteropsylla cubana* Crawford, has been a serious pest of the multipurpose tree species *Leucaena leucocephala* de Wit in several countries since 1984. The psyllid has been a threat to both industrial and small-farm use of leucaena for some areas. This pest has seriously reduced the value of the species for fodder, shade and other uses.

Keyword: Multipurpose trees, Tree species, Legume tree, Pest/Insect damage, Forest damage

K. PINYOPUSARERK

Acacia auriculiformis: an annotated bibliography

Winrock International Institute of Agricultural Development, USA

154, 1990, English

The aim of this bibliography is to provide access to information on *Acacia auriculiformis* for foresters and scientists engaged in agroforestry and in management on research in the species. It is compiled from literature in scientific journals, proceedings, books, abstracting journals as well as unpublished paper for conferences and other reports. Foreign-language reports and publications are a special feature of this bibliography.

More than 450 references in total were located but only 368 have been included. An abstract is given for each of the listed references. Other references were not included because they did not contain significant information or information was not original.

Keyword: Acacia, Agro-forestry, Fast-growing tree species, Tree species, Legume tree

K. G. MACDICKEN, G.V. WOLF & CB. BRISCOE (editors)

Standard research methods for multipurpose trees and shrubs

Multipurpose Tree Species Network Research Series, Winrock, USA

92, 1991, English

MPTS can be defined as trees or shrubs grown to provide more than one significant product and/or service in land-use systems they occupy. For small farms, this frequently means significant use of both wood and foliage from the same tree.

For example, *Gliricidia sepium* grown in Central America or Southeast Asia is used simultaneously for fuel, fodder and green manure in living fences. This typifies the co-production management described above. *Leucaena leucocephala*, on the other hand, managed for wood products on same trees and leaf meal on adjacent trees, typifies production of different products from different trees of the same species.

Keyword: Multipurpose trees, Tree species, Shrub, Fast-growing tree species

NANCY GLOVER (editor)

Gliricidia production and use

Nitrogen fixing tree association, U.S.A., 1-44, 1989, English

Gliricidia is a versatile fast-growing, nitrogen fixing tropical tree. Farmers around the world grow *gliricidia* for fuelwood, animal feed, green manure, shade, poles and as a support plant. It is easy to establish, coppices vigorously, and tolerates regular lopping. *Gliricidia* is useful for planting in fence lines, woodlots, alley farming systems and in association with perennial crops and pasture lands. Its ability to fix nitrogen makes it an excellent source of this important nutrient.

Keyword: Nitrogen fixation, Legume tree, Multipurpose trees, Tree species, Fuelwood, Firewood

DALE O. EVANS & BILL MACKLIN (editors)

Perennial Sesbania production and use

Nitrogen fixing tree association, U.S.A., 1-41, 1990, English

This manual provides information on growing and using perennial sesbania species. These species are found in diverse agroforestry systems in tropical and subtropical regions. They are used for ruminant fodder, firewood, wood products soil improvement, and human food. In Southeast Asia, *S. grandiflora* is planted on rice bunds and is common in home gardens. In South Asia and Africa, *S. sesbania* has traditionally been used for fodder and soil improvement.

Keyword: Agro-forestry, Multipurpose trees, Soil improvement, Tree species

FRANCOIS MERGEN et al.

Mangium and other fast-growing Acacias for the humid tropics
National Academy Press, USA, 62, 1983, English

Mangium is only one of a number of acacias from the humid Australasian tropics. Collectively they make up a group of little-known trees that have been largely untested in forest plantations. This study draws attention to nine of mangium's relatives because virtually nothing describing their promise as crops can be found in literature readily available to an international readership. Fast-growing leguminous trees such as these acacias may become an important weapon in the battle against the rampant deforestation in tropical areas.

To compile this report, the National Research Council sponsored a panel of American, Australian, and Dutch researchers to visit Sabah, Malaysia, and meet with counterparts from Pusat Penyelidikan Hutan.

Keyword: Legume tree, Fast-growing tree species, Plantation, Tree species, Acacia

R.J. VANDENBELDT

Faidherbia albida in the West African semi-arid tropics
Proceedings of a Workshop: Niamey, Niger, ICRAF, Kenya
1-183, 1991, English

This workshop brought together scientists and development workers, primarily those working in the West Africa region, to: review past and present research findings on *Faidherbia albida*; discuss development issues and "lessons learned" from past and present; list research priorities for the future; and promote collaboration between research and development programs.

These proceedings summarize the state of knowledge on the species and provide a comprehensive list of ongoing research. Papers are divided into sessions on: botany and distribution; uses; genetics, provenance trials, and vegetative propagation; site effects, silviculture, and rhizosphere; and development issues. Recommendations from Working Groups for future research and multidisciplinary linkages are included.

Keyword: Ecology, Tree species, Propagation, Plant propagation, Plantation

MICHAEL D. BENGE

Neem, the cornucopia tree
Agro-forestation technical series, Science & Technology, USAID, USA
No. 5, 90, 1986, English

The neem tree offers great potential for agricultural, industrial and commercial exploitation. Its most promising use is for commercial and on-farm production of pesticides, which so far have proven to be non-toxic to man. Not only can it protect plants from insect damage, but it can greatly contribute to reducing post-harvest food losses, and could be substituted for many of the environmentally damaging pesticides such as DDT. Neem seed extract, azadirachtin, has proven effective against 131 species of insects, 60 in the U.S., of which 45 are extremely damaging to agricultural crops here. These include the leafminer, which attacks vegetable and flower crops, and the gypsy moth, which causes millions of dollars of losses to the U.S. forest industry every year. It even stops the common cockroach.

Keyword: Multipurpose trees, Tree species, Plantation

ZHU ZHAO-HUA et al.

***Paulownia* in China: cultivation and unitization**
Asian Network for Biological Science, IDRC, Canada
65, 1986, English

The genus *Paulownia* is represented by nine species of fast growing timber trees which are indigenous to China. It is very adaptable, widely distributed and extremely fast growing both in south and north China. Presently, the genus is either naturally distributed or cultivated in 23 provinces, municipalities and autonomous regions. It grows equally well on the plains as well as in mountainous regions up to 2,000 m high. Therefore, the genus provides a great potential for extensive cultivation all over China.

Keyword: Biodiversity, Environmental conservation, Global forest management

NATIONAL RESEARCH COUNCIL

Neem, a tree for solving global problems

Report of an Ad Hoc Panel of the Board of Science and Technology
for International Development National Research Council,
National Academy Press, USA, 141, 1992, English

Neem is a fascinating tree. On the one hand, it seems to be one of the most promising of all plants and may eventually benefit every person on the planet. Probably no other yields as many strange and varied products or has as many exploitable by-products. Indeed, as foreseen by some scientists, this plant may usher in a new era in pest control, provide millions with inexpensive medicines, cut down the rate of human population growth, and perhaps even reduce erosion, deforestation, and the excessive temperature of an overheated globe.

On the other hand, that all remains only a vague promise. Although the enthusiasm may be justified, it is largely founded on empirical or anecdotal evidence. Our purpose here is to marshal the various facts about this little-known species, to help illuminate its future promise, and to speed realization of its potential. It is intended as an economic development document, not a scientific monograph.

Keyword: Tree species, Fast growing tree species, Plantation, Indigenous species

M. KANE, H. URUEÑA, W. DVORAK & C. ATEMORTÚA

The potential of *Bombacopsis quinata* as a commercial plantation species
Forest Ecology and Management, Elsevier, Netherlands
Vol. 56 (1-4), 99-112, 1993, English

Bombacopsis quinata (red ceiba) is a broadleaf, deciduous tree which occurs naturally from southern Honduras to central Venezuela in areas with a well-defined dry season and elevations ranging from sea level to 900 m above sea level. Wood of the species from natural stands is much in demand for the production of lumber, furniture, door and window framing, particle-board, plywood and veneer, resulting in extensive harvesting that threatens populations in a number of areas. Genetic and silvicultural research on the species began during the 1960s, but it was not until the 1980s that *B. quinata* was used in commercial-scale plantations established in Columbia and Costa Rica. The species offers relatively easy plantation culture, moderate growth rates (10-20m³ha⁻¹year⁻¹ on most sites), and the production of a valuable and versatile wood of moderate density. Although well adapted to many sites in the tropics with a pronounced dry season, the species may have greatest value in areas of relatively low rainfall (800-1200 mm annual rainfall) where other commercial species exhibit poor survival or slow growth. The species is relatively easy to reproduce sexually and vegetatively, providing opportunities for rapid gains through breeding. Site selection, planting stock quality, time of planting, site preparation and weed control are important aspects in achieving good plantation productivity. Prunings and thinnings will be implemented in many plantations to produce defect-free, high-quality wood. Gene conservation and associated genetic improvement programs are underway but gene conservation activities should be intensified. The species has potential for planting in the seasonally dry tropics outside of its natural range.

Keyword: Tree species, Plantation, Semi-arid region, Site condition, Commercial tree species

J.A. WRIGHT & L.F. OSORIO

Results of provenance and family within provenance trials of *Pinus tecunumanii* in Colombia, South America

Forest Ecology and Management, Elsevier, Netherlands

Vol. 55 (1-4), 107-116, 1992, English

A total of 13 trials comprised of 24 provenances and more than 520 families have been planted to date with CAMCORE (Central America and Mexico Coniferous Resources Cooperative) collections of *Pinus tecunumanii* Egulus and Perry in the Andes region of Colombia. Provenances and families differed significantly ($P < 0.01$) for volume per tree and gravimetric density in 8-year-old trial, for volume per tree in 5-year-old trials and for total height in 3-year-old trials. Provenance of *Pinus tecunumanii* produced significantly ($P < 0.05$) more volume per tree than provenances of *Pinus oocarpa* Schiede. For four trials measured at 8 years of age, correlation of family ranking were statistically significant ($P < 0.001$) for volume per tree at ages 8 and 5 years.

Keyword: Pine, Provenance test, Plantation, Breeding

2-2 Seed (for Propagation)

NOEMI GERALDES VIANNA

Armazenamento de sementes de Mogno (*Swietenia macrophylla* King)

40 Congress Florestal Brasileiro 5-5-83 CPATU-EMBRAPA, Brasil

539-540, 1983, Portuguese

Results on conservation of mogno (*Swietenia macrophylla* King) seed stored on 3 environmental conditions and packed in two kinds of sealed containers are shown. The best results obtained to date show chamber (12°C e 30% R.H.) for both containers tested. On natural environment the seeds did not remained viable for both containers.

Keyword: Seed, Seed storage, Seed viability

NOEMI VIANNA MARTINS LEÃO & ROSEMARY MORAES FERREIRA VIÉGAS

Conservação de sementes de freijó-cinza (*Cordia goeldiana* HUBER)

1st Symposium on the Humid Tropics, Anais Proceedings Anales Belém,

PA, 12 a 17 de novembro de 1984 Volume II Flora e Floresta

341-349, 1986, Portuguese

The freijó-cinza (*Cordia goeldiana* Huber) is a species with high commercial value. Its seeds quickly lose viability when stored in environmental condition of the Amazon. This fact is one of the main obstacles to the rational cultivation of this species. The objective of this study was to determine the ideal conditions for maintaining freijó seeds viability for a long period. The seeds were collected in the Tapajós National Forest, country of Santarém, Pará State. For the germination tests, blotting paper substratum with six replications of fifty seeds were placed in germinators at 25°C . Seed viability conservation was verified every two months, removing the samples that were in four different environments: 1) natural environment (averaging 26°C and 80% relative humidity subjected to variations), 2) dry chamber (12°C and 30% relative humidity), 3) cool chamber (8°C and 50% relative humidity) and 4) moist chamber (14°C and 80% relative humidity, the latter subjected to variation). Two packaging type were utilized: permeable (paper bag) and semi-permeable (plastic bag). After eleven months, the best storage condition for freijó-cinza seeds with low initial humidity content, was the cool chamber using semipermeable packaging where seed germination was 32.67%.

Keyword: Seed, Germination, Seed viability

ROSA MARIA TALLO, NOEMI VIANNA MARTINS LEÃO et al.
Secagem de sementes de freijó-cinza (*Cordia goeldiana* HUBER)
1st Symposium on the Humid Tropics, Anais Proceedings Amale Belém,
PA, 12 a 17 de novembro de 1984 Volume II Flora e Floresta
359-365, 1986, Portuguese

Freijó-cinza (*Cordia goeldiana* Huber) has been distinguished as a promising species for artificial regeneration. It has fast growth and good shape. Its wood is moderately heavy, easy to work and durable. Several factors are harmful to physiological quality of the seeds, among them, drying in unstable environmental conditions. The objective of this study is to determine the critical levels of humidity and temperature for storage of freijó seeds without affecting their germination. The seeds used in this test were collected in Belterra, near Santarém, Pará State, Amazon region. They were put in an oven with air circulation, using four temperature levels: 30° C, 35° C, 40° C and 45° C. The exposure times were 0, 30, 60, 90, 120, 150, 180, 240 and 300 minutes. The main results showed that the germination percentage and the freijó seed vigor were better when dried at 30° C and 35° C than at 40° C and 45° C. It was noted that the humidity values were reduced in a way proportional to temperature and exposure time at drying.

Keyword: Seed, Seed storage, Germination, Seed viability

NOEMI VIANNA MARTINS LEÃO

Conservation of morototo (*Didymopanax morototoni* (Aublet) Decne) seeds
Simposio Internacional: Methods of Production and Quality Control
of Forest Seeds and Seedlings Curitiba (Brazil), 19-23/03/84
51-64, 1984, Portuguese

The short lifespan of morototo (*Didymopanax morototoni* (Aublet.) Decne) seeds has been one of the main problem for the utilization of the species. The purpose of this research was to study the behavior of the seeds of "morototo" in different storage conditions; in order to increase its conservation period. In this study the seeds were conserved in dry storage (12° C of temperature and 30% of relative humidity), cold storage (8° C of temperature and 50% of relative humidity), humid storage (14° C of temperature and 80% of relative humidity) and natural environment (average of 26° C of temperature and 80% of relative humidity). In all cases, the seeds were stored in two different containers: polyethylene and paper bags. The best results were obtained on cold storage in paper bag, after eleven months of storage, keeping a germination percentage of 33%.

Keyword: Seed, Seed storage, Germination

NOEMI VIANNA MARTINS LEÃO

Disseminação de sementes e distribuição especial de espécies arbóreas
na floresta nacional do Tapajós, Santarém - Para
PIRACICABA Estado de São Paulo, Brasil, 129, 1990, Portuguese

Aspects of reproduction phenology and seed dispersal for freijó-cinza (*Cordia goeldiana* Huber); carapanaúba (*Aspidosperma oblongum* A.DC.); sucupira-preta (*Diptotropis purpurea* (Rich.) Amusch.); sumaúma (*Ceiba pentandra* (L.) Gaertn.) and quaruba-verdadeira (*Vochysia maxima* Ducke), were studied. The main objectives were: a) to quantify the dispersal of seeds, classifying the species according to seed flight apparatus; b) to evaluate the reproductive phenology phases; and c) to determine spatial distribution patterns of the studied species. Phenology and spatial distribution of the individual trees were studied by demarcating a 400 ha area which was divided in a hundred 4 ha plots (200 m x 200 m).

Seeds without flight apparatus present a more abundant dispersal (80.3%) than seeds with flight apparatus (10.7%). Dispersal of seeds with flight apparatus is mainly concentrated in the dry season. "Freijó-cinza" and "sumaúma" disseminated their propagules in between the end of the dry season and the beginning of the rainy season whereas "carapanaúba", "sucupira-preta" and "quaruba-verdadeira" disseminated their seeds during the period of highest rainfall. It was observed that in the whole studied area "freijó-cinza", "sumaúma", "carapanaúba" "sucupira-preta" and "quaruba-verdadeira" present random spatial distribution with variation according to the methodology used.

Keyword: Phenology, Seed, Regeneration, Seed production, Seed tree, Mother tree

RODOLFO SALAZAR & DAVID BOSHIER

Establecimiento y manejo de rodales semilleros de especies forestales prioritarias en America Central
Serie Técnica, Informe Técnico No. 148, CATIE-ROCAP 596-0117,
Costa Rica, 77, 1989, Spanish

As a result of the species selection surveys that national and international organizations have been carrying out in Central America, a group of forest species with potential for the different ecological zones that characterize the region has been identified. The demonstrative effect of the established experimental forests and also the increase in the demand of forest products are in part what triggered an increased interest in the establishment of forest plantations in the region.

One of the main problems faced by those engaged in reforestation is the lack of enough seeds appropriate in terms of quality and quantity to satisfy demand. This shortage has led to the use of material that is undesirable in terms of genetic quality. As a result, plantations that largely vary in terms performance and tree shape are frequently found.

This guide is meant to help in the achievement of supplying genetically bred seeds and to make known the role of seed beds in small scale fields within the global scheme of forest genetic enhancement. Practical steps are described for the establishment and management of seed beds in small scale fields for species that are of interest to the region, under conditions specific to plantations in Central America based on the experience obtained from the MADELEÑA Project.

Keyword: Seed, Seed origin, Nursery operation, Seedling

JOÃO OLEGÁRIO PEREIRA DE CARVALHO

Fenologia de espécies florestais de potencial econômico que ocorrem na floresta nacional do Tapajós
Boletim de Pesquisa No. 20, EMBRAPA-CPATU, Belém, Brazil
15, 1980, Portuguese

This book presents the fortnightly observations of periods of flowering, fructification, dissemination and foliar changes, undertaken in 32 months, in 473 trees of 66 species of economical interest, in one area of 90 ha, in the National Forest of Tapajós. The main objective was to obtain informations regarding the appropriate period for seed collection of the mentioned species. The results have allowed to determine the period of seed collection for the majority of studied species.

Keyword: Phenology, Flowering and fruiting, Seed collection, Seed

MILTON KANASHIRO & NOEMI GERALDES VIANNA

Maturação de sementes de *Cordia goeldiana* Huber
Circular Técnica No. 28, EMBRAPA-CPATU, Belém, Brasil
11, 1982, Portuguese

This book presents the informations obtained in seed bed on germination of *Cordia goeldiana* [freijó cinza] with seeds collected in different periods, determining the point of maturation of the species. It has been verified that the seeds with 5-7 mm of diameter (normal size) and passing from green to brown color represent the greater percentage of germination (68.0%). The results obtained are shown in the table and figure.

Keyword: Seed, Phenology, Seed collection

J.W. TURNBULL (editor)

Tropical tree seed research
URRO/ACIAR Proceedings, Austria, No. 28, 156, 1989, English

The demand for high quality seed of the so-called multipurpose trees and shrubs cannot be met at present and the detrimental consequences of using poor seed can be major and long-term. The supply of tree

seed of an adequate genetic and physiological quality poses a major challenge for national and international agencies and research to support this effort is particularly important. It is especially crucial to develop well based techniques to guarantee seed supplies of the many lesser-known trees and shrubs that have the potential to make a contribution to tropical reforestation programs.

Keyword: Multipurpose trees, Seed, Seed production

2-3 Nursery Practice

ANDRÉS AGUIRRE QUEENS

Técnicas de propagación de especies forestales nativas en el Cusco

Consejo Nacional de Ciencia y Tecnología (CONCYTEC), Peru, 56, 1986, Spanish

A propagation test was carried out on six indigenous species, namely aliso (*Alnus jorullensis*), c'olle blanco (*Buddleia* spp.), c'olle negro (*Buddleia coriacea*), q'enua (*Polylepis incana*), quishuar (*Buddleia longifolia*) and chachacomo (*Escallonia resinosa*). Their germination and cuttings were examined.

Highly organic soil such as black soil was effective for the growth of aliso and c'olle after their germination because this soil has a high water content. Shading was effective for the germination of aliso. Adding ash improved the germination rate of c'olle negro seeds. Ash-mixed soil and Activol (a hormone) were effective in facilitating the germination of aliso. In this test, chachacomo showed the lowest germination rate.

The test on the cuttings of q'enua and quishuar was affected by the types of their cuttings and the time of collection. Cuttings collected from the top of q'enua in December showed the highest rooting rate. As for quishuar, cuttings collected from its side branches in December showed a high rooting rate. Soil containing no agriculturally-prepared soil produced better results than that containing such soil.

Many of the cuttings of q'enua and quishuar had slightly better rooting when a mixture of Rootone, a hormone, or ALA with AIB was used, and when potassium nitrate was used alone. It is important to keep leaves on the cuttings of these species.

Keyword: Propagation, Rooting, Cutting, Hormone

JICA PROJECT

Sección de vivero forestal

MAG-SFN-JICA, proyecto Capiibary, Paraguay, 43, Spanish

This publication is a text book compiled for training conducted by Paraguay/JICA Project, Capiibary, Paraguay.

The book consists of 8 chapters and deals with mainly nursery practices. The contents is the following.

Chapter I Natural Resources, Chapter II Weather in Paraguay, Chapter III Forest Nursery, Chapter IV Nursery Operations, Chapter V Presowing Treatments, Chapter VI Other activities of Nursery, Chapter VII Pests and Diseases, Chapter VIII Forest Management.

Keyword: Nursery, Nursery operation, Pre-sowing seed treatment, Pest/Insect damage, Tree disease

JICA PROJECT

Manual vivero forestal

No. 006, Proyecto Capiibary, Paraguay, 61, 1987, Spanish

This book is a manual for nursery practices compiled by Paraguay/JICA Project, Capiibary, Paraguay. It is prepared for staff of the Project.

The manual deals with practical technique for nursery activities in Paraguay.

Keyword: Nursery, Nursery operation, Guideline

SCOTT J. JOSIAH & NORMAN JONES

Root trainers in seedling production systems for tropical forestry and agroforestry

The World Bank Asia Technical Department Agriculture Division, USA, No. 4, 31, 1992, English

The poly-bag has been used for nursery production for many years, yet solutions to the serious problems inherent with this system have not appeared. Developing country nursery and reforestation program managers should shift from poly-bags to root trainer nursery production systems to minimize costs, improve seedling root morphology and vigor, improve post-planting survival and growth, and to maximize program effectiveness, and impact. Root trainer systems must be used if managers wish to avoid large-scale plantation losses from root deformities, and to considerably improve the overall cost effectiveness and financial returns from their forestry and agroforestry investments.

Keyword: Nursery operation, Seedling, Planting

PH. MIALHE & J. PIOT

Upper volta: trial preparation and plantation of bare rooted eucalyptus camaldulensis

Bois et Forets des Tropiques, France

No. 187, 31-45, 1979, Spanish

Research carried out by the C.T.F.T. in upper volta revealed the qualities of certain provenances of *Eucalyptus camaldulensis* as a standard species for reforestation in that country.

Parallel with acclimatization trials, a series of experiments was conducted in an attempt to develop nursery and silviculture techniques allowing large-scale planting.

From this angle, after reviewing the different phases of production and plantation of potted *Eucalyptus camaldulensis* the authors explain the advantages of bare rooted planting methods over the conventional method. These advantages are obvious in respect to cost, transport, loss of soil, and speed of operations. On the other hand, the period of plantation is shorter than in the case of potted plantation, and the mortality risks are sometimes unpredictable.

Keyword: Eucalypt, Tree species, Bare root seedling, Nursery operation

S.A. EKWEBELAM

Experiments with long-term fertilizers in a tropical forest nursery

Research paper (Forest Series), Nigeria

No. 22, 9, 1974, English

The effects on container-grown tree seedlings of including long-term fertilizers in the potting medium were investigated. The standard medium consisted of small quantities of bonemeal, hornflakes and granular single superphosphate in contractor's sand. No humic materials were employed. The long-term fertilizers comprised fritted trace elements and longfeed tablets. Neither were deleterious to the growth of seedlings in the nursery and it was found that longfeed tablets could be substituted for the normal fertilizer addition. Where the long-term fertilizers were incorporated as well as the standard fertilizers, there was improved growth. The nursery experiments will be followed by establishment and growth trials in the field.

Keyword: Seedling, Nursery operation, Fertilization, Growth, Potting media

LEON H. LIEGEL & CHARLES R. VENATOR

A technical guide for forest nursery management in the Caribbean and Latin America

USDA Forest Service, Southern Forest Experiment Station, USA

SO-67, 156, 1987, English