

## 4-3 Forest Management

**IAN S. FERGUSON**

**The economics of plantation forestry in the savanna region (Nigeria)**

**Project Working Document, FAO, Samaru, Nigeria, DP/NIR/64/516**

**99 pp., 1973, English**

This six northern states of Nigeria correspond roughly with the savanna region in Nigeria.

This report is based on a second consultancy assignment as forest economist with the Savanna Research Station, Nigeria. Main task of the consultant is to establish the cost/benefit relationships for different types of plantations and design the data collection system.

The cost/benefit analyses have been carried out to indicate the economic potential of the major species and products in relation to the major cities of the savanna region. These analyses also provide an estimate of the maximum economic radius of the supply zone around each city with respect to location of plantation of a given species.

The contents of the report are markets, cost and yields, preliminary analyses of plantation prospects, a plantation project at Kaduna and recommendations.

**Keyword:** Savanna, Plantation, Cost analysis, Social and economic analysis

### **PLANNING, RESEARCH & STATISTICS, FORESTRY DEVELOPMENT AUTHORITY (LIBERIA)**

**The state of FDA's plantations in Nimba, Grand Gedeh, Sinoe, Bong and  
Grand Cape Mount Counties and Bomi Territory**

**Planning, Research & Statistics, Forestry development Authority, Monrovia,  
Liberia, 30 pp., 1981, English**

To prevent depletion of the forest growing stock and as a safeguard against reduction in the natural resources of the country as a result of removal of logs by timber concessionaires, the Government of Liberia formulated the reforestation program in 1971, giving the then Bureau of Forest Conservation now the Forestry Development Authority the mandate and finance to set about a systematic program of establishing plantations of fast growing indigenous and exotic species. These plantations are to supplement and complement the production from the existing natural forests in order to provide for the supply of future needs for export and for the local wood processing industries.

This is an evaluation report of all plantation areas in the country. It assesses the state of the plantations and reviews progress made in the implementation of the program of work institutionally and technically.

**Keyword:** Plantation, Evaluation, Exotic species, Indigenous species

**K.F.S. KING**

**An economic analysis of the Ibadan fuel plantation**

**Nigerian Forestry Information Bulletin, The Ministry of Information, Nigeria**

**New series No. 17, 13 pp., 1966, English**

A cost/benefit analysis was made of the Ibadan Fuel Plantation. It was found that when annual expenditure was compared with annual revenue, a small, sustained, profit was attained only after the first twenty-five years of the plantation's life. When total expenditure and total revenue were calculated the plantation showed a profit of three shillings per acre per annum. When interest was charged on the funds invested the plantation made a small profit only if the rate was lower than 3 percent, and this accrued only after 47 years.

It is suggested that the Ibadan Fuel Plantation should not be reestablished when the existing stumps lose their vitality and that no more fuel plantation should be established in Southern Nigeria until an economic analysis is made of the other existing fuel plantations, and unless studies show that the new ventures are economically feasible.

**Keyword:** Fuelwood, Plantation, Forest management, Cost analysis

**WILLIAM NDIFON OGAR**

**Forest management strategies for NNMC pulpwood plantations**

**A paper presented at the 20th Annual Conference of the Forestry Association, Nigeria  
20 pp., 1990, English**

The Nigerian Newsprint Manufacturing Company (NNMC) is one of the three large pulp and paper mills in Nigeria designed to use short fiber pulp from *Gmelina arborea*. NNMC has a concession agreement with the state Government for the supply of *Gmelina* pulpwood from its plantation centers. The total area of pulpwood of these plantation centers is 11,120 ha.

The establishment costs of most afforestation projects is high, and even when a financial or economic appraisal may indicate that the plantations are capable of yielding an acceptable rate of return, the eventual economic and financial liability is dependent on the costs and yields actually achieved during appraisal, an apparently economic project can become a financial liability.

Forest management is therefore primarily concerned with utilizing the available resources in the most efficient way possible, so that the economic and objective expectations of the project can be achieved. The most important resources in afforestation projects are labour, capital, trees and land. The correct quantities, species, localities and timing will be determined by the objects of management. To ensure a market for the output a guarantee of continuity of supply and quality control are required.

**Keyword:** Pulp, Plantation, Afforestation, Forest management

**FAO & UNDP**

**Plantation forestry in South Pacific: a compilation and assessment of practices  
RAS/86/036 Field Document 8, South Pacific Forestry Development Programme,  
FAO/UNDP, Vanuatu, 121 pp., 1992, English**

Plantation forestry in the South Pacific Island States is still in its infancy. The forest policies of most countries state that the purpose for plantation programs are: to provide wood for domestic consumption to reduce or eliminate reliance on imports; to support a domestic industry processing wood for export and; to conserve and enhance soil and water resources. That plantation forestry can protect the soil and water resources is undeniable, especially in countries like Papua New Guinea and Fiji with steeply dissected landscapes.

**Keyword:** Plantation, Forest policy, Soil conservation, Water conservation

**P.K.A. KONUCHE & J.M. KIMONDO**

**Prospects of re-planting clearfelled forest plantations without shamba system  
Kenya Forestry Research Institute Technical Note, Kenya  
No. 8, 16 pp., 1990, English**

The use of shamba system for establishing forest plantations in Kenya dates back to 1910. In 1977, some major socio-economic changes were introduced within the shamba system. The system of resident workmen's shambas forming part of their emoluments was abolished. The workmen started earning wages and paying rent for the shambas, thus becoming licenced cultivators. This made it difficult for the Forest Department to induce them to work in more remote and agriculturally less profitable areas. As licenses, the cultivators also began to maximise crop production and paid less attention to tending of the young trees.

Following these developments, plantation establishment became less successful under shamba system and it became necessary to investigate on other alternative methods such as natural regeneration and direct planting.

**Keyword:** Planting, Reforestation, Regeneration, Forest management

**B.K. KAALE & A.B. TEMU**

**Guidelines for compiling regional and district afforestation plans in Tanzania**  
**Ministry of Lands, Natural Resources and Tourism, Dar es Salaam, Tanzania**  
**32 pp., 1985, English**

Tanzania has embarked on extensive village afforestation and tree planting programmes during the last 18 years. During the last five years, the programmes have been intensified following realisation of the rapidness with which deforestation and desertification are taking place. Forestry experts at national, regional, district and ward level have been called upon to make plans and programmes covering their areas. At national level, general strategies have been established. At regional and lower levels, it has been realised that the forestry experts do not have enough guidance on how to develop plans and programmes to cover their areas.

This manual presents guidelines on the preparation of plans and programmes for afforestation and tree planting at regional, district and ward levels. A five-year afforestation plan (1985-1990) for Kilimanjaro Region is attached as an appendix to provide a practical example.

**Keyword:** Afforestation, Management plan, Village forestry, Guideline

**FRANK R. MILLER & KATE L. ADAM**

**Wise management of tropical forests: proceedings of the Oxford Conference on tropical forest 1992**  
**Oxford Forestry Institute, University of Oxford, Oxford, UK**  
**288 pp., 1992, English**

Clearly there is no simple solution to the problem of tropical deforestation, the whole environment, the political and social environment in which we exist has to change for the tropical forest problem to be adequately addressed. There won't be any rapid changes. There are certain factors that are outside the forestry sector and control of foresters. Firstly, there has to be agricultural intensification in the tropics. Secondly there has to be employment creation and wealth generation, because the conditions under which the people of most tropical countries live should not be tolerated in the twenty-first century. Forest should be amongst the resources mobilised to create employment and generate wealth, and this can reduce the need for land to be cleared to expand agriculture.

Forest institutions and forest departments need to change. In particular, they are going to learn to work in partnership and not dictate the forest peoples how those people should live. Forest department must learn to develop local solutions to local problems and work with local communities. It also must shift their focus away from timber. There are many other products that are so much more important.

It is difficult for foresters and forest department to determine the balance between their well-recognised technical roles, and political roles. Clearly, we all feel that they must be much more vocal politically in representing the case of the forests at the political level.

**Keyword:** Forest management, Deforestation, Land-use, Multiple purpose forestry, Non-timber products, Food production

**P.G. ADLARD & S.F. WRIGHT**

**Annotated bibliography - the effects of fast-growing tree crops on long-term site productivity**  
**Oxford Forestry Institute, Oxford, UK, 105 pp., 1987, English**

This bibliography has been prepared as part of the Overseas Development Administration Research Project on the effect of fast growing trees in Karnataka in Southern India. It has been reproduced for circulation to individuals and organizations who have expressed interest in the aim of the project.

This cannot be considered to be a comprehensive list in any sense. Emphasis has been placed on work that is of particular relevance to the project, that is biomass productivity, nutrient cycling, water uptake and social aspects of fast-growing tree plantation.

**Keyword:** Fast growing tree species, Biomass, Plantation, Research and development, Soil fertility, Site condition

**H.BORG, A. HORDACRE & F. BATINI**

**Effects of logging in stream and river buffers on watercourses and water quality  
in the Southern forest of Western Australia  
Australian Forestry, Australia, 51(2), 98-105, 1988, English**

During the summers of 1984/85 and 1985/86 several stream and river buffers were logged in the southern forest of Western Australia to assess the effects on the watercourses and water quality. All cut-over areas were regenerated to forest soon after logging. Reducing the width of river buffers from the usual 200 m to 100 m (3 trials), and reducing the width of stream buffers from the usual 100 m to 60 m (2 trials) had no effect on the watercourses or water quality. The complete removal of stream buffers (1 trial) introduced logging debris to the stream channel and led to minor changes in the stream channel profile and algal blooms. However, it had no detectable effect on suspended sediment concentrations in the stream, in all six trials some minor erosion occurred on the boundary tracks. In two trials major logging roads crossed a stream. At these crossings organic matter and road surfacing material were found in the watercourses.

From these six trials it was concluded that stream and river buffers in the southern forest of Western Australia can be reduced to half near usual width without any detrimental effects on the watercourses as long as logging is confined to the any season, and all roads and tracks are built and drained properly and located away from the watercourse. Due to the risk of damage to a watercourse, the complete removal of buffers should not be made a general practice.

**Keyword:** Logging, Water quality

**D. LAMB**

**Exploiting the tropical rain forest - an account of pulpwood logging in  
Papua New Guinea  
Man and the Biosphere series, UNESCO, Paris, France,  
Vol. 3, 259 pp., 1990, English**

Papua New Guinea has large areas of tropical rain forest. On a simple area per capita basis, it is the best endowed country in the Asian-Pacific region. However, it has never been able to develop an appropriate way of managing its forests to help finance national development. For many years, it exploited these forests by selectively logging the few commercially saleable species. There was no real knowledge of the silvicultural consequences of much of this logging and the economic benefits were not especially high. Yet it seemed difficult to develop alternative approaches.

In the late 1960's, however, a change in paper making technology occurred that was to lead to a radical new approach to logging in Papua New Guinea. Paper chemists devised a way of using a mixture of tropical hardwood species woodchips to make paper pulp. This change in technology opened the way to overcome the problems of species diversity and commercial acceptability. Instead of selective logging, whole areas of forest could be clear-felled, giving a much higher wood yield. The cleared land could be replanted with fast-growing tree plantations as well as be used for various agricultural projects.

This volume is a review of pulpwood logging in PNG with the Gogol Timber Project as a case study.

**Keyword:** Tropical rainforest, Logging, Forest management, Forest development, Evaluation, Forest utilization

## 5. FOREST CONSERVATION

### 5-1 Watershed Management

**FAO**

**Torrent control terminology**

**FAO Conservation Guide 6, Forestry Dep., FAO, Rome, Italy, 156 pp., 1981, English**

This Terminology of torrent control in French, German, English, Spanish and Italian, produced by the FAO (European Forestry Commission) Working Party on the Management of Mountain Watersheds includes the definition of the technical terms in the first three languages and the translation into the other two, an index of the terms in each language and illustrations presenting the various aspects of torrential processes and torrent control.

**Keyword:** Torrent work, Water conservation, Watershed management, Stream work, Land conservation

**FAO**

**Environmental impact of forestry**

**FAO Conservation Guide 7, Forestry Dep., FAO, Rome, Italy, 85 pp., 1982, English**

The need for environmental planning is being increasingly recognized in developing countries. Costly degradation of the environment as a result of ill-conceived projects in the past has provided an impetus for this publication. At the same time, international funding agencies are becoming more concerned with environmental considerations in project planning and evaluation. As a result, Environmental Impact Assessment is gradually taking its place in the decision-making process, alongside cost-benefit analysis and technical evaluation. Unlike traditional environmental norms which concentrate on limiting the extent of the damage which has already occurred, Environmental Impact Assessment methods are instruments of environmental policy through which possible negative environmental effects of organized human actions can be analysed in advance, and hopefully prevented.

It can be expected that the environmental dimension will receive growing attention in the development of projects for the utilization of the resources of forest ecosystems. These guidelines of the publication, published within the series of the FAO Conservation Guides, attempt specifically to propagate experience gained in the environmental assessment of forestry projects.

**Keyword:** Environmental assessment, Environmental conservation, Environmental protection, Guideline, Forest policy

**JEAN-JACQUES BOCHET**

**Management of upland watersheds: participation of the mountain communities**

**FAO Conservation Guide 8, Forestry Dep., FAO, Rome, Italy, 199 pp., 1983, English**

FAO governing and advisory bodies have often stressed the importance of the socio-economic aspects of mountain watershed management. They have asked the Organization to draw up guidelines on enlisting the participation of local people in watershed management programmes. We are all aware of the need for approaches ensuring sustained yield of natural resources, stabilizing rural population in line with the carrying capacity of the environment, and, most important, enlisting rural people's participation in the planning, execution and benefits of programmes to conserve, restore and make proper use of mountain ecosystems primarily suited for forestry.

The purpose of this paper is to examine the role of mountain communities in the design and implementation of watershed management programmes, in short, their moral commitment to and physical and material participation in these programmes. Part one analyses the problem and its effect on various socio-economic groups. Part two looks at the administrative structures and legal regulations for intervention, socio-economic data gathering and analysis, planning and programming. Part three deals with implementation: the role of the community and measures to be adopted.

**Keyword:** Watershed management, Social and economic analysis, Social forestry, Forest management

**FAO**

**FAO watershed management field manual: vegetative and soil treatment measures**  
**FAO Conservation Guide 13/1, Forestry Dep., FAO, Rome, Italy, 61 pp., 1985, English**

The FAO Watershed Management Field Manual is published within the FAO Conservation Guide series on Conservation Guide No. 13 and will consist of eight separate volumes:

Watershed Survey and Planning  
Slope Treatment Measures and Practices  
Vegetative and Soil Treatment Measures (this volume)  
Roadway Protection Measures  
landslide Prevention Measures  
Gully Control  
Torrent Control  
Water Harvesting

The objective of these Manuals is to assist professionals concerned with the planning and implementation of watershed management activities by providing practical information supported by examples from a wide variety of situations. However, the user of the Manuals are therefore invited to add the local experience and information deemed necessary.

The purpose of this volume is to provide practical guidance for vegetative measures for slope stabilization. This may be particularly useful in environments with a wide choice of readily available vegetative material. Measures include revegetation of slopes by living material, slope stabilization measures using living material, slope stabilization by the combined use of dead and living materials, and biotechnical drainage systems.

**Keyword:** Guideline, Watershed, Watershed management, Hillside work, Soil conservation

**FAO**

**FAO watershed management field manual: watershed survey and planning**  
**FAO Conservation Guide 13/6, Forestry Dep., FAO, Rome, Italy, 170 pp., 1990, English**

This document is published as the sixth volume of Conservation Guide No. 13 within the FAO Conservation Guide series.

The document is a guide for watershed managers and planners, providing basic knowledge and practical approaches for the survey and planning of small upland watersheds with combinations of forest, cultivated and grazing lands and populated mostly by small farmers. The manual consists of three parts. The first part gives an overall introduction and explains what preparatory work is needed. The second parts covers survey approaches and techniques together with specific examples. The third part describes planning and plan formulation.

**Keyword:** Guideline, Watershed management, Land conservation, Soil conservation, Water conservation, Forest management

**FAO**

**Strategies, approaches and systems in integrated watershed management**  
**FAO Conservation Guide 14, Forestry Dep., FAO, Rome, Italy, 232 pp., 1986, English**

This document constitutes the proceedings of an expert meeting on strategies, approaches and systems in integrated watershed management held in Kathmandu, Nepal, from 25 February to 1 March 1985.

The purpose of this meeting was to: (i) make an assessment of the accrued knowledge and experience on methods and approaches for achieving watershed management in uplands and mountainous areas of developing countries, and (ii) recommend the most suitable ways to formulate and implement national programmes and to develop specific projects in watershed management in conditions of high population pressure of rural communities practicing shifting cultivation, grazing and other uses of forest land.

The first section of the document is an executive summary which contains conclusions and recommendations that were reached by the participants. The intent of this section is in part to highlight the

presentations and discussions of the expert group and, more importantly, to impart to national leaders and other policy and decision-makers at the highest levels of governments of developing countries, the message that watershed problems severely constrain natural resource and rural development programs and that it is urgent to correct the situation.

Following the executive summary are the technical papers and discussion summaries that have been grouped together under common themes.

**Keyword:** Watershed management, Shifting cultivation, Forest management, Forest policy

**H.M. GREGERSEN, K.N. BROOKS, J.A. DIXON & L.S. HAMILTON**  
**Guidelines for economic appraisal of watershed management projects**  
**FAO Conservation Guide 16, Forestry Dep., FAO, Rome, Italy, 144 pp., 1987, English**

The purpose of this document is to contribute to a better understanding of the economic implications and impacts of watershed management activities and projects. Such insights can only be generated by a thorough integration of physical and biological considerations with economic considerations. Thus, the framework for analysis established in the early parts of the book explicitly provides for such an integration and a logical model within which the estimation of physical input-output relationships can, to the best extent possible, smoothly lead into quantitative measures of economic worth. The integration has been facilitated by having two economists, one watershed hydrology specialist and a forest resource specialist make up the writing team.

**Keyword:** Watershed management, Guideline, Forest hydrology, Social and economic analysis

**M.C. FELLER**  
**Water balances in *Eucalyptus regnans*, *E. obliqua*, and *Pinus radiata***  
**forest in Victoria**  
**Australia Forestry, Australia, 44(3), 153-161, 1981, English**

The movement of precipitation in a forest, as throughfall, stemflow, canopy interception, forest floor interception, and forest floor leachate was estimated from measurements made in two eucalypt forest types (*Eucalyptus regnans* and *E. obliqua*) and a *Pinus radiata* plantation in the Maroondah catchment, which lies on the southerly slopes of the Great Dividing Range approximately 60 km northeast of Melbourne. The amount of water immobilized by the growing trees in all three forests and that transpired by the trees in the two eucalypt forests were estimated from available data. The greater stream flow from the *E. regnans* forests, compared to the *E. obliqua* forests is due partly to the greater precipitation falling on the *E. regnans* forests and may also be partly due to their small transpiration losses. Less water reached the mineral soil beneath the *P. radiata* plantation than beneath the adjacent *E. obliqua* forest. This together with other studies suggest that replacement of dry sclerophyll eucalypt forest with pines will lead to declines in water yield unless the pines are heavily thinned, but the generality of this is still uncertain.

**Keyword:** Eucalypt, Pine, Water balance, Plantation

**JAMES H. FRENCH & ROMEO H. GECOLEA**  
**A forester's guide for community involvement in upland conservation**  
**- with special reference to the Asia and Pacific region**  
**Forestry Dept., FAO, Rome, Italy, 125 pp., 1986, English**

The active involvement of rural communities was found to be a critical ingredient in the more successful upland conservation programmes. Ability to deal with local people is as important for foresters as are their technical skills. However, it is also observed that a major constraint in achieving such involvement has been a shortage of dedicated local leaders and foresters who have the skill to do the job.

This guide, therefore, evolved out of a need for practical advice which can be directly applied by foresters. The guide aims to assist the forester and conservation field practitioner in their endeavour to supplement their technical background with knowledge and guidance on how to involve upland communities in forestry and conservation.

**Keyword:** Community forestry, Social forestry, Watershed management, Soil conservation, Land conservation

**FAO**

**Soil erosion by water (some measure for its control on cultivated lands)**

**FAO Land and Water development Series, FAO, Rome, Italy, No. 7, 284 pp., 1965, English**

Soil erosion is directly related to food shortages and hunger. Eroded land is unproductive land, and therefore, in many parts of the world, the control of erosion is essential in order to maintain the productivity of farming land. However, in developing countries it often happens that individuals with limited experience of soil conservation and erosion control are called upon to initiate programs for these purposes, to plant control measures and to supervise construction. The primary object of this book is to provide a general reference work for those who have little material available.

Contributions from specialists in the United States provided the material for the main part of the book. It deals with the results of investigations of water erosion, and with the methods of control that are successfully used in North America.

**Keyword:** Erosion, Soil conservation, Land-use, Soil management

**FAO**

**Soil erosion by wind and measures for its control on agricultural lands**

**FAO Land and Water Development Series, FAO, Rome, Italy, No. 6, 89 pp., 1960, English**

This paper has been prepared by the staff of the Agricultural Engineering Branch, Land and Water Development Division of FAO.

Major areas of occurrence and damages caused by wind erosion of soils are briefly described in the study as an indication of the scope and serious nature of the problem in many agricultural areas. The process of soil erosion, its effect on the soil and the dominant soil and land surface conditions relating to soil erodibility are discussed in some detail, since they are the basis for control measures.

The chapter entitled "Wind erosion control measures" describes those which have been successfully developed in North America, Australia and elsewhere. Particular attention is devoted to the part that improved tillage and cultural practices play in control of soil erosion by wind in dry-farming areas.

**Keyword:** Erosion, Wind, Vegetation, Soil conservation

**FAO**

**Forest influences (An introduction to ecological forestry)**

**FAO Forestry Series, FAO, Rome, Italy, No. 9, 307 pp., 1962, English**

In the hydrological cycle, man with his present knowledge is only able to exercise measures of control on water after it reaches the ground. It is at the soil surface that varying degrees of control of water are effective. Broadly, these control measures are biological and structural. The present study deals with the biological and physical influences of a vegetative soil cover, particularly tree growth, as it relates to the weather and other environmental factors and to the influence that shelterbelt of trees and shrubs have on adjacent and intermingle land areas.

Highly controversial are the means of determining in the total economy of a region the money values represented by the influence of forests and other protective vegetal cover. For this reason, the relationship of costs to benefit in watershed rehabilitation programs are extremely difficult to assess, particularly in situations where land hunger results in unwise land use practices, regardless of the location of the land, its potentialities, and its limitations. Some of the problems of evaluation and their possible solution are discussed in the chapter on the economics of forest influences.

**Keyword:** Infiltration, Rainfall interception, Evaporation, Transpiration, Water storage, Hydrology



**KOMOL NGAMSOMSUKE, PRASAT SAENCHAI et al.**

**Farmers attitudes towards forest plantation and conservation farming in selected villages of the Phu Wiang Valley, Khon Kaen  
Integrated Development of the Phu Wiang Watershed Thailand,  
UNDP and FAO, Field Document 3, 156 pp., 1987, English**

The government of Thailand, assisted by UNDP and FAO, is carrying out the integrated development of the Phu Wiang Watershed to prevent deterioration of the upland catchments, protect the existing forest reserve and improve the living condition of the rural population. A good mutual understanding between the project and the watershed population is considered crucial for sustained success.

This report presents the results of a study of attitudes of the Phu Wiang watershed population toward forestry and conservation farming. The study was conducted by the Rural Systems Research Project of Khon Kaen University using rapid rural appraisal techniques and formal questionnaire survey. The report contains information on the following.

- (1) forest product use ... food, medicine, wood, etc.
- (2) villager perceptions of environmental - ecological relationships and their impact ... water supply, soil problems, deforestation and forest fires.
- (3) Farmer perception of, and attitudes toward, reforestation ... benefits, disadvantages, farmers' adjustments and recommendations.

**Keyword:** Watershed management, Social forestry, Community forestry, Environmental conservation, Soil conservation

**M. M. WAIRAGU**

**Run-off harvesting in Kenya: experiences gained from the Njemps Flats of Baringo district  
Kenya Forest Research Institute Technical Note, Kenya, No. 15, 20 pp., 1991, English**

The study has given useful information for run-off management in the area and can be applied to other dry areas with similar conditions. As an effective run-off harvesting requires a good knowledge of run-off pattern, the following steps are recommended.

- (a) Determination of the hydrological response and run-off potential of the planting sites.
- (b) Determination of the moisture deficit and then the micro-catchment plot size.
- (c) Determination of the run-off variability patterns which then determines factors like the planting dates and species selection.

**Keyword:** Run-off of soil, Forest hydrology, Catchment, Afforestation

**D.K. GANGULY**

**Soil conservation in the Damodar valley  
The Indian Forestry, India, Vol. 116(1), 11-16, 1990, English**

The Damodar Valley in the eastern India extends over 5.6 million ha and is inhabited by nearly 30 million people. The valley is drained by many rivers and rivulets of which Damodar is the major one flowing along a distance of 540 kms. The entire precipitation is in the form of rain which is concentrated during the three monsoon months. To prevent recurrence of severe floods, a Corporation was created in 1948 which constructed a number of reservoirs to store water for flood cushion and undertook integrated soil conservation measures. The valley is long, narrow and gently sloping, with outcrops of hillocks. The soil is poor and only about 25% of land is under regular cultivation. The valley is thickly populated. The traditional soil conservation measures like field bunds, gully bunds, check dams, afforestation are being implemented. The implementation of the work is monitored and evaluated. The available data have been analysed. A new approach with modification in technology and methodology has been suggested. The DVC with an open mind have initiated steps for a gradual change over keeping a close watch on the effectiveness.

**Keyword:** Soil conservation, Flood, Stream work, Water conservation

**P.C. PATHAK, Y.S. RAWAT & R.P. SINGH**

**Rainfall interception by leaf litter in central Himalayan forests**  
**The Indian Forester, India, Vol. 115(11), 822-831, 1989, English**

Litter biomass interception by different forest ecosystems in Central Himalaya was assessed during the 1982 monsoon season. Average litter biomass varied from 6.2 to 7.1 t ha<sup>-1</sup> and the litter interception ranged in between 7.9 to 11.8% of gross rainfall among the sites. The broadleaf species intercepted greater amount of rain water compared to the conifers.

**Keyword:** Litter layer, Biomass, Rainfall interception

**OM KUMAR & H.N. MATHUR**

**Water quality status in Doon valley forest**  
**The Indian Forester, India, Vol. 115(8), 526-535, 1989, English**

The major part of Doon Valley Forest is drained into river Ganga through two main tributaries Song and Suwa river. The water of these streams are used by rural people for drinking, bathing and agriculture, one important forest recreation spot is also located on the Song river.

The studies on water quality status have been carried out on the perennial streams Song, Suswa and Reh, selecting the eight representatives sites. Temperature, conductivity and pH of water samples analysed have been described in this paper.

**Keyword:** Watershed, Water quality

**ANIL BERRY**

**Perspective plan of watershed management of Himalayan region**  
**Indian Forestry, India, Vol. 114(7), 349-359, 1988, English**

Watershed Management as an integrated multidisciplinary task covering works of Forestry, Agriculture, Horticulture, Animal Husbandry, Minor Irrigation, Soil Conservation and Energy Conservation, is the right approach for conserving Himalayan eco-system and checking its bio-degradation. For it, proper data base be generated by collecting field information in an all India standardised format for the whole of the Himalayan region. The data collection and project formulation works are estimated to cost Rs. 12 crores. The estimated cost for executing the watershed management works in the whole hill region of India covering 12 States would be of the order or Rs. 1900 crore for a five year plan period, extending over five FYPs, @ 2200 Rs./ha based on a few case studies. These works will not only conserve Himalayas but will bring multi-farious benefits to local and down-stream communities.

**Keyword:** Watershed management, Ecosystem, Cost analysis, Soil conservation, Water conservation

**E.R.C. REYNOLDS, R.M. SINGHAL & S.P. PANT**

**Investigation the water-table under *Eucalyptus hybrid***  
**by resistivity method**  
**The Indian Forester, India, Vol. 114(6), 320-327, 1988, English**

Hydrologically it is important to distinguish phreatophytic vegetation, as the access to the water-table enables plants to transpire the full potential and not conserve water. However, there is much misunderstanding outside the hydrological discipline on the location and behaviour of the water-table. We describe the methods of wells and electrical resistivity which we have employed in a Terai *Eucalyptus* plantation to study the water-table, and we discuss the preliminary results which as yet demonstrate little direct abstraction by the trees from water-table deeper than 1.5 metres.

**Keyword:** Water balance, Eucalypt, Forest hydrology

**R.P. SINGH**

**Rainfall interception by *Pinus wallichiana* plantation in temperate region of Himachal Pradesh, India**

**The Indian Forester, India, Vol. 113(8), 559-565, 1987, English**

In the present investigation deals with the rainfall interception by *Pinus wallichiana* plantation in temperate region of Himachal Pradesh. Of the total rainfall (1327.20 mm), 2.73% (36.27 mm) stemflow; 76.23% (1011.82 mm) throughfall and 21.02% (279.11 mm) interception loss were recorded respectively for the whole study period. The minimum interception loss (10.08%) was observed in the month of August, 1983 which had the maximum (198.00 mm) rainfall. The highest interception (75.00%) was recorded in the month of March, 1984, which had the lowest (4.00 mm) rainfall. Interception loss was decreased with the increasing amount of interception.

**Keyword:** Rainfall interception, Pine, Stemflow, Throughfall, Plantation

**L.J. BREN**

**Flooding characteristics of a riparian red gum forest**

**Australian Forestry, Australia, 51(1), 57-62, 1988, English**

Information extracted from 0.5 x 0.5 km cells on maps depicting floodings since 1963 in a red gum forest near Barmah. Victoria were combined with historical records of water flow in the River Murray to prepare maps showing some characteristics of the floods occurring in the forest from 1985 to 1984 inclusive. Characteristics estimated included the distributions of frequency, duration of flooding, and duration of periods between flooding.

**Keyword:** Flood

**P.M. CORNISH**

**Water quality in unlogged and logged eucalypt forests near Bega, N.S.W., during a nine year period**

**Australian Forestry, Australia, 52(4), 276-285, 1989, English**

There were increases in stream turbidity levels over a nine year period in a eucalypt forest near Bega, during which time integrated logging for sawlogs and woodchips and associated logging track construction occurred. While these increases were statistically significant their magnitude was less than 1 NTU and would have had no effect on water values or stream ecology. The imposition of stringent erosion mitigation measures during logging and a period of drought would have both contributed to this result.

Specific conductivity values of the streamwater were related to the major bedrock in the catchments. These values declined relatively in one logged catchment as a possible consequence of dilution resulting from increased flow associated with reduction in vegetation and hence transpiration.

This effect was not observed in another catchment subject to logging at a low intensity.

**Keyword:** Water quality, Logging, Logging machine, Turbidity

**L.J. BREN**

**Modelling the influence of river Murray management on the Barmah river red gum forests**

**Australian Forestry, Australia, 54(1-2), 9-15, 1991, English**

Three modelled sequences of estimated average monthly flows of the River Murray were used to study the likely effects of river management on the frequency and duration of flooding of the river red gum forest at Barmah in northern Victoria. One model gave monthly flows in the River Murray at Yarrawonga from 1890 to the present with no regulation or diversions. The second model gave flows with Hume Dam regulation and diversion. The third model gave flow with Dartmouth and Hume Dam regulation and diversion. This corresponds to "current" regulation. The Hume Dam (only) sequence was regarded as the one that correspond best to the state of the river for which forest flooding data were available. A relation between the average

monthly flow (expressed in gigalitres per day) and the percentage of forest flooded was used to transform the historical sequences of monthly flows into the corresponding maximum monthly percentages of forest flooded. This, in turn, was used as input in a grid cell model of the forest flooding based on historical flood maps. From the estimates of the maximum monthly extent of flooding between 1890 and 1984, statistical parameters describing the change in flooding regime for the "natural" and the "current" river were computed.

The results showed an average annual reduction of 1-2 months duration in flooding and a substantial increase in the time between flooding for all sites. many sites may suffer a 50% reduction in flooding frequency. This suggests that the vigor of the red gum within the Barmah Forest will be diminished, and some red gum areas may revert to dryland box forest.

**Keyword:** Flood, Flow rate, Forest land

#### **L.J. BREN**

##### **The contribution of River Murray tributaries to the flooding of Barmah forest Australian Forestry, Australia, 54(1), 23-29, 1991, English**

The contribution of River Murray tributaries to the flooding of the Barmah river red gum forest was examined. The main stem of the River Murray above Lake Hume was the major source. Removal of this would lead to a 55% decrease in forest flooding. Removal of either the Ovens or the Mitta Mitta Rivers would give a 30% reduction in flooding. Removal of the Kiewa River would give a 15% reduction in flooding. All tributaries act to some extent in concert. A backwater influence due to high water levels at the downstream confluence of the Gouburn and Murray Rivers may cause high water levels at Barmah. Because of the short-lived nature of these high water levels it is unlikely that such floods penetrate far into the forest.

**Keyword:** Flood, Water conservation, Watershed, Vegetation

#### **A. FALKLAND**

##### **Hydrology and water resources of small island: a practical guide Studies and reports in hydrology UNESCO, Paris, France, 435 pp., 1991, English**

This guide has been prepared to assist technical hydrologists, engineers and managers in the identification, assessment, development, management and protection of water resources on small islands. It is not intended as a textbook or manual of practice, but rather as a guide to the selection of methods and practices, appropriate to the special conditions of small island.

The guide is presented in eight chapters:

Chapter 1 presents definitions and distinctions between small and very small islands, some details and problems of small islands and the types of fresh water occurrence on small islands.

Chapter 2 deals with conditions for water occurrence in small islands including climate, geology, geomorphology, soils and vegetation.

Chapter 3 describes the hydrology of small islands including hydrometeorology, hydrological processes, water balance studies.

Chapter 4 presents details of water resources assessment and measurement in small island.

Chapter 5 outlines the uses of water on small island.

Chapter 6 considers training, education, research and technical cooperation aspects of small islands.

Chapter 7 contains reference material and Chapter 8 presents thirteen case studies on small islands from various parts of the world.

**Keyword:** Hydrology, Geological feature, Water balance, Water conservation

## 5-2 Soil Conservation

### **UNSO**

#### **Desertification control through rural community forestry development in Karamoja (Uganda), Project Proposal Descon IV**

**United Nations Sudano-Sahelian Office (UNSO), 25 pp., 1983, English**

The primary cause of desertification in Karamoja today is the cutting of tree and woody shrubs for fuel and building materials. The removal of the thorn acacias for fencing around dwellings and homesteads has also led to a considerable reduction in regenerative capacity of these trees which would otherwise help in the control of wind erosion and help mitigate the effects of droughts. It is in the plain that most of the human activities take place and also where the impact of desertification is most serious.

This paper is the project proposal for desertification control programme in Karamoja, Uganda. Desertification is largely a result of human activity, deforestation being one of its principal causes. The project aims at mainly expanding the afforestation of rural Uganda through planting timber and fruit trees around homestead, and reducing human pressures on existing forest cover. Therefore, the rural communities are involved in implementing of the project.

The implementation of the project will contribute towards increasing the public awareness of the uses of plantation for fuelwood and fodder from which economic benefits may be derived.

**Keyword:** Desertification, Deforestation, Afforestation, Community forestry

### **FAO**

#### **Shifting cultivation and soil conservation in africa - papers presented at fao/sida/arcn regional seminar, nigeria, 1973**

**FAO Soils Bulletin, FAO, Rome, Italy, 248 pp., 1974, English**

This Regional Seminar on Shifting Cultivation and Soil Conservation in Africa has been organized by FAO in cooperation with the Swedish International Development Authority and the Federal Government of Nigeria. The Seminar is the outcome of numerous recommendation and proposals made to FAO during recent years by meetings of different types, by countries and by persons concerned with the problems of traditional farming in relation to changing requirements.

The programme of the Seminar focussed first on identifying the nature of the shifting cultivation problem both in general and in Africa in particular, with a review of the positive and negative effects of the farming practices involved. The papers and discussion which followed covered current work on the problem, the need to make areas of shifting cultivation more productive, the possibilities of doing so, and the interrelation between shifting cultivation and soil conservation. Finally, proposals were worked out for the introduction of changes in shifting cultivation that would meet the objectives of soils conservation in the context of practical agriculture.

**Keyword:** Shifting cultivation, Soil conservation, Environmental conservation

### **NORMAN W. HUDSON**

#### **Soil and water conservation in semi-arid areas**

**FAO Soils Bulletin 57, FAO, Rome, Italy, 172 pp., 1987, English**

This bulletin does not offer easy solutions to all the problems of soil and water conservation in semi-arid regions. There is no storehouse of tested methods and techniques ready to be taken off the shelf for immediate application. The conditions vary too much - climate, soil, and social and economic factors. Instead, this bulletin reviews methods and techniques which have been tested and found useful somewhere, and which might be suitable for use in other conditions. The objective is to make the bulletin relevant anywhere that rainfall is a problem because of amount, distribution, or unreliability. The bulletin argues strongly, and presents evidence, that drought is part of the natural order in semi-arid areas, and that the recent disasters of degradation and famine in Africa result from misuse and mis-management of natural resources which reduced the region's

ability to cope with the additional stress of drought.

In semi-arid areas the landscape is always a mixture of woodland, bush, grazing land and arable land, and trees or shrubs are always a part of the ecosystem. The usual techniques for afforestation are seldom appropriate in semi-arid areas because of the unreliability of the rainfall. The methods suggested are variations of the rainfall multiplier approach for cropland. They range from a small basin in which a tree seedlings is planted, perhaps with small channels to lead extra water to the basin, up to 250 m<sup>2</sup> microcatchments developed in the Negev desert in Israel.

**Keyword:** Soil conservation, Water conservation, Semi-arid, Deforestation

#### **FAO**

##### **Guidelines for watershed management**

**FAO Conservation Guide 1, Forestry Dep., FAO, Rome, Italy, 293 pp., 1977, English**

This "Conservation Guide" is one of a series of publications which illustrate conservation techniques, examples of land rehabilitation and watershed management principles, primarily for mountain lands, forests, eroded areas and other lands not normally used for intensive agriculture. The papers are based on case studies from all regions but are mainly oriented to provide practical examples of interest to developing countries. The topics in the volume presented here include: erosion evaluations, watershed management principles, erosion control methods, land classification, land use planning, slope rehabilitation by terracing, remote sensing for watershed management, the cost/benefit relations of conservation, landslide problems, environmental impact evaluations and water quality measurements.

**Keyword:** Watershed management, Watershed, Land conservation, Erosion, Land-use, Land slide, Hillside erosion control

#### **S.H. KUNKLE & J.I. THAMES**

##### **Hydrological techniques for upstream conservation**

**FAO Conservation Guide 2, Forestry Dep., FAO, Rome, Italy, 134 pp., 1976, English**

This "Conservation Guide", Number 2, contains 12 papers which are examples and case studies of hydrological methods related to conservation work, particularly in mountain and forested zones. The examples include torrent control, sedimentation surveys, some field techniques for estimating runoff, measurement of snow cover in the mountains, surveys for erosion and water quality measurements, as well as case studies of forest influences and evaporation measurements.

**Keyword:** Water conservation, Soil conservation, Torrent work, Sediment yield, Surface runoff

#### **FAO**

##### **Conservation in arid and semi-arid zones**

**FAO Conservation Guide 3, Forestry dep., FAO, Rome, Italy, 125 pp., 1976, English**

This collection of articles from conservation specialists in nine countries around the world reviews a number of conservation techniques for arid and semi-arid areas from the point of view of forestry and range management and with emphasis on developing countries.

The phenomenon of desertization is described, including the problems of wind, rangeland degradation, erosion, water shortage and blowing dunes. Examples are then given for the correction of these problems including: techniques for erosion and degradation surveys; dune stabilization and afforestation methods; shelterbelt establishment guidelines; ways to restore degraded rangelands; range management guides; rainfall harvesting methods; vegetation management schemes and methods for terracing and other treatment of slopes.

**Keyword:** Semiarid region, Desertification, Soil conservation, Erosion, Afforestation, Shelterbelt, Land conservation, Arid region

#### **FAO**

##### **Special readings in conservation**

**FAO Conservation Guide 4, Forestry Dep., FAO, Rome, Italy, 101 pp., 1978, English**

This group of papers in Number 4 of the "FAO Conservation Guide" presents particular techniques used in the conservation of forest, mountain and wildland areas. The six papers include material on: the use of fire to improve the management of forest lands; management of snow in mountain areas of temperate countries; the use of certain mulching techniques for shrublands; a method to evaluate temperature on a watershed; hydro-seeding: procedures, examples and prospects in Jamaica; and forest plantation techniques for the rehabilitation of eroded lands.

**Keyword:** Land conservation, Forest land conservation, Degraded land, Silvicultural technique

#### **FAO**

**Sand dune stabilization, shelterbelts and afforestation in dry zones**

**FAO Conservation Guide 10, Forestry dep., FAO, Rome, Italy, 232 pp., 1985, English**

The FAO/DANIDA Training Course on Sand Dune Stabilization, Shelterbelts and Afforestation in Dry Zones took place from 3 to 30 March, 1980 and was sponsored by the Danish International Development Agency (DANIDA) and FAO in cooperation with the Government of India, Ministry of Agriculture and Irrigation, Central Arid Zone Research Institute, Jodhpur. The course was organized in New Delhi, Jodhpur and Hissar.

Twenty forestry officers from the following 11 countries attended the course: Afghanistan, Botswana, Egypt, Ethiopia, Nigeria, Pakistan, Somalia, Sudan, Syria, Turkey and India. The participants were professional foresters and development officers concerned with research and development on dune stabilization, shelterbelts, arid zone afforestation and management.

The training course offered 28 formal lectures by FAO staff and consultants and scientists from India, and dealt with the basic principles of the different aspects of sand dune stabilization, shelterbelt establishment and afforestation. These lectures were complemented by field excursions, practical field exercises and discussion groups.

The information presented in this report is the result of the training course.

**Keyword:** Arid region, Shelterbelt, afforestation, Training, Forest management

#### **FAO**

**Watershed management field manual: slope treatment measures and practices**

**FAO Conservation Guide 13/3, Forestry Dep., FAO, Rome, Italy, 144 pp., 1988, English**

This document is published as the third volume of conservation Guide No. 13 with the FAO Conservation Guide series.

The purpose of the document is to provide practical guidance on land preparation for afforestation and cultivation on sloping land affected by water erosion. Part I deals with practices and techniques for land clearing and preparation for afforestation in watersheds. Special consideration is given to environmental effects and means to minimize erosion. Part II on terraces and ditches describes conservation methods and land treatment for agricultural use of sloping land, ranging from annual to permanent crops. Layout, construction and maintenance of terraces and hillside ditches are described in detail, as well as the protection of terrace risers, outlets and waterways.

**Keyword:** Watershed, Watershed management, Guideline, Soil conservation, Erosion, Water conservation

#### **FAO**

**FAO watershed management field manual: landslide prevention measures**

**FAO Conservation Guide 13/4, Forestry Dep., FAO, Rome, Italy, 156 pp., 1988, English**

This document is the fourth volume of Conservation Guide No. 13 published within the FAO Conservation Guide series.

This document describes and classifies landslides and landslide phenomena. Detailed specifications are provided for investigation and maintenance of slope stability as a basis for detection of and early warning against landslides. Measures for slope stabilization through mechanical and vegetative means are described.

**Keyword:** Land slide, Hillside erosion control, Hillside work, Erosion, Afforestation, Guideline

**FAO**

**Watershed management field manual: road design and construction in sensitive watersheds**

**FAO Conservation Guide 13/5, Forestry Dep., FAO, Rome, Italy, 196 pp., 1990, English**

This document is the fifth volume of Conservation Guide No. 13 published within the FAO Conservation Guide series.

The document provides detailed specifications for road design and construction in mountain areas in sensitive watersheds where on-site protection of the road itself as well as the downstream effects of soil disturbance and changes in drainage patterns are important considerations. Protection includes provision for adequate drainage as well as surface and slope protection measures. Road construction and maintenance techniques are adapted to conditions of low traffic volumes in steep terrain.

**Keyword:** Guideline, Watershed management, Forest road, Land conservation, Revegetation on cut slope

**R.P. SINGH**

**Hydrological response of coniferous forest in temperate region of Himachal Pradesh**

**The Indian Forester, India, Vol. 115(5), 310-319, 1989, English**

The state of Himachal Pradesh is mountainous except small valley areas adjoining Punjab, Haryana and Uttar Pradesh. The elevation varies from 350 m in the foot hills to 6,975 m in the high hills. So the climate varies from sub-tropical, mountain temperature to arctic in high mountains covered perpetually with snow. The northern-most area of the state has cold desert conditions and does not receive rainfall during monsoons; most of the precipitation being received through snow during winter. The annual precipitation in the state varies between 40 mm to 1300 mm.

The present paper deals with the different aspects of hydrological cycle in coniferous forest of Himachal Pradesh and some suggestions have been made to minimize the soil erosion and sedimentation.

**Keyword:** Conifer, Forest hydrology, Erosion, Sediment yield

**ANTHONY YOUNG**

**Agroforestry for soil conservation**

**ICRAF Science and Practice of Agroforestry 4, ICRAF, Nairobi, Kenya 276 pp., 1988, English**

This book provides the most authoritative analysis available up to now of the various hypotheses that trees and shrubs, if properly chosen and managed, have a potential to conserve the soil's productive capacity. Soil conservation is not seen in its traditional, narrow sense of preventing water and wind erosion, but in the broader and much more important sense of maintaining soil fertility. It was written by a scientist for a scientific and technical audience, explaining clearly what we know about tree-soil relations, what are reasonably well founded hypotheses calling for further research, and what is plain speculation or misconception. The main value of this book is that it brings together a substantial amount of information from fundamental research, applied research and observations of real farm and forest conditions.

**Keyword:** Shrub, Soil conservation, Agro-forestry, Research and development



## 6. FOREST PRODUCTS

### 6-1 Timber

**CHRISTOPHER N. LEMA, MASONIC M. KITALI & GUSTAV S. KLEM**

Basic density and its variation within and between trees of pine (*Pinus patula*) and cypress (*Cupressus lusitanica*) in the Meru Forest Project  
Faculty of Agriculture, Forestry and Veterinary Science,  
University of Dar es Salaam, Tanzania, Record No. 3, 11 pp., 1978, English

Increment core samples were taken at breast height from 112 trees of pine (*Pinus patula*) from 6 different plots, and from 82 trees of cypress (*Cupressus lusitanica*) from 4 different plots, all in planted stands in the Meru Forest Project in Tanzania. Tree age varied from 15 to 21 years and breast height diameters from 11 to 48 cm.

The increment cores were divided in three parts representing juvenile, transition and mature wood. Basic densities were determined for the three parts separately and for the whole core as oven dry weight divided by green volume.

The main results were these:

- average diameter weighted basic density at breast height for pine was  $438 \text{ kg/m}^3$  and for cypress  $375 \text{ kg/m}^3$
- basic density in 16-22 year old pine varied from  $352 \text{ kg/m}^3$  near the pitch to  $489 \text{ kg/m}^3$  near the bark.
- Basic density in 15-16 year old cypress did not show any significant variation from pitch to bark
- neither of the species showed any significant correlation between basic density and tree diameter
- pine showed increasing basic densities with increase in annual rainfall in the range of from less than 500 to more than 1,500 mm. Cypress did not show any clear correlation between basic density and rainfall
- in species with consistent changes in wood basic density with age the volume based curves for mean and current annual increments will give a wrong estimate of the dry matter or wood substance produced. A correct basis for the determination of rotation periods can be obtained from curves for mean and current annual production corrected for basic density.

**Keyword:** Pine, Plantation, Wood quality, Density, Diameter grade, Precipitation

**WINNYSTON N. RINGO & GUSTAV S. KLEM**

Basic density and heartwood content in the wood of *Pinus patula* from Sao Hill  
Faculty of Agriculture, Forestry and Veterinary Science,  
University of Dar es Salaam, Tanzania, Record No. 14, 17 pp., 1978, English

Basic density variations and heartwood content were studied in *Pinus patula* trees aged between 16 and 25 years from the Sao Hill Forest Project in southern Tanzania.

Axial and radial wood density variations were studied in two groups of 10 trees, all 25 years old and randomly selected from two compartments in one management block. Disks of 2.5 cm 2 m intervals from the stump, including breast height, from each tree. One sector with  $40^\circ$  apex angle was marked and sawn from each disk in the first ten trees. Two increment cores, two sectors and two radial strips were extracted from each disk in the second batch of ten trees. Variation between stands was studied on single increment cores extracted at breast height from 50 randomly picked trees from the oldest stands in each of four management blocks.

Green volume and oven dry weight were then obtained for whole sectors, parts of radial strips and whole increment cores. Basic density was calculated from oven dry weight and green volume.

These were the main results:

- mean whole tree volume weighted basic density for 25 year old *Pinus patula* grown at Sao Hill is  $410 \text{ kg/m}^3$  with a standard deviation of  $32 \text{ kg/m}^3$
- single increment cores extracted at breast height can be used to estimate whole tree volume weighted basic density. Basic density values for increment cores may underestimate the latter slightly
- basic density increases significantly from pith outward at all stem heights, but most sharply from stump

- to 8 m height
  - basic density decreases significantly in the stem from stump to tree top
  - there is significant positive relationship between wood density and tree age
  - stem dry matter production culminates at 16-17 years of age for site classes 24 and 27 and 16-18 years for site class 30
  - the wood contains insignificant amounts of heartwood.
- Keyword:** Pine, Heartwood, Density

**MICHAEL G. WHITE, ADAMU S. KIJAZI, JONASAI E.N. MAPHOLE et al.**  
**Strength properties and tracheid lengths in pine (*Pinus patula*) and cypress (*Cupressus lusitanica*) from the Meru forest project**  
**Faculty of Agriculture, Forestry and Veterinary Science, University of Dar es Salaam, Tanzania, Record No. 15, 11 pp., 1980, English**

Samples for strength testing of *Pinus patula* and *Cupressus lusitanica* were taken from a bolt at 5% of tree height from five trees in each of two stands for each species. Standard samples of 2 x 2 x 30 cm were tested at 12% moisture content. The pine trees were 19-22 years old, the cypresses were 16-17 years old.

Samples for tracheid length measurements were taken from disks cut at four different heights from the same trees. Five radial positions in each disk were sampled, from each position the length of 30 tracheids was measured.

The main results were these:

- *Pinus patula* showed moduli of rupture and elasticity of 81 and 9,794 N/mm<sup>2</sup> respectively, energy to maximum load and to fracture of 0.085 and 0.114 mmN/mm<sup>3</sup> respectively and compression strength parallel to grain of 39 N/mm<sup>2</sup>. The pine samples showed a significant increase in strength from pith to bark
- *Cupressus lusitanica* showed moduli of rupture and elasticity of 62 and 4,938 N/mm<sup>2</sup> respectively, energy to maximum load and to fracture of 0.092 and 0.098 mmN/mm<sup>3</sup> respectively and compression strength parallel to grain of 30 N/mm<sup>2</sup>. The cypress samples showed no significant increase in strength from pith to bark, possibly because of the low ages of the trees sampled
- tracheid lengths of *Pinus patula* and *Cupressus lusitanica* were on average 3.6 and 2.2 mm respectively, both species showing a significant increase in tracheid length from pith to bark
- the juvenile wood phenomenon, i.e. low strength and short tracheids, was pronounced in both species and points to the necessity of long rotation periods if maximum strength and tracheid length are required.

**Keyword:** Pine, Physical quality of wood

**ELY J.M. MWANZA**  
**Some factors influencing natural decay, resistance in eucalyptus and cedar**  
**Research Note, Kenya Forestry Research Institute (KEFRI), Muguga, Kenya**  
**No. 1, 24 pp., 1989, English**

The natural decay resistance of wood of five species of Eucalyptus was compared with *Juniperus procera* (Cedar) in the laboratory by inoculating with brown and white rot fungi and in the field (graeyard) by exposing the wood to environmental conditions like to be encountered in nature. Under laboratory conditions, wood samples in contact with the soil generally decayed to a greater extent than those buried in the soil. Wood of *J. procera* and *Eucalyptus microcorys* was more resistant to decay than that of the other species. After five years in the field, wood billets of *E. saligna* and *E. grandis* had incipient rot while those of *E. camaldulensis*, *E. globulus*, *E. microcorys* and *J. procera* had only superficial mycelium. Termite attack was severe on *E. saligna*, moderate on *E. globulus* and *E. grandis*, and slight on *E. camaldulensis*, *E. microcorys* and *J. procera*. The overall results suggest that timbers of *E. microcorys* and *J. procera* are more resistant to decay at the age of twenty years and do not indicate significant differences in decay resistance.

**Keyword:** Fungi damage, Control measure, Inoculation, Fungus, Eucalypt

**B.T. KIMARYO & E.A. MOSHI**

**List of research publications 1957-1991, third edition**

**Timber Utilization Research Center, Tanzania Forestry Research Institute,  
Tanzania, 20 pp., 1991, English**

This publication is a list of research publications issued in the period of 1957-1991 by Timber Utilization Research Center, Tanzania Forestry Research Institute.

**Keyword:** Wood utilization, Wood quality, Research system, Research and development

**S.K. SANWO**

**Intra-tree variations of strength properties in plantation grown teak  
and techniques for their systematic sampling**

**O.F.I. Occasional Papers, Oxford, UK, No. 31, 41 pp., 1986, English**

This investigation involved an assessment of the intra-tree variation of some strength properties in teak (*Tectona grandis* L.f) grown in Nigeria: nominal specific gravity, modulus of rupture (MOR), modulus of elasticity (MOE), total work done (TWD) and maximum compressive strength parallel-to-grain (MCS).

Nine trees were examined from three canopy classes: two dominants, five co-dominants and two sub-dominants. Within each tree, systematic sampling was carried out (a modification of Richardson's (1961) methods). Twenty samples were removed from each tree in positions common to all the trees. Non-standard samples were tested, following the procedure of Wood (1970). Results were analysed by graphical analysis by the method used by Duff and Nolan (1953). The results show that within each tree, the pattern of variation of these wood properties is systematic.

This study highlights the techniques of systematic sampling in tropical plantation species, the use of non-standard, small, clear specimens in strength evaluation, and the justification for applying these techniques to fast grown tropical hardwoods.

**Keyword:** Teak, Wood quality, Tree species, Plantation, Evaluation

## 6-2 Non-timber Products

**F.E.M. BOOTH & G.E. WICKENS**

**Non-timber uses of selected arid zone trees and shrubs in Africa**

**FAO Conservation Guide 19, Forestry Dep., FAO, Rome, Italy, 176 pp., 1988, English**

Timber products are almost always seen as the only contribution of forestry to national economies. However non-wood products are also very important and often, most significant to local economies and to the wellbeing of rural people. In dry areas especially, these products make woody vegetation economically and socially relevant to rural people. There are many examples in Africa, Asia and Latin America of non-timber forest products being more important in economic and monetary terms than timber itself. The evolution of forestry in the last two decades has highlighted the importance of these products and related technology, to rural development and particularly to food security.

When deciding on the production of this document, FAO had two main objectives. The first one was to collect and summarize information on production, processing and utilization of a few major non-wood products which are significant at subregional and regional level. The second objective was to identify development constraints and research needs, and make appropriate recommendations for priority action. The requirement was therefore not only for monographs and descriptions of resources and traditional technologies, but also for strategies, methods and courses of action to conserve the resource in a period of rapid degradation and genetic erosion, and to improve known technologies and develop new ones.

The document deals with non-timber uses of 27 species.

**Keyword:** Arid region, Non-timber products, Forest resources, Tree species, Shrub

**FAO**

**Simple technologies for charcoal making**

**FAO Forestry Paper 41, Forestry Dep., FAO, Rome, Italy, 154 pp., 1983, English**

This manual on making charcoal using simple technology systems represents another step by FAO to help overcome fuel shortages in the developing world.

Sixty percent of all wood taken from the world's forests is believed to be burnt as fuel—either directly or by first converting it into charcoal. The proportion of fuelwood used to make charcoal can only be estimated. But it is probably around 25 percent or about 400 million cubic metres per year throughout the world.

Making charcoal by using labour-intensive methods is the concern of this manual. Its main purpose is to inform and orient government agencies and industrialists in developing countries concerned with improving production and distribution of charcoal.

This manual cannot reach easily and directly the mass of small charcoal producers, distributors and users as, in general, they do not acquire knowledge of improved methods from books but from practical experience. This knowledge must be made available to them by government agencies directly or through internationally sponsored development projects.

The manual embodies the collective wisdom of charcoal makers of many countries and is offered in the hope that it will aid both to increase production of charcoal and, at the same time, conserve forest resources by curbing wasteful methods of production.

**Keyword:** Charcoal, Non-timber products, Handbook, Fuelwood

**FAO**

**Industrial charcoal making**

**FAO Forestry Paper 63, Forestry Dep., FAO, Rome, Italy, 133 pp., 1985, English**

Energy is one of the most important commodities required to satisfy the physical needs of mankind. Over the years, limits in the availability, technological changes, locations of resources, prices and use of certain fuels have required the use of new sources of energy.

In most developing countries the traditional methods of charcoal making are the only technology known, but due to shortages and rising prices of raw materials in industrialized countries, new and improved technologies for charcoal production have been developed and taken into the during the last decades. Through technical achievements, the carbonisation of almost any type of forest, wood industry or agricultural residues became feasible and also higher energy yields were obtained by producing commercially valuable by-products. Progress was made in particular in carbonisation of small-sized biomass, in manufacturing charcoal briquettes and in the design of equipment for energy co-generation to produce mechanical, electrical or thermal energy, through the recovery of energy from pyrolysis gases.

This publication is a manual on Industrial Technologies for Charcoal Making which represents another step by FAO to help overcome fuel shortages in the developing world.

The manual embodies the collective wisdom of charcoal makers of many countries and is offered in the hope that it will aid both to increase production of charcoal and, at the same time, to conserve forest resources by introducing more efficient methods of production.

**Keyword:** Charcoal, Industry of forest products, Non-timber products, Fuelwood

**FAO**

**Forestry and food security**

**FAO Forestry Paper 90, Forestry Dep., FAO, Rome, Italy, 128 pp., 1989, English**

This report summarizes the current state of understanding regarding the links between forestry and food security. It is the result of a series of investigations begun in 1985 in response to the widely felt concern that excessive deforestation is threatening not only the soil and water base essential for continued food production, but also the present and future availability of the many forest plants and animals that are sources of food.

The report is a synthesis of the background material and the conclusions and recommendations of the Expert Consultation which was held in 1988, consisting of 57 experts from 27 countries and organizations.

**Keyword:** Forestry, Food production, Deforestation, Forest resources

**GUNNAR POULSEN**

**The non-wood products of africa forests**

**Unasylya, FAO, Rome, Italy, 34(137), 15-21, 1982, English**

African dependence on forests for the needs of everyday life tends to be ignored by many development officials. The forests provides an abundance of essential foods and pharmaceutical products, wood and fibres of all kinds and the environment for wild and domestic animals that people need.

To ensure that the greatest benefit from the non-wood forest resource is drawn for the well-being of people, even more basic action may be needed, i.e., a revision of the ideas guiding forest management and evaluation.

As a suitable goal for forest management where multiple resources are involved, a tentative suggestion might be: attainment of the highest possible level of compound benefits to the well-being of the highest possible level of compound benefits to the well-being of man from the multiple resource which can be ensured while maintaining an optimum relationship between input and return. This optimum will be defined differently according to the availability of capital, manpower, etc. The important point is that the forests of the tropics - in Africa and elsewhere throughout the Third World - have much more to offer than is generally assumed.

**Keyword:** Non-timber products, Food production, Forest resources, Multiple purpose forestry, Forest management

**FAO**

**Non-wood forest products: the way ahead**

**FAO Forestry Paper No. 97, Forestry Dep., FAO, Rome, Italy, 38 pp., 1991, English**

Non-wood forest products (NWFP), as used in this report, refers to market or subsistence goods and services for human or industrial consumption derived from renewable forest resources and biomass, bearing promise for augmenting real rural household incomes and employment.

An extensive bibliographical search reveals that there have been numerous meetings and conferences where the more commercially important NWFP (tannins, cork, turpentine, fungi, etc.) have been the focus of discussion. The more domestic activities, such as food, handicrafts, fuel and fodder derived for subsistence purposes have been increasingly discussed in the realm of the Community Forestry programme.

The development of NWFP is a multi-disciplinary task requiring close collaboration between specialists within FAO and other international and national organizations. More efforts should now be encouraged, as one among many approaches toward conservation and wise use of forest resources.

This publication is intended to serve as a broad guide to issues and potentials regarding NWFP development.

**Keyword:** Non-timber products, Minor forest products, Multiple purpose forestry

**B.N. KIGOMO**

**Distribution, cultivation and research status of bamboo in eastern africa**

**Ecological Series; Monograph No.1, Kenya Forestry Research Institute, Nairobi,**

**Kenya, 19 pp., 1988, English**

Among the local renewable forest resources, bamboo is one of the most important and underdeveloped resources with a high potential for increased productivity. The resource also demonstrates ease for general management and integration into farming system as a multi-purpose resource species.

Bamboos are mysterious plants and encompass many secrets as regard their biology particularly their development. To be able to protect, manage and expand bamboo resources as presently recognised, more information is required for efficient utilization.

With this realisation, and as a starting point in time, the present state is reviewed in regard to the distribution of the indigenous bamboo resource in eastern African region. Also addressed, is the potential and past attempts made in the management of the resource. Potential for expansion of local and exotic germplasm to and within eastern Africa region is discussed.

**Keyword:** Bamboo, Non-timber products, Multiple purpose forestry, Village forestry, Distribution

**B.T. KIMARYO & K.I. NGEREZA**

**Charcoal production in Tanzania: using improved traditional earth kilns  
Manuscript Report 216e, IDRC/CRDI/CIID, Canada, 27 pp., 1989, English**

A preliminary field survey of earth kilns was carried in nine villages in Tanzania. Only one design of the traditional earth kiln was found commonly adopted in the surveyed villages. The effect of the basic design on charcoal yield and production cost was evaluated for comparison among villages.

The charcoal recovery percentages from single kiln-charges in the villages are unexpectedly quite high, ranging from 17 to 37 percent. The yield variations between villages are significant due to lack of field control of certain factors of production: tree species, wood density, billet moisture content, kiln capacity, operating skills and prevailing weather conditions. The unit production costs show no significant differences between village charges.

Experimental charcoal burnings were then conducted at Kileo Forest Reserve, Mwanga District, to measure the technical and economical performances of five earth kiln models. The results show quite significant variations in yields of charcoal between and within kiln designs. The recoveries between the kiln designs tested, ranging from Tsh. 1 per kg. (Tsh. 39 per bag) to Tsh. 3 per kg. (Tsh. 108 per bag).

The results obtained at Kileo indicate that the Senegalese Casamance earth kiln is the most technically an economically efficient design, followed by the metal channel kiln, an improved version of the basic earth kiln. The adoption of either of these two designs by the rural charcoal producers may greatly improve the present traditional method of charcoal production in the country.

**Keyword:** Fuelwood, Charcoal, Village forestry

## 7. SOCIAL FORESTRY

### **TOSHIYA IKEDA**

**Collaborative research on agroforestry of the Tropical Agriculture Research Center  
International Cooperation of Agriculture & Forestry, Association for  
International Cooperation of Agriculture & Forestry, Japan  
14(5), 23-30, 1991, Japanese**

There is a wide range of problems in the technical development of agroforestry as a complex system of agriculture and forestry. The aim of the agroforestry project promoted by the Tropical Agriculture Research Center (TARC) is to obtain basic knowledge for a various purposes. To this end, two major tasks were performed: 1. a fact-finding study for agroforestry and clarification of the conditions for its establishment; and 2. structural analysis of agroforestry and evaluation of its productivity. The Taungya system and the multiple layer system were used as examples of agroforestry.

With regard to Task 1, a survey was carried out mainly in the Philippines, Thailand, and Indonesia. Task 2 was focused on analysis of actual cases of agroforestry, and an experimental plot was created as a model of the Taungya system in the Philippines for analysis. The research was subsequently extended to Thailand. The institutions in charge of research include the Tropical Agriculture Research Center, Forestry and Forest Products Research Institute, Agriculture Research Center, Philippine University, and Kasetsart University (Thailand).

This report outlines the results of the research to date.

**Keyword:** Agro-forestry, Research and development, Intercropping

### **UNSO**

**Establishment of fuelwood plantations for the townships of Dse, Debre Birhan, Nazret,  
and Dire Awa, Phase I, Ethiopia  
United Nation Sudano-Sahelian Office (UNSO), 29 pp., 1983, English**

This paper is the project proposal for the establishment of fuelwood plantation in Ethiopia.

The massive devegetation in Ethiopia continues at the alarming rate of 2,000 ha of residual forests annually for cultivation purpose alone. At the present rate, forests would disappear towards the end of this century, and with them, the available fuelwood supply for the country.

In response to this critical situation, the project has been designed by the UNSO to provide fuelwood plantations for four towns most severely affected: Dese, Debre Birhan, Nazret and Dire Dawa. The project has been devised to provide a sound basis for the establishment of fuelwood plantation through the construction of the necessary infrastructure, and pilot plantings to refine the techniques necessary for full scale plantation establishment.

While the primary benefit of this project is the necessary infrastructure and to produce the best possible quality fuelwood in the greatest quantities and lowest cost consistent with good silvicultural techniques, several other indirect benefits like soil and water conservation will also be derived.

**Keyword:** Fuelwood, Plantation, Deforestation, Afforestation, Forest development

### **KANAYO KARAMCHANDANI**

**The development of agroforestry and rural energy in Ethiopia within the  
framework of the national food and nutrition strategy  
FAO Project ETH/ICP/8851 Food and Nutrition Unit of ONCCP,  
People's Republic of Ethiopia, 51 pp., 1989, English**

The National Food and Nutrition Strategy (NFNS) has been formulated by the Government of Ethiopia as an effective, fully integrated framework to serve as a central feature of the forthcoming National Five Year Development Plan (1989-1994).

The objectives of this report are to make a contribution to the preparation of the National Five Year plan in general and more specifically to identify or support projects, programmes and institutional aspects which could

operationalize some of the components of the NFNS.

Even the adoption of other technologies of renewable sources of energy, and promotion of improved stoves on a large scale, would only make a small impact. It would therefore appear inevitable that while the agroforestry techniques are being established on farmlands and homesteads and alternative sources of bio-energy through growing of trees under the community forestry programme.

The report includes the synthesis information of agroforestry in farming system and community forestry performance.

**Keyword:** Community forestry, Agro-forestry, Forest development, Forest policy, Fuelwood

**B.K. KAALE**

**Tanzania five year national village afforestation plan**

**Ministry of Natural Resources and Tourism, Tanzania, 64 pp., 1983, English**

Village afforestation is one of the major socio-economic development programmes being implemented in Tanzania. The objectives of the programme are to provide in perpetuity enough fuelwood to the rapidly growing population as well as maintaining a sound environmental condition for sustained agricultural production.

Fuelwood which was abundant few decades ago, is now a scarce commodity in all regions. This is due to the fact that little attention have been made to plan for its sustained production.

The objectives of this plan are to outline in aggregate terms the magnitude of village afforestation to be undertaken at regional level during the plan period (1982/1983-1986/1987) as well as forming a basis for in-depth village plans to be compiled by regional and district authorities.

Shortage of fuelwood and food are two urgent problems currently facing Tanzania that could possibly be solved through self-reliance. Although food and fuelwood have previously been dealt with separately, they are in fact inter-linked, as such they require a combined solution. Sources of conflict between agriculture, forestry and livestock development should be identified and investigated, and classified into the area of cooperation emphasized or encouraged etc. It needs integrated land-use planning in order to optimise of resources, mainly multiple land use.

**Keyword:** Fuelwood, Community forestry, Forest management, Land-use

**FOREST DIVISION, MINISTRY OF LANDS, NATURAL RESOURCES AND TOURISM (TANZANIA)**

**Trees for village forestry**

**Forest Division, Ministry of Lands, Natural Resources and Tourism, Tanzania, 125 pp., 1984, English**

Since 1970 the Government of Tanzania has embarked on an intensive village afforestation programme in order to meet the every increasing wood demand and maintain sound environmental conditions desired for sustained agriculture, livestock and forestry development. In order to achieve this objective, an equivalent of 200,000 ha of trees has to be planted annually, mainly on self-reliance basis. For successful implementation of the programme, the provision of suitable tree species, which can supply within a short period, products desired by villagers, is crucial.

An attempt has been made in this book to elaborate on the practice of growing tree species at individual and village levels. The focus is broadly on the role of trees in the socio-economic development of the society. 54 tree species are covered in detail in this book.

They include tree species suitable for a very wide range of uses in the different climatic zones of Tanzania, which are silviculturally familiar with proven successful field adaption.

Particular attention is given to practical aspects; the knowledge of species suited to specific climatic and edaphic conditions and the special consideration of silvicultural practices.

**Keyword:** Tree species, Community forestry, Afforestation, Environmental conservation

**FAO FORESTRY DEPARTMENT**

**Changes in shifting cultivation in Africa: seven case studies**

**FAO Forestry Paper 50/1, FAO, Rome, Italy, 185 pp., 1985, English**



In recent years shifting cultivation has received growing attention from FAO governing and advisory bodies. The Organization has been asked to study the biological, social, economic and cultural aspects of this food production system and to draw up multidisciplinary programmes and guidelines for improving its productivity.

Within the context of this mandate from member countries, the FAO Forestry Department carried out a comprehensive study entitled "Alternative to shifting cultivation in the use of forest land". The main study has been published as FAO Forestry Paper 50: "Changes in shifting cultivation in Africa" (1984). The aim of that study, which was confined to those zones of Africa receiving 1000 mm or more annual precipitation, was to assess the extent and distribution of shifting cultivation in Africa and to document and evaluate developments from recent demographic and other land pressures. This companion volume published as FAO Forestry Paper 50/1, contained the findings of seven case studies carried out in Ghana, Ivory Coast, Madagascar, Senegal, Sierra Leone and Tanzania.

**Keyword:** Shifting cultivation, Deforestation, Degraded forest, Environmental protection

#### **FAO FORESTRY DEPARTMENT**

##### **Changes in shifting cultivation in Africa**

**FAO Forestry Paper 50, FAO, Rome, Italy, 59 pp., 1984, English**

The aim of the study, which is confined to those zones of Africa receiving 1000 mm or more of annual precipitation, is to assess the extent and distribution of shifting cultivation in Africa and to document and evaluate developments resulting from recent demographic and other land pressure.

The first part of the report concerns the definition of shifting cultivation and its distribution in Africa. Shifting cultivation, defined as long fallow agriculture as opposed to short fallow and permanent agriculture, is no longer as common in Africa as formerly.

With growing population densities and increasing land pressure there is not enough land to leave a long period of fallow and farmers are automatically changing from long fallow cultivation to short fallow and permanent cultivation on all or part of their fields. These spontaneous modifications of shifting cultivation are dealt with in a second part of the report.

The third part of the report deals with planned change, which falls into two categories: one is to improve shifting cultivation, and this is illustrated by attempts to plant certain soil-enriching trees in the fallow, and to make a better use of the cleared vegetation by exploiting the timber rather than burning it, the latter being the normal practice. But the main form of planned change is to discourage shifting cultivation and propose alternatives.

The conclusions and recommendations are presented in a final section.

**Keyword:** Shifting cultivation, Deforestation, Degraded forest, Environmental protection, Evaluation

#### **THE GOVERNMENT OF THE REPUBLIC OF MALAWI**

##### **Report of the workshop on urban fuelwood development in the SADCC region with particular reference to the Blantyre city fuelwood project**

**Malawi, 169 pp., 1988, English**

The Workshop on Urban Fuelwood Development in the SADCC Region with particular reference to the Blantyre City Fuelwood Project was held in Blantyre, Malawi from 27th June to 1st July, 1988. The main objective of the workshop was to practically demonstrate, discuss and exchange knowledge and experience in urban fuelwood project planning, implementation and management. All nine SADCC member states are Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe.

The workshop comprehensively reviewed, identified and analyzed the urban fuelwood situation and problems in the SADCC countries, and made some practical recommendations for consideration of the member governments that would benefit the SADCC Urban Fuelwood Programme. The recommendations include SADCC countries' sustainable commitment to and increase of investment in urban fuelwood projects (plantations, indigenous forests, energy demand management, research, training etc.); active involvement and participation by the people, governmental and non-governmental organizations in wood-energy matters; encouraging women's participation in all aspects of fuelwood planning, etc.

**Keyword:** Fuelwood, Plantation, Afforestation, Community forestry

**O.O. AGBEDE & G.O.A. OJO**

**Food crop yield under *Gmelina* plantations in southern Nigeria**

**Agro-forestry in the Africa humid tropics, proceedings of a workshop held in Ibadan, Nigeria, 27 April-1 May 1981, The United Nations University, Tokyo Japan, 79-88, 1981, English**

Experimental taungya plots were established at six different locations in southern Nigeria to investigate the productivity and competitive relations of intercropping agricultural crops (yams, maize, and cassava) with trees (*Gmelina arborea*). Experiments were set up in 1978 and 1979 at Gambari, Ore, Sapoba, Ukpom-Bende, Ikom, and Awi-Calabar. With the exception of Gambari, the locations are in the tropical rainforest zone of Nigeria. Results of the experiments showed that cassava depresses *G. arborea*, especially when planted at close intervals. This effect tends to diminish at age 12 months, when the trees usually attain canopy closure. Trees under yams and maize tend to perform better than those planted alone or with cassava.

Varying the space between *G. arborea* plants markedly influenced the trees, while the different spacings of agricultural crops had no effect. Likewise for crops, the space between trees was not important but the spacing between crops was significant. Yams planted at 1.5 x 1.5 m were found to be the most profitable.

**Keyword:** Plantation, Agro-forestry, Multiple purpose forestry, Intercropping

**FAO**

**Understanding tree use in farming systems based on the workshop on planning fuelwood projects with participation of rural people, Malawi, 1984**

**FAO, Rome, Italy, 82 pp., 1985, English**

The workshop on Planning Fuelwood Projects with Participation of Rural People, convened under the regular Programme of the Food and Agriculture Organization (FAO) of the United Nations, was held in Lilongwe, Malawi, from 12 to 30 November 1984 at the invitation of the Government of the Republic of Malawi. Its purpose was "to provide the participants with a reasonable exposure and understanding of certain vital dimensions involved in planning fuelwood projects which are participatory in nature, and to improve their capacity for formulating, evaluating, and implementing such projects." The Workshop was jointly organised by the Forestry Department of the FAO and the Forestry Department of the Malawi Government. Although the title of the Workshop emphasizes "fuelwood projects", it proved impossible to consider fuelwood in isolation: hence several other relevant topics were also given attention.

**Keyword:** Social forestry, Fuelwood, Forest management

**P.K.R. NAIR**

**Agroforestry species: a crop sheets manual**

**ICRAF 003e, ICRAF, Nairobi, Kenya, 336, 1980, English**

With the increasing realization of the importance of agroforestry as a sustainable land-use system, there is a growing enthusiasm among foresters to learn about agricultural species and their cultivation practices, and similarly among agriculturalists to know about forestry species and their management. In view of this, we at ICRAF deemed it advisable to prepare "crop sheets" on species suited to agroforestry, so as to collate information available in a variety of books and other reference materials, and to prepare short, concise accounts on such species from the point of view of their suitability for agroforestry.

The manual is arranged in three parts. Part I deals with the general principles and concepts of agroforestry in the context of tropical land-use patterns. Part II contains the crop sheets of 40 selected species that are widely cultivated and whose production potentials have been relatively well exploited. Besides these relatively important species, there are some underexploited and localized species with agroforestry potential: short notes on 50 such species are included as Part III. The general references give additional information on these species also.

**Keyword:** Agro-forestry, Land-use, Intercropping, Tree species

## **FAO FORESTRY DEPARTMENT**

### **Forestry for local community development**

**FAO Forestry Paper 7, FAO, Rome, Italy, 114 pp., 1978, English**

Forestry for Local Community Development is a new people-oriented policy adopted by FAO, the objective of which is to raise the standard of living of the rural dweller, to involve him in decision making processes which affect his very existence and to transform him into a dynamic citizen capable of contributing to a large range of activities than he was used to and of which he will be the direct beneficiary.

This study forms one part of a program directed towards increasing the contribution forestry makes towards alleviating the conditions of the rural poor in developing countries. The purpose of the study is to examine the nature and dimensions of dependence on forests and forest outputs at the local rural community level, to assess the associated problems and possibilities, and to identify the policies, requisites and measures that are likely to be necessary in order to initiate and implement successful forestry programs for the benefit of rural communities.

Community forestry is defined for the purpose of this study as any situation which intimately involves local people in a forestry activity.

The contents of the report are as follows:

Part-I            The nature and extent of the problem

Part-II          Solution: Policies, programs and institution

Part-III        Project specification

**Keyword:**      Community forestry, Forest policy, Forest development, Social forestry

## **FAO**

### **Monitoring and evaluation of participatory forestry projects**

**FAO Forestry Paper 60, Forestry Dep., FAO, Rome, Italy, 133 pp., 1985, English**

The purpose of projects is to help bring about future change. But the future is unavoidably subject to uncertainty. Even with the most careful prior study and planning it will be impossible to foresee all the events which will affect a project once it is underway. It is therefore important that project design incorporate procedures which will help project managers to cope with unexpected events. This is the role of monitoring and evaluation systems. Monitoring and evaluation is particularly important in participatory forestry projects, the main purpose of which is to support rural people in creating, managing and using their own forest and tree resources.

This publication describes experience gained in developing and operating monitoring and evaluation systems in two participatory forestry projects, one in Malawi and the other in Nepal. Both projects were supported by the World Bank, and were designed with joint FAO/World Bank assistance. The strong monitoring and evaluation component in each reflects the recognition at their initiation that these were innovative projects, dealing with issues and situations about which much was then unavoidably unknown. At the same time, the application of monitoring and evaluation to such forestry activities was also new. With little experience elsewhere to draw upon, these exercises have themselves been of a pioneer and exploratory nature. They have already provided valuable information for the projects and future evolution of participatory forestry in these two countries.

**Keyword:**      Forest management, Social forestry, Evaluation, Guideline

## **FAO**

### **Tree growing by rural people**

**FAO Forestry Paper 64, Forestry Dep., FAO, Rome, Italy, 130 pp., 1985, English**

This study forms part of FAO's programmes to strengthen forestry activities which directly benefit rural people in developing countries.

Over the past decade, heightened concern with energy supplies, rural poverty, environmental degradation and food shortages have all contributed to a better awareness of the magnitude and importance of the contributions that outputs of forests and trees make directly to the well-being of rural people in non-industrialized countries. The linkages through which rural people draw directly on forests and forest products

take many forms, ranging from the use of forest land for shifting cultivation to small processing enterprises based upon raw materials from the forest. In aggregate it is likely that almost all rural people in non-industrial countries depend on forests and trees for at least some of the inputs into their life systems.

The study focuses on one of the most important production strategies which meets such needs – tree growing by rural people. With the accelerating depletion of natural forest resources, such local tree growing activities are rapidly increasing in importance as the principal means of maintaining needed supplies of forest products. Over the past few years programmes to encourage and support rural people in these efforts have become one of the principal tasks of forest services.

**Keyword:** Forest management, Forest policy, Forest utilization, Multiple purpose forestry, Social forestry

#### **L. WOROUB & TRAN VAN NAO**

##### **Orienting forestry toward the needs of people**

**Unasylva, FAO, Rome, Italy, 34(136), 8-10, 1982, English**

Benin in Africa suffers from a shortage of forest resources, particularly fuelwood, joinery wood, construction timber and fodder.

In some districts, the chore of gathering fuelwood may occupy one whole day out of every four. It is often necessary to go 15 to 20 km from the village to find enough wood, and those who have to do this job – the women and children – are, therefore, subject to a severe strain which has harmful effects on their health (particularly in the case of 7- to 8-year-old children). The shortage of fuelwood also means that food is badly cooked or not cooked at all, that water is not boiled, and that hygienic conditions are unsatisfactory.

This article offers a detail information of the village forest project carried out by UNDP/FAO in Benin.

The results of the project activities may seem quite modest at the moment, but they are important because they will help the country to establish multi-purpose forestry plantations based on proved realities. It should help to avoid the kind of errors in this work that occurred elsewhere and which resulted in discouragement that doomed vitally needed plantations that could have succeeded.

**Keyword:** Community forestry, Fuelwood, Multiple purpose forestry, Social forestry, Plantation

#### **MUHAMMED AZFAL CHAUDHRY & SALIM SILIM**

##### **Agri-silviculture in Uganda – a case study**

**Unasylva, FAO, Rome, Italy, 32(128), 21-25, 1980, English**

This article is a case study on agri-silviculture in Uganda.

Agri-silviculture is a production technique which combines the growing of agricultural crops with simultaneously raised and protected forest crops. This practice, called agri-forestry, has been in existence in various primitive forms since man learned to clear forests and cultivate land, and has different names in different parts of the world.

The present-day concept of agri-silviculture is in fact a way of reconciling conflicting interests of native cultivators and foresters and also is seen as a valuable and workable means of diverting the pernicious systems of shifting cultivation into constructive channels.

It should be noted that the practice of agri-silviculture in Uganda has passed its infancy but is still young. Through careful planning and wise manipulation vast lands and human resources can be put in a progressive and productive combination. The communal farming habit of the people can be used very advantageously by educating them in agri-silviculture.

Research is required on suitable crop rotations and possibilities of introduction of perennial crops like cassava and desert bananas.

Agri-silviculture needs to be carried out as a matter of policy and not only as a localized means to get free labour for forest areas.

**Keyword:** Agro-forestry, Forest policy, Community forestry, Soil conservation, Forest land conservation

**D.J. McCONNEL**

**The forest-garden farms of Kandy, Sri Lanka**

**FAO Farm Systems Management Series, FAO, Rome, Italy, No. 3, 117 pp., 1992, English**

A farming systems approach is used here to describe, quality and evaluate the forest-garden farm. The study illustrates how such an approach can help in the evaluation and planning of appropriate agro-economic systems. It is an approach to agricultural development which has applications in the context of land-use planning, environmental protection, policy formulation and the establishment of new settlement areas.

All Asian farming systems lie at particular points along a continuum between the two extremes of pure commercialization and family sustenance. Because of the widely differing operational objectives along this continuum, it has been argued that no single farm performance criterion can be applied to all systems.

**Keyword:** Agro-forestry, multiple purpose forestry, Environmental conservation, Food production

**FAO**

**Restoring the balance - women and forest resources**

**Forestry Dept., FAO, Italy, 32 pp., English**

Trees are important in rural economies largely as a result of the uses to which they put by women. In many societies, it is women who must find and transport the fuelwood that their families need. It is often women, not men who gather wild fruits and nuts, find fodder for their domestic stock, and make medicines and other products from woody materials.

In many rural societies, a special relationship therefore exists between women, the family and trees. This fact has been only rarely acknowledged in past development programmes. If development programmes are to succeed in reducing rural poverty, the balance between women and their forest resources must be restored.

This publication describes the importance of forest products to women, the difficulties women now have in obtaining them, and what can be done to improve the situation.

**Keyword:** Social forestry, Food production, Forest resources, Forest utilization, Community forestry, Fuelwood

**FAO**

**Forests, trees and food**

**Forestry Dept., FAO, Italy, 26 pp., 1992, English**

This publication aims to afford proper recognition to the contribution forests and trees make to the food economies of rural society. It also outlines the changes that need to be made within forestry institutions to enable them to make a significant contribution to the food security of local communities.

Food security is increased not only by the presence of forests but also by the small stands of trees found in homegardens and on farms. The term 'cultivated trees' in this book is used to describe the latter, and the term 'forests' is reserved for large stands of trees situated outside the homestead or farm, whether such forests are managed or not. Both play major, often little recognized roles in improving food security in rural community.

**Keyword:** Food production, Social forestry, Non-timber products, Multiple purpose forestry, Homegarden, Natural resources

**MARYAM NIAMIR**

**Community forestry-herders' decision-making in natural resources management in arid and semi-arid africa**

**Community Forestry Note 4, Forestry dept., FAO, Italy, 126 pp., 1990, English**

The approach of this report centers on a literature review of existing information on arid and semi-arid Africa. This includes north Africa, the Sahara, the Sahel, the semi-arid parts of the Sudan zone, and the arid zones of southern Africa. A few pertinent examples from other areas are also provided.

The main emphasis is placed on the use and management of natural resources, primarily vegetation, but also water and wildlife. The majority of production systems in these arid zones in one way or another rely on livestock (ranging from settled agropastoralists to continuously mobile nomads). Thus, pastoral systems, defined as any production system that relies for more than 10% of its output on livestock, is the main focus of the

report, but other production systems that rely on resources in their natural state, such as hunting, gathering, fishing and wood collecting, are also considered.

This report is one of a series of studies designed to clarify local decision making, priorities, and knowledge in the management of tree and forest related resources.

**Keyword:** Community forestry, Agro-forestry, Multiple purpose forestry, Natural resources

**J.E.M. ARNOLD**

**Community forestry - ten years in review**

**Community Forestry Note 7 rev.1, Forestry Dep., FAO, Rome, Italy,**

**32 pp., 1992, English**

In the recent past community forestry has witnessed greater development and has influenced the nature of forestry activities more profoundly than any other field in the forestry profession. This publication justifies a review of the wealth of experience gained in community forestry during the last decade and an examination of its current orientations.

The world is becoming more aware that the crucial issues of resources conservation and sustainable development can only be addressed if people enjoy a secure livelihood. Current development patterns and inequities increasingly force the rural poor to migrate in ecologically fragile and low productive areas where forests and trees play a critical role.

In this context it is imperative that community forestry be interpreted as more than a separate branch of forestry which socio-economic aspects are particularly visible. The future development of community forest must focus on generalizing participatory approaches in all forestry activities in a systematic effort to ensure that rural as well as industrial and local as well national needs are adequately met.

In addition to providing an historical perspective of the development of new kinds of forestry activities, this review contributes a forward-looking assessment of constraints and opportunities for strengthening participation in all forestry activities.

**Keyword:** Community forestry, Social forestry, Forest management

**KATHERINE WARNER**

**Shifting cultivators - local technical knowledge and natural resources management in the humid tropics**

**Community Forestry Note 8, Forestry Dep., FAO, Rome, Italy, 80 pp., 1991, English**

In 1990, within its Forestry for Community Development Programme, the FAO Forestry Department published Community Forestry series. This was the first step in filling an information gap on what knowledge rural people have developed in the management of trees and forests in relation to their production systems.

This publication highlights the local technical knowledge applied by swidden/fallow farmers when making resource management decisions. This is an especially timely volume as it brings together data and provides valuable analysis of a practice that is currently in ill repute with forestry planners and environmentalists. The book does not claim that shifting cultivators can continue with their systems, especially in the face of competing land and tree uses for their fallow areas. It, however, points out valuable lessons that can be learned from the long-term swidden/fallow cultivators about sustainable use of tropical forests. It also provides suggestions for the evolution of systems based on what these farmers already know and use in providing a livelihood for their families in difficult tropical environments.

**Keyword:** Shifting cultivation, Environmental conservation, Agro-forestry

**FAO**

**Women in community forestry; a field guide for project design and implementation**

**Forestry Dept., FAO, Italy, 45 pp., 1991, English**

Rural women are major caretakers and users of forests. Each day they walk long distances to gather fodder and fuelwood. They seek out fruits, nuts and small creatures for food for their families. They use bark, roots and herbs for medicines. Trees provide shade, beauty and environmental protection for their homes. Thus,

trees and forests play a major role in their daily lives. Unfortunately, most forestry programmes are organized by men who may not understand women's relationships to forests.

In 1986 the FAO Community Forestry Unit developed a publication for policy makers, "Restoring the balance: women and forest resources", that identifies issues and points out the importance of considering gender when designing community forestry programmes. This field guide translates "Restoring the balance" into a manual for those who design and implement forestry projects. It focuses on practical ways to include women in project design and implementation and is meant to be a tool to facilitate discussion, offer options and promote action on behalf of women and forestry.

**Keyword:** Community forestry, Social forestry, Food production, Fuelwood, Forest utilization

#### **COR VEER & JIM CHAMBERLAIN**

**Local organizations in community forestry extension in asia**

**Regional Wood Energy Development Programme in Asia, FAO, Bangkok, Thailand, Field Document 34, 251 pp., 1992, English**

This publication is a report of Regional Experts Consultation on "Local Organizations in Forestry Extension" held in Thailand, October 1991. During the 1988 Regional Consultation on Planning Forestry Extension Programmes, participants identified the need to look more specifically in the ways forestry extension agents could effectively work in the planning and implementation of community forestry activities. The consultation reported here, is a response to that need.

More than 60 experts from 11 Asian countries and from international organizations gathered in Thailand, to share their experiences, identify successful strategies and critical issues, and agree on priorities for future action, to help forestry extension agents to improve support to local organizations in forest resources management.

The presentations, discussions, findings of working groups, poster sessions, and field visits during the consultation are presented in this report. It is hoped that the contents will advance the understanding and potential of local organizations in forestry extension.

**Keyword:** Extension work, Community forestry, Forest management

#### **ASIAN NGO COALITION (ANGOC)**

**Project formulation for people's participation in rural development activities**

**A government-NGO national workshop report, Manila, Philippines**

**87 pp., 1990, English**

This publication is an attempt to share the Philippine experience toward crafting a framework and mechanism which would operationalize GO-NGO-PO collaboration in rural development activities. The report advances the rhetoric of GO-NGO-PO tripartite policy dialogues to practical mechanisms for joint activities between government and NGOs.

**GO:** Government

**NGO:** Nongovernment Organization

**PO:** People's Organization

**NROs:** NEDA Regional Offices

**Keyword:** Forest development, Forest policy, Social forestry

#### **JOSHUA K. CHEBOIWO & PAUL O. ONGUGO**

**Growing and managing *Acacia mearnsii* (Black wattle) in Kenya**

**Research Note, Kenya Forestry Research Institute (KEFRI), Muguga, Kenya, 19 pp., 1989, English**

The paper outlines the potential gains a small scale farmer in Kenya stands to achieve by investing in the *Acacia mearnsii* (black wattle) tree. A survey which included two case studies, was conducted in wattle growing areas.

The survey and the case studies revealed that investment in the growth and management of *A. mearnsii*

for bark, post and pole production gives good returns. The magnitude of the return was increased by including maize into the management system. The level and intensity of management employed had an influence on the magnitude of the returns.

**Keyword:** Acacia, Social and economic analysis, Social forestry

#### **ICRAF**

**International center for research in agroforestry - annual report 1991**

**International Council for Research in Agroforestry (ICRAF), Nairobi, Kenya**

**148 pp., 1992, English**

The International Center for Research in Agroforestry (ICRAF) concentrates on two areas where urgent human and environmental needs must be tackled together: the humid tropics, subject to rapid deforestation; and subhumid and semi-arid tropics, where intensive grazing and cultivation are leading to severe land degradation. The goal is to help mitigate tropical deforestation, land depletion and rural poverty through improved agroforestry systems.

This publication is annual report of ICRAF for 1991. It includes various activities on research and dissemination programmes.

**Keyword:** Agro-forestry, Research and development, Extension work, Evaluation

#### **ROB A. SWINKELS & SARA J. SCHERR**

**Economic analysis of agroforestry technologies - an annotated bibliography**

**International Council for Research in Agroforestry, Nairobi, Kenya**

**215 pp., 1991, English**

The International Council for research in Agroforestry (ICRAF) was created and updated an inventory of the literature on economic aspects of agroforestry. The first annotated bibliography on this subject was produced in ICRAF's Working Paper series in 1983 and an updated version was published in 1985. Both versions were based on literature received from a network of economists dealing with agroforestry. In the past five years, many more publications have surfaced and the present bibliography attempts to bring the old and new information together.

The bibliography will help readers responsible for making decisions on the role of agroforestry within the whole spectrum of different land-use systems.

**Keyword:** Agro-forestry, Social and economic analysis

#### **E.U. MULLER & S.J. SCHERR**

**Technology monitoring and evaluation in agroforestry projects - an annotated bibliography**

**International Council for Research in Agroforestry, Nairobi, Kenya**

**191 pp., 1989, English**

Agroforestry technologies are generally characterized by a high degree of complexity and variation due to farmers' multiple objectives and the combination of trees with agricultural crops or livestock. These factors limit the development of standard technology "packages" through conventional research experiments.

Although resources for conventional applied and adaptive agroforestry research are increasing rapidly, they remain inadequate to address all of the technical questions development project and programmes will face in the foreseeable future. Monitoring and evaluation (M&E) will thus continue to play a critical role in agroforestry technology development and in the adaption of technologies to specific farming situation.

This annotated bibliography on technology monitoring and evaluation in agroforestry projects represents an effort to explore the methods, which have been developed by project, and make them available to the wider development and research communities. The annotated bibliography focused on technology monitoring and evaluation, not including economic aspects of agroforestry, which are being studied in another project at ICRAF.

**Keyword:** Agro-forestry, Evaluation, Research and development



**AMARE GETAHUN, KEDIR RESHID & HILDA MUNYUA (Compilers)**  
**Agroforestry for development in Kenya, an annotated bibliography**  
**ICRAF Book, International Council for Research in Agroforestry, Nairobi, Kenya**  
**220 pp., 1991, English**

During the last ten years, the development of agroforestry in Kenya has been rapid, involving government agencies, international organizations, many private organizations, non-governmental organizations and several donor agencies. Through these organizations and their field activities, a substantial volume of valuable information has been generated.

This annotated bibliography is part of an ongoing effort to collect and synthesize information, especially biotechnical data, in a form useful for research and the training of extension personnel.

**Keyword:** Agro-forestry, Extension work, Soil conservation, Research and development

**L.L.L. LULANDALA & J.B. HALL**

***Leucaena leucocephala*: Potential role in rural development**  
**ICRAF Working Paper, International Council for Research in Agroforestry,**  
**Nairobi, Kenya, 70 pp., 1991, English**

Dr. Luther L.L. Lulandala and his colleagues have conducted extensive on-station agroforestry research in Morogoro, Tanzania, including work on hedgerow intercropping and woodlots using *Leucaena leucocephala*. This is one of the oldest agroforestry research programmes in Africa.

This paper contains the fact that it summarizes the results of research at Morogoro and compares these for the first time with results from similar areas in other parts of the tropic.

Contents are, role within in the rural community, management strategies, growth and nutrient accumulation, products and services, alternative species and *leucaena* in the rural land-use systems.

**Keyword:** Agro-forestry, Social and economic analysis, Land-use, Research and development

**K.D. SHEPHERD & J.H. ROGER**

**Approaches to on-farm testing and evaluation of agroforestry technology**  
**ICRAF Working Paper, International Council for Research in Agroforestry,**  
**Nairobi, Kenya, No. 67, 32 pp., 1991, English**

This paper considers special problems that are encountered in the design of on-farm agroforestry experiments and discusses alternative approaches that are especially relevant for testing and evaluating agroforestry technology.

Often in agroforestry experiments we expect higher levels of variability than are common for pure agriculture or plantation forestry experiments. Agroforestry experiments require large plots and can include few treatments. They usually require complex designs and measurements, run for a number of years, and demand a high level of resources in terms of funding and well-trained manpower. These constraints generally make agroforestry experiments much more difficult to implement than experiments with annual crops.

The authors recommend that biophysical questions on component interactions of a technology should be investigated in experiments that have a high degree of control by researchers, are an environmentally representative research stations or are well-protected 'satellite' research sites.

**Keyword:** Agro-forestry, Biomass, Land-use, Research and development

**G.B. SINGH**

**The potential applications of agroforestry systems from the South Asian**  
**subcontinent to analogous ecozones of Africa**  
**ICRAF Working Paper, ICRAF, Nairobi, Kenya, No. 66, 91 pp., 1991, English**

A study on the major existing agroforestry systems in the predominant agro-ecological zones of the African continent and the South Asian subcontinent were undertaken jointly by ICAR and ICRAF to identify the potential agroforestry technologies which could be recommended for transfer to the African continent from

the South Asian subcontinent.

The predominant agroforestry systems in the arid, semi-arid, subhumid and humid agro-ecozones from the African continent and the South Asian subcontinent were described in brief. In the description the main emphasis was given to multipurpose trees, grasses and their management with crops and livestock.

Some research results from the ongoing experiments in the South Asian subcontinent are presented to emphasize the performance of specific agroforestry systems.

**Keyword:** Agro-forestry, Semi-arid region, Arid region, Research and development

**P.K.R. NAIR**

**Agroforestry with coconuts and other tropical plantation crops**

**ICRAF Reprint, International Council for Research in Agroforestry,**

**Nairobi, Kenya, No. 8, 79-102, 1984, English**

The perennial plantation crops of the tropics occupy about 8 per cent of the total arable area in developing countries and are very important, both economically and socially.

The coconut palm is one of the most widely grown tree crops in the tropics with a total area of over 6 million hectares, mostly as small holdings in densely populated areas. The growth habit of the palm is remarkably suited both to small-scale production and to combination with other crops. The age and stand density of the palms is an important factor in determining the type and form of crop association. Where the intercrop and the coconut crop are properly manured and well managed, a substantial number of additional crops can be produced without impairing long-term productivity.

The examples given of intensive coconut based systems are relevant to other smallholder plantation crops using some form of plant association or mixed farming technique that will result in higher income and land equivalent ratios per farm. As with the development of the coconut systems, their development will need to be supported by adequate research efforts.

**Keyword:** Agro-forestry, Land-use, Food production, Intercropping

**J.B. RAIN TREE & K. WARNER**

**Agroforestry pathways for the intensification of shifting cultivation**

**ICRAF Reprint, International Council for Research in Agroforestry,**

**Nairobi, Kenya, No. 32, 39-54, 1986, English**

As a system of land use which entails the deliberate association of trees with herbaceous field crops in time, shifting cultivation is one of the most ancient, widespread and, until recently, ecologically stable forms of agroforestry. However, under pressure of population and competing uses for land and labour, traditional swidden systems have been observed historically to undergo more or less predictable processes of intensification. Since shifting cultivation is an indigenous form of agroforestry, scientific agroforestry is not, strictly speaking, an 'alternative' to shifting cultivation, but rather a systematic approach to the recombination of its basic elements into more intensive, sustainable and politically viable forms of land use, whenever pressures signal the need for change in traditional swidden systems.

Different agroforestry options open up from different stages of intensification in swidden systems. A review of evolutionary topologies of shifting cultivation gives rise to a framework for the identification of agroforestry interventions and development pathways appropriate to specific systems. Technological proposals are limited to a short list of the most promising agroforestry interventions in 'main sequence' swidden systems. These include 'integral taungya', economically and biologically enriched fallows, variations on the "alley cropping" theme, and various tree crop alternatives to annual cropping systems. Examples and quantitative data are cited to substantiate the main hypotheses behind the proposals.

**Keyword:** Agro-forestry, Shifting cultivation, Land-use, Fallow

**P.K.R. NAIR**

**Agroforestry and firewood production**

**ICRAF Reprint, International Council for Research in Agroforestry,**

**Nairobi, Kenya, No. 51, 367-386, 1988, English**

The benefits and potentials of traditional integrated land-use systems involving trees are now being increasingly recognized. Agroforestry is a term that encompasses a large number of variants of such land-use systems and practices. In a relatively short span of time, the term has earned a distinct identity of its own and raised a lot of expectations about its potential.

An inventory of the existing agroforestry systems and practices, which is currently being undertaken by ICRAF reveals that agroforestry is widespread in the developing countries in almost all ecological regions. Based on the nature of the components involved, agroforestry systems can broadly be classified as:

- (1) agrisilvocultural (crops and trees),
- (2) silvopastoral (pasture/animals + trees); and
- (3) agrosilvopastoral (crops + pasture/animal + trees).

Agroforestry, with its underlying concept of simultaneous and sustainable production of food and wood products is of great scope and potential in fuelwood production programmes in developing countries.

**Keyword:** Agro-forestry, Firewood, Fuelwood, Food production, Social forestry

**GREGOR V. WOLF, JAMES H. ROGER et al.**

**Assessing multi-product tree yields from linear agroforestry technologies**

**Working Paper, International Council for Research in Agroforestry,**

**Nairobi, Kenya, No. 55, 60 pp., 1990, English**

Due to the relatively short history of agroforestry in development, there is presently a dearth of guidelines that help extension staff to assess the applicability of the agroforestry interventions which are proposed to farmers. On the other hand, the continued adoption of agroforestry practices by farmers makes it more urgent than ever to disseminate methods which help to evaluate the economic and ecological effects. The working paper proposes guidelines that are aimed at extension projects with an interest in objectively evaluating product-specific yields of the tree component in locally-used agroforestry practices. Methods are proposed to qualify yields, based on species choice or differences in management techniques. The guidelines incorporate basic principles of sampling and statistics in a step-by-step approach. Practical procedures are introduced that help match the requirements in precision of the results with observed site or genetic variability and a project's resources to conduct the study. The survey design is kept as simple as possible, so that only limited facilities are required for both their implementation and analysis. Basic concepts of MPT morphology and related aspects of product-specific yields are considered. Suggestions on how to measure these in a standardized way and how to report them are made.

**Keyword:** Agro-forestry, Tree growth, Yield volume, Line planting, Multiple purpose forestry

**A. GETAHUN**

**Agroforestry for development in Kenya: an overview**

**Planning for Agroforestry, ICRAF Reprint, ICRAF, Nairobi, Kenya**

**No. 71, 183-202, 1990, English**

Plant introduction into Kenya has been active over the year and as a result, there are over 100 exotic tree and shrub species being grown, more than 75% of the tree and shrub species annually planted are exotic and such imbalances are currently being addressed by the government through programmes promoting indigenous tree and shrub species.

Fifteen major GOK policy interventions that have had a direct and positive effect on agroforestry development were enacted between 1971 and 1987. While the necessary policy instruments are in place and government efforts to date are commendable, government-based agroforestry programmes and activities are nonetheless weak and require donors support and the active participation of non-governmental organizations.

Equally important in agroforestry development are the Kenya farmers, especially the Kenyan women and youths who have become active in tree planting and are now adopting agroforestry practices. Continued and growing mass-awareness of farmers regarding agroforestry as the most appropriate tropical land-use system in the face of a growing population pressure will facilitate GOK, NGO and donor efforts.

**Keyword:** Agro-forestry, Planting, Tree species, Evaluation, Research and Development

**A. YOUNG**

**Agroforestry, environment and sustainability**

**Outlook on Agriculture (ICRAF Reprint), ICRAF, Nairobi, Kenya**

**No. 73, 155-160, 1990, English**

Sustainability means continued production, at levels at or above those of today, coupled with conservation of the natural resources on which that production depends. In brief:

Sustainability = Production + Conservation

There is an essential difference of emphasis from the concept of environment which came to the fore in the late 1960s. At that time the emphasis was on conservation, sometimes regarded as an end in its own right. This is not the way in which smallholder farmers in less-developed countries look at things. For them, feeding the family, and providing for other essential needs come first.

This paper describes how to combine production with conservation of natural resources.

**Keyword:** Agro-forestry, Environment conservation, Soil conservation

**E.G.C. BARROW**

**Evaluating the effectiveness of participatory agroforestry extension**

**programmes in a pastoral system, based on existing traditional values**

**Agroforestry Systems, (ICRAF Reprint), ICRAF, Nairobi, Kenya**

**No. 84, 1-21, 1991, English**

The Turukana silvo-pastoral system is a traditional natural resource management strategy for dry lands that forms a sensible basis for improvement. Involvement of the local people is vital in adapting and improving the system, to bring out the potentials that exist in terms of broad land management strategies and more specifically in terms of individual tree species. The participatory extension process being used by the forestry department is presented. It relates to the traditional natural management base as a means of trying to identify potentials, constraints, problems and solutions. Such extension programmes are difficult to evaluate. The data gathering methods for evaluating such extension work, involving over 6,000 people, is discussed in the light of a mobile people, lack of sampling frame and large distances in an arid and semi-arid environment. The results of two surveys, together with other informal data gathering mechanisms, show that change is taking place, particularly in qualitative terms, and indicates the effectiveness of the participatory extension programme.

**Keyword:** Natural resources, Arid region, Agro-forestry, Evaluation, Extension work, Social forestry

**BASHIR TAMA & AMARE GETAHUN**

**Intercropping *Acacia albida* with maize (*Zea mays*) and green gram**

**(*Phaseolus aureus*) at Mtwapa, Coast Province, Kenya**

**Agroforestry System (ICRAF Reprint), ICRAF, Nairobi, Kenya**

**No. 86, 193-205, 1991, English**

Long-term agroforestry demonstrations using *Acacia albida* and other nitrogen fixing multipurpose trees/shrubs were initiated in mid-1982 to assess soil and crop productivity at a coastal lowland site characterized by low soil fertility, weed problems and consequent poor crop yields.

Growth performance (height and diameter at breast height) of *Acacia albida* under eight densities rotationally intercropped with maize (*Zea mays*) and green gram (*Phaseolus aureus*), crop gain yields, soil fertility changes and weed control were assessed for a 5-year period (May 1982 to March 1987). A parallel-row systematic spacing field layout was used.

**Keyword:** Acacia, Agro-forestry, Planting interval, Intercropping

**M.R. RAO, C.K. ONG, P. PATHAK & M.M. SHARMA**

**Productivity of annual cropping and agroforestry systems on a shallow alfisol in semi-arid India**

**Agroforestry Systems (ICRAF Reprint), ICRAF, Nairobi, Kenya**

**No. 88, 51-63, 1991, English**

An experiment was conducted at ICRISAT Center, Patancheru, India from June 1984 to April 1988 on a shallow Alfisol to determine whether the productivity of annual crop systems can be improved by adding perennial species such as *Leucaena leucocephala* managed as hedgerow. Except in the first year, crop yields were suppressed by *Leucaena* due to competition for moisture. The severity of competition was high in years of low rainfall and on long-duration crops such as castor and pigeonpea. Based on total biomass, sole *Leucaena* was most productive; even on the basis of land productivity requiring both *Leucaena* fodder and annual crops, alley cropping had little or no advantage over book planting of both components. Application of hedge prunings as green manure or mulch on top of 60 kg N and 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> to annual crops did not show any benefit during the experimental period, characterized by below average rainfall. Indications are that (i) alley cropping was beneficial in terms of soil and water conservation with less runoff and soil loss with 3 m alleys than with 5.4 m alleys, and (ii) root pruning or deep ploughing might be effective in reducing moisture competition.

**Keyword:** Agro-forestry, Semi-arid region, soil conservation, Water conservation, Intercropping

**M.R. RAO & R.D. COE**

**Measuring crop yields in on-farm agroforestry studies**

**Agroforestry Systems (ICRAF Reprint), ICRAF, Nairobi, Kenya**

**No. 90, 275-285, 1991, English**

The paper describes the agronomic and statistical principles that form the basis for measuring crop yields in on-farm agroforestry studies. Agroforestry systems differ from agricultural systems because of the presence of tree/crop interfaces and the need for large plots, large borders and long-term monitoring. These differences accentuate the variability of crop performance on farms. Crop yield estimation per unit area in any agroforestry system involves essentially (i) stratification of the plot into different, clearly distinguishable crop zones such as those under and free from the influence of trees, those on sloping and flat area, and those on area affected by pests, (ii) drawing presentative samples from each stratum, and (iii) weighting the sample yields with weights proportional to the stratum area.

**Keyword:** Agro-forestry, Intercropping, Evaluation

**RONALD ALVIN & P.K.R., NAIR**

**Combination of cacao with other plantation crops: an agroforestry system in Southeast Bahia, Brazil**

**ICRAF Agroforestry System, International Council for Research in Agroforestry, Nairobi, Kenya, No. 4, 3-15, 1987, English**

Brazil accounts for about 20% of the world production of cocoa and about 95% of cocoa production in Brazil is from the southeastern part of Bahia State. Traditionally, cacao is grown in monoculture (though under the shade of various other species). But various crop combinations involving cacao have recently undertaken by the farmers with encouragement from Brazilian government.

The paper presents some data on the performance of some of the combinations involving cacao and other plantation crops based on field survey, and discusses the potentials and constraints extending the system to more areas in the region.

**Keyword:** Agro-forestry, Intercropping, Non-timber products

**V. BALASUBRAMANIAN & A. EGLI**

**The role of agroforestry in the farming systems in Rwanda with special reference to the Bugesera - Gisaka - Migongo (BGM) region**

**Agroforestry System Descriptions (reprinted from Agroforestry Systems), ICRAF, Nairobi, Kenya, 271-289, 1987, English**

The Rwandan farmers, faced with a perpetual land shortage, have evolved certain intensive systems of organic agriculture. These systems, particularly the homestead (compound) farming, involve the combination of food, fodder and tree crops. To a certain extent these systems can satisfy the multiple needs of the subsistence farmers living under several risks and constraints. However, they cannot cope with the expanding

food demand of the rapidly increasing population. Some multipurpose, low-input technologies and agroforestry approaches have been designed to improve the productivity of these traditional systems; these include inter/mixed cropping systems and rotations, alley cropping with leguminous trees and shrubs, use of planted 'fallow', planting tree legumes on anti-erosive lines, mixed farming, community forestry and woodlots, and tree planting on farm/field boundaries. The essential aspects of these technologies are briefly discussed.

**Keyword:** Agro-forestry, Food production, Land-use, Multiple purpose forestry

**WILLIAM A. LEUSCHNER & KIBRIAUL KHALEGUE**

**Homestead agroforestry in Bangladesh**

**ICRAF Agroforestry System, International Council for Research in Agroforestry,  
Nairobi, Kenya, No. 5, 139-151, 1987, English**

The homestead agroforestry system is very important in the economy of Bangladesh. The many woody species grown in the homesteads are a significant source of fuelwood; they also provide fodder, building materials and other forms of wood. In the context of the prevailing shortage of fuelwood and excessive deforestation in Bangladesh, this homestead agroforestry system needs to be strengthened.

A field survey was undertaken to assess the prospects and feasibility of initiating a programme for the improvement of homestead agroforestry system. It showed that the prospects for improving homestead agroforestry systems are good because most respondents own their homesteads and believe there is room for more trees on them. Although they know that raising trees is relatively difficult and requires special practices, they are familiar with the government nurseries and local agricultural extension officers, and are confident about the success of programme. Result also indicates that multipurpose trees and specific modules for involving women in the farm operations are likely to enhance success of the programme.

**Keyword:** Agro-forestry, Homegarden, Fruit tree, Multipurpose trees, Fodder tree

**J.C. OKAFOR & E.C.M. FERNANDES**

**Compound farms of southeastern Nigeria: A predominant agroforestry homegarden system with crops and small livestock**

**ICRAF Agroforestry Systems, International Council for Research in Agroforestry,  
Nairobi, Kenya, No. 5, 153-168, 1987, English**

Compound farms are a homegarden-type of agroforestry system involving the deliberate management of multipurpose trees and shrubs in a multistoried association with agricultural crops and small livestock within the compounds of individual houses. In addition to the advantages of diversified production, risk minimization, improved labour and nutrient use efficiencies and soil conservation, compound farms represent germplasm banks containing many of the useful tree/shrub species currently disappearing due to indiscriminate clearing of forests and woodlands.

**Keyword:** Agro-forestry, Homegarden, Multipurpose tree, Soil conservation

**PETER ALLAN ODVOL**

**The shamba system: An indigenous system of food production from forest areas in Kenya**

**ICRAF Agroforestry Systems, International Council for Research in Agroforestry,  
Nairobi, Kenya, No. 4, 365-373, 1987, English**

The shamba system, a form of Taungya where agricultural crops are grown together with forest tree species, has been quite widespread in the high-potential areas of Kenya since the early 1900s, and still is very popular. When properly practiced, the system allows sustained, optimum production of food crops along with forestry species from the same land and thus meets most of the social and economic needs of the shamba farmer. This paper briefly describes the system's productivity and functioning and analyses its ecological as well as socio-economic characteristics.

**Keyword:** Agro-forestry, Intercropping, Social and economic analysis, Food production, Ecology

**PETER POSCHEN**

An evaluation of the *Acacia* - based agroforestry practices in the Hararghe highlands of Eastern Ethiopia

Agroforestry Systems (ICRAF Reprint), International Council for Research in Agroforestry, Nairobi, Kenya, No. 4, 129-143, 1986, English

Growing *Acacia albida* as a permanent tree crop, on farmlands with cereals, vegetables and coffee underneath or in between, is an indigenous agroforestry system in the Hararghe highlands of Eastern Ethiopia. However, there is practically no systematic record or data on the merits and benefits of this practice.

The paper presents the results of an investigation into the effects of the presence of *A. albida* on farmlands on the yield of maize (*Zea mays*) and sorghum (*sorghum bicolor* L. Moench). Twenty seven plot pairs each consisting of one plot underneath of *A. albida* foliage cover and other in the open, away from the tree-on farmer's field, in a 40 km radius around the Alemaya College of Agriculture, were sampled and the yield components analyzed.

**Keyword:** Acacia, Agro-forestry, Intercropping, Food production, Yield

**S. MIEHE**

*Acacia albida* and other multipurpose trees on the fur farmlands in the Jebel Marra highlands, Western Darfur, Sudan

Agroforestry Systems (ICRAF Reprint), International Council for Research in Agroforestry, Nairobi, Kenya, No. 4, 89-119, 1986, English

This paper describes the traditional agroforestry systems based on *Acacia albida* and other multipurpose trees as practiced by the sedentary Fur people on the lower slopes and highlands of the Jebel massif, Sudan. The basic agrosilvopastoral system consists of terraced village fields, where semipermanent rainfed cropping of staple millet and other subsistence crops takes place under stands of multipurpose trees dominated by *Acacia albida*, *Cordia abyssinica* and *Ziziphus spinachristi*. Trees have been retained primarily for food, wood and fodder. Thorn from cut and browsed branches makes a good fencing material.

**Keyword:** Acacia, Agro-forestry, Multipurpose trees, Yields

**P.H. MAY, A.B. ANDERSON, J.M.F. FRAZAO & M.J. BALICK**

Babassu palm in the agroforestry systems in Brazil's Mid-North region

Agroforestry Systems (ICRAF Reprint), International Council for Research in Agroforestry, Nairobi, Kenya, No. 3, 275-295, 1985, English

Babassu palms (*Orbignya* spp.) cover nearly 200,000 km<sup>2</sup> in Brazil, providing cash income, fuel, fibre, edible oil and food to a large number of tenant farm house-holds. Babassu is closely integrated within pastoral and shifting cultivation systems of Mid-North Brazil. In pastures, babassu provides shade for cattle, aids soil moisture retention, produces organic matter, generates supplementary farm income at little cost, and offers year-round employment. On the other hand, the persistence of juvenile palms reduces pasture grass productivity due to plant competition, and therefore there is a trend to eradicate babassu through clear cutting and understorey suppression. At moderate densities of less than 100 individuals per ha, mature babassu palms in cropland do not appear to harm crop productivity. In such cases, palms are thinned and leaves of the remaining ones are cut back, supplying fuel for the burn and nutrients to the soil. However, reduced fallow cycles due to pasture conversion threaten babassu as well as crop productivity.

**Keyword:** Palms, Multipurpose trees, Shifting cultivation, Agro-forestry

**EDUARDO E. ESCALANTE**

Promising agroforestry systems in Venezuela

Agroforestry Systems (ICRAF Reprint), International Council for Research in Agroforestry, Nairobi, Kenya, No. 3, 209-221, 1985, English

The main agroforestry systems in Venezuela are the multispecies plant associations in integrated coffee

production system and the silvopastoral system. This paper describes the functional and structural aspects of these systems. The multilayered coffee production systems are practiced mainly in the premontane moist forest of the Andes region, but are also found in other areas of the country. Various tree species are used for shade and as fence in big coffee plantations, whereas in small units with traditional production pattern, coffee is planted along with many other species, often constituting a 3-4 layer canopy. Available data are presented on the production as well as some socioeconomic aspects.

**Keyword:** Agro-forestry, Non-timber products, Fodder tree, Nurse tree, Yields, Social and economic analysis

**DENNIS V. JOHNSON & P.K.R. NAIR**

**Perennial crop-based agroforestry systems in Northeast Brazil**

**Agroforestry System (ICRAF Reprint), International Council for Research in Agroforestry, Nairobi, Kenya, No. 2, 281-292, 1985, English**

Land use systems in the Northeast Region of Brazil are dominated by large holdings and extensive cultivation of perennial crops such as cashew, coconut, carnauba wax palm, babacu palm and so on. The common feature which links these crops is the silvopastoral system of livestock (chiefly cattle, sheep and donkeys) grazing under them. Agrosilvicultural systems involving cultivation of annual subsistence crops, and in some instances other perennials in the stands of these perennial crops is also common. The paper presents the available information on the management, production, rate of growth, economic importance, etc. of these agroforestry systems involving cashew, coconut and carnauba palm.

**Keyword:** Agro-forestry, Evaluation, Palms, Non-timber products, Yields

**FELICIAN B. KILAHAMA**

**Community and farm forestry programme: policies and strategies**

**Forest and Beekeeping Div., Ministry of Tourism, Natural Resources and Environment, Tanzania, 14 pp., English**

Tanzania's policies advocate self-reliance. People should be able to meet their basic requirements for food, fuelwood, building materials, fodder, medicines, etc. Furthermore, efforts are geared towards environmental stability and conservation. However, for the people to attain self-reliance, they need to work hard and use the available resources efficiently. Community Forestry activities in Tanzania as they are implemented by the Forestry and Beekeeping Division of the Ministry of Tourism, Natural Resources and environment, are meant to assist the communities, be it in the rural or urban areas, to become self-reliant in wood-based products.

Our efforts are all out to make sure that each and every household especially in rural areas produces enough trees to meet own basic needs for food particularly (fruits), fodder, firewood, poles, timber shade, medicine and at the same time maintain sound environmental conditions. The idea is to make the people in both rural and urban areas takes appropriate measures to sustain their survival and well-being by growing trees and conserving the environment they live in. We are therefore, struggling to help people help themselves to become self reliant in terms of woodfuel, poles, fodder, food and timber. In other words, the Division undertakes a catalytic role in promoting tree growing in villages through active participation by individuals, households, schools, NGOs, and Co-operative groups. By catalytic role we mean acting as initiators and/or facilitators through various means such as educational campaigns and training so that eventually the respondent can continue on his/her own without further assistance from the catalytic agent (become self-reliant).

**Keyword:** Social forestry, Community forestry, Forest policy, Village forestry

**LOUISE FORTMANN & CALVIN NHIRA**

**Local management of trees and woodland resources in Zimbabwe:  
a tenurial niche approach**

**O.F.I. Occasional Papers, Oxford, UK, No. 43, 34 pp., 1992, English**

This study of forest and woodland management in the rural Zimbabwe begins from two relatively new conceptual starting points: the social forest and the tenurial niche. The social forest is a concept encompassing the more traditional view of forests, taking into consideration all trees used by local people regardless of their



location, density, species or size. The tenurial niche takes a more fine grained look at property relations, allowing for the consideration of the complexities that tree tenure introduces to tenure in general. Using key informant interviews, a literature review and rapid rural appraisal, this study examines the prevalence of four management mechanisms (sacred controls, pragmatic controls, the civil contract and new institutions and rules) across various tenurial niches and suggests strategies for improving management and reducing conflict in each niche.

**Keyword:** Social forestry, Forest management, Evaluation, Village forestry

**D. ROCHELEAU, F. WEBER & A. FIELD-JUMA**

**Agroforestry in dryland Africa**

**ICRAF Science and Practice Agroforestry, 3, International Council for Research in Agroforestry, Nairobi, Kenya, 311 pp., 1988, English**

The material in *Agroforestry in Dryland Africa* is drawn from the accumulated experience of practitioners and researchers. It provides an introduction to agroforestry and the roles of various agroforestry practices in the community setting. This is followed by a description of the process of working with community members to identify and adapt agroforestry practices to meet local needs. Fifteen agroforestry practices are described in Part II with examples from dry regions of Africa. Part III consists of tools for the practitioner: information on trees and shrubs suited to the region and guidelines for assessing community needs and designing appropriate agroforestry activities. A list of contacts in the region is also provided to facilitate and encourage communication of research results and experience in the field.

**Keyword:** Agro-forestry, Tree species, Shrub, Evaluation

**H.A. STEPPLER & P.K.R. NAIR**

**Agroforestry a decade of development**

**ICRAF, 10th Anniversary, International Council for Research in Agroforestry, Nairobi, Kenya, 335 pp., 1987, English**

This volume is part of the celebrations of the tenth anniversary of the establishment of the International Council for Research in Agroforestry (ICRAF).

This book is divided into five sections. Chapters 1 and 2 are an introduction. Chapters 3, 4 and 5 present some perspectives on agroforestry from the ecological, the institutional and the developmental viewpoints. Chapters 6, 7, 8, 9 and 10 describe the prominent agroforestry systems in some particular regions as seen by residents of each region or by persons with many year's experience there. Chapters 11, 12 and 13 cover problems associated with the measurement, impact and transfer of the technology of agroforestry interventions. Finally, Chapters 14, 15, 16 and 17 discuss some research findings and proposals for research activities in four areas of agroforestry, namely, systems, nutrient enrichment, germplasm evaluation and tree-component improvement.

**Keyword:** Agro-forestry, Ecology, Evaluation, Soil fertility

**A.M. KILEWE, K.M. KEALEY & K.K. KEBARA**

**Agroforestry development in Kenya**

**Proceedings of the Second Kenya National Seminar on Agroforestry, Kenya, 533 pp., 1988, English**

This publication contains the full proceedings of the Second Kenya National Seminar on Agroforestry, held from 7 to 16 November 1988 at ICRAF headquarters in Nairobi, Kenya, as a joint venture between the National Council for Science and technology (NCST) and the International Council for Research in Agroforestry (ICRAF). The Seminar was the second major meeting of this kind in Kenya, the first one was held in 1980, to bring together a wide variety of professionals to highlight trends in agroforestry science and practice, facilitate the exchange of ideas and experience through plenary and working-group discussions and field tours, and set general guidelines and make specific recommendations for a national agroforestry research and development strategy for the next decade.

The Seminar consisted of plenary sessions in which technical papers were presented. Poster sessions were also included as well as three field tours and five working-group meetings. The main objectives of the working-group meetings were to provide an opportunity to the participants, based on their expertise and on what they gathered from the plenary sessions and field tours, to make specific recommendations on research strategies and priorities, extension strategies and packages, socioeconomic factors, education and training, and institutional issues in agroforestry research and development.

The information generated at the Seminar has been provided in two publications, an executive summary and a complete seminar proceedings. The executive summary publication contains an introduction, a list of the most important recommendations, summaries of 15 invited papers, and a list of participants. This publication, however, of the complete seminar proceedings contains the executive summary as well as all technical papers presented in the plenary sessions.

**Keyword:** Agro-forestry, Social and economic analysis, Research and development

### **J.B. RAINTREE**

**D & D user's manual (An introduction of agroforestry diagnosis and design)**

**International Council for Research in Agroforestry, Nairobi, Kenya,**

**110 pp., 1987, English**

D&D is a methodology for the diagnosis of land management problems and design of agroforestry solutions. It was developed by ICRAF to assist agroforestry researchers and development field workers to plan and implement effective research and development projects.

In response to reader feedback on earlier publications in the D&D manual series, this manual has been written to answer popular demand for a user-friendly introduction to ICRAF's methodology for agroforestry diagnosis and design. It replaces the earlier guidelines for agroforestry diagnosis and design and represents a new synthesis of the most generally useful and adaptable procedures to emerge from practical applications of the D&D methodology during a five year trial period in sites around the world.

**Keyword:** Agro-forestry, Research and development, Guideline, Land-use

### **JOHN B. RAINTREE**

**Socioeconomic attributes of trees and tree planting practices**

**FAO, Rome, Italy, 115 pp., 1991, English**

Socioeconomic attributes of trees and tree planting practices began with a request that community forest unit look at the socioeconomic effects of specific tree species. But that is not a subject that can be universally addressed. In one place a specific tree species will live, in another it will not; in one region there is undergrowth beneath it, in another there is not; in one area women farmers may want trees that offer one product, in the same area men farmers may want a different function to be played by the trees. The issue is not that some trees are universally helpful or harmful; certain species are simultaneously perceived to be miraculous by some and bad, even evil, by others.

Dr. John Raintree of the International Council for Research in Agroforestry, with the support of its Director General Bjorn Lundgren, has cooperated with the Forestry Department of FAO to write this forestry note.

**Keyword:** Social forestry, Planting, Tree species, Social and economic analysis, Community forestry

### **UNESCO**

**Women's concerns and planning: a methodological approach for their integration into local, regional and national planning**

**Socio-economic Studies, Belgium, No. 13, 166 pp., 1986, English**

The publication consists of an introduction and six chapters, the five national case studies, and the recommendations of the San Marino meeting.

Chapter I, prepared by the Togolese Federation of Women in Legal Profession deals with "Women's participation in development" and demonstrates the diversity and the importance of women's activities in the

home; the community and the nation.

Chapter II, "Problems that concern women and their incorporation in development planning".

Chapter III, "Women in China's socio-economic development" by the all-China women's federation.

Chapter IV, "Women and development".

Chapter V, "The response of public authorities in Italy to needs expressed by women".

Chapter VI presents the recommendations of the meeting which represent the consensus reached after lively discussions which focused on.

**Keyword:** Social and economic analysis, Forest development, Rural community

#### **KATHERINE WARNER**

**Patterns of farmer tree growing in Eastern Africa:**

**a socioeconomic analysis**

**ICRAF Tropical Forestry Papers, International Council for Research in**

**Agroforestry, Nairobi, Kenya, No. 27, 270 pp., 1993, English**

This study presents the results of a major attempt by two international institutions, the Oxford Forestry Institute and the International Council for Research in Agroforestry, to collect, organize and synthesize secondary and primary data in Eastern Africa which shed light on the key socio-economic factors affecting farmer's decisions about the growing of trees. The study identified important explanatory variables in this respect, such as tenure rights, crop and livestock management, availability of tree based products, market opportunity, as well as factor supply and costs, cultural attitudes, sustainability concerns and governmental interventions. The information was obtained from eight countries in the region: Burundi, Kenya, Malawi, Rwanda, Tanzania, Uganda, Zambia and Zimbabwe. Since these countries represent a wide diversity of natural environments, cultures, population density, land use systems and development potentials, these results have strategic value not only in the study region but also in other parts of the world.

**Keyword:** Agro-forestry, Social forestry, Social and economic analysis

#### **P.S. RAMAKRISHNAN**

**Shifting agriculture and sustainable development - an interdisciplinary study from north-eastern India**

**Man and the Biosphere Series, UNESCO, Paris, France**

**Vol. 10, 424 pp., 1992, English**

This volume presents a wide ranging synthesis of a long-term ecological study of shifting cultivation in north-eastern India.

The work has been wide ranging in scope and content, covering such topics as nutrient cycling, hydrology, plant succession, soil microbiology and socio-economics. The work has sought to combine detailed ecological studies on the dynamics of rural ecosystems with practical suggestions for improving the systems of land use and land management in the region. It has also placed studies on rain forest conservation and management within the broader human ecological context of village function and its redevelopment. Though the present case study is focused on upland areas of north-eastern India, it is hoped that the approaches and concepts set out in this volume will be of wider interest to those interested in the ecological systems and cultures of the humid tropics, as an example of the sort of contribution that scientists can make in assisting tropical peoples to adapt to changing social and economic circumstances.

**Keyword:** Shifting cultivation, Ecology, Succession, Forest hydrology, Ecosystem, Land-use

#### **DANIEL M. ROBISON & SHEILA J. MCKEAN**

**Shifting cultivation and alternatives - an annotated bibliography 1972-1989**

**CAB International, Oxon, UK, 281 pp., 1992, English**

Something which has not changed in the last 30 years is the ubiquity of shifting cultivation, or at least the practice of slash and burn followed by fallow. Slashing and burning followed by fallow is at once a strategy for fertilizing and controlling weeds and diseases. Where adequate fallow occurs, it results in ecosystem

maintenance. However, fallow periods are decreasing for most of the approximately 250 million people that depend on this system. This results in, among other things, decreasing system nutrient stocks, degrading soils, and decreasing biological diversity. This in turn affects living conditions and nutritional quality. The land is more exposed, leading to broader ecological effects such as increased probability of erosion and flooding and decreased quality and quantity of water for domestic use.

The book therefore addresses a topic of great current concern. It seeks to gather and classify research work that has been carried out on the subject over a period of nearly twenty years drawing upon summaries of the research literature from the CAB ABSTRACTS database. The first half of the book provides descriptions of shifting cultivation in three sections: farming systems, the cropping period and the fallow period. The second part of the book then considers alternatives to shifting cultivation under various headings such as improved fallows, agroforestry and social forestry, etc. In each section, abstracts are listed alphabetically by author. The book will therefore provide a unique synthesis of research in this field and will be invaluable to all concerned with soil science farming systems and environmental issues associated with tropical agriculture.

**Keyword:** Shifting cultivation, Agro-forestry, Fallow, Social forestry

## 8. OTHERS

**A.B. TEMU, B.K. KAALE & J.K. MAGHEMBE**

**Wood-based energy for development: Proceedings of a national seminar held in Dar es Salaam, Tanzania**

**The Ministry of Natural Resources and Tourism and SIDA, Tanzania**

**107 pp., 1984, English**

Wood is by tradition the most important source of energy in Tanzania, supplying about 90% of the country's total energy demand. However, fuelwood which was abundant few decades ago, is now a scarce commodity in all regions. This is due to the fact that little attention has been made to plan for its sustained production. The result is overexploitation of the natural forests causing deforestation and environmental decline.

Still Tanzania has a great potential for production of wood in fast growing plantation for sustained supply of timber and energy. The over 100,000 ha of plantations and woodlots established in the country during the last 20 - 30 years are good examples of this potential.

The National Seminar on wood-based energy for development in Tanzania was held in Dar es Salaam, and it was the first of this kind, drawing participants from all ministries involved in the development and utilization of energy in the country. The objective of the Seminar was to formulate action oriented strategies for ensuring sustained supply of wood energy, and maintenance of sound vegetation cover for environment conditions desired for increased agriculture and livestock production.

This documentation is a proceedings of the Seminar.

**Keyword:** Fuelwood, Plantation, Environmental conservation, Forest policy, Forest management

**JAN A. EKLOF & HANS PETTERSSON**

**A study on energy use and afforestation in Tabora**

**Statistics Sweden (Stockholm) & Takwimu (Dar es Salaam), Tanzania**

**30 pp., 1984, English**

The research reported here is an integral part of a field project carried out during the training of a group of Tanzanian Regional Statistical Officers. The field work took place in Tabora region during three weeks in February and March 1984. In many parts of Tanzania, the crises in fuelwood, for both household consumption and for other rural activities, is becoming increasingly felt by the people. Without effective measures being taken, the problem will become more severe as the population continues to increase while the supply of fuelwood continues to diminish.

The field project was proposed as a general study of the demand for and supply of forest products in Tabora region. Due to the limited resources, the study had to be restricted in scope and coverage. Some forest products like timber, pole, withies and wood for beekeeping were excluded from the study. It was also found difficult to study charcoal in the envisaged survey.

The study was oriented towards measurement of energy use by households and tobacco farmers, and afforestation efforts by households, farmers and institutions (villages, schools). This information would enable some estimates of the deforestation/afforestation balance in the region.

**Keyword:** Afforestation, Fuelwood, Social and economic analysis

**AIDA C. MONARES**

**Energy, forestry and natural resources activities in the African Region**

**Bureau for Africa, Agency for International Development, Washington, D.C.,**

**USA, 199 pp., 1984, English**

The purpose of this compedium is to provide an overview of the United States Agency for International Development (USAID)'s project activities in energy, forestry and natural resources in the Africa Region. Projects described herein have been developed in response to Congressional mandates and USAID policies to address critical shortages in energy, forestry/fuelwood and natural resources confronting less-developed countries (LDCs)

of the world. Project efforts encompass a wide spectrum of activities, are tailored to meet specific LDC needs, and are aimed at LDC assistance in the following fields: policy planning, training and institutional support; technology development, testing and research; program evaluation; data collection; energy research; and expansions of energy supplies. Through these efforts, it is hoped that LDC energy constraints to development will be alleviated and a transition to a balanced mix of energy sources will be achieved.

The contents of the compendium are as followings.

1. Introduction
2. Africa Bureau Bilateral Projects
3. Bureau for Food for Peace and Voluntary Assistance
4. Africa Bureau Regional Projects
5. Bureau for Science and Technology Projects

**Keyword:** Fuelwood, Forest development, Forest policy, Research and development

### **UNESCO**

**Man belongs to the earth, international cooperation in environmental research**

**Unesco's Man and the Biosphere Programme, UNESCO, Paris, France**

**175 pp., 1988, English**

The Man and the Biosphere (MAB) Programme is an international programme of research, training, demonstration and information diffusion, launched by Unesco in the early 1970s. An integral part of Unesco's broader programme on the human environment and terrestrial and marine resources, its objective is to provide the scientific basis and the trained personnel needed to deal with problems relating to resource use, conservation and human settlements.

The aim of the present report is to provide a semi-popular account of the MAB programme as it stood in 1987 - its status at that time, recent activities, examples of substantive accomplishments, future directions, etc. It is hoped that the report will be of interest to those taking part in MAB and others involved in environmental research and management who wish to learn something about the programme's recent work. The report is wide-ranging, but does not pretend to cover all the areas of activity within MAB. It provides insights and examples, but not an overall balance-sheet.

The report has been written and compiled by a two-man team comprising a science writer familiar with the MAB Programme and a member of the Unesco-MAB secretariat. Many sources have been drawn upon in preparing the report as well as information as yet unpublished or in draft form.

**Keyword:** Environmental conservation, Environmental protection, Research system, Research and development

### **G.F. WHITE**

**Environmental effects of arid land irrigation in developing countries**

**MAB Technical Notes 8, UNESCO, Paris, France, 67 pp., 1978, English**

Irrigation in arid lands has long been used to extend the total area of arable land and to thereby provide more food for growing populations. With the rapid development of irrigated areas and the dramatic population growth rate in developing countries, the effective use of irrigation becomes increasingly important.

This Technical Note examines both the beneficial and negative effects of irrigation in developing countries, seen in the context of the practical problems these countries face with respect to demands of a growing population, limited natural and financial resources, climatic conditions, etc. The need for integrated research addressed to the technical and human aspects of these problems is stressed. Means for improving the efficiency of existing schemes are reviewed, and criteria suggested for evaluating the desirability of inaugurating new projects. Social response and communication among the various groups or individuals involved - from the planner to the farmer - are also discussed.

**Keyword:** Arid region, Land-use, Research and development, Environmental factor

**MARGARET I. EVANS**

**Firewood versus alternatives: Domestic fuel in Mexico**  
C.F.I. Occasional Papers No. 23, Commonwealth Forestry Institute,  
University of Oxford, UK, 66 pp., 1984, English

About 20 million people use firewood in Mexico as a whole. A transition was found from complete dependence upon firewood among the subsistence families who produce maize, to the combined use of both wood and LPG among the households having a mixed economy, and finally reliance upon gas only by wage-earning employees for whom the opportunity cost of obtaining firewood is too high. The largest single domestic use of firewood is the preparation of maize tortillas (which cannot be conveniently done using currently available gas stoves). Households who do not grow maize buy ready-made tortillas and thus use less firewood than do the subsistence farmers. Scarcity of fuel is felt most, however, by the landless households who earn their livelihood from selling firewood and timber and can often only afford to burn twigs and crop residues for themselves. The capital investment for a gas stove (of the currently available models) and steel cylinders, and regular cash outlay for LPG refills is beyond the means of the poorer sector.

In all, 80 per cent of the total population had gas stoves, but an average of 8 kg of wood per capita weekly was also used. The need to have an alternative fuel supply was very evident, since not only access to both fuels is difficult, but entitlement to either fuel are complex and vary with both external economic factors and internal social and political pressures including land tenure.

**Keyword:** Firewood, Fuelwood, Social forestry, Social and economic analysis

**MELVIN BOLTON**

**The management of crocodiles in captivity**  
FAO Conservation Guide 22, Forestry Dep., FAO, Rome, Italy  
62 pp., 1989, English

This document is a guideline of crocodiles farming.

Wild populations of crocodiles were seriously depleted in many parts of the world after the Second World War, due to over-exploitation for their skins. However, a demand for skins had been created and in order to satisfy this, and at the same time to ease pressure on remaining wild stocks, attempts to raise and manage various species in captivity were made.

During the 1970's, FAO executed milestone crocodile management projects in India and Papua New Guinea. The first was notable for hatching and rearing hundreds of the endangered gharial (*Gavialis gangeticus*) in captivity, to bring the species back from the brink of extinction. The second, developed approaches to crocodile management which both involved and improved benefits to rural people. It also became the model used for designing other sustainable crocodile utilization programmes that met the requirements of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Subsequently, FAO has been active in providing assistance to other countries, not only in the Asia-Pacific region, but also in Africa and Latin America. Thus, in addition to technologies and documentation generated by various workers in this field, there was a wealth of in-house experience to draw upon in compiling this Manual.

It is hoped that this manual will help to clarify the requirements for a successful enterprise and will instruct the beginner in the basics of crocodile husbandry.

**Keyword:** Guideline, Non-timber products

**FAO**

**National parks planning: a manual with annotated examples**  
FAO Conservation Guide 17, Forestry Dep., FAO Rome, Italy  
105 pp., 1988, English

FAO has been, and continues to be, involved in assisting member countries with the planning and management of their national parks and other protected areas. The original Spanish version of this Manual was prepared by members of the Regional Wildland Management and Environmental Conservation Project for Latin America (FAO/RBF TF 199). There was an urgent need for a similar publication for other parts of the

developing world, and members of the Forest and Wildlands Conservation Branch cooperated with their colleagues in the Latin American region to produce a document, applicable on a world-wide basis, in both English and French, as well as Spanish. This was published in 1976.

The present document is an updated, revised version of the 1976 publication. It incorporates the experience gained by FAO and other international organizations, especially IUCN/WWF, in park planning during the years following the publication of the original document. The Manual is illustrated with annotated examples drawn from management plans for individual national parks in many parts of the world.

**Keyword:** Guideline, National park, Protected area

**FAO**

**Appropriate technology in forestry**

**FAO Conservation Guide 31, Forestry Dep., FAO Rome, Italy**

**137 pp., 1982, English**

The SIDA/FAO Consultation in Intermediate Technology in Forestry took place in India from 18 October to 7 November 1981.

The purpose of the Consultation was to contribute to the development of intermediate local technology and to raise its level in rural areas; to spread information amongst forestry top supervisors and staff responsible for forest operations with regard to the balancing of equipment and investment in forestry against prevailing social conditions, and the role and status of intermediate technology in this.

The Consultation was attended by 37 participants. The Programme of the Consultation included lectures, case studies, group work, general discussion and study trips. The participants of each country were requested to present a Country Report reflecting the conditions prevailing in their home countries.

The Report is a compilation of the documents presented by the lecturers at the Consultation and the Country Reports prepared by its participants. The Consultation's Recommendations are also included in the Report. It has been published in order that the information contained herein can attain a wider distribution.

**Keyword:** Silvicultural technique, Study and training, Forest management

**FAO**

**Conservation and development of tropical forest resources**

**FAO Conservation Guide 37, Forestry Dep., FAO Rome, Italy**

**122 pp., 1982, English**

The 2nd Expert Meeting on Tropical Forests, jointly sponsored by UNEP, FAO and Unesco, was held at FAO Headquarters, Rome, Italy, from 12 to 15 January 1982. The session was attended by 34 experts from 21 countries and from nine international governmental and non-governmental organizations.

This paper assembles the main documents related to this important meeting, viz: the report of the meeting as approved by the participants, the discussion paper "Harmonizing International Action in support of National efforts for Tropical Forest resources Management" and its supplement "International Activities in the field of Tropical Forestry".

The discussions highlighted the main cause for the continued destruction of the world's tropical forests which, basically, is the increasing demand for agricultural land to supply the needs of rapidly growing populations. The recommendations of the meeting, amongst other things, call for the harmonization of the programmes of the international organizations in the field of tropical forestry development and conservation and closer coordination between agricultural and forestry activities.

**Keyword:** Tropical forest, Forest resources, Forest management, Forest development, Land-use, Deforestation

**FAO**

**Land evaluation for forestry**

**FAO Conservation Guide 48, Forestry Dep., FAO Rome, Italy**

**123 pp., 1984, English**

The basis of land evaluation is comparison between land use and land. The land uses considered can



range from broadly defined classes, e.g. softwood plantations, conservation forestry, to uses described in more detail, e.g. by tree species, silvicultural methods and harvesting practices. Land refers to all features of the natural environment which can influence its use by man; land included not only landforms and soils but also climate and vegetation, including existing forest stands.

The guideline presents procedures for conducting land evaluation with particular reference to forestry. The principles and methods described here will be found applicable to most forest land use planning situations. These could deal with choices among kinds and intensities of land uses; for example forestry versus agriculture, or timber production versus soil/water conservation, selection versus intensive forest working, or could relate to different levels of planning; for example, national, provincial, district or local.

The present guideline should not be regarded as a definitive manual on land evaluation for forestry. Rather, they represent a summary of present knowledge and experience. In future, it may be possible to prepare more specific guidelines on land evaluation for different forestry purposes, e.g. afforestation, wildlife management, soil and water conservation, etc. The immediate need is to put these guidelines to the test of practical experience in field projects, in order that the experience gained can lead to future improvements.

**Keyword:** Guideline, Land-use, Forest management, Soil conservation, Water conservation, Forest utilization

#### **D. SIM & H.A. HILMI**

**Forestry extension methods**

**FAO Forestry Paper 80, Forestry Dep., FAO Rome, Italy**

**155 pp., 1987, English**

This publication is the second in a series of three dealing with forestry extension in its current context. The initial publication, Forestry Extension Organization, FAO Forestry Paper 66, FAO Rome 1986, dealt with the establishment and organization of forestry extension activities. This volume covers the design and implementation of forestry extension activities in the field. Throughout these publications, extension is regarded in its widest attitudes and skills to determine what is needed, how it can be done, what local co-operation and resources can be mobilised and what additional assistance may be necessary to overcome particular obstacles. It implies action by the people to solve local problems, not action for them, though it does not preclude assistance where local resources are inadequate to meet otherwise realistic and necessary targets. It places particular emphasis on determining appropriate targets for extension work by the people themselves who must be involved in achieving these, and in the identification and mobilisation of local resources.

**Keyword:** Forest policy, Extension work, Training

#### **FAO**

**A new approach to energy planning for sustainable rural development**

**FAO Environment and Energy Paper 12, Forestry Dep. & Fisheries Dep.,**

**FAO, Rome, Italy, 43 pp., 1990, English**

The concept of sustainable development is especially relevant when applied to the growing energy needs of more than three billion people living in the rural areas of Africa, Asia and Latin America.

An integrated approach for energy planning for sustainable rural development is presented and the framework within which this approach can be implemented is discussed in this document. Guidelines are proposed for a comprehensive integrated rural energy planning programme which is intended to make the integrated approach and the framework operational in developing countries.

The approach set out in the document stresses that energy planning, without effective mechanisms to convert its findings into implementable projects, becomes an academic exercise. National energy policies which do not converge with the interests of the smallest rural communities can only be theoretical. Mature rural technologies such as small diesel engines, solar dryers, wind generators, small hydropower schemes, biomass gasifiers or rural electrification programmes, can only be successfully implemented if they fulfil identified and assessed energy requirements for rural and agricultural activities and if they are supported by technical, financial and policy measures.

**Keyword:** Fuelwood, Forest protection, Biomass, Natural resources

**J.D. KEITA**

**Plantations in the Sahel**

**Unasyilva, FAO, Rome, Italy, 33(134), 25-29, 1981, English**

Faced with ecological crisis foresters have reacted by establishing plantations of exotic species of trees for fuelwood needs. These plantations are designed to be set up and maintained with machinery for clearing land and working the soil. Machinery will have to be imported and the machines in turn will require imported fuel, all to be paid for with scarce foreign exchange. The question is, will not Sahelian forestry consume too much energy for the sake of creating energy? Its answer, which this article attempts to give, may also be useful beyond the Sahel, anywhere in the world where similar ecological, economic and human factors exist in combination.

One of the aims of Sahelian silviculture is indeed the production of energy. It would be paradoxical if it itself consumed too much energy. But, most of all, foresters in the Sahel and elsewhere must be reminded that in all their activities it is man and man's needs that must play the leading role.

**Keyword:** Plantation, Arid region, Silvicultural technique, Fuelwood, Forest management, Forest policy

**FAO**

**World list of institutions engaged in forestry and forest products research**

**FAO Forestry Paper No. 62, Forestry Dep., FAO Rome, Italy**

**166 pp., 1985, English**

The present publication is an expanded and updated version of the Provisional List of Institutions Engaged in Forestry and Forest Products published in 1982.

It is hoped that the World List will facilitate contacts between institutions and thus help to improve interinstitutional cooperation and exchange of information on research of common interest.

**Keyword:** Research and development, Research system

**FAO**

**Forestry extension organization**

**FAO Forestry Paper No. 66, Forestry Dep., FAO Rome, Italy**

**167 pp., 1986, English**

This publication is the result of team work and based on a number of contributions from consultants and FAO staff members. It attempts to bring together some of the major institutional considerations in forestry extension. It does not claim to provide a prescription for every type of forestry extension organization. Instead, it offers a broad review of institutional arrangements for extension in forestry.

The document deals with extension programmes, methods of extension, communication for extension, strategy, organization structure, managing the extension service, etc. It will be of assistance to developing countries wishing to establish forestry extension programmes or to improve their existing services.

**Keyword:** Extension work, Training

**FAO/UNDP**

**Proceedings of heads of forestry meeting 08-12 October 1991 Lautoka, Fiji**

**RAS/86/036 Field Document 9, South Pacific Forestry Development**

**Programme, FAO/UNDP, 180 pp., 1992, English**

The 1991 Heads of Forestry meeting was the second such meeting organised by the UNDP/FAO South Pacific Forestry Development Program (RAS/86/036). Eleven Project countries and two non-Project countries were presented, compared to eight Project countries at the 1990 meeting. There was also stronger participation by other agencies, including the USDA Forest service, donors and non-governmental organisations, bringing the total number of participants to 38.

This report, together with the country reports and agency statements tabled make up the present Proceedings of the meeting.

**Keyword:** Land-use, Forest resource, Forest policy

**MINISTRY OF FORESTRY, VIETNAM**  
Vietnam forestry sector review tropical forestry action  
programme, main report  
Ministry of Forestry, Hanoi, Vietnam, 201 pp., 1991, English

The Government of Vietnam has made considerable efforts in the last few years in initiating development of the forestry sector. With the present transformation from central planning to market orientation, significant changes are taking place and are being implemented. Termination of subsidies to state enterprises and the allocation of forest land on long-term leases to families, cooperatives and non-state units are drastic measures compared to the past system of direct state control.

**Keyword:** Land-use, Forest development, Forest protection, Forest management

**B.N. KIGOMO, P. BARAZA et al.**  
A perspective on the structure and research programmes  
Kenya Forestry Research Institute (KEFRI), Muguga, Kenya  
31 pp., 1990, English

The Kenya Forestry Research Institute (KEFRI) was established in July, 1986, as a national statutory Science Research Institute under the Science Technology Act.

The need for a national policy supportive of a stable environment for forest management and development has become more intensive during the past ten years. Also realised are the constraints on limitation of production as posed by the small land base under forest management. It is moreover becoming evident today that the population is growing faster than the trees, as the effects of the increasing population impinge on the limited forest resources base.

To address the above and other critical issues, KEFRI has mapped out a strategic research plan that focuses on defining schemes for solving problems that continue reducing the performance of the research initiative by undertaking actual research on problem oriented investigations.

This prospectus gives an overview of the management structure of KEFRI and the research programmes.

**Keyword:** Research system, Research and development

**KEFRI**  
Proceedings of the workshop on setting national forestry research  
priorities in Kenya  
Kenya Forestry Research Institute (KEFRI), Nairobi, Kenya  
146 pp., 1989, English

This report presents the proceedings at the National Workshop on Setting Forestry Research Priorities held from 6th to 10th February, 1989 in Nyeri, Kenya. The workshop was the second meeting on strengthening forest research in Kenya. The first National Workshop was held in November, 1983. This workshop recommended to convene a second workshop to determine national research priorities. In compliance with this recommendation, the second workshop was held at Nyeri in 1989. The Nyeri workshop was convened to establish research and development priorities for the medium and long term to enable KEFRI (Kenya Forestry Research Institute) to develop its research blue print or strategic plans for the period.

The report includes forty-one technical papers presented and a summary of the recommendations.

**Keyword:** Research system, Research and development

**KEFRI**  
KEFRI Strategic plan 2000 - executive summary  
Kenya Forestry Research Institute (KEFRI), Nairobi, Kenya  
7 pp., 1990, English

Forestry research has the potential for generating information and technologies necessary for sustainable development, management and utilization of forestry and related resources for all time. In the past, forest research in Kenya has contributed significantly in the management of water catchment areas and in industrial forestry development. With increasing pressure on forest land, and escalating demand for forest/tree products and other related resources, forestry research holds a central role in determining the success of forestry development and conservation programmes.

The forest research plan in Kenya has been formulated as a strategic plan focusing on medium and long term problems upto the year 2000.

**Keyword:** Research system, Research and development

#### **TAFORI**

**Forestry research master plan 1993–2002, draft**

**Tanzania Forestry Research Institute (TAFORI), Morogoro, Tanzania**

**76 pp., 1992, English**

The understanding of the role of forests in the amelioration of the environment has placed great emphasis on better informed development, management and judicious utilization of forest resources. Global and regional concerns have been merged into the national forestry development blue print, now known as Tanzania Forestry Action Plan (TFAP). While the plan raises hopes for improvement of the status of our forests, it is quite clear that for that to happen, strong backstopping from forestry research is a necessary precondition.

Information is needed to answer crucial question such as: the drying up of rivers, the persistent lack of fuelwood, the progressive desertification and the deteriorating food production. These, and other question, can only be answered through concerted effort to support and carry out properly targeted forestry research.

This document presents a forestry research master plan for the period 1993 to 2002. The plan attempts to address crucial questions, and provides viable strategies. However, the success of the plan will depend very much on the availability of the proposed inputs and institutional support.

**Keyword:** Research and development, Research system

#### **TAFORI**

**Forestry research master plan 1993–2002 – project profiles**

**Tanzania Forestry Research Institute (TAFORI), Morogoro, Tanzania**

**72 pp., 1992, English**

This volume is project profiles based on the Forestry Research Master Plan in Tanzania. The projects proposed here are by no means exhaustive. The list of forestry problems plaguing Tanzania and its neighbours is too long to be addressed realistically in a ten-year plan.

TAFORI invites potential collaborators and financiers to discuss details on projects of their interest and work out mutually rewarding packages.

**Keyword:** Research system, Research and development

#### **J. BURIEY et al.**

**Forestry research in Eastern and Southern Africa**

**Tropical Forestry Papers, Oxford Forestry Institute, Oxford, UK**

**No. 19, 1989, English**

A concise tabular style is used in this report to reduce the text and increase the impact of main concepts.

Chapter 1 relates the present publication to its context as a contribution to the wider Eastern and Southern Africa Research Review carried out by the World Bank.

Chapter 2 records the terms of reference for the forestry research study in eastern and southern Africa carried out by the Oxford Forestry Institute.

Chapter 3 outlines the concept of the continuum from research through development to application and emphasizes the relationship between policy, management, research and beneficiaries of the major tree

management practices.

Chapter 4 describes the main theoretical strategies for meeting research needs, including both national and international working and support mechanisms.

Chapter 5 identifies 13 major issues in the region that related to forestry.

Chapter 6 identifies 17 key research topics required for appropriate land use in the regions.

Chapter 7 summarizes the current professional and technical staff position and chapter 8 amplifies the three complementary strategies.

**Keyword:** Forest policy, Forest management, Research and development, Land-use

#### **OFI**

##### **Tropical forestry research 1982-1985**

**Oxford Forestry Institute, Department of Plant Sciences,  
University of Oxford, UK, 27 pp., 1988, English**

Some 20 years ago the Commonwealth Forestry Institute, now the Oxford Forestry Institute, embarked on research in support of the conservation and improved use of tropical forest genetic resources. The sustained effort necessary for this work to succeed has been made possible by a series of projects supported by the British Government's Overseas Development Administration (ODA) as part of its Forest Research and Development Programme. The Programme is reviewed periodically by an ad hoc review panel convened by the ODA. Following the first review in 1982, Willan described the background to the Programme and gave accounts of those projects that were implemented up to that date. The present report follows the second meeting of the review panel three years later and is concerned with those projects that were implemented at the OFI between 1983 and 1985.

**Keyword:** Tropical forest, Research and development, Evaluation, Genetic resources, Forest management

#### **A. PAULO M. GALVAO**

**International cooperation on forestry research and development Brazil  
Oxford Forestry Institute, University of Oxford, UK  
122 pp., 1991, English**

International technical cooperation (ITC) is an efficient means of promoting scientific, technological, economic and social development in the Third World. Furthermore, it disseminates languages and cultures and leads to a better relationship between partners.

The Brazilian Cooperation Agency (ABC, 1990) reveals that it coordinated twenty-five environmental projects (including forestry research and development) which involved technical cooperation, totalling \$36 million funded from a number of sources.

As financial resources for research in Brazil have been dramatically squeezed by the debt burden and by other related and unrelated problems, one of the main purposes of this work is to examine the possibilities for the country to enhance technical cooperation (TC) on forestry research and development. Therefore, the focus is more on past and present Brazilian activities in this field as well as on international agencies, institutions and countries which have provided or may provide aid to Brazil and on entities which promote international collaborative research. The report also reviews drawbacks, successes and benefits of typical projects, as case studies. It provides an overview of international policies, economics and environmental case studies.

**Keyword:** Research system, Research and development

#### **S.C. PEARCE**

**Field experimentation with fruit trees and other perennial plants  
Technical Communication, Kent, UK, No. 23, 182 pp., 1976, English**

A good field experiment has to be satisfactory in several ways. The farm superintendent has to be able to manage it on the ground, the statistician must be able to carry out a valid analysis of the data and, above all, the experiment has to obtain precise results relevant to what he wants to know. In this book, first published in 1953, and now fully revised, the author attempts to bring the threads together. Other texts deal more fully with

particular aspects; the aim here is integration.

For 37 years the author was a member of the Statistics Section of the East Malling Research Station and saw field experimentation on temperate fruit trees at close quarters, but he became ever more interested in similar problems with tropical crops, so the reference in the title to "other perennial plants" is not perfunctory. The book deals with the place of the field experiment in agricultural research and sets out the usual experimental designs, but with the emphasis that there are more possibilities than most people suspect. There is a chapter on the control of experimental error by the use of covariance and another on plot technique, while the various sorts of experiment, e.g. on fertilizers, varieties, attention is given to problems of data analysis and the general principles of recording and measuring.

**Keyword:** Fruit tree, Tree species, Fertilizing, Experiment forest

**J. BURIEY et al.**

**Forestry Research in Eastern and Southern Africa  
Tropical Forestry Papers, Oxford Forestry Institute,  
University of Oxford, UK, No. 19, 276 pp., 1989, English**

The OFI staff and consultants who contributed to this report have had considerable experience in forest management, research and consultancy in Africa. As an Institute the OFI programme, with some 40 full-time professionals and 10 part-time associates, is directed largely towards strengthening national institutional capabilities in tropical countries through education, training, research and advice. One of the main research tools is the library and information service which is the western world's library of deposit for forestry and related literature and contains most published and considerable unpublished "grey" literature for over 100 years. This collective information and experience was used in the preparation of the 24 country review for this report.

**Keyword:** Research and development, Research system, Training



## **APPENDIX**

### **LIST OF INFORMATION RESOURCES**





## ITALY

### Food and Agriculture Organization of the United Nations Bookshop

Address: Viale delle Terme di Caracalla-00100 Rome, Italy  
Tel: 6-957973915 Fax.: 57973152 Telex: 610181 FAO1  
5782610  
57975155

Identification of parent organization:  
Food and Agriculture Organization of the United Nations (FAO)

Type of service:  
Information Services

Geographic coverage of information resources:  
World-wide

Subject coverage:  
Natural resources; crops; livestock; rural development; nutrition; agriculture statistics;  
food and agriculture policies; forestry; fisheries

Types of indexes provided for access to the services:  
Publication catalogue; Computerized information series

Identification of target users:  
Experts and laymen; booksellers and librarians; those involved in agriculture, food, rural  
development

Types of services provided for users:  
Publications; microfiches

Charge of services:  
Charge

Procedure required for applying services:  
Letter, fax, telex and direct request

Types of periodical publications available to users:  
FAO Forestry Papers; FAO Conservation Guides; FAO Environment and Energy Papers;  
FAO Soil Bulletins; Forestry Statistics, etc.

Procedure required for applying the publications and their charges:  
Letter, fax, telex and direct request; sales agents; charge

## KENYA

### Kenya Energy and Environment Organization (KENGO)

Address: Mwanzi Road, P.O. Box 48197, Nairobi, Kenya  
Tel: 749747/748281 Fax.: Telex:

Identification of parent organization:  
Kenya Energy and Environment Organizations

Type of service:  
Information Services

Geographic coverage of information resources: African region

Subject coverage:  
Energy; environmental conservation; community development

Identification of target users:  
Non-government organizations; individual

Date of establishment of the services: 1982

Types of services provided for users:  
Dissemination of information e.g. publication, documentation, training

Charge of services:  
Charge

Procedure required for applying services:

Direct request

Types of periodical publications available to users:

Resources (journal); Kengo news

Procedure required for applying the publications and their charges:

Direct request; charge

#### Kenya Forestry Research Institute (KEFRI)

Address: P.O. Box 20412, Nairobi, Kenya

Tel: 0154-32891/2 Fax.: 0154-32844 Telex:

Identification of parent organization:

Ministry of Environment and Natural Resources

Type of service:

Library

Geographic coverage of information resources:

National - Kenya; International

Subject coverage:

Agriculture; forestry; natural resources, etc.

Types of indexes provided for access to the services:

Author indexes; subject/title indexes

Identification of target users:

Researchers of KEFRI

Types of services provided for users:

Quick reference services; library loan

Charge of services:

No-charge

Procedure required for applying services:

Application form

Types of periodical publications available to users:

Technical Notes; KEFRI Newsletter

Procedure required for applying the publications and their charges:

Direct request; No-charge

#### International Center for Research in Agroforestry (ICRAF)

Address: United Nations Avenue, P.O. Box 30677, Nairobi, Kenya

Tel: (254-2)521450 Fax.: (254-2)521001 Telex: 22048

Identification of parent organization:

International Center for Research in Agroforestry

Type of service:

Information Services

Geographic coverage of information resources:

Developing countries of the topics

Subject coverage:

Agroforestry research focusing on land-use systems

Types of indexes provided for access to the services:

Publication lists

Identification of target users:

Individuals and organization; libraries

Date of establishment of the services:

1977

Types of services provided for users:

Publications; slide/video series; compute programs

Charge of services:

Charge except publication list

Procedure required for applying services:

Letter, fax, telex and application form

Types of periodical publications available to users:

Agroforestry today; Agroforestry Systems; Agroforestry abstracts

Procedure required for applying the publications and their charges:

No-charge for Agroforestry today; Further information, write to the Coordinator of ICRAF's Information and Documentation Programme

## UK

### Oxford Forestry Institute

Address: South Parks Road, Oxford, OX1 3RB, UK

Tel: (0865)275000 Fax: (0865)275074

Telex: 83147 VIAOR G ATTN FOROX

Identification of parent organization:

Dept. of Plant Sciences, University of Oxford

Type of service:

Library; information center; documentation center

Geographic coverage of information resources:

World-wide

Subject coverage:

Institutional aspects of forestry; silviculture; forest mensuration and management; physical forest environment; forest fire; forest plant biology; forest genetics and breeding; forest mycology and pathology; forest insects and other invertebrates; game, wildlife and national parks; forest protection and soil conservation; dendrochronology and dendroclimatology; wood properties; timber extraction and conversion; timber damage and timber protection; marketing and trade of forest products.

Types of indexes provided for access to the services:

Subject and personal indexes; geographical indexes; publication catalogue

Identification of target users:

Research institutions; educational institutions; individual researchers and students

Date of establishment of the services:

1905

Types of services provided for users:

Quick reference services; back up services, e.g. library loans, document copying

Charge of services:

Charge for photocopy and publication

Procedure required for applying services:

Direct request

Types of periodical publications available to users:

Publication catalogue

Procedure required for applying the publications and their charges: Direct request; no-charge

### C.A.B. International Center

Address: Wallingford, Oxon OX10 8DE, UK

Tel: (0491)32111 Fax.: (0491)33508

Telex: 847964 (COMAGG G)

Identification of parent organization:

C.A.B. International

Type of service:

Publication

Geographic coverage of information resources:

World-wide

Subject coverage:

Research on agriculture, forestry and allied disciplines, including agricultural economics and rural sociology, aspects of human medicine, veterinary medicine, crop protection and biotechnology

Types of indexes provided for access to the services:

Publication catalogue

Identification of target users:

Researchers; development planners; educators; students

Date of establishment of the services:

1928

Types of services provided for users:

Information services; publication; online; floppy disk, etc.

Charge of services:

Charge

Procedure required for applying services:

Letter, fax, telex and order form

Types of periodical publications available to users:

Forestry Abstracts (Journal); Agroforestry Abstracts

Procedure required for applying the publications and their charges:

Letter, fax, telex and order form; charge

## FRANCE

### United Nations Educational, Scientific and Cultural Organization, Bookshop

Address: 7, place de Fontenoy, 75352 Paris 07 SP, France

Tel: (1) 45 68 10 00 Fax.: (1)42 73 30 07 Telex: 204661 Paris

Identification of parent organization:

United Nations Educational, Scientific and Cultural Organization (UNESCO)

Type of service:

Publications

Geographic coverage of information resources:

World-wide

Subject coverage:

Science; Social sciences; Culture; Education, etc.

Types of indexes provided for access to the services:

Publication catalogue

Identification of target users:

Experts and laymen

Types of services provided for users:

Publications; microfiches

Charge of services:

Charge

Procedure required for applying services:

Direct request; academic bookshops; sales agents



