PN ABD 793

Agroforestry Literature:

A Selected Bibliography

ICRAF

The **International Council for Research in Agroforestry** (ICRAF) was established in 1978 with headquarters in Nairobi, Kenya. ICRAF is an autonomous, non-profit international research council governed by a Board of Trustees with equal representation from developed and developing countries. The mandate is to initiate, stimulate and support research leading to more sustainable and productive land use in developing countries through the integration or better management of trees in land-use systems.

The Council derives its operational funds from voluntary contributions by several bilateral, multilateral and private organizations. In 1988, these included the Canadian International Development Agency (CIDA), the World Bank (International Bank for Reconstruction and Development—IBRD), the Ministry of Development Cooperation of The Netherlands, Swiss Development Cooperation, The Royal Norwegian Ministry of Development Cooperation, the Swedish Agency for Research Cooperation with Developing Countries (SAREC), the Ford Foundation, the Federal Republic of Germany (BMZ/GTZ), the United States Agency for International Development (USAID), the Swedish International Development Authority (SIDA), the Government of France, The International Development Research Centre (IDRC) and the Near East Foundation.

ICRAF's programme of work is carried out through four divisions: the Research Development Division (RDD), the Collaborative Programmes Division (COLLPRO), the Information and Communications Division (INFOCOMM), and the Finance and Administration Division (FINAD).

© International Council for Research in Agroforestry 1988
P O Box 30677, Nairobi, Kenya

Labelle, R., Majisu, L., Munyua, H.

Agroforestry Literature: A Selected Bibliography. Nairobi, Kenya, ICRAF, 1988. vi + 269p.

Agroforestry; fuelwood; tropics; agrosilvopastoral systems; agropastoral systems; agrisilviculture; tenure; land use; soil conservation; food production; forestry; agriculture; farming systems; shifting cultivation; soil fertility.

UDC: 016:634.0.26

ISBN: 92 9059 048 3

Cover photo : An ICRAF scientist studies citrus intercropped with cabbage in the high-potential area of Tigoni/Limuru, Kenya, and looks up information on the relevant agroecological zone in the ICRAF library.

Agroforestry Literature:
A Selected Bibliography

Compilers:
R. Labelle, L. Majisu, and H. Munyua

CONTENTS

Introduction iv

Sample Entry vi

Abstracts 1

Author Index.....215

Species Index 230

Subject Index.....243

Country/Geographic Index 266

INTRODUCTION

Agroforestry, as the term is used at ICRAF, is a collective word for all land-use systems and practices in which woody perennials are deliberately grown on the same land-management unit as crops or animals or both. This can be done in some form of spatial arrangement or in a time sequence. To qualify as agroforestry, a given land-use system or practice must permit significant economic and ecological interactions between the woody and nonwoody components.

Within this broad definition, a wide variety of both traditional and new systems and practices falls under the umbrella concept of agroforestry. Shifting cultivation, taungya afforestation, various types of 'home gardens' in humid tropical areas, silvopastoral systems in dry areas, crop or livestock production under commercial tree crops—such as coconut, rubber, or oil palm—, alley cropping, windbreaks and live fences are some of the host of agroforestry practices found throughout the tropical and subtropical developing world.

Some of these practices have traditionally fallen under the disciplinary mandate of agricultural departments, others under forestry, still others under horticulture or animal husbandry. Most of them, however, have attracted little or no attention from established research, extension or development institutions.

The structure of information on agroforestry is complex, and there are significant gaps in knowledge and literature on the subject. Even the definition of agroforestry is debatable. There is also controversy between, agronomists, foresters, and other specialists about the appropriate institutional niche for agroforestry. In spite of these questions, agroforestry is now clearly established as an area of organized scientific research—the literature in this selected biliography attests to that.

This bibliography on agroforestry covers the period from the mid-1970s to early 1986. It contains 531 references and serves as an introduction to the essential readings on the subject. It will complement *Agroforestry Abstracts*, a quarterly journal copublished since June 1988 by ICRAF and the Commonwealth Agricultural Bureaux International (CABI). The bibliography has been produced using the Micro CDS/ISIS textual database management software (version 1.0) developed by the United Nations Educational, Scientific, and Cultural Organization (UNESCO).

Each bibliographic unit has been described according to the ICRAF in-house format and rules. References have been selected from the ICRAF Library database, and entries have been indexed using keywords selected from CABI and AGROVOC (Food and Agriculture Organization of the United Nations) thesauri, as well as our own in-house terms (see in particular ICRAF Working Paper No. 8).

Entries in the bibliography are listed sequentially by a master file number, which is a unique number assigned to each record by the computer. Four indexes appear at the end of the bibliography: one each for author, species, subject, and country/geographic area. The country index is based on the two-letter country codes provided by the International Standards Organization (ISO).

All documents listed in the bibliography are available from ICRAF. They can also be consulted in the ICRAF Library. Individual photocopies of documents for scientific research are available at a charge of US$ 0.20 per page. Books will usually not be photocopied for reasons of copyright. Requests for photocopies of documents cited in the bibliography may be referred to: INFODOC/ICRAF, PO Box 30677, Nairobi, Kenya.

The support of the Information Sciences Division of the International Development Research Centre (IDRC) is gratefully acknowledged.

Richard Labelle
Head, Information and
Documentation Unit
ICRAF

SAMPLE ENTRY

1._____	00206
2._____	06833
3._____	HARDOUIN, J.
4._____	Institut de medicine tropicale, Antwerpen (Belgium)
5._____	**AN EXAMPLE OF AGROFORESTRY IN RWANDA**
6._____	**UN EXEMPLE D'AGROFORESTERIE AU RWANDA**
7._____	Tropicultura
8, 9, 10, 11, 12	(1984); Vol: 2, No: 3; pg 104-106; Fr; 3 Tables; 2 Figures
13._____	XA; RW
14._____	Defines agroforestry and describes the physical and environmental conditions of the Kenyan coast. Spells out the research needs of agroforestry systems and shows the importance of tree crop based land use systems. Lists the important agricultural tree crops and their acreages. Gives a description of fuelwood/agroforestry research and demonstration and covers forestry.
15._____	AGROFORESTRY: EXPERIMENTAL STATION; PROJECTS;

1. Master File Number
2. Accession Number
3. Author
4. Affiliation
5. English Title
6. Other Title (in original language)
7. Source
8. Date of Publication
9. Volume and Issue Number
10. Pagination
11. Language of the Text
12. Notes
13. Geographic/Country Location
14. Species and Subject Descriptors
15. Abstract

ABSTRACTS

00001
01875
BUDOWSKI, G.
<THE> PLACE OF AGROFORESTRY IN MANAGING TROPICAL FORESTS.
(1980); EN
XL/CR; pg 18
Agroforestry is defined and its main variants are highlighted. The paper focuses on the relation between agroforestry and the management of tropical forests. Cases are provided to illustrate where agroforestry is beneficial or harmfull to the management of tropical high forests. Any favourable relationship between agroforestry and tropical moist forests would imply the braking of the rate of destruction and eventual stabilization of land use. Case examples include: intercrops of coffee/cocoa with either Erythrina poeppigiana or Cordia alliodora; timber trees in pastures and the practicing of the taungya system under tropical forest management. Data is also provided to clarify these different combinations.
SPECIES LIST; AGROFORESTRY; FOREST MANAGEMENT; SOCIOECONOMIC ASPECTS; BIOLOGY; MICROCLIMATE; NITROGEN FIXING TREES; HUMID TROPICS;

00002
00859
CHAN KUO, P.
AGROFORESTRY: ITS CONCEPTS AND IMPLICATIONS OF A SOUND LAND USE GOAL
CANOPY; Vol: 3, No: 11; (1977); EN
XP/PH; pg 6-7
The term agroforestry is defined here as a multiple cropping system in which agriculture and forestry enterprises are combined, within the notion of diversification of crops, forests and pastures. A major consideration underlying the system is to resolve the competition between land use for forestry and for farming. Socioeconomic considerations are also important in raising the farmers' level of income. Under the system land can be put to productive use for longer periods. The development of agroforestry throughout the world is described and diagrams give additional information.
AGROFORESTRY; SOCIOLOGY; ECONOMICS; CROPPING PATTERNS; LAND USE; FORESTS; FOOD; FUELWOOD; FODDER; PASTURES; FARMING SYSTEMS;

00003
01125
COMBE, J.; BUDOWSKI, G.
CLASSIFICATION OF AGROFORESTRY TECHNIQUES
PROC WORKSHOP ON AGROFORESTRY SYSTEMS IN LATIN AMERICA, TURRIALBA, COSTA RICA; (1979); EN
XL; pg 17-47
The paper examines techniques used in agroforestry and the need and purpose of their classification. The various terms used in the literature are reviewed. A three level classification is proposed: 1) (a) combined agrisilvicultural systems (b) combined silvopastoral systems, and (c) a combination of the two 2

classification by function of the forest component, viz. production or protection services; and 3) classification according to the destruction of the forest in time and space. The major agroforestry systems known and practiced in the tropics are tabulated.
SPECIES LIST; AGROFORESTRY; CROPS; FORESTS; NATURAL DISTRIBUTION;

00004
00646
GORDON, W.A.
AGRICULTURE AND FORESTRY
TROP AGRIC; Vol: 33, No: 3; (1956); EN
XZ; pg 171-175
Writing in 1956, Gordon has clearly seen the non-cooperative competitive nature of foresters and agriculturists. The article, in very precise detail, outlines the major factors that reduce the level of good land-use management. The foresters and agriculturists lay down strategies to counteract the action of their opponents, which are always seen to be offensive. The author recommends an integrated planning of the two major land-use systems. In a kind of foresight or default the foresters devised a land-use system which integrates the two regimes in a mutually complementary manner called the taungya system. The author similarly recommends foresight in planning the use of resources. There is a ready appreciation of the fact that the success of any programme depends a lot on political will and social acceptability.
TAUNGYA SYSTEMS; SILVOPASTORAL SYSTEMS; DESERTIFICATION; LEGISLATION; FREE RANGE GRAZING;

00005
01226
HESMER, H.
THE COMBINATION OF AGRICULTURE AND FORESTRY VOL 2. TROPICAL AND SUBTROPICAL ASIA. (ENGLISH SUMMARY TRANSLATION)
(1970); EN
XP
This volume has been summarized in a 22 page paper. The summary gives indications of site conditions under which the practice of combined agriculture and forestry applied. A brief outline on the origin of the taungya system is provided. The commonly used tree species (native and exotic) plus crop plants (annuals and perennials) are briefly discussed. A number of countries in South East Asia in which experiments on intercropping and interplanting are underway are similarly given a brief discussion. Finally the author has remarked on the success of combined cultivation. He discards the old views which equated the practice to primitive behaviour. The author recommends further search into the problems and potentials of this system.
GMELINA ARBOREA; TECTONA GRANDIS; ACACIA ARABICA; ALBIZIA LEBBEK; CASUARINA EQUISETIFOLIA; CRYPTOMERIA JAPONICA; EUCALYPTUS GRANDIS; EUCALYPTUS CAMALDULENSIS; HEVEA BRASILIENSIS; LEUCAENA GLAUCA; SHIFTING CULTIVATION; TROPICAL RAIN FORESTS; POPULATION; AGRISILVICULTURE; IRRIGATION; DRY FARMING; SPECIES LIST; INTERCROPPING; SOUTH EAST ASIA;

00006
06065
HUXLEY, P.A.
COMMENTS ON AGROFORESTRY CLASSIFICATIONS: WITH SPECIAL REFERENCE TO PLANT ASPECTS
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1984); EN
ICRAF; XZ; pg 161-171
A structural process is suggested for designing classifications for particular purposes . Clearer conceptions of the spatial and temporal patterns involved in various forms of agroforestry land use are needed if they are to be adequately classified. The chronology of plants occupying land is related to the sequence of crop species and succession, or the occupancy of the land itself. Space utilization must take into account sole, mixed or zonal cropping systems. A standard terminology that will encompass all forms of land use is proposed.
AGROFORESTRY; CLASSIFICATION; PLANTS; LAND USE;

00007
01548
KING, K.F.S.
CONCEPTS OF AGROFORESTRY
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1980); EN
XZ; pg 1-13
The paper begins by examining the definitions of agroforestry systems. It then goes to great lengths in exploiting the biological premises on which agroforestry systems can be built. By reviewing other works, the paper arrives at some valid and acceptable conclusions on the biological front. The socioeconomic premises, however, remain speculative because of a lack of solid data to support the arguments forwarded. None the less, the article is highly readable and interesting.
BIOLOGICAL FACTORS; SOCIOECONOMIC ASPECTS; TAUNGYA SYSTEMS; AGROFORESTRY; SHIFTING CULTIVATION; FRAGILE ECOSYSTEMS; MARGINAL LANDS;

00008
01872
KING, K.F.S.
SOME PRINCIPLES OF AGROFORESTRY
(1979); EN
XZ; pg 19
The author emphasizes the need to devise a system that will help meet people's economic needs and at the same time conserve the environment. Such a system is agroforestry, which tends to minimize biological competition between its components. However, a careful choice of tree species is necessary. Characteristics of potential agroforestry tree species are outlined. The author notes that research on the genetics of agroforestry species is lacking, although this does not imply that research on the socioeconomic aspects of the system is complete. Agroforestry systems, being location specific, cannot possibly be duplicated.
AGROFORESTRY; MANAGEMENT; ECOSYSTEMS; CONSERVATION; SOCIOECONOMIC ASPECTS; MULTIPLE CROPPING; WASTE LAND; AGRISILVICULTURE; TROPICS

00009
B01852
KING, K.F.S.
AGRISILVICULTURE (THE TAUNGYA SYSTEM)
DEPT FOR UNIV OF IBADAN BULL NO 1; (1968); EN
XA/XL/XP; pg 1-109
Food production in the developing countries is not keeping pace with the rate of population growth. Several reasons are given for this. Fallow periods under traditional agriculture have been shortened, land use has been intensified and environmental stability has been adversely affected. If tropical countries are to meet their growing demands for food, wood and wood products, there must be an increased shift from natural to artificial regeneration so that the new fast growing species may be introduced, the establishment of which should not be cost prohibitive. The agrisilviculture system could be used for a profitable tree establishment system. However, the replacement of the traditional farming system with a more advanced system is not simply a biological problem; it is very much a socioeconomic one. The author has given a list of suitable forest species and their method of establishment, together with a list of crop plants suitable for intercropping.
ACACIA ARABICA; CASUARINA; GMELINA ARBOREA; EUCALYPTUS GLOBULUS; JUNIPERUS PROCERA; PINUS RADIATA; CASSIA SIAMEA; AZADIRACHTA INDICA; CORDIA ALLIODORA; TECTONA GRANDIS; AGRISILVICULTURE; TROPICS; MULTIPLE USE; SPECIES LIST; SOCIOLOGY; LAND USE; TECHNOLOGY; TROPICS; HUMID TROPICS;

00010
01774
KING, K.F.S.
AGROFORESTRY: A NEW SYSTEM OF LAND MANAGEMENT
PROC 50TH SYMP ON TROPICAL AGRICULTURE; (1978); EN
XA/XL/XP; pg 1-10
Increasing population and unbalanced distribution of the world's resources are the main bottlenecks to improvement of the living standards of people in the third world. Unfavourably endowed with suitable agricultural land and technology, the LDCs are expected to feed more than half of the world's population. The role of agroforestry becomes especially important in these areas, which are highly demarginalized under low capital input and technology. The author has expounded on the term agroforestry and its main variants. The rationale behind existing farming systems is discussed at length along with the need to fully understand how they are managed. Special attention is directed to research into both species suitable for agroforestry and the socioeconomic viability of agroforestry systems.
AGROFORESTRY; AGRISILVICULTURE; SILVOPASTORAL SYSTEMS; AGROSILVOPASTORAL SYSTEMS; MULTIPURPOSE TREES; SHRUBS; LAND USE; DEVELOPING COUNTRIES; TROPICS; FARMING SYSTEMS;

00011
01778
KING, K.F.S.
AGROFORESTRY AND UTILISATION OF FRAGILE ECOSYSTEMS
Vol: 2, (1979); EN
XZ; pg 161-168
The rate of soil degradation is highest in fragile ecosystems. The inhabitants of these regions have been practicing shifting cultivation to maintain soil fertility. However, with rising population, the fallow periods are reduced. Soil fertility decreases along with the carrying capacity of the land. New systems must be improvised to take the place of traditional shifting cultivation. The author defines agroforestry and calls for further research on tree species that can fit into these systems, which can help to meet the basic needs of the inhabitants.
TROPICS; FARMING SYSTEMS; TAUNGYA SYSTEMS; SOIL DETERIORATION; DESERTIFICATION; FOREST PRODUCTS; RESEARCH;

00012
03880
VON MAYDELL, H.J.
AGROFORESTRY: CONTRIBUTION OF TREES AND SHRUBS TO FOOD SUPPLY IN THE TROPICS
(AGROFORSTWIRTSCHAFT: BEITRAGE VON BAUMEN UND STRAUCHERN SUR NAHRUNGSMITTELVERSORGUNG IN DEN TROPEN)
TROPENLAN ZEITS LANDWIRT TROP SUBTROP; Vol: 84, (1983); DE
XA/XP/XL; pg 157-167
Different from most other land use systems, agroforestry does not aim at disintegrating cultures and crops by area and specialization but, instead, combining and integrating forest, agricultural and pastoral components and activities. The ruling objective for agroforestry is increasing the human-ecological carrying capacity of rural areas, with the priority of improving food production systems. Trees and shrubs can contribute by providing a multitude of edible products, protective and soil improving functions, fodder, and wood for rural and household implements, transport, storage and food processing. With regard to decreasing land resources, increasing population and growing dependencies on external aid and development, agroforestry can make essential contributions to securing substantial economies in various regions of the third world.
SPECIES LIST; AGROFORESTRY; TREES; SHRUBS; FOOD PRODUCTION; LAND USE; DEVELOPING COUNTRIES; TROPICS; SOIL CONSERVATION;

00013
03402
NAIR, P.K.R.
<THE> RE-MARRIAGE OF CROPS AND TREES
INT AGRIC DEV; (1983); EN
XA/XL/XP; pg 5-8
Shifting cultivation, a farming system that has been used in the tropics for ages, is no longer productive because of reduction of the length of the fallow periods caused by changes in demographic factors such as increased population, migration and reduction of available arable land. The growing of woody perennials on the same

unit of land with annual crops and animals aims at benefiting from the protection and productivity of such species. The author defines agroforestry and briefly describes the various forms of agroforestry systems.
LEUCAENA LEUCOCEPHALA; PROSOPIS CINERARIA; ACACIA ALBIDA; CASUARINA; ALNUS; PARASPONIA; SHIFTING CULTIVATION; AGROFORESTRY; WOODY PLANTS; FARMING SYSTEMS; SOIL FERTILITY; ALLEY CROPPING; FUELWOOD; AGRISILVICULTURE; TROPICS ;

00014
B01663
NAIR, P.K.R.
MULTIPLE LAND USE AND AGROFORESTRY
BETTER CROPS FOR FOOD: CIBA FOUND SYMP NO 97; (1982); EN
XA/XL/XP; pg 101-115
The conservation benefits and sustained yield potentials of the age-old multiple land-use systems of the tropics and subtropics are now receiving scientific attention. Agroforestry is a new name for an old approach to land use in which woody perennials are deliberately mixed or retained with crop or animal production units with a view to optimizing the beneficial effects of the resultant interactions. Because of its distinct biological and socioeconomic characteristics this approach could be more desirable than either agriculture or forestry in certain situations, as indicated by various examples from different parts of the world. Besides the many economic plants that are adaptable to combined production systems, several less known and unexploited species have resource sharing and microsite enriching qualities and are adaptable to harsher environments. With these species, and appropriate management practices, it will be possible to devise agroforestry systems for different ecological situations. Agroforestry aims to attain productivity and sustainability simultaneously, the emphasis being on the overall system rather than on the components. Therefore research methods and evaluation criteria have to be developed that keep in mind this objective and the systems perspective.
AGROFORESTRY; MULTIPLE CROPPING; FARMING SYSTEMS; SHIFTING CULTIVATION; MARGINAL LANDS; FOOD PRODUCTION; MULTIPURPOSE TREES; TROPICS ;

00015
06078
NAIR, P.K.R.
CLASSIFICATION OF AGROFORESTRY SYSTEMS
AGROFOR SYST; Vol: 3, No: 1; (1985); EN
XZ; pg 97-128
Classification of agroforestry (AF) systems is necessary in order to provide a framework for evaluating systems and developing action plans for their improvement. No single classification can be accepted universally; therefore classification will depend on the purpose for which it is intended. The logical first step is to classify AF systems based on their component composition. This paper provides background information for an approach to classification being undertaken by ICRAF - the Agroforestry Systems Inventory (AFSI). The most commonly used criteria for classifying and grouping AF systems and practices are the system's

structure (composition, arrangement of components), its function, its socioeconomic scale and level of management, and its ecological spread. The system can structurally be grouped as agrisilviculture, silvopastoral and agrosilvopastoral. Others include apiculture with trees, aquaculture in mangrove areas and multipurpose tree lots.
AGROFORESTRY; CLASSIFICATION; AGRISILVICULTURE; SILVOPASTORAL SYSTEMS; AGROSILVOPASTORAL SYSTEMS;

00016
00640
OSARA, N.A.
FORESTRY AND AGRICULTURE: COMPETITION OR COOPERATION
(1983); EN
XZ; pg 1-16
This general paper describes the potential role of forests and forest products. Forests have never been seen desirable as alternative land use systems. Food and not fuel has always had the greatest priority. In the persistent dichotomy between forestry and agriculture, forestry has always lost to agriculture in terms of land resources. The concept of agrisilviculture could open up a way for a harmonious co-existence and hence a long lasting solution to some of the most serious problems facing mankind today.
AGRISILVICULTURE; FOREST MANAGEMENT; FORESTRY POLICIES; FEED CROPS;

00017
01967
VON MAYDELL, H.J.
AGROFORESTRY: A COMBINATION OF AGRICULTURAL, SILVICULTURAL AND PASTORAL LAND USE
PLANT RES DEV ; Vol: 9, (1981); EN
XA; pg 17-23
The concept of agroforestry is defined and the commonly agreed characteristics highlighted. Agroforestry means in all cases that silvicultural and agricultural land uses are interdependent, that woody plants, agricultural crops, and cattle are obviously ecologically interdependent and complementarity among components is the best solution. Without agroforestry a number of ecological detriments are observed; therefore, integration of land use practices is most likely the only means of avoiding these detrimental effects.
ACACIA ALBIDA; LAND USE; AGROFORESTRY; NOMADISM; SILVICULTURE; SILVOPASTORAL SYSTEMS; MULTIPURPOSE TREES; ENVIRONMENTAL CONDITIONS; ARID ZONES; SEMI ARID ZONES;

00018
04335
ALTIERI, M.A.; FARELL, J.
TRADITIONAL FARMIMG SYSTEMS OF SOUTH CENTRAL CHILE, WITH SPECIAL EMPHASIS ON AGROFORESTRY
AGROFOR SYST; Vol: 2, No: 1; (1984); EN
XL/CL; pg 3-18
The paper describes some general structural and functional

characteristics of actual Chilean farming systems managed by small farmers (campesinos) with traditional technologies. Campesino farming systems can be divided into two major groups: (1) small-scale (no more than 1 ha) intensive systems with a wide array of tree and annual crops and three to four animal species per farm; and (2) extensive semi commercial systems (5-12 ha) composed of diversified combinations of crops and animals designed to increase production, producing a marketable surplus for the local community. In most systems campesinos include trees (whether for food, fodder, wood, construction materials, fuel, etc.) as integrated elements of farm management constituting agroforestry systems. Understanding these traditional farming systems and the rationales behind their management is an important first step toward the ultimate development of appropriate agricultural technologies attuned to the ecological and socioeconomic circumstances of the Chilean campesinos.
SMALL SCALE FARMING; AGROFORESTRY; FARMING SYSTEMS; AGRISILVICULTURE; MEDITERRANEAN CLIMATE;

00019
B01271
AMERICAN SOCIETY OF AGRONOMY
MULTIPLE CROPPING
ASA SPEC PUBL NO 27; (1976); EN
XX; pg 1-380
This monograph from a symposium sponsored jointly by the American Society of Agronomy, the Crop Science Society of America and the Soil Science Society of America. The papers were presented at an annual meeting in Knoxville, Tennessee, August 1975. The purpose of the symposium was to bring together the available knowledge about multiple cropping systems. A uniform terminology was maintained throughout the papers presented. Multiple cropping is defined and its component parts are examined. The practice of multiple cropping is described in Asia, Africa, the United States, tropical America, and the Middle East. Other papers cover 1) plant interactions in mixed crop communities, 2) radiation and micro-climate relationships in cropping systems, 3) strip intercropping for wind protection, 4) adapting species for forage mixtures, 5) adapting varieties for intercropped systems in the tropics, 6) land preparation and seedling establishment practices in multiple cropping systems, 7) soil fertility management in tropical multiple cropping, 8) integrated pest management in multiple cropping systems, 9) water and wind erosion control in multiple cropping, 10) machinery adaptations for multiple cropping, and 11) multiple cropping systems.
MULTIPLE CROPPING; INTERCROPPING; TROPICS; MIXED CROPPING; MICROCLIMATE; SPECIES LIST; SOIL FERTILITY; MANAGEMENT; RESEARCH; INTEGRATION;

00020
02025
BAZILEVIC, N.I.; RODIN, L.E.
<THE> BIOLOGICAL CYCLE OF NITROGEN AND ASH ELEMENTS IN PLANT COMMUNITIES OF THE TROPICAL AND SUBTROPICAL ZONES
F[illegible] ABST, Vol: 27, No: 3; (1976); EN
[illegible] pg 357-368

A review of literature on the state of moist tropical and subtropical forests. Discusses all the available data on all aspects covered in this paper. The main aspects addressed are the total quantity of organic matter accumulated by the higher plants in secondary tropical forests, structure of biomass,increment of stemwood, and foliage litter accumulation. All the data provided indicate a very high rate of annual increase of organic matter in the tropics and subtropics, greatly exceeding that in temperate communities. The total amount of chemical elements taken up by the growing organic matter and returned in the annual litter is much higher in the tropics, owing to the year-round growth of plants. The intensity of the biological cycle in plant communities of the subtropics is much less than in the tropics. Intense processes of decomposition are accompanied by rapid loss not only of organic but also of mineral substances from the plant remains.
PROSOPIS SPICIGERA; CALOTROPIS PROCERA; ACACIA; ALBIZIA LEBBEK; TECTONA GRANDIS; DIPTEROCARPUS TUBERCULATUS; MANGIFERA INDICA; PINUS MASSONIANA; CELTIS OCCIDENTALIS; SHIFTING CULTIVATION; ORGANIC MATTER; BIOMASS; MANGROVES; TROPICAL RAIN FORESTS; FOREST LITTER; COMPOSITION; WOODY PLANTS; NITROGEN; NUTRIENTS; LEACHING; BIOLOGY; TREES; SPECIES LIST; HUMID TROPICS;

00021
06125
FERNANDES, E.C.M.; NAIR, P.K.R.
<AN> EVALUATION OF THE STRUCTURE AND FUNCTION OF TROPICAL HOMEGARDENS
ICRAF WORK PAP NO 38; (1986); EN
XZ; pg 1-41
Homegardens represent land use systems involving deliberate management of multipurpose trees and shrubs in association with annual and perennial agricultural crops and invariably livestock within the compounds of individual houses (usually units not exceeding 0.5 ha), managed by the family labour. This paper aims at evaluating the structure and function of some selected traditional homegardens from different ecological and geographical regions, highlighting their special characteristics, similarities and merits. The paper also presents schematic presentations of canopy configurations of four common homegardens.
HOME GARDENS; PROJECT EVALUATION; FUNCTIONS; HUMID TROPICS;

00022
00063
GILL, T.
FORESTS AND FARMERS: FORESTRY'S CONTRIBUTION TO A PERMANENT AGRICULTURE
UNASYLVA; Vol: 17, No: 2; (1963); EN
XZ; pg 64-67
A deliberate effort to point out the intimate relationship that forests bear to a balanced agriculture is the objective of this paper. It suggests how the economic potential of the forest may contribute to the living standards of the nation's rural population. The essential role of forests in protection, production and other useful ways is outlined. The author recommends pilot tests to determine what tree species are most desirable from the standpoint of survival and rapidity of growth

and what species are best suited to special needs. Recommendations include research on exotic species that promise to be well adapted to farm needs, research to find species most suitable for windbreaks, and soil retention.
FARM FORESTRY; WINDBREAKS; EXOTIC PLANTS; LAND CLASSIFICATION; LAND USE; CONSERVATION; RESEARCH;

00023
01121
JUO, A.S.R.; LAL, R.
<THE> EFFECT OF FALLOW AND CONTINUOUS CULTIVATION ON THE CHEMICAL AND PHYSICAL PROPERTIES OF AN ALFISOL IN WESTERN NIGERIA
PLANT SOIL; Vol: 47, (1977); EN
XA/NG; pg 567-584
This paper reports the results of a three-year experiment, conducted to investigate the changes in chemical, physical and biological properties of an alfisol under continuous cropping and various types of planted fallow after clearing from a secondary forest. The methodology and results of the experiment are outlined.
LEUCAENA LEUCOCEPHALA; CAJANUS CAJAN; PANICUM MAXIMUM; GLYCINE MAX; ZEA MAYS; PENNISETUM PURPUREUM; PUERARIA PHASEOLOIDES; STYLOSANTHES GUIANENSIS; SHIFTING CULTIVATION; ORGANIC MATTER; SOIL WATER CONTENT; ZERO TILLAGE; CLIMATE; FALLOW SYSTEMS; SOIL PHYSICOCHEMICAL PROPERTIES; ALFISOLS; SOIL TYPES;

00024
01677
KELLMAN, M.
SOIL ENRICHMENT BY NEOTROPICAL SAVANNA TREES
J ECOL; Vol: 67, (1979); EN
XZ; pg 556-577
The paper examines the degree to which some of the commoner savanna tree and shrub species are enriching the soil about them and explores the sources of these nutrients. Five of the commoner broad-leaved species present in the mountain Pine Ridge Savanna were selected for analysis: the trees Byrsonima crassifolia, Clethra hondurensis, Quercus schippii and Q. oleoides and the shrub Miconia albicans. All trees showed preferential enrichment of the soil about them, in some cases to levels approaching or exceeding those found in nearby rainforest soil. However, there were differences in the degree of enrichment achieved beneath different species. Quercus schippii had proportionately little effect upon calcium and magnesium. Observations reported point to the conclusion that captured precipitation is the main source of nutrients. However, the mechanisms responsible for the preferential nutrient capture by savanna trees remain unspecified.
PINUS CARIBAEA; BYRSONIMA CRASSIFOLIA; CLETHRA HONDURENSIS; QUERCUS SCHIPPII; MICONIA ALBICANS; QUERCUS OLEOIDES; BIOMASS; SEEDLINGS; CANOPIES; FOREST LITTER; VEGETATION; SOIL WATER CONTENT; SOIL FERTILITY; NUTRIENTS; NITROGEN; WEATHERING; RAIN; ECOSYSTEMS; ORGANIC MATTER; SAVANNAS;

00025
B01083
LUNDGREN, B.O.
SOIL CONDITIONS AND NUTRIENT CYCLING UNDER NATURAL AND PLANTATION FORESTS IN TANZANIAN HIGHLANDS
REP FOR ECO FOR SOILS NO 31; (1978); EN
XA/TZ; pg 1-426
This report presents the results of a study on soil conditions and nutrient cycling under plantations of Pinus patula and Cupressus lusitanica under natural montane forests, on two different soil types (andosol and latosol) in highland areas of Tanzania. The author has attempted to analyse and evaluate the state of knowledge of the interrelations between plantation management and tropical soils. Changes in soil chemical and physical conditions have been quantified to determine the effects on tropical soils of replacing natural forests by monocultural plantations. Patterns of production, flow, storage, decomposition and cycling of organic macro-nutrients in stands of Pinus patula and Cupressus lusitanica are examined, taking conditions under natural forests for comparison. Studies of rainfall interception and evaporation in natural forests have been excluded and studies on small-scale variation and correlation between different soil properties are only superficially reported. A broad outline is proposed for soils management approaches and research needs in tropical plantation forestry. The appendix carries primary data which have been statistically analysed.
PINUS; SHOREA ROBUSTA; TERMINALIA SUPERBA; AUCOUMEA KLAINEANA; GMELINA ARBOREA; CUPRESSUS LUSITANICA; PODOCARPUS; EUCALYPTUS CAMALDULENSIS; ALBIZIA; WOOD; POPULATION; SILVICULTURE; DEVELOPING COUNTRIES; FOREST PLANTATIONS; REGENERATION; FUELWOOD; MANAGEMENT; TROPICAL RAIN FORESTS; GENETICS; EXOTIC PLANTS; LEACHING; WEATHERING; FRAGILE ECOSYSTEMS;

00026
00088
NAIR, P.K.R.; SINGH, A.; MODGAL, S.C.
HARVEST OF SOLAR ENERGY THROUGH INTENSIVE MULTIPLE CROPPING
INDIAN AGRIC SCI; Vol: 43, No: 11; (1973); EN
XA; pg 983-988
In a field experiment comprising five high-intensity cropping patterns involving rice (Oryza sativa L.), the maximum amount of total biological yield obtained from rice-wheat energy as economic produce (as well as energy-harvest index) was highest under rice-potato (Solanum tuberosum L.) plus wheat rotation. The energy harvest index varied from 33.27 to 41.37. The photosynthetic efficiency on the basis of the whole crop year ranged from 1.583 to 2.015 whereas on the basis of the total crop duration these values were 1.707 to 2.384. The highest value of photosynthetic efficiency in terms of economic produce was 0.986 obtained from rice-potato-wheat rotation.
ORYZA SATIVA; TRITICUM EASTIVUM; PANICUM MILIACEUM; BRASSICA CAMPESTRIS; GLYCINE MAX; SOLANUM TUBEROSUM; CROPPING PATTERNS; PHOTOSYNTHESIS; ENERGY; TROPICS; SOIL MANAGEMENT; DRY MATTER CONTENT;

00027
B02915
OKIGBO, B.N.; GREENLAND, D.J.
INTERCROPPING SYSTEMS IN TROPICAL AFRICA
ASA SPEC PUBL NO 27; (1976); EN
XA; pg 63-101
In this review of traditional farming systems in tropical Africa, various types of farming systems are identified and systematically classified. It is on this basis that a further survey on multiple cropping is established. Case studies on the latter aspect are drawn from a number of countries in Africa, with special emphasis on West and East Africa. In Nigeria, the predominant multiple cropping system consists of mixed intercropping, whereas several complex forms of shifting cultivation, bush fallow and semi-permanent farming systems are found in the Congo, N. Rhodesia and adjacent regions of Central and Southern Africa. The authors have classified the existing farming system types for each region in the case studies. Finally, the authors provide a comprehensive review of research on intercropping in Africa.
TRADITIONAL FARMING; MANAGEMENT; EVOLUTION; POPULATION; PLANTATIONS; NOMADISM; SHIFTING CULTIVATION; MIXED FARMING; HORTICULTURE; BUSH FALLOWING; COMPOUND FARMS; CROPPING SYSTEMS; INTERCROPPING; FARMING SYSTEMS;

00028
06089
OLOFSON, H.
TRADITIONAL AGROFORESTRY, PARCEL MANAGEMENT, AND SOCIAL FORESTRY DEVELOPMENT IN A PIONEER AGRICULTURAL COMMUNITY: THE CASE OF JALA-JALA, RIZAL, PHILIPPINES
AGROFOR SYST; Vol: 3, No: 4; (1985); EN
XP/PH; pg 317-337
The paper overviews a variety of traditional agroforestry systems found in a small community of Filipino migrant farmers. Background information provides context, and then case studies of seven farmers are offered to illustrate the function which the agroforestry interventions they practice fulfill in a situation of parcelization of farmholdings into both level and sloping fields. The implication of the brief portraits presented for further research and development and for the acceptability of social forestry programmes now going on in the community are suggested.
AGROFORESTRY; SOCIAL FORESTRY; HILL FARMING; FARM MANAGEMENT; SMALL SCALE FARMING; TROPICS;

00029
06093
RAINTREE, J.B.; WARNER, K.
AGROFORESTRY PATHWAYS FOR THE INTENSIFICATION OF SHIFTING CULTIVATION
AGROFOR SYST; Vol: 4, No: 1; (1985); EN
XZ; pg 39-54
As a system of land use that 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 process of intensification. Since shifting cultivation is an indigenous form of agroforestry, scientific agroforestry is not, strictly speaking, an 'alternative', but rather a systematic approach to the recombination of its basic elements into more intensive, sustainable and politically viable forms of land use, whenever pressure signals 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 typologies 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.
AGROFORESTRY; SHIFTING CULTIVATION; FALLOW SYSTEMS; TAUNGYA SYSTEMS;

00030
B03221
SANCHEZ, P.A.
PROPERTIES AND MANAGEMENT OF SOILS IN THE TROPICS
AAAS SEL SYMP NO 38; (1976); EN
XA; pg 1-259
The 13 chapters of the book cover three major areas. Chapters 1 and 2 describe the different tropical environments in physical, economic and human terms and discuss the geographical distribution and classification of soils in the tropics. Emphasis is on the variable environments in the tropics and the wide variety of soils that occur in the region. Chapters 3 to 9 focus on specific soil-plant relationships related to physical and chemical properties, organic matter, nitrogen, soil acidity and liming, phosphorous, sulphur and silicon, and methods of transmitting fertilizer recommendations to farmers. Chapters 10 to 13 integrate the previous concepts in terms of four principal soil management systems: shifting cultivation, rice cultivation, multiple cropping and pasture production. These last chapters are of particular interest to agroforestry systems development.
CASUARINA; PANICUM MAXIMUM; PENNISETUM PURPUREUM; ACIOA BARTERII; HELICONIA; TECTONA GRANDIS; GMELINA ARBOREA; LEUCAENA LEUCOCEPHALA; GLYCINE WIGHTII; MEDICAGO SATIVA; TRIFOLIUM; PHOTOSYNTHESIS; VEGETATION; SOIL CHEMISTRY; FOREST LITTER; SOILS; TECHNOLOGY; LAND USE; FARMING SYSTEMS; SOIL MANAGEMENT; BIOMASS; LEACHING; NITROGEN FIXATION; ORGANIC MATTER; SYMBIOSIS; LEGUMES; PASTURES; TROPICS;

00031
01969
STEINLIN, H.
DEVELOPMENT OF NEW AGROFORESTRY LAND USE SYSTEMS IN THE HUMID TROPICS
PLANT DEV; Vol: 10, (1979); EN

XZ; pg 7-17
Tropical ecosystems are ill-suited to various types of agricultural land use based on continuous cropping. This is in part due to the poor nature of tropical soils, which are easily exhaustible. The land management systems are equally unsuited for these fragile ecosystems. Only cropping under perennial crops has been reported to have been successful. The paper broadly examines the various aspects of tropical soils and farming systems. The production constraints are addressed and tentative solutions are explored. One solution to the land use problems in the humid tropics may be to develop an artificial ecosystem whose vital aspects simulate the highly efficient rainforest ecosystems. A celebrated case study is that of Costa Rica, where Cordia alliodora and Erythrina species are intercropped with coffee trees. The final part of the paper discusses agroforestry systems.
ERYTHRINA; CORDIA ALLIODORA; LEUCAENA LEUCOCEPHALA; AGROFORESTRY; FORESTS; LAND USE; SOIL TEMPERATURE; BIOMASS; CULTIVARS; TROPICAL SOILS; IRRIGATION; ROTATIONAL CROPPING; MULCHES; MULTIPLE CROPPING; MULTIPURPOSE TREES; TROPICS;

00032
04430
WADE, M.K.; SANCHEZ, P.A.
PRODUCTIVE POTENTIAL OF AN ANNUAL INTERCROPPING SCHEME IN THE AMAZON
FIELD CROPS RES; Vol: 9, (1984); EN
XL/PE; pg 253-263
A quantified, year-long intercropping system was based on the concept of relay planting for continuous crop growth. This involved using the traditional planting scheme of the local farmers. The system utilized intercropping and relay planting to produce four and five crops per year in two consecutive years; 1-, 2- and 3-m row spacings of corn and cassava were studied, interplanted with short-statured companion crops (soyabeans, cowpea in the first year, and upland rice, peanuts and cowpeas in the second year). As the row spacing widened, corn and cassava yields decreased, while yields of the short companion crops increased.
GLYCINE MAX; MANIHOT ESCULENTA; ARACHIS HYPOGAEA; VIGNA UNGUICULATA; ORYZA SATIVA; ZEA MAYS; MULTIPLE CROPPING; HUMID CLIMATE; YIELDS; INTERCROPPING; EROSION CONTROL; CROPPING PATTERNS; HUMID TROPICS;

00033
06090
WEINSTOCK, J.A.
ALTERNATE CYCLE AGROFORESTRY
AGROFOR SYST; Vol: 3, No: 4; (1985); EN
XZ; pg 387-397
Agroforestry research and design has heavily favoured integrated production of tree crops on the same parcel of land and at the same time as production of food crop annuals. For areas with high population densities and intensive models of agricultural production, integral agroforestry may be appropriate, but for areas of sparse population where extensive agriculture is practiced on marginal hill lands, alternate cycle agroforestry may

prove more suitable. Alternate cycle agroforestry, in the form of a modified forest swidden system, is discussed and compared to integral agroforestry systems. Advantages and disadvantages of each system are discussed relative to their use on marginal hill and forest lands.
AGROFORESTRY; SHIFTING CULTIVATION; MARGINAL LANDS; SPECIES LIST; SEMI ARID ZONES;

00034
06109
WOOD, P.J.
MIXED SYSTEMS OF PLANT PRODUCTION IN AFRICA, PAST, PRESENT AND FUTURE
ICRAF WORK PAP NO 20; (1984); EN
XA; pg 1 -18
This paper considers all multiple cropping systems, including agroforestry, agrisilviculture and taungya as mixed systems. Mixed cropping includes all cropping patterns where more than one crop is grown on a piece of land in a year. This may consist of mixed annual crops, species interactions, tree crop mixtures with a wide variety of benefits, trees for grazing or to benefit cultivated land, etc. Taungya and shifting cultivation are, however, now breaking down under the pressure of increased population. The paper discusses a few examples of the traditional African mixed cropping systems, most of which reveal a thoughtful and sophisticated approach to the problems of sustained production.
SPECIES LIST; FARMING SYSTEMS; MIXED FARMING; PLANT PRODUCTION;

00035
01865
ADEYOJU, S.K.
<THE> FUTURE OF TROPICAL AGROFORESTRY SYSTEMS
COMMONW FOR REV; Vol: 59, No: 2; (1980); EN
XZ; pg 155-161
The paper describes one conceivable method for lessening the apparent conflict between agriculture and forestry. Planning for the two regimes has always been diametrically opposed. This approach has been detrimental to both the ecological systems and social welfare. The agroforestry systems approach to land use management, which integrates the two regimes in a complementary manner, has proved to be quite attractive. Originating in Burma hill-farming, the system has spread to other parts of the tropics. However, the potentialities of agroforestry systems cannot be realized unless, the socioeconomic matrix is understood as well.
AGROFORESTRY; TROPICS; SOCIOECONOMIC ASPECTS; ECOSYSTEMS; RURAL DEVELOPMENT; POLITICAL SYSTEMS; LAND USE; FOOD; WOOD;

00036
B00969
ALVIM, P. DE T.
<THE> BALANCE BETWEEN CONSERVATION AND UTILIZATION IN THE HUMID TROPICS WITH SPECIAL REFERENCE TO AMAZONIAN BRAZIL
EXTINCTION IS FOREVER (PRANCE, G.T. & ELIAS, T.S. EDS.); (1977); EN
XL/BR; pg 347-352

Conservation and utilization of environmental natural resources are two seemingly conflicting aspects. The conservationists maintain that natural ecosystems should be maintained in their natural state without undue interference by man. On the other hand the utilitarian school of thought advocates economic use. According to this author, who differs from pure conservationism or pure utilitarianism, human welfare should form the core of all thinking and therefore the tropical rainforests should be developed to serve human needs. This can be done by encouraging commercial agriculture. Growing such crops as cacao, rice, oil palm, Brazil nut and rubber could provide additional income to the farmer and at the same time conserve the environment. Silvicultural practices that involve growing Gmelina arborea and Pinus caribaea var hondurensis have proved successful as they are an economic source of commercial timber. Management of pasturelands should similarly be encouraged.
PIPER NIGRUM; GMELINA ARBOREA; PINUS CARIBAEA; TROPICAL RAIN FORESTS; CONSERVATION; MANAGEMENT; LAND USE; NITROGEN FIXING TREES; GERMPLASM; ECOLOGY; SHIFTING CULTIVATION; SILVICULTURE; RESEARCH; PASTURES; LEGUMES; EROSION; ECOSYSTEMS;

00037
01774
ANDRIESSE, J.P.
<FROM> SHIFTING CULTIVATION TO AGROFORESTRY OR PERMANENT AGRICULTURE?
RTI AGROFOR BULL 303; (1978); EN
XZ; pg 35-43
Replacement or substitution of traditional farming systems based on shifting cultivation methods is not simply a problem of technology. Past experience has shown that the replacement of one system by another is not always the best way to alleviate a problematic situation. If anything, this approach has tended to create more problems. In an attempt to strike a balance between shifting cultivation, permanent agriculture and agroforestry, the author has defined and evaluated each system in turn. Agroforestry systems are region-specific and therefore cannot be hoped to perfectly replace shifting cultivation or permanent agriculture. The author argues that to maintain an artificial ecological confinement by agroforestry would be even more problematic.
AGROFORESTRY; SHIFTING CULTIVATION; CROPPING SYSTEMS; LAND CLASSIFICATION; ECOLOGY; RESEARCH; FARMING SYSTEMS; LAND USE; ECOLOGY; TROPICS;

00038
B01422
ARELLANO, P.G.
ECOLOGICAL ASPECTS OF AGROFORESTRY IN ARID SAVANNAS
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D.EDS.) ; (1979); EN
XL; pg 37-67
This paper discusses the bio-physio-geographic changes that have taken place in the Venezuelan llanos through time. The natural forests have been depleted to give way to savanna grasslands. The climates of these savannas vary from semi arid to very humid. There is one dry season followed by a long wet season. The soils

are highly leached and therefore low in fertility. Livestock grazing is practiced without effective management of pastures. Attempts to reclaim the Venezuelan savannas include afforestations and soil and water management. Agrosilvopastoral methods are similarly practiced. Plantations of Pinus caribaea and Eucalyptus have been successfully established. The potential for agroforestry systems is high, and they should be incorporated in existing development strategies.
PINUS CARIBAEA; EUCALYPTUS; TRACHYPOGON; CURATELLA AMERICANA; AGROFORESTRY; PHYSIOGRAPHY; ECOLOGY; LAND USE; TREES; AFFORESTATION; AGROSILVOPASTORAL SYSTEMS; RECLAMATION; HUMID TROPICS;

00039
01747
BENE, J.G.; BEALL, H.W.; COTE, A.
<THE> TROPICAL FOREST OVER EXPLOITED AND UNDERUSED: RESEARCH PRIORITIES IN TROPICAL FORESTRY
(1976); EN
XZ; pg 1-69
This is a monograph on forestry development in the tropics, its ecological implications, and the need for improved forest management and land utilization. It is divided into two parts. Part 1 provides the background information on ecological utility of forests, specifically addressing tree production systems, the utilization of forest resources and constraints on resource development. Part 2 looks at research needs and priority areas and adds a note on recommended action. This suggests that combining certain trees and agricultural crops on the same land or growing them sequentially is the best means of preserving the fertility and structure of most tropical soils.
IMPERATA CYLINDRICA; ANACARDIUM; LEUCAENA; CERATONIA SILIQUA; ALNUS JORULLENSIS; EUCALYPTUS DEGLUPTA; PROSOPIS CHILENSIS; PROSOPIS TAMARUGO; PARKIA; AGROFORESTRY; REMOTE SENSING; LAND USE; WASTE LAND; TROPICAL RAIN FORESTS; MANGROVES; WOODLANDS; MULTIPLE USE; EROSION; WINDBREAKS; TREES; SPECIES; SILVICULTURE; MANAGEMENT; SHIFTING CULTIVATION;

00041
B01344
BUCK, L.E.
PROCEEDINGS OF THE KENYA NATIONAL SEMINAR ON AGROFORESTRY, NAIROBI, 12-22 NOVEMBER 1980
(1981); EN
XA/KE; pg 1-638
The proceedings of the Kenya National Seminar on Agroforestry (AF) in 1980 highlight the need to assist in shaping rational land use policies and to formulate specific AF agendas. They stress the need to assist in the development of the appropriate national land use policies which will fully recognize the need for an integrated approach to land management. They outline Kenya's land use problems and suggest AF as a potentially appropriate land use strategy for stabilizing production systems, and give attention to the need for appropriate tree species selection, highlighting several principles to be considered. The proceedings also discuss broad issues of rural development and stress that some fundamental

constraints exist in the way of easy improvement in agricultural productivity. Promising projects designed to develop and test methods for overcoming some of these constraints are highlighted.
AGROFORESTRY; LAND USE; RURAL DEVELOPMENT; POLICIES; SPECIES LIST; TROPICS;

00042
B01346
BUDOWSKI, G.
AGROFORESTRY IN HUMID TROPICS
(1977); EN
XL/CR; pg 1-27
This publication discusses very elaborately the guidelines for a strategy to develop agroforestry in the humid tropics. Involvement of the local people is an important step to success. Research scientists are required to expand their field of coverage to include indigenous agroforestry systems. The author discusses promising lines of research. Fast-growing agroforestry tree species are gaining favour with farmers, because of their promising value for timber or for other purposes such as firewood, charcoal, poles, and soil improvement. The publication carries a list of a number of tree species currently under use or that show great potential for agroforestry systems. A summary diagram is added at the end of this publication. The author's viewpoint stems largely from his experience in the humid tropics of Latin America, of which he describes several agroforestry practices.
CORDIA ALLIODORA; ERYTHRINA POEPPIGIANA; ALNUS JORULLENSIS; EUCALYPTUS DEGLUPTA; AGROFORESTRY; MULTIPLE CROPPING; TAUNGYA SYSTEMS; HUMID TROPICS; RESEARCH; EDUCATION;

00043
B01423
CHANDLER, T. (ED.); SPURGEON, D. (ED.)
INTERNATIONAL COOPERATION IN AGROFORESTRY: PROCEEDINGS OF AN INTERNATIONAL CONFERENCE, NAIROBI, 16-21 JULY 1979
(1980); EN
XL/XP/XA; pg 1-469
The papers stress that agroforestry is an integral land management system designed to provide long-term ecological stability on marginal and other lands while sustaining the production of food and wood. The system's greatest potential impact is seen to be on the socioeconomic development of rural communities. The book is arranged in six main sections: 1) ecological aspects of agroforestry, which describes the AF practices or possibilities in 11 different areas in Latin America, Asia and Africa; 2) AF projects around the world, which gives a list of AF projects currently under way in Latin America, Asia and Africa; 3) documentation, training and extension for AF stresses the importance of obtaining specially trained people in teaching, research, policy formulation, programme planning and implementation, extension and adult education in the integration of trees into agricultural production systems; 4) AF research, which emphasizes on the need for AF to be developed by injecting adequate and appropriate technology into it; 5) socioeconomic aspects of AF, which discusses the examples of successful AF in China, Korea, Costa Rica and East Africa; 6) description of ICRAF

and DSE activities.
AGROFORESTRY; ECOLOGICAL ASPECTS; PROJECTS; EXTENSION ACTIVITIES; RESEARCH; SOCIOECONOMIC ASPECTS; DEVELOPING COUNTRIES; HUMID TROPICS; TROPICS;

00044
B00499
CHAPMAN, E.C.
SHIFTING AGRICULTURE IN TROPICAL FOREST AREAS OF SOUTH EAST ASIA
IUCN PUBL NO 32; (1975); EN
XP; pg 120-135
The extent of shifting or swidden cultivation has never been accurately assessed in S.E. Asia. It is practiced by about 30 million people or 15-20 per cent of the rural population of the region. Its distribution within the region shows areas of concentration. Often swidden cultivation is combined with permanent field agriculture. Population pressure drastically shortens the period of forest fallow in the swidden cycle. Farmers commonly regard a cultivation fallow ratio of 1:9 as minimal for yield maintenance. There are several ways to improve swidden farming or to transform it gradually into permanent agriculture. The need for planning the rural economy in areas of swidden cultivation is stressed.
NIPER NIGRUM; HEVEA BRASILIENSIS; TECTONA GRANDIS; IMPERATA CYLINDRICA; LEUCAENA GLAUCA; CASUARINA EQUISETIFOLIA; ERYTHRINA POEPPIGIANA; TROPICS; FORESTS; LAND USE; SHIFTING CULTIVATION; FARMING SYSTEMS; TAUNGYA SYSTEMS; TECHNOLOGY;

00045
06057
COMBE, J.
AGROFORESTRY TECHNIQUES IN TROPICAL COUNTRIES: POTENTIAL AND LIMITATIONS
AGROFOR SYST; Vol: 1, No: 1; (1982); EN
XZ; pg 13-27
Agroforestry designates land management techniques, which implies the combination of forest trees with crops, or with domestic animals, or both. Because of their interdisciplinary character, they are of particular interest for many countries of the third world, where an equilibrated development of all rural lands must be obtained. It is no longer tolerable to consider separately forestry and agriculture in the tropics or to manage forest resources as an isolated ecosystem. Through their traditions, tropical farmers are an agroforesters and it is possible to take advantage of their experience in forestry to increase the yields of their agricultural crops. A sustained yield agriculture is the best protection for tropical forests. A classification of the principal agroforestry techniques is proposed and some traditional practices are described. The outstanding advantages of agroforestry in the social, economic and ecological fields suggest some principles for future investigation programmes, which will still have many problems to solve.
AGROFORESTRY; METHODS; TROPICS; LIMITING FACTORS;

00046
04920
COSSINS, N.J.
<THE> PRODUCTIVITY AND POTENTIAL OF PASTORAL SYSTEMS
ILCA BULL NO 21; (1985); EN
XA/ET; pg 10-15
African pastoral systems are often considered relatively unproductive, with poor breeds of animals, poorly fed and badly managed, present in such large numbers that serious rangeland degradation is unavoidable. The large herds are reviewed as the result of the pastoralists' irrational attachment to their animals, with prestige and status, rather than economic gain, allegedly being the concern. Analysis of the Borana pastoral system has, however, proved it to be very productive as compared to some commercial ranches. The study suggests that Borana families could improve their annual incomes tremendously if they adopted the growing of food crops and legume forages into their pastoral system.
PASTORALISM; FOOD CROPS; LEGUMES; FODDER CROPS; PASTORALISTS; RANGELANDS;

00047
01682
ALVIM, P. DE T.
PERSPECTIVES OF AGRICULTURAL PRODUCTION IN THE AMAZON REGION
INTERCIENCIA; Vol: 3, No: 4; (1978); PT
XL/BR; pg 243-251
Most of the Amazon basin can be categorized as a fragile ecosystem. Thus cultivation of any plant species with conventional methods leads to a decrease in soil fertility. To maintain production of crops, addition of artificial fertilizers has become a necessity. Since most farmers cannot afford to buy fertilizers, shifting cultivation still merits as the next best alternative. The author has suggested practical ways of expanding the agricultural frontier with little or no use of fertilizers: preferential utilization of fertile land, cattle raising in appropriate areas, and self sustained systems. The latter means an efficient cultivation system which includes tree species that produce edible fruit, of which there are many species in the tropics such as breadfruit and many multipurpose palms.
THEOBROMA CACAO; HEVEA BRASILIENSIS; ELAEIS GUINEENSIS; BERTHOLLETIA EXCELSA; GMELINA ARBOREA; PINUS CARIBAEA; VIGNA; CAJANUS CAJAN; SHIFTING CULTIVATION; FIELD CROPS; ANIMAL HUSBANDRY; PLANTS; AGRICULTURAL PRODUCTS; FERTILIZERS; PASTURES; FOOD PRODUCTION; ECONOMICS; AMAZONAS;

00050
00710
ECKHOLM, E.P.; NEWLAND, K.
GROWING FOOD IN THE TROPICAL FORESTS: NO BREAD BASKET IN THE JUNGLE
DEV FORUM; Vol: 3, No: 6; (1975); EN
EARTHSCAN; XZ; pg 6-7
The tropical forest regions have long been viewed as areas with great potential for the world's future food production. However, acquired knowledge and experience have shown that these are highly

fragile ecosystems. Besides the soils being very vulnerable to erosion and leaching they are easily exhausted under continuous use. Shifting cultivation is the only single method of land use that has proved fitted to the specific demands of these environments. It is only by improvising and improving upon shifting agriculture practices that these ecozones can be utilised on a productive and sustainable basis. The taungya system is receiving increased attention among tropical foresters and agronomists as a way of combining forestry and farming activities.
SHIFTING CULTIVATION; TROPICAL RAIN FORESTS; FOOD PRODUCTION; TROPICS;

00051
B01554
GALVAO, A.P.M.
ECOLOGICAL ASPECTS OF AGROFORESTRY IN THE HUMID TROPICS: THE BRAZILIAN AMAZON
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1979); EN
XL/BR; pg 109-116
This publication offers background information on the ecological environments of the Brazilian forests. The role of agroforestry in this region should be to offer the opportunity to combine production of fast maturing crops for food and cash with longer term forest tree crops for timber. Agroforestry is not required in the high fertility lowland 'Varzea' or in the eutrophic uplands and is at present impracticable in permanently flooded lowlands. It is, however, the best alternative for the dystrophic uplands where exposed land without the protection of trees is rapidly degraded by leaching and erosion caused by high temperatures and high rainfall intensities. Successful agroforestry systems must be commercially viable and should be based on a planned and managed settlement programme.
CORDIA GOELDIANA; PAULLINIA CUPANA; AGROFORESTRY; FRAGILE ECOSYSTEMS; SOCIOECONOMIC ASPECTS; HUMID TROPICS; LOWLANDS; UPLAND CROPPING; ECOLOGY; LAND USE;

00052
B01270
BUDOWSKI, G.
APPLICABILITY OF AGROFORESTRY SYSTEMS
AGROFORESTRY IN THE AFRICAN HUMID TROPICS: PROC. (MACDONALD, L.H., ED.); (1982); EN
XL/CR; pg 13-16
This paper lists and discusses the advantages and disadvantages of agroforestry practices as compared to monocultures. The author offers a well-balanced argument on the need to carry out a complete appraisal of agroforestry systems before recommending their practical application. Agroforestry should not be seen as a technology for the poor and their poor lands. It includes productive and stable systems on all kinds of climate, soils and under various social conditions.
AGROFORESTRY; RURAL DEVELOPMENT; LAND USE; FARMING SYSTEMS; BIOLOGY; MONOCULTURE; INTERCROPPING; AGRISILVICULTURE; RESEARCH; SERVICES; HUMID TROPICS;

00053
00686
GREENLAND, D.J.
BRINGING THE GREEN REVOLUTION TO THE SHIFTING CULTIVATOR: BETTER SEED, FERTILIZERS, ZERO OR MINIMUM TILLAGE AND MIXED CROPPING ARE NECESSARY
SCIENCE; Vol: 190, No: 4217; (1975); EN
XZ; pg 841-844
Advances in modern farming methods have by-passed the small farmer, who in most cases has been practicing shifting cultivation. Improvement of this farmer through extension of the benefits of the Green Revolution has received little success; it was a technological breakthrough that benefited only a few farmers who could afford the outlay of capital investments required. Any alternative recommended to the small farmer should take into consideration production constraints that face the shifting cultivator. One such solution is to retain the land in such areas for forestry-tree crops such as cocoa, oil palm or timber - or where livestock can be raised for pasture. The associated benefits of such a system (taungya or agroforestry) are discussed in this paper.
VIGNA UNGUICULATA; PHASEOLUS LUNATUS; PSOPHOCARPUS TETRAGONOLOBUS; ACIOA BARTERII; AGRISILVICULTURE; SHIFTING CULTIVATION; FARMING SYSTEMS; RESEARCH; SOIL TYPES; HUMID TROPICS; NUTRIENTS; EROSION; FALLOW SYSTEMS; MIXED CROPPING; ZERO TILLAGE; CROP RESIDUES; SOIL TEMPERATURE;

00054
B01108
GREENLAND, D.J.; LAL, R.
SOIL CONSERVATION AND MANAGEMENT IN THE HUMID TROPICS
PROC INT CONF ON SOIL CONSERVATION AND MANAGEMENT IN THE HUMID TROPICS; (1977); EN
XZ; pg 1-283
Farming systems in western Europe do not need to take account of soil erosion to any great extent, because of the prevailing rainfall pattern. However, the increasing population density in developing countries, where heavy rainfall is a regular characteristic of the climate, is now producing a soil erosion problem far more serious than existed previously in the indigenous cultivation scheme. Modification of the present system or development of new systems is essential. This book deals with the characteristics of soils and climates in the humid tropics and with soil erosion under existing systems and new systems needed to control it.
CLITORIA CAJANIFOLIA; CALOPOGONIUM MUCUNOIDES; CENTROSEMA PUBESCENS; DOLICHOS HOSEI; PUERARIA PHASEOLOIDES; IMPERATA CYLINDRICA; ARACHIS HYPOGAEA; FARMING SYSTEMS; CLIMATE; EROSION CONTROL; CONSERVATION; LAND USE; WEATHERING; VEGETATION; EROSION; CARRYING CAPACITY; FOREST LITTER; ORGANIC MATTER; SOIL MANAGEMENT; FLOODING; RESEARCH; HUMID TROPICS;

00055
01225
HESMER, H.

<THE> COMBINATION OF AGRICULTURE AND FORESTRY: 1. TROPICAL AFRICA (ENGLISH SUMMARY)
ZUSAMMENARBEIT, BD. 8; (1966); EN
XA; pg 1-11
This book explains the effects of shifting cultivation on forest vegetation, soil fertility and overall crop production. Clearing of the vegetation cover renders low infiltration of minerals such as N and Ca into the soil. Forest resources are similarly affected, creating fear of total depletion of forest capital - as cultivation encroaches on the forest lands. The author recommends rejuvenation of the taungya system, which has been in practice for many years in different parts of the world. A brief account is given of how this system operates and the advantages accruing to it.
TROPICAL RAIN FORESTS; SHIFTING CULTIVATION; NUTRIENT CONTENT; AGRISILVICULTURE; TAUNGYA SYSTEMS; HUMID TROPICS;

00056
06064
HUXLEY, P.A.
<THE> ROLE OF TREES IN AGROFORESTRY: SOME COMMENTS
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1984); EN
XZ; pg 257-270
Trees play a role in both productivity and sustainability in agroforestry systems. The author outlines some characteristics of woody perennials and the need to consider their possible advantages and disadvantages in relation to specific agroforestry systems. The many existing and planned trials with multipurpose trees worldwide help answer questions like what trees? how many? how should they best be arranged? etc. This paper, laying emphasis on 'how many trees?', presents three dimensional diagrams illustrating the effects of a replacement series (tree-crop, crop tree) on changes in total productivity and soil status with type. It illustrates the value of this approach and briefly discusses shrub/tree arrangement, which will depend on management considerations, soil/water conservation needs and biological aspects of optimizing productivity.
TREES; AGROFORESTRY; USES; LAND USE;

00057
B01928
HUXLEY, P.A. (ED.)
PLANT RESEARCH AND AGROFORESTRY: PROCEEDINGS OF A CONSULTATIVE MEETING HELD IN NAIROBI, 8-15 APRIL 1981
(1983); EN
XZ; pg 1-617
The book is arranged in four major parts. Part 1 deals with plants and agroforestry. It gives some examples that establish how much existing knowledge about plants there is and discusses methods used to study the plants that are relevant to our specific needs. This section also states whether research methodologies for the exploration and evaluation of multipurpose tree species as sole crops and in agroforestry mixtures. Part 2 deals with understanding agroforestry systems and suggests the need for systems analysis/systems synthesis methods that will be essentially supportive of all the other kinds of investigations.

It also deals with design and methodologies to evaluate land use potentials and problems with regard to the possibilities for agroforestry interventions or improvements. Part 3 deals with applications of plant science to agroforestry and explores specific plant related subject areas to evaluate their relevance to the development of agroforestry research; plant nutrition in relation to management practices and exploitation of di-nitrogen fixation and the benefits of mycorrhizal associations to the best advantage in more complex systems. Part 4 deals with reports of the working groups and meeting organization.
AGROFORESTRY; PLANTS; RESEARCH; METHODS; MULTIPURPOSE TREES; LAND USE;

00058
B01264
IVES, J.D.; SABHASRI, S.; VORAURAI, P.
CONSERVATION AND DEVELOPMENT IN NORTHERN THAILAND
PROC OF A WORKSHOP ON AGROFOR AND HIGHLAND-LOWLAND INTERACTIVE SYSTEM, CHIANG MAI, 13-17 NOV 78, UNU; (1980); EN
UNU; XP/TH; pg 1-114
The concern for provident use and management of natural resources prompted the UN University to organize a body of scholars to look into four main areas of concern: 1) rural energy systems; 2) agroforestry systems; 3) water-land resource systems; 4) highland-lowland interactions. This was made possible by developing a wider information network throughout the developing countries. The Chiang Mai University workshop was an accumulation of these efforts. This workshop concentrated mainly on two aspects of the natural resource programme, namely those related to agroforestry and those related to highland and lowland interactions. During the workshop 15 major papers were presented including an introduction by Dr. Walther Manshard.
PINUS MERKUSII; IMPERATA CYLINDRICA; AGRISILVICULTURE; AGROFORESTRY; LAND USE; FARMING SYSTEMS; SOIL CONSERVATION; SHIFTING CULTIVATION; CLIMATE; PRECIPITATION; CROPPING PATTERNS; HUMID TROPICS;

00059
01545
IYAMABO, D.E.
ECOLOGICAL ASPECTS OF AGROFORESTRY IN LOWLAND HUMID TROPICS OF WEST AFRICA
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1979); EN
XA; pg 129-143
This paper discusses the ecological basis of agroforestry in the lowland humid tropics (LHT) of Africa. Several ecological features of the LHT of Africa have influenced the evolution of current production and land use systems and affect the potential for agroforestry. The author outlines some of the problems and constraints in agroforestry such as the orientation of foresters, the paucity of literature, the ecological setting for agroforestry, attitude, political will and commitment, and institutional problems. The author recommends expansion of training in agroforestry; research, planning, and organization of agroforestry programmes; collection and documentation of

information; and finally, education in agroforestry, which deserves a top priority.
GMELINA; PTEROCARPUS; CEIBA PENTANDRA; ELAEIS GUINEENSIS; RAPHIA; TAMARINDUS INDICA; TRECULIA AFRICANA; CHRYSOPHYLLUM ALBIDUM; CHLOROPHORA EXCELSA; AFZELIA; SPONDIAS MOMBIN; AGRISILVICULTURE; AGROFORESTRY; HUMID TROPICS; PLANTS; NUTRIENTS; TROPICAL FORESTS; SOILS; FARMING SYSTEMS; BIOLOGICAL PRODUCTION; DEFORESTATION; SPECIES LIST; TAUNGYA SYSTEMS; FARM FORESTRY; EDUCATION; RESEARCH;

00060
00341
KELLOG, C.E.
SHIFTING CULTIVATION
SOIL SCI; Vol: 95, No: 4; (1962); EN
XZ; pg 221-230
This discussion is limited to the effects of natural fallows and some suggestions for their improvement or replacement. The system of shifting cultivation may be notorious and undesirable, but it is irresponsible to castigate the system without offering proved substitutes. Research should look into other closely related systems. Closely allied with shifting cultivation is the use of mixed cultures of fruit trees, nut-bearing trees, vines and shrubs, along with tall plants like bananas and cassava. Forests can be thinned gradually and the forest trees replaced with food and industrial crops. The corridor systems can be improved further. The author feels that effective and practical alternatives are not easy to come by without intensive soil study.
IMPERATA CYLINDRICA; PENNISETUM; PANICUM MAXIMUM; SETARIA SPHACELATA; CYNODON DACTYLON; SHIFTING CULTIVATION; TROPICS; MIXED CROPPING; TRADITIONAL FARMING; THINNING; RESEARCH;

00061
01931
KING, K.F.S.
AGROFORESTRY AND THE DEVELOPMENT OF TROPICAL FORESTRY
(1980); EN
XZ; pg 1-32
This paper is divided into three parts. Part one deals specifically with deforestation. Deforestation is caused mainly by 1) conversion of forest lands into agricultural lands, 2) the quest for fuelwood and building poles, and 3) social and economic deprivation. The author warns of the dangers of confusing symptoms with causes of deforestation. Before embarking on the subject of agroforestry, the author, in the second part of this paper, gives a broad view of the ecological requirements of various plant species. The final, well detailed and comprehensive section deals specifically with agroforestry related aspects. A list of suitable agroforestry trees, shrubs and fodder crops is included.
ACACIA; AZADIRACHTA INDICA; ALBIZIA LEBBEK; AILANTHUS EXCELSA; CASSIA SIAMEA; CASUARINA; CORDIA ALLIODORA; EUCALYPTUS; LEUCAENA LEUCOCEPHALA; AGROFORESTRY; SPECIES LIST; HUMID TROPICS; ECOLOGY; SHIFTING CULTIVATION; AGRISILVICULTURE; SILVOPASTORAL SYSTEMS; MIXED CROPPING; COMPETITIVE EFFECTS; CULTURES; ECONOMICS; RESEARCH;

00062
01054
KING, K.F.S.
DEVELOPMENT AND CONSERVATION OF FOREST RESOURCES
CONSERVATION AND AGRICULTURE (HAWKES, J.G. ED.); (1978); EN
XZ; pg 161-170
This general essay on the conservation and preservation of forest ecosystems starts off with a well-balanced argument on conservation versus development. It goes on to discuss the role of forest resources in complementing development efforts and stabilizing the ecosystems. Agrisilviculture is suggested as a suitable system of land utilization in place of the notorious shifting cultivation. Shifting cultivation more than anything else has contributed to the destruction of tropical forests. The author finally recommends land capability classification and landuse planning before embarking on the utilization of new lands in the humid tropics.
PINUS RADIATA; PINUS CARIBAEA; AGRISILVICULTURE; AFFORESTATION; CONSERVATION; TROPICAL RAIN FORESTS; HYBRIDIZATION; LAND CAPABILITY; LAND USE;

00063
01504
KING, K.F.S.
SOME ASPECTS OF LAND USE PLANNING
EIGHTH WORLD FORESTRY CONGRESS, JAKARTA, 16-28 OCTOBER 1978; (19 78); EN
XZ; pg 1-14
This paper, which was presented at the above conference, examines critically the need for land capability classification principles. The theory upon which the classification system is built is outlined. The author has thrown a challenge to scientists to apply the accumulated scientific knowledge properly in planning. The tendency to apply models to the tropical environment that have been proven elsewhere is castigated. The author has expressed the need to collect and analyze information as a basis for deciding on objectives. Explaining the merits of agroforestry, the author has underlined the importance of background information as a basis for planning. For example, in fragile ecosystems the most suitable land use ought to provide a many layered cover to soil. If that is so, agroforestry systems might be more profitable.
LAND CAPABILITY; LAND CLASSIFICATION; LAND USE; SOIL DETERIORATION; INTERCROPPING; SOCIOLOGY; ECONOMICS; CROPPING PATTERNS; AGROFORESTRY; MANAGEMENT; FOREST PRODUCTS; FOOD; FODDER; TROPICS;

00064
06071
LUNDGREN, B.O.; RAINTREE, J.B.
SUSTAINED AGROFORESTRY
AGRICULTURAL RESEARCH FOR DEVELOPMENT: POTENTIALS AND CHALLENGES IN ASIA (NESTEL, B., ED.); (1983); EN
XZ; pg 1-26
Describes in a brief and sketchy form the core logic of an evolving diagnosis and design methodology intended to serve as a reliable tool for arriving at effective agroforestry solutions to

local land use problems. The paper is set up under four main sub-headings: 1) agroforestry approach - potentials and constraints; 2) agroforestry research today; 3) ICRAF's role and programme; 4) ICRAF's diagnostic and design approach.
AGROFORESTRY; DIAGNOSIS; DESIGN; METHODOS;

00065
05158
VON MAYDELL, H.J.
<THE> CONTRIBUTION OF AGROFORESTRY TO WORLD FORESTRY DEVELOPMENT
AGROFOR SYST; No: 2; (1985); EN
XZ; pg 83-90
Agroforestry with its outstanding variety of systems and technologies has been practised in all parts of the world since time immemorial. Its worldwide recognition, scientific promotion and application in rural development strategies in the tropics, however, 'exploded' with two events: the foundation of the International Council for Research in Agroforestry (ICRAF) in 1977 and the Eighth World Forestry Conference in Jakarta in 1978. It is important to recall these events on the occasion of the Ninth World Forestry Congress to be held in Mexico this year. Agroforestry's holistic approach to solving land use problems under prevailing conditions and constraints of different humid, semi arid and mountainous regions has gained importance and produced remarkable results with regards to increasing the human ecological carrying capacity. Forestry is gaining from the newly promoted strategies of integrated land use in various ways: less pressure on forest resources and thus less destruction of forest vegetation, additional lands for wood production outside the forest estate, cooperation instead of confrontation with other target groups, and an expanded multiple use concept increasing the value of marginal forest lands. Agriculture and livestock management are improved by various environmental benefits of the forest component and by the availability of forest products within agroforestry systems. Achievements over the past seven years have been encouraging in many instances. Much more, however, remains to be done in future.
AGROFORESTRY; FORESTRY DEVELOPMENT; LAND USE;

00066
05309
MILLER, R.P.; EHLICH, M.
MID-TERM EVALUATION FOR THE AGROFORESTRY OUTREACH PROJECT
(1983); EN
XL/HT; pg 1-66
The study evaluates an agroforestry outreach project in Haiti designed to protect the productive capacity of agricultural lands in Haiti. The project addresses the negative effects of the historical and continuing deforestation of the Haitian countryside, which led to declining agricultural productivity, energy supplies and standards of living in rural Haiti. It promotes and implements peasant agroforestry activities in order to combat soil erosion, energy scarcity and rural poverty. The findings of the evaluation team are assessed, and more specific conclusions and recommendations are presented.
PINUS ELLIOTTII; PASPALUM NOTATUM; CYNODON DACTYLON; AGROFORESTRY;

PROJECTS; EVALUATIONS;

00067
06120
NAIR, P.K.R.
AGROFORESTRY IN THE CONTEXT OF LAND CLEARING AND DEVELOPMENT IN THE TROPICS
ICRAF WORK PAP NO 33; (1985); EN
XZ; pg 1-57
The paper addresses itself to some critical issues of land clearing and reviews and evaluates the current status of some methods of land clearing. It also formulates some technological packages for improvement and considers the benefits and potentials of agroforestry and other integrated land use systems. Describes various land use systems like taungya, plantation crop production, shifting cultivation, multispecies crop mixes, and home gardens. Gives the agroforestry options for cleared lands, with emphasis on the technologies to be adopted during the transitory phase between uncleared and cultivated land, in order to reduce soil loss and other degradation likely to occur immediately after clearing. The best agroforestry options include alley cropping, leguminous woody perennials, multistoried crop mixes, tree integration in agricultural lands, tree gardens, intercropping in tree stands, multipurpose shade trees for commercial plant crops, woody perennials as soil conservation hedges, shelterbelts and windbreaks, agroforestry fuelwood production, woody mulch and green manure woodlots.
AGROFORESTRY; TROPICS; LAND; CLEARING;

00068
06080
NAIR, P.K.R.; FERNANDES, E.C.M.
AGROFORESTRY AS AN ALTERNATIVE TO SHIFTING CULTIVATION
FAO SOILS BULL NO. 53; (1985); EN
XZ; pg 1-17
Shifting cultivation is a traditional farming system over vast areas of the tropics and is the most widespread farming system. It has however been criticized for being wasteful and inefficient and for causing soil degradation. The alternative therefore seems to be to devise land management systems that will reduce fallow or eliminate it altogether while retaining its beneficial effects. Agroforestry (AF) allows for simultaneous production of food and wood products from the same piece of land, depends on low-cost inputs, conserves the ecosystem, sustains production, and is compatible with sociocultural aspirations and economic conditions of the people. Covers the production role of AF and discusses some woody perennial species for AF.
LEUCAENA LEUCOCEPHALA; AGROFORESTRY; SHIFTING CULTIVATION; SPECIES LIST; LAND USE; TROPICS;

00069
06086
NAIR, P.K.R.
MULTIPLE LAND USE AND AGROFORESTRY
BETTER CROPS FOR FOOD: CIBA FOUND SYMP NO 97; (1983); EN

XZ; pg 101-115
The conservation benefits and sustained yield potentials of multiple land use systems of the tropics and subtropics are now receiving more scientific attention because they may be more desirable than agriculture or forestry in certain situations. There are many economic plants adaptable to combined production systems and even more unexploited species with resource-sharing and microsite enriching qualities that are adaptable to harsh environments. Agroforestry therefore has special relevance for such areas, but a number of potentials will remain underdeveloped if agroforestry research only adopts the usual experimental station approach.
AGROFORESTRY; LAND USE; TROPICS; MULTIPLE US;

00070
B02759
OBEL, E.; AMARE GETAHUN; MACKLIN, B.
PROCEEDINGS OF AGROFORESTRY WORKSHOP FOR HIGH-POTENTIAL AREAS IN KENYA: SEMINAR HELD IN BUKURA, KAKAMEGA, IN MARCH 1983
(1983); EN
KENGO; XA/KE; pg 1-68
The high potential highlands of Kenya are estimated to cover nine per cent of the total area. Commercialized agriculture has been dominated by large scale cash crop and dairy farming, and the traditional land use system practiced here still remains small-holder farming for food, cash and livestock rearing. The increasing pressure on land has led to the adoption of agroforestry systems. The workshop deliberations revealed the impact felt from land pressure problems, and in order to meet the high fuel demand, food crops are now being interplanted with fast-growing multipurpose trees.
AGROFORESTRY; TREES; SEEDS; SEEDLINGS; FUELWOOD; AFFORESTATION; SEMINARS; EXTENSION ACTIVITIES; TROPICS ;

00071
04939
PERCIVAL, N.S.; KNOWLES, R.L.
AGROFORESTRY: EXPANDING HORIZONS
PROC 35th RUAKURA FARMERS' CONF; (1983); EN
XP/NZ; pg 37-40
Agroforestry is a land use option that aims to improve profitability by combining agricultural and forestry production on the same land unit. The management requirements for successful integration of the forestry and agricultural components have evolved partly from the experience gained on agroforestry trials in both of New Zealand's islands, and also from large scale commercial agroforestry projects. The authors look into some important aspects of agroforestry: establishing trees on farmland, weed control in agroforests, livestock production under trees, tree management, and profitability of agroforests and, give some important findings.
GRAZING; AGROFORESTRY; FARMLAND; WEED CONTROL; LIVESTOCK; ECONOMICS; TREES; MANAGEMENT;

00072
01014
SAJISE, P.E.
SOME ECOLOGICAL CONSIDERATIONS FOR AGROFORESTRY (FOR WHOM?)
(1979); EN
XP/PH; pg 2
Agroforestry needs and expectations are discussed in the context of increased production and ecological sustainability. The author has outlined the major development goals of ecological amelioration and satisfaction of socioeconomic needs and has centred discussion on agroforestry systems. A tentative agroforestry model is discussed whose main components are input requirements and expected outputs benefits. In summary, the author has stressed the need for an interdisciplinary and interagency approach to agroforestry research and development.
LEUCAENA LEUCOCEPHALA; GLIRICIDIA SEPIUM; ALBIZIA PROCERA; DESMODIUM; SESBANIA; STYLOSANTHES; GLYCINE MAX; PTERIDIUM; HELIANTHUS; AGROFORESTRY; ECOLOGY; EROSION; FLOODING; POPULATION; CROPPING SYSTEMS; CANOPIES; PRUNING; MICROCLIMATE; BIOGEOGRAPHY; WATER RESOURCES; CYCLING; RESEARCH;

00073
B01262
SANCHEZ, P.A.
SOIL FERTILITY AND CONSERVATION CONSIDERATIONS FOR AGROFORESTRY SYSTEMS IN THE HUMID TROPICS OF LATIN AMERICA
SOIL RESEARCH IN AGROFORESTRY (MONGI, H.O. & HUXLEY, P.A. EDS.);
(1979); EN
XL; pg 79-124
This paper examines available data about soil management in several regions of tropical America. Soil fertility, management and conservation are discussed in terms of soil geography, nutrient cycling, land clearing, maintenance of soil fertility in various systems, soil conservation and research needs. The data drawn from various disciplinary studies in the area are presented to outline components of potential agroforestry systems. The research needs in agroforestry from the soil fertility and management point of view are outlined.
HYPARRHENIA RUFA; PANICUM MAXIMUM; BRACHIARIA HUMIDICOLA; ANDROPOGON GAYANUS; STYLOSANTHES GUIANENSIS; CENTROSEMA PUBESCENS; PUERARIA PHASEOLOIDES; BAUHINIA MACROTACHIA; AGROFORESTRY; SOIL WATER CONTENT; RADIATION; EVAPOTRANSPIRATION; CLIMATE; RESEARCH; CONSERVATION; PASTURES; MANAGEMENT; SOIL FERTILITY; FLOODING; SOIL PHYSICOCHEMICAL PROPERTIES; BIOMASS; LEGUMES; HUMID TROPICS;

00076
B02754
SRIVASTAVA, L.J.; KHURANA, D.K.; TOKY, O.P.
NATIONAL SYMPOSIUM ON PRODUCTION AND CONSERVATION FORESTRY, APRIL 12 & 13, 1985 (ABSTRACTS)
(1985); EN
INDIAN SOCIETY OF TREE SCIENTIST; XP/IN; pg 1-92
These abstracts of papers cover topics like forest resources, soil fertility, agroforestry and productivity biotechnology as an aid to production forestry, horticulture and conservation, watershed management, and environmental conservation.

FORESTRY; FOREST RESOURCES; RESOURCE CONSERVATION; ABSTRACTS;

00077
B01415
VAN BAREN, F.A.
<THE> SOIL AS AN ECOLOGICAL FACTOR IN THE DEVELOPMENT OF TROPICAL FOREST AREAS
ECOLOGICAL GUIDELINES FOR DEVELOPMENT IN TROPICAL FOREST AREAS OF S.E. ASIA. IUCN PUBL NO 32; (1973); EN
XP; pg 88-96
In this review of literature related to tropical soils, the author has combined data sources from various publications to arrive at the following conclusions: 1) the statement that a luxurious tropical forest may cover an almost sterile soil still holds true; 2) a thorough pedo-ecological study should go hand in hand with an analysis of the vegetational cover; and 3) paucity of composition of tree-species and poor regrowth are indicative of limitations in ecological conditions to which full weight should be given before decisions on reclamation of a given forest area are taken.
CELTIS; TRIPLOCHITON; DACRYDIUM ELATAN; PODOCARPUS; CROTON; ARUNDINARIA; ASPIDOSPERMA; NUTRIENTS; VEGETATION; RESEARCH; LEACHING; SHIFTING CULTIVATION; ORGANIC MATTER; SOIL FERTILITY; TROPICS ;

00078
05030
VOGTMANN, H.
ALTERNATIVE AGRICULTURAL METHODS: AN OPPORTUNITY FOR DEVELOPING COUNTRIES
PLANT RES DEV; Vol: 21, (1985); EN
XZ; pg 114-125
This review summarizes the problems of chemo-industrial agricultural production systems, especially in developing countries, and shows the possible alternatives in the form of sustainable agroecosystems. Explains the theoretical basis and the various forms of such systems, and illustrates the current practical applications at the farm level. Finally, the review demonstrates the possibility of realizing such programmes in developing countries, using the valley of Cochabamba in Bolivia as an example.
DEVELOPING COUNTRIES; AGRICULTURAL PRODUCTION; FARMING SYSTEMS; TROPICS;

00079
01072
VON MAYDELL, H.J.
AGROFORESTRY TO CONTROL DESERTIFICATION: A CASE STUDY OF THE SAHEL
(1977); EN
XA; pg 1-16
Land use methods in the Sahel, have exacerbated desertification problem. The Plan of Action adopted in the Nairobi Conference on Desertification (UNCOD) recommended application of forestry activities in the affected areas to combat soil erosion, optimize land use and, improve the socioeconomic well-being of the people. The author has introduced the idea of agroforestry systems in the

Sahel zone. According to the author, agroforestry should be concentrated on and only applied to suitable sites; it should aim at diversification of crops and hence at making better use of the lands and reducing risks. Multipurpose trees and shrubs adapted to the region should be used. The author, drawing examples from experiences gained elsewhere, has shown that agroforestry is a productive and sustainable system in the Sahel. Case examples provided include a combination of Acacia albida with dry farming and a combination of Acacia senegal with semi-nomadic or transhumance pastoralism.
AGROFORESTRY; DESERTIFICATION; LAND USE; GRAZING LANDS; MANAGEMENT; FUELWOOD; CHARCOAL; ENERGY SOURCES; EDUCATION; RESEARCH; DRY FARMING; SOCIOECONOMIC ASPECTS; SAHEL; ARID ZONES;

00080
01075
VON MAYDELL, H.J.
RESEARCH RELATED TO JOINT PRODUCTION OF WOOD AND FOOD IN AGROFORESTRY SYSTEMS
IUFRO SPECIAL PAPER: EIGHTH WORLD FORESTRY CONGR, JAKARTA, INDONESIA, 16-28 OCTOBER 1978; (1978); EN
XZ; pg 1-12
Food production and employment creation are the two most challenging rural development problems. The systems and technology so far applied in both the agricultural and forestry sector seem to result in conflict rather than in an integrative solution. In this thought-provoking paper, the author very critically looks at the existing farming systems and the rationale behind adopting new ways of doing old things. Agroforestry merits as a viable alternative, but its usefulness and effects on man and the environment are dependent upon appropriate application. Agroforestry is a term comprising all land use systems, combining forestry with farming or range management. It offers many suitable solutions. The author, however, feels that these solutions may remain theoretical as long as no efforts are made to further understanding of the ecological, cultural, social and political environments. More research is needed. It is due to this realization that international bodies, such as FAO, IUFRO, UNEP and ICRAF are increasingly devoting research to agroforestry land use systems, their problems and prospects.
AGROFORESTRY; EMPLOYMENT; FOOD; SOCIOECONOMIC ASPECTS; RESEARCH; AGRICULTURE; FORESTRY; LAND USE; CARRYING CAPACITY; ECOLOGY; INTEGRATION;

00081
00748
WASSINK, J.T.
AGROFORESTRY: INTEGRATION OF AGRICULTURE AND FORESTRY FOR THE BENEFIT OF MAN AND HIS ENVIRONMENT
(1977); EN
XZ; pg 1-19
Shifting cultivation, which is widely practiced in the tropics, is detrimental to fragile tropical ecosystems. However, replacement of the traditional systems with more advanced ones is a task that invites total cooperation from scientists in various disciplines, local authorities and the people. Agroforestry is a candidate

technology - the aim of which is to create a new type of environment, strongly related to the natural one - that is reasonably stable ecologically and that within a fixed area offers a reasonable and acceptable permanent way of life to the people living there. However, the system is not seen as the one and only solution, and the complexity of the situation and the material on it no means underrated. The booklet contains illustrative diagrams and photographs.
COCOS NUCIFERA; THEOBROMA CACAO; ANANAS COMOSUS; AGROFORESTRY; HOME GARDENS; SHIFTING CULTIVATION; FORESTRY; AGRICULTURE; TROPICS;

00082
01988
WIERSUM, K.F.
POSSIBILITIES FOR USE AND DEVELOPMENT OF INDIGENOUS AGROFORESTRY SYSTEMS FOR SUSTAINED LAND USE ON JAVA
TROPICAL ECOLOGY AND DEVELOPMENT (FURTADO, J.I. ED.); (1980); EN
XP/ID; pg 515-521
The transformation of traditional agricultural systems with the advent of the colonial period in Java, plus the population pressure, has adversely affected the agricultural environment. Soil erosion and disturbed hydrological systems have led to serious environmental degradation. The author discusses the possibilities not only of improving traditional farming systems, but also of developing traditional agroforestry systems. However, a successful improvisation of the system will have to overcome both environmental and socioeconomic constraints.
AGROFORESTRY; ENVIRONMENTAL CONDITIONS; IRRIGATION; FARMING SYSTEMS; HOME GARDENS; EROSION; SOILS; AFFORESTATION; ECOLOGY; LAND USE; MICROCLIMATE; SHIFTING CULTIVATION; MANAGEMENT; SOCIOECONOMIC ASPECTS; CROPS;

00083
04932
WOOD, P.J.
INVESTMENT IN AGROFORESTRY
(1985); EN
XZ; pg 1-16
This paper outlines the different ways in which agroforestry can be approached, and the different expectations of technologies. The paper also gives a brief account of the state of the art of agroforestry including a consideration of setting objectives. It reviews investment and gives examples of economic analysis.
AGROFORESTRY; LAND USE; DIAGNOSIS; ECONOMIC ANALYSIS; DECISION MAKING; SMALL SCALE FARMING; TREES; CROPS; PASTURES; ANIMALS;

00084
06115
YOUNG, A.
EVALUATION OF AGROFORESTRY POTENTIAL IN SLOPING AREAS
ICRAF WORK PAP NO 27; (1984); EN
XZ; pg 1-33
Eight examples of agroforestry systems in sloping areas are described with two examples of economic analysis of agroforestry

systems. The ICRAF diagnosis and design methodology is outlined, exemplified and compared with land-evaluation procedures. Distinctive features in land evaluation for agroforestry are that surveys commence with a phase of diagnosis; that the performance of systems, and hence the land use requirements, cannot be precisely specified at present; and that as a consequence, the output from agroforestry surveys is frequently a research programme. The ICRAF/FAO project, Land Evaluation for Agroforestry, is outlined. Classification of an agroforestry land utilization type as highly suitable for a given area is not related to environment alone but depends on existing land use systems and problems. The major benefit that agroforestry can bring to sloping areas lies in its capacity to combine soil conservation with productive functions. Agroforestry may often be the preferred form of land use in sloping lands which have problems of soil erosion, soil fertility decline, and shortages of fuelwood or fodder. Sloping areas should be a priority environment for the application of research and development in agroforestry.
AGROFORESTRY; SLOPING LAND; ECONOMIC ANALYSIS; LAND EVALUATION; LAND USE;

00085
05318
ALIEU, E.K.
AGROFORESTRY PRACTICES IN SIERRA LEONE
LILONGWE WORKSHOP ON MULTIPURPOSE TREES; (1983); EN
XA/SL; pg 1-6
Land available for either agricultural or forestry operations is decreasing gradually. The ultimate solution is to accept agroforestry. The idea of growing timber trees and cash crops simultaneously on the same piece of land has been unconsciously practiced in Sierra Leone from time immemorial, e.g. cocoa. The commonest type of agroforestry practiced in Sierra Leone is the 'old taungya' system, which takes advantage of the farmer's labour. The advantage of this system is that the forest crops are established at a very low cost. The 'new taungya' system is now being practiced and the plantations are now cleaned and thinned; hence there is no damage to the young cocoa or coffee trees. The author emphasizes the need for research and the implementation of results.
THEOBROMA CACAO; CORDIA ALLIODORA; TERMINALIA IVORENSIS; GMELINA ARBOREA; AGROFORESTRY; TRADITIONAL FARMING; POPULATION CHANGE; TAUNGYA SYSTEMS; SHADE PLANTS; FOOD PRODUCTION; TROPICS;

00086
04360
ALLEN, B.J.
DYNAMICS OF FALLOW SUCCESSIONS AND INTRODUCTION OF ROBUSTA COFFEE IN SHIFTING CULTIVATION AREAS IN THE LOWLANDS OF PAPUA NEW GUINEA
AGROFOR SYST; Vol: 3, No: 3; (1985); EN
XP/PG; pg 227-238
The traditional shifting cultivation system in the lowlands of Papua New Guinea consists of mixed food crop gardens in which yams (Discorea spp.), bananas, taro (Colocasia esculenta) and sugarcane predominate. The cropping cycle is usually for 18 months, followed by a fallow cycle of up to 30 years. During the cropping cycle,

two species of fruit trees, Pometia pinnata and Artocarpus altilis, are also planted, the leaves of the former also being used as a mulch and green manure in yam cultivation. Fallow succession follows rather systematic patterns about which farmers have a thorough understanding. Robusta coffee, a cash-crop component, has been added to the system in some areas since the late 1950s. It is usually grown in permanent blocks, but is interplanted with Leucaena as shade. Food crops are planted in the establishment stage, bananas and Xanthosoma being retained even in mature coffee gardens. The system seems to be a potentially promising one. But very little quantitative information is available on the production and performance of the system and practically no systematic research has been undertaken. Since the Papua New Guinea fallow gardeners are willing to accept innovations, it will be appropriate and timely to undertake serious studies so that the system can be improved. A few items that merit immediate research attention are indicated.
DIOSCOREA; COLOCASIA ESCULENTA; POMETIA PINNATA; ARTOCARPUS ALTILIS; LEUCAENA; COFFEA ROBUSTA; XANTHOSOMA; AGROFORESTRY; FALLOW SYSTEMS; SHIFTING CULTIVATION; SPECIES LIST; HUMID TROPICS;

00087
02908
AMARE GETAHUN
ALLEY CROPPING IN THE HUMID AND SUB-HUMID TROPICS: STATE OF THE ART AND RECOMMENDATION
(1980); EN
IITA; XA/NG; pg 23
This publication investigates the problems being experienced in the humid eco-climatic zone of southern Nigeria, in relation to traditional agricultural land use. Population and ecology-based problems limit optimal use of the land resources. The author examines the possibilities of introducing a more stable type of land use system, which includes a tree component. The proposed system is alley cropping, which is defined as a cropping system in which food crops are grown in alleys formed by trees or shrubs, established mainly to hasten soil fertility restoration and enhance productivity. Included in this publication is a list of tree species identified for possible experimentation. Different Leucaena species are examined in depth together with their establishment methods.
CAJANUS CAJAN; LEUCAENA; GLIRICIDIA SEPIUM; TEPHROSIA CANDIDA; SESBANIA GRANDIFLORA; ALBIZIA FALCATARIA; SAMANEA SAMAN; ACACIA ALBIDA; PROSOPIS; ALLEY CROPPING; MULTISTOREYED CROPPING; MIXED FARMING; MULTIPLE CROPPING; INTERCROPPING; LAND USE; BUSH FALLOWING; SPECIES LIST; HUMID TROPICS; SUBHUMID TROPICS;

00088
04867
ANON
AGROFORESTRY IN JAMAICA
(1982); EN
XL/JM; pg 1-6
Agroforestry has been practised for many centuries in Jamaica. Cocoa and coffee are grown under shade of trees and yam vines. The paper explains the benefits of agroforestry and agroforestry

systems and discusses some problems of agroforestry in Jamaica.
AGROFORESTRY; TAUNGYA SYSTEMS; ALLEY CROPPING; RURAL DEVELOPMENT;

00089
01767
ARNOLD, M.
NEW APPROACHES TO TROPICAL FORESTRY: A HABITAT OF MORE THAN JUST TREES
CERES; Vol: 12, No: 5; (1979); EN
XP/TH; pg 29-37
Past programmes on utilization of forest resources have not benefited the developing countries. The programmes were based on utilitarian principles which viewed the forests as useful only as a source of industrial timber. The land-hungry shifting cultivators encroached upon the forest areas to take advantage of the fertile soil. Such an approach was not only detrimental to the forest capital, neither was it creating a sustainable ecological system. The new approach discussed in this paper involves the integration of forest trees and food crops under the taungya system. The utilization of forest trees for bee farming and use of forest areas for grazing. An activity to help the rural people meet their fuel needs, includes introduction to fast-growing species, mainly tropical legumes such as Calliandra calothyrsus.
ALBIZIA FALCATARIA; EUCALYPTUS DEGLUPTA; LEUCAENA LEUCOCEPHALA; TECTONA GRANDIS; CALLIANDRA CALOTHYRSUS; PENNISETUM PURPUREUM; TROPICAL RAIN FORESTS; SHIFTING CULTIVATION; TAUNGYA SYSTEMS; TENURE; CYCLING; SOILS; EROSION; TREES; CROPS; SILVOPASTORAL SYSTEMS; BEES; WOOD; FUELWOOD; LEGUMES; HUMID TROPICS;

00090
01555
ATMOSOEDARYO, S.; WIJAYAKUSUMAH, K.
ECOLOGICAL ASPECTS OF AGROFORESTRY IN LOWLAND HUMID TROPICS OF SOUTH EAST ASIA
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1977); EN
XP/ID; pg 117--128
This paper provides a qualitative evaluation of agroforestry systems in South East Asia. Several variations are practised according to local, social or climatic conditions in the form of taungya or tumpangsari system, in the form of home gardens in the villages and on dry agricultural land, has been practised over decades. The most commonly used tree species in home gardens are: Sesbania grandiflora, Gliricidia maculata, Eugenia aromatica, Anacardium occidentalle, Ceiba pentandra, Hevea braziliensis, Cinnamomum spp., Parkia sreciosa, Artocarpus integra, Artocarpus lommunis, Monilkara kauki, Durio zibethinus, Nephelium lapaceum and others. The authors finally recommend that both ICRAF and DSE pursue research on the lines outlined in this paper.
TECTONA GRANDIS; ACACIA; LEUCAENA; ALBIZIA CHINENSIS; DALBERGIA LATIFOLIA; EUCALYPTUS ALBA; SESBANIA GRANDIFLORA; GLIRICIDIA MACULATA; PARKIA SPECIOSA; AGROFORESTRY; TAUNGYA SYSTEMS; HOME GARDENS; INDIGENOUS PLANTS; SOUTH EAST ASIA; SPECIES LIST; HUMID TROPICS;

00091
00985
BALL, J.
TAUNGYA IN SOUTHERN NIGERIA
(1977); EN
FAO; XA/NG; pg 1-24
This paper presents results of a survey of taungya farmers in southern Nigeria. It offers recommendations for the improvisation of a similar system elsewhere. The paper has addressed itself in depth to social, economic and biological benefits and costs of the system. It gives an elaborative economic analysis - cost/benefit and IRR. The author, however, has expressed doubts about further development of the system unless there is a shift in the present methods of planning and implementation. The author recommends land-capability planning, provision of amenities, extension of credit facilities, further training of extension staff, and improved methods of farm management. With great precision, the author has provided useful statistical figures and a list of tree species planted in taungya farms.
AGRISILVICULTURE; TAUNGYA SYSTEMS; SOCIOECONOMIC ASPECTS; ECOLOGY; SPECIES LIST; ECONOMIC ANALYSIS; RESEARCH; FOOD PRODUCTION; HUMID TROPICS;

00092
01605
BAYOUMI, A.A.
<THE> ROLE OF SHELTERBELTS IN SUDANESE IRRIGATED AGRICULTURE WITH PARTICULAR REFERENCE TO THE GEZIRA
SUDAN SILVA; Vol: 3, No: 21; (1976); EN
XA/SD; pg 24-39
In areas with few trees scattered over the landscape, wind can have detrimental effects on soil and crops. Wind increases transpiration rates, causes various types of mechanical damage to plants and speeds the rate of moisture loss from the surface. Introduction of shelterbelts in such environments may help to reduce those effects. A case for the introduction of tree shelterbelts in irrigated agriculture in the Sudan with particular reference to the Gezira is presented and supporting evidence of the beneficial effects of shelterbelts in various countries is reviewed. Penman's equation is applied on readily available data to determine the potential of transpiration and irrigation requirements for cotton and other crops grown in the Gezira. The same formula is used to predict the theoretical evaporation and transpiration reductions such as would be expected in the presence of shelter. Other benefits accruing to the introduction of shelterbelts would be the improvement of the Gezira environment and the supply of wood requirements to part of the population.
IRRIGATION; WINDBREAKS; WATER SUPPLY; WINDS; SOIL WATER; PHOTOSYNTHESIS; DEFOLIATION; FRUITS; WIND EROSION; ANIMALS; ARID ZONES; VEGETATION; MICROCLIMATE; BIOLOGICAL FACTORS; SHADE TREES; AGRICULTURE;

00093
01823
BEER, J.W.; CLARKIN, K.L.; DE LAS SALAS, G.; GLOVER, N.L.
<A> CASE STUDY OF TRADITIONAL AGROFORESTRY PRACTICES IN WET

TROPICAL ZONES
(1979); EN
XL/CR; pg 1-27
This paper describes the structure as well as the species use in the agroforestry combinations found in the area and the results of a survey used to discuss the farmer's perception of the systems. For the most important associations, which combine the valuable timber tree laurel (Cordia alliodora) with coffee (Coffea arabica) or sugar cane (Saccharum officinarum) or pasture, standing basal areas and volumes are given together with estimates of annual increments. Results of crop yields with or without the tree overstorey are presented. These initial statistical results support the contention that these combinations are economically and ecologically sound. A discussion and maps of the present land use, soils, and the proposed land use classification are included and data on the two reforestation plots established to date are given.
CORDIA ALLIODORA; ERYTHRINA POEPPIGIANA; GLIRICIDIA SEPIUM; CITRUS SINENSIS; PSIDIUM GUAJAVA; MANGIFERA INDICA; CEDRELA ODORATA; PINUS CARIBAEA; CUPRESSUS LUSITANICA; LIPPIA TORRESSII; AGROFORESTRY; LAND CAPABILITY; DEFORESTATION; LAND USE; MULTIPURPOSE TREES; TROPICS;

00094
04787
BOURKE, R.M.
FOOD, COFFEE AND CASUARINA: AN AGROFORESTRY SYSTEM FROM THE PAPUA NEW GUINEA HIGHLANDS
AGROFOR SYST; Vol: 2, No: 4; (1985); EN
XP/PG; pg 273-279
An agroforestry farming system is described from the Papua New Guinea highlands (1400 to 2100 m) that has been developed by village growers since about 1960 and has expanded rapidly since about 1970. Major components of the system are numerous species of annual and perennial food crops (especially bananas), arabica coffee and Casuarina oligodon. It provides food, a cash crop, and timber for construction and fuel. It is likely that returns on labour inputs are very favourable, but no formal assessments have been made. Evaluation of the system as a whole and research on certain key components (casuarina ecology, banana cultivars, timing of operations) are suggested as high-priority areas for systematic studies.
CASUARINA OLIGODON; COFFEA ARABICA; IPOMOEA BATATAS; AGROFORESTRY; FOOD CROPS; FARMING SYSTEMS; AGRISILVICULTURE; WOOD; FUELWOOD; SHADE TREES; CASH CROPS; HUMID TROPICS;

00095
03932
CHACHU, R.E.O.; ASABERE, P.K.
GUIDELINES FOR COMMUNITY FORESTRY AND ITS INTEGRATION WITH AGRISILVICULTURE IN GHANA
(1984); EN
XA/GH; pg 1-11
The authors discuss the agrisilviculture systems in Ghana in terms of community forestry. The necessity of guidelines for community forestry are examined. The criteria for selecting sites and

choosing tree species to plant are also reviewed. It is concluded that the rate of population growth in Ghana (3 per cent annually) is the main cause of deforestation and environmental deterioration. Community forestry is therefore necessary for a meaningful rehabilitation of the environment, but activities should be integrated with food production. The sites for the programme should include watershed-areas of high population, degraded farmlands, erosion-prone localities, and industrially degraded sites. The use of fast-growing nitrogen fixing trees as well as legumes as fallow tree crops is also described.
GMELINA ARBOREA; TECTONA GRANDIS; ALBIZIA LEBBEK; CALLIANDRA CALOTHYRSUS; ACACIA MANGIUM; LEUCAENA LEUCOCEPHALA; PINUS; EUCALYPTUS; TROPICAL RAIN FORESTS; COMMUNITY FORESTRY; AGRISILVICULTURE; FAST GROWING TREES; NITROGEN FIXATION; ZERO TILLAGE; FOOD PRODUCTION; SPECIES SELECTION; HUMID TROPICS;

00096
04697
CHAUDHRY, M.A.; SILIM, S.
AGRISILVICULTURE IN UGANDA (A CASE STUDY)
UNASYLVA; Vol: 32, No: 128; (1980); EN
XA/UG; pg 21-25
The authors define agrisilviculture as the system of production of food crops with simultaneously raised and protected forest crops. The various forms and names used in different countries in the tropics are discussed. The effects of the taungya system on the ecosystem and aspects of labour, ecology and socioeconomics are examined. The impact of the system on the Ugandan forest and on agricultural development is detailed.
MAESOPSIS EMINII; PINUS CARIBAEA; IMPERATA CYLINDRICA; FOOD PRODUCTION; FOOD CROPS; AGRISILVICULTURE; GRAZING; TAUNGYA SYSTEMS;

00097
01611
DE LAS SALAS, G.
PROCEEDINGS OF A WORKSHOP ON AGROFORESTRY IN LATIN AMERICA
(1979); EN
CR/XL; pg 1-220
The proceedings of a workshop jointly sponsored by CATIE and the United Nations University include the introductory speeches by representatives of the sponsors, summaries of the activities of the international organizations represented in the workshop (ICRAF, FAO, IICA - TROPICOS), contributions of the participants, accounts of visits to case study sites in Costa Rica, and the conclusions reached at the workshop.
PINUS JORULLENSIS; CORDIA ALLIODORA; CEDRELA ODORATA; GMELINA ARBOREA; ALNUS ACUMINATA; PAULLINIA CUPANA; GUILIELMA GASIPAES; MAURITIA FLEXUOSA; IPOMOEA AQUATICA; CYTOSPERMA EDULIS; INOCARPUS EDULIS; AGROFORESTRY; SPECIES LIST; LAND USE; FARMING SYSTEMS; AGRISILVICULTURE; RESEARCH; PLANTATIONS; ARID ZONES; RURAL DEVELOPMENT; EROSION; DEFORESTATION; PASTURES; INTERCROPPING;

00098
47
DEPOMMIER, D.; CTFT
ASPECTS DE LA FORESTERIE VILLAGEOISE DANS L'OUEST ET LE NORD CAMEROUN
(1983); FR
XA/CM; pg 25
Dans une premiere partie sont analyses les aspects de la foresterie privee en pays Bamileke, tout particulierement en ce qui concerne les petites plantations paysannes d'Eucalyptus, (de la pepiniere a leur exploitation). L'Eucalyptus, qui depuis une generation a colonise massivement de nombreux terrains marginaux, d'anciennes prairies, voire remplace des plantations de cafeiers, est traite principalement en taillis a courte revolution (4 a 12 ans) afin de donner perches et poteaux dont la commercialisation assure des revenus importants aux annexe, est donnee une liste des principales essences a bois et leur utilisation ainsi qu'une breve presentation du systeme traditionnel de haies vives. La seconde partie de cette etude analyse l'arbre dans le paysage Kapsiki et les besoins en boit des populations locals. Acacia albida et surtout Ziziphus mauritiana sont les especes le plus souvent associees aux cultures. Le taillis de jujubiers, parfois present en parc dense (50 a 100 arbes/ha) joue un role fondamental dans l'economie domestique Kapsiki (bois de construction des cases, surtout). Les arbes et arbustes de savane sont principalement pourvoyeurs de bois feu. Leur degradationet disparition rapide oblige a considerer.
EUCALYPTUS; FICUS; CROTON; ALBIZIA; MARKHAMIA LUTEA; VERNONIA AMYGDALINA; PODOCARPUS MANNI; KHAYA; SOCIAL FORESTRY; AGROFORESTRY; HOME GARDENS; TREES; PLANTING; WOOD PRODUCTS; FENCES; MULTIPURPOSE TREES; FUELWOOD; WOOD; ENVIRONMENTAL CONDITIONS;

00099
04891
FREEMAN, P.H.
LAND REGENERATION AND AGRICULTURAL INTENSIFICATION IN SENEGAL'S GROUNDNUT BASIN
(1982); EN
XA/SN; pg 1-34
The groundnut basin land in Senegal is constantly losing its natural productivity and adequate fallowing is no longer possible, because of the land constraint. Research in Senegal and elsewhere in Africa has shown that degraded lands can be restored by various radical innovations that require substantial investment in energy, time and capital, like ploughing under manure, applying micronutrients, and deep ploughing. The paper describes an important dynamic, which links agricultural intensification with food and fuel by using agroforestry techniques. The common trees being planted are Acacia albida, Gueira senegalensis and Eucalyptus.
CROP PRODUCTION; FUELWOOD; LAND; CONSERVATION; FOOD PRODUCTION; MANURES; FEEDS;

00100
B01270
AMARE GETAHUN; WILSON, G.F.; KANG, B.T.
<THE> ROLE OF TREES IN FARMING SYSTEMS IN THE HUMID TROPICS
PAPER PRESENTED TO WORKSHOP ON AGROFORESTRY IN THE HUMID TROPICS, 27 APRIL-1 MAY, IBADAN, NIGERIA; (1981); EN
XZ; pg 28-35
Population increases and the associated pressure on land have been threatening the stability and productivity of bush fallowing systems. There has not yet been an acceptable alternative. A survey conducted in southern Nigeria confirmed that bush fallowing is still the dominant land use pattern. There is a consensus on the beneficial role of trees in stabilizing the ecosystems. Trees and shrubs in fallow or in association with food crops are essential components in land and soil management. Their role in providing fuel, staking material and edible products has aroused the present attention being given to improving the bush fallow system. Selected multipurpose tree species are intercropped or rotated in fallow with major food crops in an agroforestry system.
GLIRICIDIA SEPIUM; LEUCAENA; ALBIZIA GUMMIFERA; ANTHOCLEISTA VOGELLI; ACIOA BARTERII; DIALIUM GUIANENSE; CRESTIS FERRUGINEA; FICUS; ELAEIS GUINEENSIS; BUSH FALLOWING; SHIFTING CULTIVATION; AGRISILVICULTURE; COMPOUND FARMS; MULTIPLE CROPPING; SPECIES LIST; ALLEY CROPPING; LEGUMES; LAND USE; MIXED CROPPING; HUMID TROPICS; AGROFORESTRY;

00101
46
GIFFARD, P.L.
THE TREE IN THE LANDSCAPE OF SENEGAL -SILVICULTURE IN DRY TROPICAL AFRICA
(L'ARBRE DANS LE PAYSAGE SENEGALAIS- SYLVICULTURE EN ZONE TROPICALE SECHE)
(1974); FR
CTFT; XA/SN; pg 431
Cet ouvrage tres documente sur le role des arbres et arbustes en zone seche est en outre un guide precieux pour le praticien operant en agroforesterie foresterie rurale. La premiere partie, l'arbre et le milieu, est une etude detaillee et geographiquement sectorisee des caracteres climatiques, edaphiques et phytodynamiques du territoire Senegalais. La seconde partie fait une revue thematique des usages ou roles des principaux ligneux exploites par les populations locales, l'etat ou des societes privees (alimentations humaine et animale, pharmacopee, artisanat, industrie, combustible, protection et regeneration des sols). Les legumineuses arborees tiennent ici une place considerable qui doit beaucoup a l'importance des arbres fourragers dans ce pays largement sahelien. La derniere partie traite de methodes et techniques sylvicoles comme principes de base appliques en zone tropicale seche et en particulier de celles experimentees recommandees pour les especes plus utilisees en reboisement au Senegal.
ACACIA ALBIDA; ACACIA SENEGAL; ACACIA; BORASSUS AETHIOPICUM; CASSIA SIAMEA; CASUARINA EQUISETIFOLIA; ANACARDIUM OCCIDENTALE; AZADIRACHTA INDICA; GMELINA ARBOREA; PROSOPIS CHILENSIS; MULTIPURPOSE TREES; AGROFORESTRY; SILVOPASTORAL SYSTEMS; RURAL AREAS; FORESTRY; TAUNGYA SYSTEMS; SOIL CONSERVATION; WINDBREAKS;

DIETS; FODDER CROPS; DRUG PLANTS; FUELWOOD; WOOD; TECHNOLOGY; METHODS;

00102
01506
GRINNELL, H.R.
<A> STUDY OF AGRISILVICULTURE POTENTIAL IN WEST AFRICA (1977); EN
IDRC; XA/NG/GH; pg 1-52
Three traditional forms of producing food in the humid tropical zones of West Africa, i.e. shifting cultivation with planted fallow and without it and taungya, are discussed. The paper stresses that taungya should be evaluated not only from the forestry service point of view but also from the farmer's point of view. To decrease the rate of soil degradation, some alternatives to the above-mentioned systems are discussed, i.e. field crops alternated with planted forest fallow (agrisilviculture) and field crops with natural bush fallow with permanent oil palm upper storey (shifting cultivation). Average annual costs and benefits of these models are included.
GMELINA ARBOREA; ELAEIS GUINEENSIS; ZEA MAYS; DIOSCOREA; MANIHOT; AGRISILVICULTURE; SHIFTING CULTIVATION; FARMING SYSTEMS; PLANTATIONS; ECONOMICS; CLIMATE; VEGETATION; AGROSILVOPASTORAL SYSTEMS; SHADING; FUELWOOD; RESEARCH; TENURE; LAND CAPABILITY;

00103
B00674
HOEKSTRA, D.A. (ED.); KUGURU, F.M. (ED.)
AGROFORESTRY SYSTEMS FOR SMALL-SCALE FARMERS
PROC ICRAF/BAT WORKSHOP HELD IN NAIROBI, SEPTEMBER 1982; (1983); EN
XA; pg 1-283
The theme of the topics under discussion at this workshop dwelt specifically on the potential role of agroforestry on small farms where fuelwood is required for domestic use as well as for tobacco curing. Section 1 contains papers of general introduction to agroforestry, including ICRAF's programme of work for deriving appropriate agroforestry research/development. Section 2 constitutes topics on a range of issues, from the availability of tree seed resources to aspects of shelterbelt planning. Sections 3 and 4 carry interesting reading material from a number of countries, plus specific case studies on tobacco-growing areas of Kenya.
AZADIRACHTA INDICA; DERRIS INDICA; PROSOPIS CINERARIA; BRACHYSTEGIA SPICIFORMIS; JULBERNARDIA GLOBIFLORA; PROSOPIS TAMARUGO; GLEDITSIA TRIACANTHOS; ZIZIPHUS JUJUBA; AGROFORESTRY; FUELWOOD; DEFORESTATION; EROSION CONTROL; CONSERVATION; TECHNOLOGY; FOOD; FODDER CROPS; RESEARCH; LEGUMES; GERMINATION; SEEDLINGS; ROTATIONAL CROPPING; THINNING; WEEDING; CULTIVATION; LAND USE;

00104
01224
HOFSTAD, O.
PRELIMINARY EVALUATION OF THE TAUNGYA SYSTEMS FOR COMBINED WOOD

AND FOOD PRODUCTION IN NORTH-EASTERN TANZANIA
DIV FORESTRY, UNIV DAR ES SALAAM, RECORD NO 2; (1978); EN
XA/TZ; pg 1-14
The article discusses the economics of taungya system in Tanzania. Various arguments for and against it are discussed. The main arguments against it are that it hinders permanent settlement, causes soil erosion, is politically unacceptable, and produces less wood than forestry. The author has done an actual quantitative analysis of both forestry and taungya systems, extrapolating to a 24-year rotation. The taungya system is shown to be more profitable. The author recommends a continued application of the system with modification where necessary.
PINUS PATULA; ZEA MAYS; TAUNGYA SYSTEMS; ECONOMIC ANALYSIS; SOFTWOOD; FOOD PRODUCTION;

00105
01932
HUGUET, L.
SYMBIOSIS OF AGRICULTURE AND FORESTRY
UNASYLVA; Vol: 30, No: 122; (1978); EN
XZ; pg 25-29
In this paper the author makes some points on the food production situation of the tropics. Shifting cultivation is now the major cause of deforestation in the tropics because of shortened fallows caused by population explosion. To tropical farmers, forests are therefore a hindrance to food production as they are hungry for new land. A system that can bring together forestry and agriculture is agrisilviculture, which is regarded as an improved version of shifting cultivation. The system is described in detail, and examples from various regions of the world are given.
SHIFTING CULTIVATION; TROPICS; DEFORESTATION; POPULATION CHANGE; AGRISILVICULTURE; FALLOW SYSTEMS; FARMING SYSTEMS;

00106
04667
INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE (IITA)
IITA ANNUAL REPORT FOR 1983, IBADAN, NIGERIA
(1983); EN
XA/NG; pg 139-196
Results from on-going research on farming systems is reported. Of interest is work on soil physico-chemical properties, erosion, alley cropping with Sesbania rostrata, multiple cropping of maize and cassava, maize and cowpeas, the root distribution of crops, nodulation and nitrogen fixation of Leucaena, the evaluation of tree and shrub species for alley cropping (Gliricidia sepium, Leucaena, Acioa barterii, Alchornea cordifolia, Flemingia congesta, Cassia scairea), resource use in alley cropping, staking Leucaena for yams, long term trials of Leucaena, maize and yams, live mulches and cover crops (Canavalis ensiformis as an intercrop for green manure production). Other research of more general agronomic interest is also reported. All of the results are quantitative and have been interpreted statistically. In alley cropping Leucaena produced the highest dry weight of prunings and stakes, followed by Gliricidia sepium. Leucaena also produced the highest amount of nitrogen (232 kg N/ha) followed by Gliricidia (144 kg N/ha), Alchornea cordifolia (84.3 kg N/ha) and Acioa

barterii (28.7 kg N/ha). In other trials Cassia siamea showed high leaf production rates and good mulching characteristics.
SESBANIA ROSTRATA; RHIZOBIUM; FARMING SYSTEMS; SOILS; CROPS; RUNOFF; RESEARCH; STATISTICS; ALLEY CROPPING; ROOT NODULATION; GREEN MANURES; NITROGEN FIXATION; YIELDS; MULCHES; SPACING; TILLAGE;

00107
02868
KANG, B.T.; WILSON, G.F.; SIPKENS, L.
ALLEY CROPPING MAIZE (ZEA MAYS) AND LEUCAENA (LEUCAENA LEUCOCEPHALA) IN SOUTHER NIGERIA
PLANT SOIL; Vol: 63, (1981); EN
XA/NG; pg 165-179
This paper reports some results of maize and Leucaena alley cropping investigations conducted at Ibadan in the forest zone of southern Nigeria. The survey was conducted on an N-deficient Sandy Apomu soil series. Alley cropping and nitrogen application resulted in some changes in soil properties, and soil pH of this sandy soil was lowered significantly with high nitrogen application rates. Addition of Leucaena prunings resulted in an increase in soil organic matter level, though the increase was not significant. There was a marked decrease in the soil-exchangeable K and Mg levels with continuous cropping. Soil-exchangeable Mg and Ca levels increased with addition of Leucaena prunings with no nitrogen application. The total annual dry matter yield from the pruning showed some positive response to the nitrogen dressings given to maize crops. Application of nitrogen and also of Leucaena prunings at planting significantly increased maize grain yields. All the information provided in this paper was obtained primarily between 1978 to 1980. The results are brought together in graphs and charts.
LEUCAENA LEUCOCEPHALA; ZEA MAYS; LEGUMES; GREEN MANURES; SOIL PHYSICOCHEMICAL PROPERTIES; ALLEY CROPPING; NUTRIENT CONTENT; HUMID CLIMATE; BUSH FALLOWING; FERTILIZERS; NITROGEN;

00108
05023
KANG, B.T.; GRIMME, H.; LAWSON, T.L.
ALLEY CROPPING SEQUENTIALLY CROPPED MAIZE AND COWPEA WITH LEUCAENA ON A SANDY SOIL IN SOUTHERN NIGERIA
PLANT SOIL, (1985); EN
XA/NG; pg 267-277
The potential of alley cropping maize and cowpea with the giant leucaena cultivar K-28 was studied on an entisol in southern Nigeria. Crops were grown in 4-m wide alleys formed by periodically pruned leucaena hedgerows. The effect of application of leucaena prunings, nitrogen fertilizer and tillage was studied. The leucaena hedgerows continued to produce substantial amounts of prunings, nitrogen yield and stakes despite the intensive pruning regime. N application to the maize crop increased dry matter and N yield from the leucaena prunings. Cowpea grain yield was affected neither by leucaena prunings nor residual N. Tillage had little effect on maize and cowpea yields, but application of leucaena prunings resulted in higher soil moisture retention, organic matter, exchangeable K, Ca, Mg and nitrate levels in soil

solution.
LEUCAENA LEUCOCEPHALA; VIGNA UNGUICULATA; ZEA MAYS; ALLEY CROPPING; NUTRIENTS; SOIL WATER CONTENY; SANDY SOILS; YIELDS; HEDGEROW PLANTING; PRUNING; NITROGEN FERTILIZERS; TROPICS ;

00109
03611
KARTASUBRATA, Y.
TUMPANGSARI METHOD FOR ESTABLISHING A TEAK PLANTATION IN JAVA
TROP AGRIC SER ; Vol: 12, (1979); EN
XP/ID; pg 141-152
Tumpangsari is defined as an agrisilviculture method for establishing plantations, practiced mainly in Java. The requirements for a successful application of the method are need for agricultural land, use of selected food crops and right application of the required silviculture techniques. The fast population growth in rural areas necessitates an overall intensification of agricultural practices. In forest plantation the intensification of tumpangsari has been successfully introduced and developed. The author discusses the system in detail.
TECTONA GRANDIS; AGRISILVICULTURE; FOOD PRODUCTION; WOOD; YIELDS; HUMID CLIMATE; HUMID TROPICS;

00110
02928
LAGEMAN, J.; HEUVELDOP, J.
CHARACTERIZATION AND EVALUATION OF AGROFORESTRY SYSTEMS: THE CASE OF ACOSTA, PURISCAL, COSTA RICA
(1982); EN
CATIE; XL/CR; pg 1-19
This paper reports on the methodological approach, and the initial result from field work conducted in the region of Acosta Puriscal, Costa Rica. The study was confined to an analysis of the traditional agroforestry systems, classified and subjected to statistical analysis. The authors hence conclude that: 1) farmers are rational in their use of resources, and 2) Agroforestry systems can be used as a starting point to increase production and productivity by using improved varieties and better management techniques without a decrease in ecological stability.
ERYTHRINA POEPPIGIANA; MANGIFERA INDICA; CITRUS; CEDRELA ODORATA; SPONDIAS PURPUREA; PERSEA AMERICANA; GLIRICIDIA SEPIUM; PSIDIUM GUAJAVA; CORDIA ALLIODORA; AGROFORESTRY; SOCIOECONOMIC ASPECTS; PHYSIOGRAPHY; LAND USE; SPECIES LIST; BIOLOGY; ECONOMIC ANALYSIS; HUMID TROPICS;

00111
03106
LESLIE, A.; CONLIN, S.
IMATONG FORESTRY PROJECT, SOUTHERN SUDAN: SUBSISTENCE FOOD PRODUCTION UNDER THE TAUNGYA SYSTEM
ODA PROJ REP NO 103; (1980); EN
XA/SD; pg 1-42
The taungya system, with some improvements, can make a contribution to food production and also aid tree growth. However,

sufficient land is not available to allow surplus forest workers to become farmers using the taungya method. Moreover, there is insufficient land outside the forest reserves to enable agricultural settlement schemes to be established. Recommendations are made to improve the taungya system, to increase food production and to improve working conditions.
ZEA MAYS; SORGHUM BICOLOR; CUPRESSUS; TAUNGYA SYSTEMS; FORESTRY; AGRICULTURE; SOCIOLOGY; FOOD PRODUCTION; TENURE; SHIFTING CULTIVATION; POPULATION;

00112
01227
LUNDGREN, B.O.
AGROFORESTRY IN WEST AFRICA: AN APPRAISAL OF SOME IDRC SUPPORTED PROJECTS IN GHANA AND NIGERIA
(1978); EN
IDRC; XA/GH/NG; pg 1-42
The appraisal whose objective was to provide assistance in designing research projects in the above countries had important findings and recommendations to make. The appraisal is preceded by a critical examination of agroforestry systems - their potential role in ameliorating economic and ecological land use problems. The author cautions against any misunderstandings of the concept, either in theory or in practice. Within this background, the appraisal proceeds to look at project-to-project site conditions. The aims and objectives of each project are outlined. A close examination of each project revealed the major flaws and shortcomings in relation to project design, which needed remedial measures. Some of the objectives were found to be over-ambitious and hence could not have realized within the outlay of the available physical resources, manpower and time. In other cases background activities were not well designed to achieve the stated objectives. As a result the author has offered tentative recommendations to overcome the outlined constraints, shortcomings and gaps identified.
GMELINA ARBOREA; ALBIZIA LEBBEK; LEUCAENA LEUCOCEPHALA; CASSIA SIAMEA; CEIBA PENTANDRA; BAMBUSA VULGARIS; STERCULIA; ANTIARIS AFRICANA; IRVINGIA GABONENSIS; AGROFORESTRY; SHIFTING CULTIVATION; BUSH FALLOWING; BIOMASS; EVOLUTION; LEACHING; LAND USE; ECONOMICS; ECOLOGY; POPULATION; SOIL FERTILITY; HUMID TROPICS; NITROGEN FIXATION; SOIL PHYSICOCHEMICAL PROPERTIES;

00113
02747
LYNCH, J.J.; ELWIN, R.L.; MOTTERSHEAD, B.E.
<THE> INFLUENCE OF ARTIFICIAL WINDBREAKS ON LOSS OF SOIL WATER FROM A CONTINUOUSLY GRAZED AREA DURING A DRY PERIOD
AUST J EXP AGRIC ANIM HUSB; Vol: 20, (1980); EN
AU; pg 170-174
The paper presents results of a study in which the effects of windbreaks and stocking rate on pasture and sheep production were investigated. The experiment was restricted to four paddocks that had treatments of shelter and no shelter at two stocking rates (20 and 30 sheep/ha). The pasture was dominated by Phalaris aquatica and Trifolium repens. It was noted that less water was lost from the two sheltered paddocks compared with the two unsheltered

paddocks. Similarly herbage availability was higher over the dry period in the sheltered paddocks. Thus windbreaks should be considered in planning pasture lands in environments with long dry periods.
PHALARIS AQUATICA; TRIFOLIUM REPENS; PASTURES; SOIL WATER CONTENT; WINDBREAKS; EXPERIMENTS; EVAPOTRANSPIRATION; ENERGY; NUTRIENT CONTENT; CONSERVATION;

00114
B01270
MACDONALD, L.H. (ED.)
AGROFORESTRY IN THE AFRICAN HUMID TROPICS
PROC WORKSHOP ON AGROFORESTRY IN THE AFRICAN HUMID TROPICS, APRIL-MAY 1981, IBADAN; (1982); EN
XA; pg 1-163
A workshop was organized in Ibadan, Nigeria, in 1981 to enhance the United Nations University's programmes on the use and management of natural resources. The workshop was co-sponsored by UNU and IDRC with collaboration of ICRAF, IITA, the University of Ibadan, and the Federal Department of Forestry of Nigeria. The report provides introductory material on the principles of agroforestry, traditional agroforestry systems and prospects for their development, a discussion on taungya systems, and current agroforestry activities. The final chapter consists of papers on future development of agroforestry and reports of the working groups. References for all papers are combined in a bibliography.
PROSOPIS CHILENSIS; ACACIA TORTILIS; TAMARIX APHYLLA; EUCALYPTUS; BLEPHARIS; ACACIA SENEGAL; ADANSONIA DIGITATA; ZIZIPHUS; LAND USE; WILDLIFE; RESEARCH; SOIL CONSERVATION; FARMING SYSTEMS; PASTURES; CULTIVATION; SOIL FERTILITY; MANAGEMENT; ARID ZONES; HUMID TROPICS; AGROFORESTRY;

00115
02919
MAGHEMBE, J.A.; REDHEAD, J.F.
AGROFORESTRY PRELIMINARY RESULTS OF INTERCROPPING ACACIA, EUCALYPTUS AND LEUCAENA WITH MAIZE AND BEANS
(1980); EN
DIV FORESTRY, UNIV OF DAR ES SALAAM; XA/TZ; pg 1-17
This paper gives results of an agroforestry experiment conducted in Morogoro, Tanzania, in the period 1978-1980. It gives a stage-by-stage analysis of the intercropping systems involved in the experiment. Leucaena leucocephala, Acacia albida and Eucalyptus melliodora were the main tree species under test. The results, which were subjected to statistical analysis, are produced in both tabulated and graphed forms.
EUCALYPTUS; ACACIA ALBIDA; LEUCAENA LEUCOCEPHALA; GREVILLEA ROBUSTA; CORDIA ABYSSINICA; ZEA MAYS; PHASEOLUS VULGARIS; AGROFORESTRY; INTERCROPPING; AFFORESTATION; SOCIOECONOMICS; FOOD; FODDER; FUELWOOD;

00116
01986
MAGHEMBE, J.A.; CHINGAIPE, T.M.; LULANDALA, L.L.L.
AGROFORESTRY AND FARMING SYSTEMS: ROLE IN MARGINAL AGRICULTURAL

AREAS
(1981); EN
XA/TZ; pg 1-14
Concern over the need to develop a land use system that is both sustainable and productive has been expressed by scientists and governments the world over. This paper reviews a few case studies that have demonstrated the potentiality of agroforestry systems in demarginalized lands. It presents an intercropping trial that involved Leucaena leucocephala with maize and beans. Crop yield in the first year showed insignificant difference between crop monocultures and those under intercropping. At six months tree height growth showed highly significant differences between intercropping regimes. In the maize-leucaena intercrops, the leucaena showed tremendous height growth, unbranched and without flowers, whereas leucaena under bean intercrop branched and flowered profusely. At 12 months, leucaena under maize intercrop had lost the earlier height growth advantage but had one stem compared with multiple stem production under beans or monocultures. This implies that leucaena under maize intercrop can produce good building poles. Intercropping with beans may be the better alternative if the objective is fodder production.
LEUCAENA LEUCOCEPHALA; ACACIA ALBIDA; GREVILLEA ROBUSTA; ALBIZIA ; CORDIA ABYSSINICA; EUCALYPTUS MELLIODORA; FARMING SYSTEMS; AGROFORESTRY; NOMADISM; FUELWOOD; CHARCOAL; MANURES; CROP RESIDUES; ENVIRONMENTAL CONDITIONS; FOOD; TROPICS; ECOSYSTEMS; SHIFTING CULTIVATION; NUTRIENTS; EROSION; LEACHING;

00117
00992
MARKS, P.J.
AFFORESTATION OF FOOD CROP TREES: A SCIENTIFIC GLOBAL ANTI-HUNGER STRATEGY UTILIZING UNDER PRODUCTIVE LANDS
(1978); EN
XZ; pg 1-21
The paper introduces a new organization, the Agrisilviculture Institute and the author details its rationale. The institute will help youth explore ways and means of growing tree crops in marginal lands so as to make these lands more productive. The challenge to world hunger lies in the ability of people to produce enough wood and food together and to afforest of degraded lands.
FOOD PRODUCTION; AFFORESTATION; AGRISILVICULTURE; MARGINAL LANDS; TREE CROPS; TRAINING;

00118
03570
MASSON, J.L.
AGRISILVICULTURE IN THE PUCALLPA REGION OF THE PERUVIAN AMAZON
FAO WORK DOC NO 20; (1978); EN
XL/PE; pg 1-15
Shifting cultivation, the major farming system of the tropics, was practiced in the Pucallpa. The construction of a highway and the development of a logging industry led to the development of small farming communities. This meant a need for more farm land, gained by clearing more forest area. The agrisilviculture system was introduced to enable the settlers to produce more foodstuffs and animals as well as trees under the same management. The author

describes the site, farming techniques, and marketing and then discusses the agrisilviculture system.
AGRISILVICULTURE; SHIFTING CULTIVATION; FOOD CROPS; FALLOW SYSTEMS; FARMING SYSTEMS; TROPICS;

00120
B01060
NAIR, P.K.R.
INTENSIVE MULTIPLE CROPPING WITH COCONUTS IN INDIA
(1979); EN
VERLAG PAUL PAREY, BERLIN & HAMBURG; IN/XP; pg 1-147
Research on multiple cropping systems carried out at the Central Plantation Crop Research Institute at Kasaragod, Kerala, is reported in this book with a view to outline the possibilities for increasing agricultural production in India from the areas planted with coconuts. In its nine chapters, a wide array of data, experimental results and literature are examined. These have supported the final findings that coconut palm is amenable to intensive crop combinations in most periods of its life and that there exist great possibilities for increasing agriculture through intensive cropping in coconut areas. The application of systems analysis in research has been emphasized. The author concludes with a note on how research should proceed to obtain higher agricultural output within the constraints of higher demand, emanating from high population growth rates. Graphs, tables, photographs and other forms of presentation are included.
AMORPHOPHALLUS CAMPANULATUS; ANACARDIUM OCCIDENTALE; ANANAS COMOSUS; ARECA CATECHU; BRASSICA; CAMELLIA SINENSIS; COLOCASIA ESCULENTA; CROTALARIA; DHAINCHA; SESBANIA CANNABINA; DIOSCOREA; MULTIPLE CROPPING; LAND USE; MANAGEMENT; RESEARCH; EXPERIMENTS; SOIL FERTILITY; CLIMATE; PLANT ANATOMY; PLANTATIONS; SHADING; TOLERANCE; CROPPING PATTERNS; FARMING SYSTEMS; RADIATION;

00121
03953
NAIR, P.K.R.
TROPICAL AGROFORESTRY SYSTEMS AND PRACTICES
TROPICAL RESOURCES ECOLOGY AND DEVELOPMENT (FURTADO, J.J. & RUDDLE, K. EDS.); (1984); EN
XA/XL/XP
The paper describes the various agroforestry systems and practices in different ecological and geographical regions of the world. Depending on the components, the systems can be classified into agrisilviculture, silvopastoral and agrosilvopastoral. Prominent examples of each are given from different parts of the tropics. The role in agroforestry systems of wood perennials, which can be both productive (producing food, fodder, fuel, wood, etc.) and protective (soil conservation, windbreaks and shelterbelts), are discussed. In conclusion the author indicates that although agroforestry has generated a lot of enthusiasm among various groups of people, it should be noted that the systems are all very complex in nature and scientific study into these complex systems is difficult, time consuming and needs multidisciplinary input. Therefore in order to validate the hypothesis concerning the potential as well as management approaches to agroforestry, research has to be undertaken on those various aspects in a

systematic manner in different agroecological situations.
ACACIA ALBIDA; LEUCAENA LEUCOCEPHALA; PROSOPIS CINERARIA; AGROFORESTRY; MARGINAL LANDS; AGROSILVOPASTORAL SYSTEMS; AGRISILVICULTURE; SILVOPASTORAL SYSTEMS; LAND USE; TROPICAL SOILS; FUELWOOD; FOOD PRODUCTION; SOIL CONSERVATION;

00122
05225
NEIL, P.E.; JACOBELLI, P.A.
AGROFORESTRY AS AN AID TO RATIONAL RURAL DEVELOPMENT IN VANUATU
COMMONW FOR REV; Vol: 64, No: 3; (1985); EN
XP/VU; pg 259-266
In an agroforestry experiment being conducted by the Vanuatu Forest Service, subsistence crops have been grown between lines of Cordia alliodora, which is the principal forest tree species. Work has also been initiated on growing cash crops (cocoa, coffee) within forestry plantations. The authors stress the need for research in other potentially important forest tree species.
CORDIA ALLIODORA; COFFEA; THEOBROMA CACAO; AGROFORESTRY; TENURE; SUBSISTENCE FARMING; FOOD CROPS; RURAL AREAS; RURAL DEVELOPMENT; TROPICS;

00123
00084
NELLIAT, E.V.; BAVAPPA, K.V.A.; NAIR, P.K.R.
MULTI-STOREYED CROPPING: A NEW DIMENSION OF MULTIPLE CROPPING IN COCONUT PLANTATIONS
WORLD CROPS; (1974); EN
XP/IN; pg 262-266
The paper describes a land use practice in which both perennials and annuals can be grown together on the same ground with minimal competition for resources: the multistoried cropping system. The concept is defined and illustrated with an example from experimental trials at Central Plantation Crops Research Institute, Kasaragod, S. India. Crops grown in a multistoried system are usually selected on the basis of their rooting habits and their water and light requirements. The factors that influence biological economic efficiencies of such systems are likewise outlined.
AMORPHOPHALLUS CAMPANULATUS; MANIHOT ESCULENTA; IPOMOEA BATATAS; CURCUMA LONGA; EUGENIA CARYOPHYLLUS; THEOBROMA CACAO; PIPER NIGRUM; MYRISTICA FRAGRANS; COCOS NUCIFERA; MIXED CROPPING; INTERCROPPING; AGRONOMY; ECONOMICS; LAND USE; PLANTATIONS; CROPS; FOOD CROPS;

00124
B02912
NGEH, C.P.
AGROFORESTRY IN THE NORTH-WEST AND SOUTH-WEST PROVINCES (THE CASE OF TAUNGYA)
(1985); EN
XA/CM/NG; pg 1-62
Introduced into the forest reserves of Southern Bakundu and South West Province in 1958, the taungya system failed. The paper gives the main reasons that led to the failure, and describes the

re-introduction of the system in North West Province in the mid seventies. This work contains a number of proposals for the amelioration and subsequent revival of the system when and where necessary.
TAUNGYA SYSTEMS; AGRISILVICULTURE; AGROFORESTRY; LAND USE; FARMING SYSTEMS; METHODS; CLIMATE; VEGETATION; SOILS; TROPICS;

00125
49
CARE NIGER
NOTES ON EXPERIMENTS WITH LIVE FENCES IN THE TAGAZAR (NIGER)
(NOTES SUR L'EXPERIMANTATION DES HAIES-VIVES DANS LE TAGAZAR)
(1982); FR
CARE; XA/NE; pg 1-22
Afin de proteger contre le betail leurs cultures de bas-fonds, les payans du Dallol Bosso construisent des clotures traditonnelles, haies mortes et plus rarement haies vives. Les consequences ecologiques et economiques des coupes excessives fait pour realiser des haies mortes justifient le project de developpement des haies vives. Suite a divers essais preliminaires ayant connu peu de succes et fort de cette experience de nouveaux essais ont ete entrepris en milieu paysan. Ils privilegient surtout Acacia laeta, Acacia senegal, Acacia scorpioides et Commiphora africana lesquels, parmi les nombre ux ligneux essayes, ont montre les meilleures reprise et resistance a la secheresse. La production de plants a ete assuree par des prepinieres paysannes. Il est essentiellement fait etat de conseils practiques tant au niveau de la pepiniere qu'a ceux de la plantation et de l'entretien des jeunes haies vives.
COMMIPHORA AFRICANA; BAUHINIA RUFESCENS; PROSOPIS JULIFLORA; ZIZIPHUS MAURITIANA; ACACIA SCORPIOIDES; ACACIA ATAXANCANTHA; ACACIA LAETA; ACACIA SENEGAL; PROSOPIS CHILENSIS; BALANITES AEGYPTIACA; HEDGING PLANTS; FENCES; TREES; PLANTATIONS; NURSERY MANAGEMENT; TREES; MANAGEMENT;

00126
03285
NWOBOSHI, L.C.
SOIL PRODUCTIVITY ASPECTS OF AGRISILVICULTURE IN THE WEST AFRICAN RAIN FOREST ZONE
AGRO-ECOSYSTEMS; Vol: 7, (1981); EN
XA/NG; pg 263--270
The ferralitic soils that dominate the West African rain forests are old, weathered and have low fertility. Agrisilviculture as practiced in this area is held as a progressive variant of shifting cultivation in that it encourages multiple use of land in producing food and reforesting sites. However, no attention has been given to the soil. Drawing on various sources, this paper examines the impact of clearing, burning, cultivation and cropping and monospecific tree fallows, on the productive potential of these soils. It concludes that much has still to be learnt about the restoration of soil fertility under short rotation crops, the loss of nutrients during cropping, and the behaviour and response of ferralitic soils to various intensities of cropping and management methods. Some possible topics for research are suggested.

TROPICAL RAIN FORESTS; AGRISILVICULTURE; SOIL TYPES; SOIL FERTILITY; CROPS; SHIFTING CULTIVATION; FALLOW SYSTEMS; RESEARCH; TROPICS;

00127
01950
OJENIYI, S.O.; AGBEDE, O.O.
EFFECTS OF SINGLE CROP AGRISILVICULTURE ON SOIL ANALYSIS
EXP AGRIC; Vol: 16, (1980); EN
XA/NG; pg 371-375
Sites in three zones of southern Nigeria were planted with Gmelina arborea singly and together with yam, maize and cassava. Composite soil samples before and after each treatment were analysed. Intercropping young forest plantations with food crops caused increased N and P but reduced C in most zones compared with forest trees as sole crops. Changes in soil K, Ca, Mg and Ph were not significant. Agrisilviculture could therefore be used to increase food production without danger to soil fertility. This study is based on primary data that have been subjected to statistical tests. The results are provided in tabulated form.
EUCALYPTUS TORELLIANA; GMELINA ARBOREA; TERMINALIA IVORENSIS; DIOSCOREA; MANIHOT; AGRISILVICULTURE; ECOZONES; SOIL PHYSICOCHEMICAL PROPERTIES; YIELDS; INTERCROPPING; CROPS; FORESTS; TREES; MULTIPLE CROPPING; FOOD CROPS;

00128
03612
OJENIYI, S.O.; AGBEDE, O.O.
SOIL ORGANIC MATTER AND YIELD OF FOREST AND TREE CROPS
PLANT SOIL; Vol: 57, (1981); EN
XA/NG; pg 61-67
The paper investigates the influence of soil organic matter in forest husbandry and plantation agriculture in different ecological zones of Nigeria. The two tree crops dealt with are Coffea robusta and Gmelina arborea. Unlike Coffea arabica, soil fertility studies have not been done on Coffea robusta. Gmelina is a forest tree for the production of paper, but in its first and second years it is interplanted with food crops to boost food production in an agrisilviculture system. Soil analysis for organic carbon, total nitrogen and loss-on ignition as the case may be was done for soil samples collected from plantations of Coffea robusta and Gmelina arborea. Methods of analysis and results are discussed.
GMELINA ARBOREA; COFFEA ROBUSTA; ZEA MAYS; MANIHOT ESCULENTA; SOILS; ORGANIC MATTER; NITROGEN; CARBON; TREE CROPS; FOOD CROPS; AGRISILVICULTURE; YIELDS;

00129
01946
OJENIYI, S.O.; AGBEDE, O.O.; FAGBENRO, J.A.
INCREASING FOOD PRODUCTION IN NIGERIA: 1. EFFECTS OF AGRISILVICULTURE ON SOIL CHEMICAL PROPERTIES
SOIL SCI; Vol: 130, No: 2; (1980); EN
XA/NG; pg 76-82
Two hundred forty soil samples collected from two surface layers

of plots planted with a forest tree crop (Gmelina arborea), alone and interplanted with single and multiple food crops were analysed to investigate the effect of agrisilviculture, or farm forestry, on soil fertility. In addition to the control plot, four other plots were interplanted separately with three food crops and the three food crops combined in three ecological zones of southern Nigeria. Intercropping of the young forest tree crop with food crops increased (though insignificantly) soil nitrogen and phosphorus in two of the ecological zones. Total exchangeable bases, exchangeable acidity and percentage of carbon did not vary significantly as a result of agrisilviculture. The increase in N and P were related to an insignificant reduction in organic C in the respective plots. The findings gave scientific support to the practice of agrisilviculture as a means of increasing food production in Nigeria.
EUCALYPTUS TORELLIANA; GMELINA ARBOREA; TERMINALIA NORENSIS; DIOSCOREA ROTUNDATA; AGRISILVICULTURE; SOIL PHYSICOCHEMICAL PROPERTIES; YIELDS; INTERCROPPING; CROPS; FORESTS; TREES; MULTIPLE CROPPING;

00130
00506
OLAWOYE, O.O.
AGRISILVICULTURAL SYSTEMS IN NIGERIA
COMMONW FOR REV; Vol: 54, No: 3-4; (1975); EN
XA/NG; pg 229-236
The paper describes the current practice of agrisilviculture in Nigeria. There are two basic kinds of agrisilviculture: 'own your own crop' and 'farming for pay'. The two systems are well discussed and their role in alleviating unemployment problems is underlined. The two systems have improved rural life and living standards of the participants. However, the age structure of the farmers threatens the continued operation of this practice unless more incentives to the younger farmers are provided. The author calls for more research in areas of ecology, silviculture, socioeconomics, and the politico-cultural and legal aspects of agrisilviculture.
AGRISILVICULTURE; LAND; MULTIPLE USE; FOOD; MIXED CROPPING; SOCIAL UNREST; ECOLOGY; POLITICAL FACTORS; SOCIOECONOMICS ASPECTS; LEGISLATION;

00131
00962
OLAWOYE, O.O.
FOOD PRODUCTION FROM TROPICAL MOIST FORESTS
(1977); EN
DEPT RES MANAGEMENT, UNIV IBADAN; XA/NG; pg 1-55
The problem of food shortage in tropical Africa is highlighted. A number of social, economic and institutional problems militate against increased food production. Tropical farming systems apply obsolete methods of cultivation and management. The author discusses a number of open alternatives to increase food production among peasant farmers. A careful utilization of forest areas is recommended. Attractive methods of such practice are agrisilvicultural systems, which have been practiced by forest workers of many countries. In sum, the paper stresses the need for

better planning for optimum contribution of tropical high forests to increase food production. Research should be emphasized on possible ways of integrating forestry into agricultural regimes.
ELAEIS GUINEENSIS; BUTYROSPERMUM PARADOXUM; BRACHYSTEGIA; PARKIA; TROPICAL RAIN FORESTS; FOOD; SPECIES LIST; AGRISILVICULTURE; TENURE; FARMING SYSTEMS; SHIFTING CULTIVATION; FARMLAND; IRRIGATION; RESEARCH; FOREST TREES; TROPICS;

00132
05171
PADOCH, C.; CHOTA INUMA, J.; DE JONG, W.; UNRUH, J.
AMAZONIAN AGROFORESTRY: A MARKET ORIENTED SYSTEM IN PERU
AGROFOR SYST; Vol: 3, No: 1; (1985); EN
XL/PE; pg 47-58
Most reports on indigenous agroforestry systems of the Amazon region have described patterns employed by tribal groups almost exclusively for their own subsistence. This article discusses a market-oriented cyclic agroforestry system practised by non-tribal 'mestizo' farmers in Tamshiyacu, Peru. The system produces charcoal as well as annual, semi-perennial, and perennial crops for local consumption and for a regional market. The sale for these products provides a substantial cash income for many farmers. The data presented demonstrate that Amazonian cyclic agroforestry systems are capable of being commercially successful enterprises and of serving as possible models for further agricultural development.
AMAZONAS; AGROFORESTRY; MARKETING; FRUITS; AGROSILVOPASTORAL SYSTEMS; HUMID TROPICS;

00133
01796
POLLISCO, F.S.
AGRISILVICULTURE CONCEPTS AND PRACTICES: THE PHILLIPINES EXPERIENCE
EIGHTH WORLD FORESTRY CONGRESS, JAKARTA, 16-28 OCTOBER 1978; (19 78); EN
XP/PH; pg 1-18
Agrisilviculture has evolved into a tool for efficient management of the practices of shifting cultivation. This concept has spawned various patterns and techniques for effective soil conservation, fertility restoration and food production. Three methods of agrisilviculture are currently in use; tree farming, a modified taungya system and a family approach system. Several farming systems to implement agrisilviculture are discussed; prospects, problems, research needs and programmes of action are forwarded for each system.
LEUCAENA; ALBIZIA FALCATARIA; PINUS KESIYA; AGRISILVICULTURE; TAUNGYA SYSTEMS; VILLAGES; FORESTRY; SOCIOECONOMIC ASPECTS; FARMING SYSTEMS; RESEARCH;

00134
02783
RADWANSKI, S.A.; WICKENS, G.E.
VEGETATIVE FALLOWS AND POTENTIAL VALUE OF THE NEEM TREE (AZADIRACHTA INDICA) IN THE TROPICS

ECON BOT; Vol: 35, No: 4; (1981); EN
XZ; pg 398-414
Traditional agricultural practices have not been well managed to meet the population's demand for food, fuelwood and timber on a sustainable basis. Scientists proposing the domestication of shifting cultivation have often recommended combined production related to other aspects, but not a vegetative fallow system. Agricultural production which relies on vegetative fallow for the recycling of plant nutrients is closely integrated with rural industry, based on available raw materials. The neem tree, Azadirachta indica, is a crucial species in this system. It is not only an efficient soil ameliorant, it can also provide a series of products highly competitive in price and quality with petroleum-based synthetics. All the various beneficial attributes of this tree species are outlined. Proposals are forwarded for further research and implementation of programmes. However, unlike other identified agroforestry species such as Leucaena leucocephala and Acacia albida, the neem tree cannot be grown among agricultural crops, since it will not tolerate the presence of any other species within its vicinity.
ACACIA; LEUCAENA LEUCOCEPHALA; PROSOPIS; CYNODON PLECTOSTACHYUS; ACACIA ALBIDA; AZADIRACHTA INDICA; MELIA AZADIRACHTA; MELIA INDICA; FARMING SYSTEMS; RESEARCH; EROSION; ENVIRONMENTAL CONDITIONS; SHIFTING CULTIVATION; WOODY PLANTS; NUTRIENT CONTENT; BUSH FALLOWING; TROPICAL RAIN FORESTS; FODDER; ROTATIONAL GRAZING; BROWSING; HUMID TROPICS;

00135
05113
RAMANUJAM, T.; NAIR, G.M.; INDIRA, P.
GROWTH AND DEVELOPMENT OF CASSAVA (MANIHOT ESCULENTA CRANTZ) GENOTYPES UNDER SHADE IN A COCONUT GARDEN
TURRIALBA; Vol: 34, No: 3; (1984); EN
XP/IN; pg 267-274
The growth and the development of 12 cassava genotypes were studied under the shade in a coconut garden. Internodal elongation, thin leaves and absence of branching were the most significant morphological changes noticed under shade. Cross-sections of leaves grown under shade showed poor starch deposition in the vascular region. Most of the photosynthates of shade-grown cassava were utilized for shoot growth, adversely affecting tuber development significantly. The cultivars H165 and C1590 recorded higher yield under shade when compared to other cultivars. Wider spacings of cassava in coconut garden resulted in higher tuber yield.
MANIHOT ESCULENTA; COCOS NUCIFERA; ROOT CROPS; PHOTOSYNTHESIS; SHADE PLANTS; MIXED CROPPING; SHADING; TOLERANCE; TROPICS;

00136
02917
REDHEAD, J.F.; MAGHEMBE, J.A.
AGROFORESTRY: INTEGRATED LAND USE FOR RURAL COMMUNITIES IN TROPICAL AFRICA
(1981); EN
DIV FORESTRY, UNIV OF DAR ES SALAAM; XA/TZ; pg 1-19
This article discusses various aspects of agroforestry in general

and specifically reports agroforestry trials at Morogoro, Tanzania. In 1978, the main trials were interplanting of maize, beans and sorghum with Eucalyptus melliodora. The experimental design is described. The results showed that the yields of maize and sorghum decreased with time; the growth of trees was also affected. Trees intercropped with beans did not show a significant reduction in growth rate. In 1980, Eucalyptus camaldulensis, Acacia albida and Leucaena leucocephala were intercropped with beans and maize in different plots. The results were not conclusive but showed long-term variation in yield of both tree species and crop plants. However, the first year results showed a complementary association of the intercrops.
CORDIA ALLIODORA; CEDRELA ODORATA; GREVILLEA ROBUSTA; ACACIA SENEGAL; ACACIA ALBIDA; PARKIA CLAPPERTONIANA; EUCALYPTUS MELLIODORA; LEUCAENA LEUCOCEPHALA; EUCALYPTUS CAMALDULENSIS; AGROFORESTRY; FARMING SYSTEMS; AGRISILVICULTURE; RESEARCH; TROPICS;

00137
03064
RIDDELL, J.C.
CAUSES OF DEFORESTATION AND FOREST AND WOODLAND DEGRADATION IN TROPICAL AFRICA
(1982); EN
XA; pg 1-49
The author discusses in detail the main causes of deforestation in Africa, which include population growth, farming systems, and wholesale tree felling for timber export. The solution to this complex problem of utilizing the renewable wealth of Africa's forests lies in agricultural development that makes existing fields more productive and that encompasses tree crops (agrisilviculture) on one hand and the rapid development of national government capacity to manage and augment the remaining forest reserves on the other.
AGRICULTURAL DEVELOPMENT; DEFORESTATION; TROPICS; TRADITIONAL FARMING; AGRISILVICULTURE; TENURE; WOODLOTS;

00138
B01258
ROCHE, L.
<THE> PRACTICE OF AGRISILVICULTURE IN THE TROPICS WITH SPECIAL REFERENCE TO NIGERIA
FAO SOILS BULL NO 24; (1974); EN
XA/NG; pg 179-188
Population pressure and increasing shortage of arable land coupled with poor resource management systems are the sole cause of deforestation and the ensuing environmental degradation. The author believes that the destructive effects of undirected shifting cultivation on natural forest ecosystems can be captured to form a socially, economically and ecologically desirable system. Agrisilviculture is cited among other systems. A review of the work by K.F.S. King provides much of the background information on these systems. A number of conflicts are mentioned and tentative methods of compromising the situation outlined.
NAUCLEA DIDERRICHII; LOVOA TRICHILIOIDES; KHAYA IVORENSIS; ENTANDROPHRAGMA; TECTONA GRANDIS; SHIFTING CULTIVATION; WILDLIFE;

RESEARCH; ECOSYSTEMS; OVERGRAZING; POPULATION; TROPICS; RESOURCE MANAGEMENT; AGRISILVICULTURE; FOOD; WOOD; TECHNOLOGY; SOCIOLOGY; FOREST PRODUCTS; RENEWABLE RESOURCES;

00139
B01963
SEIF EL DIN, A.G.
AGROFORESTRY PRACTICES IN THE DRY REGIONS
PROC KENYA NATIONAL SEMINAR ON AGROFORESTRY, 12-22 NOVEMBER 1980 (BUCK, L. ED.); (1981); EN
SD; pg 419-434
This short article discusses existing land use systems in the ecosystems. A number of factors have led to falling carrying capacities of these fragile ecosystems. The author recommends an improvement in the current methods of land utilization. An example of a sound system is that of gum gardens in the Sudan, where intercropping of Acacia senegal and crop plants has maintained productivity at a sustainable level. Farmers are however discouraged from planting trees by the forest regulations. The author has recommended a variety of tree species that can be intercropped with herbaceous plants. Diagrams and pictorial representations are included for better comprehension.
ACACIA SENEGAL; ADANSONIA DIGITATA; ACACIA ALBIDA; ACACIA TORTILIS; PARKIA BIGLOBOSA; PARINARI MACROPHYLLA; EUPHORBIA BALSAMIFERA; AGROFORESTRY; MULTIPURPOSE TREES; SHRUBS; ECOLOGICAL ZONATION; LAND USE; LEGUMES; CROPPING SYSTEMS; ARID ZONES;

00140
04512
THEMAN, R.R.; CLARKE, W.C.
PACIFIC ISLAND AGRISILVICULTURE: SYSTEMS FOR CULTURAL AND ECOLOGICAL STABILITY
15TH PACIFIC SCIENCE CONGR: GEOGRAPHY SECTION PROGRAMME 1; (1983) ; EN
XP/PC; pg 1-18
This paper looks at the trends of arboreal destruction in the Pacific Islands, the ecological and cultural functions of agrisilviculture, and possible existing or imported models or strategies that might lead to a reversal in the current trend of heedless and shameful neglect of trees. It is based on field work carried out by the authors in the Cape York Peninsula of Australia, Papua New Guinea, Fiji, Rotuna, Tonga, Cook Islands and Naura as well as on observations in other islands and on written sources.
AGRISILVICULTURE; ECOLOGY; DEFORESTATION; SPECIES SELECTION;

00141
01842
VAN NAO, T.
AGRISILVICULTURE: JOINT PRODUCTION OF FOOD AND WOOD
EIGHTH WORLD FORESTRY CONGRESS, JAKARTA, 16-28 OCTOBER 1978; (19 78); EN
XZ; pg 1-16
This paper provides a review of agrisilvicultural systems practised in various countries of the world and their contribution

to food production. A number of socioeconomic obstacles to the practice of agrisilvicultural systems are described and recommendations for further improvement underlined. Considerations for rural development in the developing countries invite a shift from the traditional systems to a more sustainable system one. Agrisilviculture has enormous potential in food production and environmental conservation.
IMPERATA CYLINDRICA; CASUARINA EQUISETIFOLIA; PENNISETUM PURPUREUM; ACACIA SENEGAL; LEUCAENA LEUCOCEPHALA; ACACIA ALBIDA; PINUS PALUSTRIS; PIPER NIGRUM; LIVISTONA; AGRISILVICULTURE; MULTIPLE USE; LAND USE; LEGISLATION; RURAL DEVELOPMENT; FOOD PRODUCTION;

00142
03326
VERACION, A.G.
<THE> PICOP's WAY
(1980); EN
XP/PH; pg 1-5
This paper describes PICOP's agroforestry projects whose main objectives are to assist in the economic uplifting of the people, to develop around the PICOP concession a belt of tree farms owned by contented land owners, and to create a supplementary source of pulpwood for the PICOP pulp and paper mill. These objectives are attained through creation of demonstration tree farms, extension of technical and financial assistance, educational programmes on the radio and through seminars, lectures and educational field trips. The projects so far have captured the interest of over 3000 farmers who have grown 9 398 812 Albizia falcataria trees on 16 709 hectares in the area.
ALBIZIA FALCATARIA; AGROFORESTRY; AFFORESTATION; SHIFTING CULTIVATION; WOOD; INTERCROPPING; CROP ROTATION; LEGUMES; WEEDS; WOODLOTS; VEGETATION; SPACING; HARVESTING; REGENERATION;

00143
06051
VERGARA, N.T.; NAIR, P.K.R.
AGROFORESTRY IN THE SOUTH PACIFIC REGION: AN OVERVIEW
AGROFOR SYST; Vol: 3, No: 4; (1985); EN
XP; pg 363-379
The developing countries of the Pacific region consist of 27 countries and territories with a total land area of 542 000 sq km and over 5 million inhabitants. Though highly variable in physical characteristics and land use patterns, these countries in general give a higher priority to the production of export crops than to other agricultural crops, so that they are net importers of food. Natural forests of the region are luxuriant and floristically rich, but the level of their commercial exploitation is low. Swidden cultivation is the mainstay of subsistence livelihood, but with the increase in population, the system is now causing severe environmental and land use problems. The immediate opportunity in agroforestry in the region lies in making better use of the unexplored potential of a large number of locally available trees and agricultural crops. Intercropping in tree crop stands and the taungya system seem to be promising methods for the Pacific region.

CASUARINA OLIGODON; AGROFORESTRY; TENURE; CASH CROPS; NITROGEN FIXING TREES; SHIFTING CULTIVATION; SPECIES LIST;

00144
01957
WASTON, G.A.
TREE CROP FARMING IN THE HUMID TROPICS: SOME CURRENT DEVELOPMENTS
PAPER PRESENTED TO THE WORKSHOP ON AGROFORESTRY IN THE HUMID TROPICS, 27 APRIL - 1 MAY, IBADAN, NG; (1981); EN
XZ; pg 6-12
This article discusses the spread of tree crop farming systems in the humid tropics. Various intercrops and their biological and socio-economic benefits are outlined. With increasing population pressures and greater realization of the limitations in cultivation of food crops, more attention is being given to food trees. Intercropping rubber, oil palms, coconuts, cocoa and coffee with food crops in an alley or multistorey management system are common practices. The building step to greater improvement of a humid tropics farming system is an incorporation of agroforestry practices. So far research has concentrated on commodity crops and many lessons have been learned that could be applied in the future development of agroforestry.
IRVINGIA GABONENSIS; TRECULIA AFRICANA; PENTACLETHRA MACROPHYLLA; CHRYSOPHYLLUM ALBIDUM; BERTHOLLETIA EXCELSA; PAULLINIA CUPANA; BACTRIS GASSIPAES; FARMING SYSTEMS; AGROFORESTRY; TAUNGYA SYSTEMS; AGRISILVICULTURE; HOME GARDENS; SHIFTING CULTIVATION; LEGUMES; INTERCROPPING; CANOPIES; SHADE TREES; PLANTATIONS; CROPS; HUMID TROPICS; RESEARCH;

00145
02543
WEAVER, P.
AGRISILVICULTURE IN TROPICAL AMERICA
UNASYLVA; Vol: 31, No: 126; (1979); EN
XL; pg 2-12
Agrisilviculture is a production scheme that supplies wood, foodstuffs and animal products from a single management unit. Such a unit could be a farm, a small community or a portion of a watershed. Despite its numerous benefits agrisilviculture should not be viewed as a substitute for intensive agriculture or forestry in any given terrain. It is best viewed as a means of rehabilitating lands degraded as a result of poor agricultural practices. The author reviews the farming systems of various countries in South America and the introduction and development of agrisilviculture in these countries.
AGRICULTURE; FORESTRY; TROPICS; AGRISILVICULTURE; FARMING SYSTEMS; AGRICULTURAL INPUTS; CYCLING; TROPICS;

00146
03517
WEBER, F.; HOSKINS, M.W.
AGROFORESTRY IN THE SAHEL
NIAMEY AGROFORESTRY SEMIN, 23 MAY - 9 JUNE 1983, NIAMEY; (1983); EN
XA; pg 1-102

The paper elaborates upon the information presented and issues raised and discussed during the June Regional CILSS (Comite inter-etats pour la lutte contre la secheresse) Country Seminar. An attempt is made to summarize the seminar's basic findings while expanding on presented information in order to provide basic reference points for effective planning, analysis and implementation of future agroforestry activities in the Sahel.
ACACIA ALBIDA; PARKIA BIGLOBOSA; BUTYROSPERMUM PARKII; ACACIA SENEGAL; MORINGA OLEIFERA; PROSOPIS; TAMARINDUS; BORASSUS AETHIOPICUM; AGROFORESTRY; TENURE; FARMING SYSTEMS; GRASSLAND MANAGEMENT; GERMINATION; LEGUMES; FARMLAND; ARID ZONES;

00147
05096
WIERSUM, K.F.
EARLY EXPERIMENTS IN AGROFORESTRY: COLONIAL TOBACCO CULTIVATION WITH TREE FALLOWS IN DELI, SUMATRA
INT TREE CROPS J; Vol: 2, (1983); EN
XP/ID; pg 313-321
A system of shifting cultivation for tobacco growing was practiced in Deli, Sumatra, from the end of the 19th century until about 1940. Tobacco was planted after clearing the forest, and after harvesting, one crop of upland rice or maize was grown. The plots were then left fallow for at least seven years. The tree fallows used included Albizia falcataria, Cassia siamea, Leucaena leucocephala, Samanea saman and Tectona grandis. The paper also describes experimental studies to investigate the floristic composition of the natural forest fallow and the effects of natural and planted fallows on tobacco diseases and quality.
NICOTIANA TABACUM; ALBIZIA FALCATARIA; CASSIA SIAMEA; LEUCAENA LEUCOCEPHALA; SAMANEA SAMAN; TECTONA GRANDIS; MIMOSA INVISA; IMPERATA CYLINDRICA; SHIFTING CULTIVATION; FALLOW SYSTEMS; PLANT DISEASES; STIMULANT CROPS; FUELWOOD; AGRICULTURAL CROPS; HUMID TROPICS;

00146
B01363
WIERSUM, K.F. (ED.)
OBSERVATION ON AGROFORESTRY IN JAVA, INDONESIA
(1981); EN
UNIV WAGENINGEN; XP/ID; pg 1-133
This report is divided into four major sections devoted to the subject of agroforestry. Part 1 is a detailed discussion on the role of agroforestry in rural communities, a section that has condensed a wide range of areas on agroforestry systems. Part 2 is composed of short, precise summaries of papers analysing the agroforestry situation in Java. Parts 3 and 4 are similarly organized on short notes with a wide coverage on the subject of agroforestry, with special reference to Java, Indonesia. In sum, this is a publication with literature on most of the facets that need to be considered when launching an agroforestry programme; it provides a comprehensive list of tables and charts and a wide bibliography.
ACACIA MEARNSII; GLIRICIDIA SEPIUM; EUCALYPTUS ALBA; LEUCAENA LEUCOCEPHALA; ALBIZIA FALCATARIA; PENNISETUM PURPUREUM; TECTONA GRANDIS; PINUS MERKUSII; CALLIANDRA CALOTHYRSUS; FARMING SYSTEMS;

TRADITIONAL FARMING; AGROFORESTRY; MULTIPURPOSE TREES; HUMID TROPICS; SILVOPASTORAL SYSTEMS; LAND USE; TAUNGYA SYSTEMS; RESEARCH;

00149
01551
AMPUERO, E.P.
ECOLOGICAL ASPECTS OF AGROFORESTRY IN THE MOUNTAIN ZONES: THE ANDEAN REGION
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1979); EN
XL; pg 77-94
This paper describes agroforestry systems in the Andean region and relates situations and experiences common to other sections of Latin America; it looks at the factors that favourably influence or adversely limit utilization of agroforestry practices. The commonly found land use systems are 1) combined forestry and 2) agrisilviculture. In the former, Eucalyptus globulus is intercropped with Kikuyu pasture grass, Pennisetum clandestinum, or Pinus radiata with the pasture grasses Agrostes spp. and Festuca spp. Native leguminous trees Aliso, Alnus, Forullencis and Acuminata are also intercropped with pasture grasses. A list of other agroforestry species that have proved to be both ecologically and economically feasible is given. In agrisilviculture, crops such as peas, corn, rice, beans, potatoes, cotton, tobacco are grown in association with forestry species such as Aucomea klaimana, Terminalia ivorensis, Cedrella odorata.
EUCALYPTUS GLOBULUS; PENNISETUM CLANDESTINUM; PINUS RADIATA; AGROSTIS; FESTUCA ; ALISO ALNUS FORULLENCIS; AUCOUMEA KLAINEANA; TERMINALIA IVORENSIS; CEDRELA ODORATA; LUPINUS ALBUS; VICIA FABA; BROMUS; AGROFORESTRY; AGRISILVICULTURE; AGROSILVOPASTORAL SYSTEMS; ANDEAN MOUNTAIN SYSTEM;

00150
04010
ANDERSON, G.W.
AN INTEGRATED SYSTEM OF SHEEP AND SOFTWOOD PRODUCTION
ANIM PROD AUST; Vol: 15, (1984); EN
XP/AU; pg 239-242
The author describes certain components of agroforestry systems in Australia. The system is basically silvopastoral as sheep are raised under pine trees, which are thinned to certain densities to give a profitable production of wood and animal products. Firstly the author describes the silvicultural, secondly the agricultural and then the other components of the system which were learnt while conducting experiments.
AGROFORESTRY; FOREST GRAZING; WOOD; YIELDS; SILVICULTURE;

00151
03725
ANDERSON, G.W.; BATINI, F.E.
PASTURE, SHEEP AND TIMBER PRODUCTION FROM AGROFORESTRY SYSTEMS WITH SUBTERRANEAN CLOVER SOWN UNDER 15-YEAR OLD PINUS RADIATA BY METHOD SIMULATING AERIAL SEEDING
AUST J EXP AGRIC ANIM HUSB; Vol: 23, (1983); EN

XP/AU; pg 123-130
The paper discusses experiments carried out to determine the productivity of wood, sheep and pasture in an agroforestry land use system. The experiments were carried out in a 15-year old plantation of Pinus radiata, which was thinned to various densities, pruned and sown with subterranean clover. Pasture, sheep and tree growth, changes in soil and foliar nutrient levels were measured over a 4 year period. In the second year the pastures under tree densities of 150 or more trees/ha carried 60 of the number of sheep carried on the pasture with no trees. Two years later, with increased canopy growth and shading, this relative carrying capacity was down to 40. After four years, soil and foliar nutrient levels were not affected by tree density. At the lowest density of trees (< 100 stems/ha) individual tree diameter growth and volume production per hectare were stimulated, and there was least loss of agricultural productivity. This density was therefore preferable for agroforestry.
PINUS RADIATA; TRIFOLIUM SUBTERRANEUM; SHEEP; WOOD; YIELDS; AGROFORESTRY; FOREST GRAZING; LAND USE; SOWING;

00152
04008
ANDERSON, G.W.; BATINI, F.E.
COMPARISON OF PRODUCTION FROM AN AGROFORESTRY SYSTEM IN A MID-ROTATION STAND OF PINUS PINASTER WITH THAT FROM OPEN PASTURE
AUST J EXP AGRIC ANIM.HUSB; Vol: 24, (1984); EN
XP/AU; pg 529-534
The paper reports on the pasture and sheep production from two densities of 15-18-year old Pinus pinaster and the effects of superphosphate applied with and without clover to trees growing on laterite soils in the same locality. Some comparisons between the two sites are made. These data on production rates at different tree ages and densities will be used to evaluate the economics of agroforestry systems compared with agriculture or tree plantations.
PINUS PINASTER; PINUS RADIATA; AGROFORESTRY; ANIMAL PRODUCTION; SHEEP; PASTURES; NUTRIENTS; ORGANIC MATTER; FERTILIZERS;

00153
04009
BATINI, F.E.; ANDERSON, G.W.
AGROFORESTRY UNDER 13-18-YEAR OLD PINUS RADIATA AT WELLBUCKET, WESTERN AUSTALIA
MANAGING NITROGEN ECONOMIES OF NATURAL AND MAN MADE FOREST ECOSYSTEMS (RUMMERY AND HINGSTON, EDS.); (1981); EN
XP/AU; pg 346-353
Clover was established beneath 13-year-old, high pruned, Pinus radiata which were thinned to 143 and 261 stems per hectare. The trees responded to thinning and fertilization but were unable to fully utilize the site at the wider spacing. The tree crowns doubled in size in five years and the increase in shading caused a loss of pasture production. The pasture responded favourably to a further thinning of the pine.
PINUS RADIATA; AGROFORESTRY; THINNING; SOILS; NUTRIENT CONTENT; PASTURES; CANOPIES; FERTILIZERS;

00154
03176
BELL, T.I.W.
TREE SPACING AND CATTLE GRAZING IN YOUNG PINUS CARIBAEA PLANTATIONS IN FIJI
FIJI PINE RES PAP NO 9; (1981); EN
XP/FJ; pg 1-7
The area under trees can successfully be utilized for grazing with proper tree spacing and allowance for age. Trials and observations with Pinus caribaea in pasture showed that cattle grazing will cause some damage to trees under one year but not at five years. It was recommended that planting rows should be at least 4 m apart to allow for selective thinning. Overstocking, however, may lead to soil erosion and therefore should be discouraged.
LEUCAENA LEUCOCEPHALA; PINUS CARIBAEA; PENNISETUM; PTERIDIUM AQUILINUM; PSIDIUM GUAJAVA; STYLOSANTHES GUIANENSIS; GRAZING LANDS; PASTURES; EROSION; LAND USE; FODDER; ROTATIONAL GRAZING; MANAGEMENT; CANOPIES; SPACING; WEEDS; VEGETATION;

00155
01611
BISHOP, J.P.
FAMILY AGRICULTURE: SWINE-FORESTRY PRODUCTION IN THE SPANISH AMERICAN HUMID TROPICS
WORKSHOP ON AGROFORESTRY SYSTEMS IN LATIN AMERICA, CATIE, COSTA RICA (DE LAS SALAS, G. ED.); (1979); EN
XL; pg 140-144
Shifting cultivation, demographic pressure and demand for higher incomes are the chief causes of soil deterioration. The author recommends swine-forestry as a promising land-rotational system that heips land users to achieve multiple benefits in the form of firewood, fodder and increased food yields. A list of tree species suitable for this system is given.
DESMODIUM OVALIFOLIUM; CANNA EDULIS; MUSA ACUMINATA; INGA EDULIS; GUILIELMA GASIPAES; PHASEOLUS LUNATUS; SHIFTING CULTIVATION; POPULATION DENSITY; PIGS; FORESTRY; SPECIES LIST; HUMID TROPICS;

00156
02685
BISHOP, J.P.
TROPICAL FOREST SHEEP ON LEGUME FORAGE/FUELWOOD FALLOWS
AGROFOR SYST; Vol: 1, No: 2; (1983); EN
XL/EC; pg 79-84
In Amazonian Ecuador, studies are being realized to intensify fallow periods by grazing African forest-type sheep (Red Afro-Colombian x Barbados BlackB) on Asian tropical forage legume cover (Desmodium ovalifolium) can tropical forest legume fuelwood trees (Inga edulis). The specific approach represents an innovative effort to address the complex problems associated with the pernicious use of less fertile lands by small scale farmers and graziers in the humid tropics. The technologies developed are closely compatible with traditional sociocultural patterns. For example, shifting cultivators are encouraged to plant contour strips of legume fuelwood trees in their cassava fields. With the cassava harvest, legume cover forage is planted

between the fuelwood trees, to be grazed later by tropical forest sheep. Forage and fuelwood legumes increase soil aeration, organic matter, nitrogen and available phosphorus, control soil erosion and leaching, as well as provide a break in cropping that checks insect, disease and weed build-ups. Tropical forest sheep improve soil fertility by depositing organic matter, which stimulates legume/Rhizobium symbiosis, and by supplying fecal microorganisms, which mineralize crop residues. In addition tropical forest sheep cause little soil compaction and erosion, produce high quality food protein from legume cover forage, as well as generate cash income, capital and employment for small scale farmers.
INGA EDULIS; DESMODIUM OVALIFOLIUM; FORESTS; FUELWOOD; SHEEP; FALLOW SYSTEMS; FEED LEGUMES; SILVOPASTORAL SYSTEMS; TROPICS;

00157
03188
BOROUGH, C.J.; REILLY, J.J.
INTEGRATED FARMING AND FORESTRY: LIMITS TO GROWTH AND OPTIONS FOR ACTION
AUST INST AGRIC SCI NAT CONF; (1976); EN
XP/AU; pg 160-161
This brief paper examines the role of integrated farm forestry systems in enhancing the living standards of the small land-holders. The type of management practices needed and its relative profitability are indicated. A hypothetical situation in which three strategies (beef strategy, radiata pine strategy and integrated strategy) are postulated show that the most profitable option is the radiata pine one, but the difference between it and the integrated strategy is relatively small.
PINUS RADIATA; PLANTATIONS; WOOD; EXOTIC PLANTS; FARM FORESTRY; MANAGEMENT; PASTURES; THINNING; ROTATIONAL GRAZING; BROWSING; GRAZING; ECONOMIC ANALYSIS;

00158
B01680
BRISCOE, C.B.
INTEGRATED FORESTRY - AGRICULTURE - LIVESTOCK LAND USE AT JARI FLORESTAL E AGROPECUARIA
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1984); EN
XL/BR; pg 63-69
The article briefly describes an integrated land use system, which offers a variety of products for immediate consumption and capital formation. Short-term and long-term management demands under crop-tree and animal associations are discussed with respect to the technical aspects involved. Possible alternatives are addressed.
GMELINA ARBOREA; PINUS CARIBAEA; EUCALYPTUS DEGLUPTA; JACARANDA COPAIA; ORYZA SATIVA; PANICUM MAXIMUM; BRACHIARIA HUMIDICOLA; ANTHOCEPHALUS CHINENSIS; AGROFORESTRY; RESEARCH; PLANTATIONS; SPACING; FLOODING; TENURE; MANAGEMENT; ROTATIONAL CROPPING; LAND USE; AGROSILVOPASTORAL SYSTEMS; LAND;

00159
05320
DJIMDE, M.

BROWSE IN MIOMBO WOODLAND
ICRAF DATA TEAM PUBL; Vol: 3, (1985); EN
TZ/MZ/MW/ZM/ZW; pg 1-8
This paper presents an overview of the nutritive value of some common browse species in the Miombo woodland. Although Miombo is an extensive woodland community it does not provide a favourable habitat for domestic livestock. The main constraints are the presence of tsetse fly, the lack of traditional skills in animal husbandry, and a long dry season. It is during the latter half of the dry season (September-November) that browse trees and shrubs are precious fodder reserves, providing livestock with critical nutrients such as protein, minerals and vitamins.
BRACHYSTEGIA; JULBERNARDIA; ACACIA; COMBRETUM; COMMIPHORA; MIOMBO; WOODLANDS; NUTRITIVE VALUE; BROWSING; GRAZING LANDS; TSETSE FLIES; NATURAL DISTRIBUTION; TROPICS;

00160
01684
FARNSWORTH, M.C.; MALE, A.J.R.; RUSSELL, I.
FORESTRY AND FARMING: A PRACTICAL EXAMPLE
PROC OF NZ GRASSL ASSOC; Vol: 37, No: 1; (1976); EN
XP/NZ; pg 32-37
The history and the development are outlined of Pouto Forest Farm, a forest project on the Pouto Peninsula of New Zealand, which has been in operation for five years on 3200 ha of land, of which 1890 ha are now planted in radiata pine. Brief consideration is given to the philosophy associated with the setting up of the project and its prime stated objective of environmental betterment. Research and development work being undertaken at Pouto are briefly outlined.
PINUS RADIATA; TRIFOLIUM REPENS; TRIFOLIUM PRATENSE; LOLIUM MULTIFLORUM; LOLIUM PERENNE; MULTIPLE USE; LAND; FARM FORESTRY; RESEARCH;

00161
04352
GISZ, P.L.
AGROFORESTRY: A CASE STUDY: ECONOMIC EVALUATION, SOUTHERN TABLELANDS OF NEW SOUTH WALES
3RD ANNUAL CONF OF THE AUSTRALIAN FOR DEV INST, MOUNT GAMBIER, SOUTH AUSTRALIA, APRIL 1982; (1982); EN
XP/AU; pg 1-10
An agroforestry project, which was carried out to evaluate the profitability of raising sheep under radiata pine, has been evaluated before. This paper presents a further evaluation. The projected radiata pine yields and returns are tabulated, the capital expenditure analyses and the sheep management costs and returns are described.
PINUS RADIATA; AGROFORESTRY; SHEEP; FOREST GRAZING; ECONOMIC ANALYSIS;

00162
04277
GISZ, P.L.; SAR, N.L.
ECONOMIC EVALUATION OF AN AGROFORESTRY PROJECT

NEW SOUTH WALES DEPT AGRIC MISC BULL NO 33; (1980); EN
XP/AU; pg 1-19
The primary aims of the paper are to evaluate the potential profitability of an agroforestry project and to provide an economic comparison of the project with a major grazing enterprise presently conducted on the same property. The paper is divided into two parts: The first part discusses briefly the role forestry can play within a farm enterprise; also some of the reason for developing interest in the concept of agroforestry are noted. The second part, is devoted to a case study analysis, describing the case study area and project, outlining the methodology and its limitations, and detailing the data on which the analysis is based. A discounted cash-flow approach is used to evaluate the defined agroforestry and sheep grazing investment alternatives.
PINUS RADIATA; EUCALYPTUS; FARM FORESTRY; AGROFORESTRY; SHEEP; FOREST GRAZING; WOOD; ECONOMIC ANALYSIS;

00163
02848
GOLDSON, J.R.
<THE> EFFECT AND CONTRIBUTION OF THE CASHEW TREE (ANACARDIUM OCCIDENTALE) IN A CASHEW-PASTURE-DAIRY CATTLE ASSOCIATION AT THE KENYA COAST
PROC KENYA NATIONAL SEMINAR ON AGROFORESTRY, ICRAF, NAIROBI, 12-22 NOVEMBER 1980 (BUCK, L. ED.); (1980); EN
XA/KE; pg 367-375
Raising cattle under cashew trees has multiple benefits for the farmer, as reported from the Mtwapa Research Station. Cattle benefit from provision of shade, cashew apples and more comfortable conditions. The pasture benefits from leaf fall, better moisture status, reduced evapotranspiration and improved soil properties. These benefits, however, are counteracted with increasing age of the trees by the generally depressive effect of the canopy shade on the presence and growth of valuable pasture species. There is a need to experiment with more species to find those that could grow under cashew trees without a decrease in herbage production. Such a pasture species is Panicum maximum, which is indigenous to the area.
ANACARDIUM OCCIDENTALE; PANICUM MAXIMUM; PASTURES; MANAGEMENT; MULCHES; CANOPIES; ENVIRONMENTAL AMELIORATION; CATTLE; MICROCLIMATE; LEAVES; NUTRIENTS; SOLAR ACTIVITY; PERENNIALS; GRASSES; PHYSIOLOGY; EVAPOTRANSPIRATION; AGROPASTORAL SYSTEMS;

00164
04480
GUPTA, T.
<THE> ECONOMICS OF TREE CROPS ON MARGINAL AGRICULTURAL LANDS WITH SPECIAL REFERENCE TO THE HOT ARID REGION IN RAJASTHAN, INDIA
INT TREE CROPS J; Vol: 2, (1984); EN
XP/IN; pg 155-194
The paper compares annual net returns from raising annual crops and livestock, based on a survey of 70 farm households in five villages with estimated returns from an alternative system of growing pasture grasses and multipurpose tree crops for the production of fodder, fuelwood and small timber. The tree species considered in the study are Acacia tortilis, Albizia lebbek,

Prosopis cineraria, Prosopis juliflora and Zizyphus. The silvopastoral system is described in detail, and the economic evaluation indicated in tabular form.
ALBIZIA LEBBEK; ACACIA TORTILIS; PROSOPIS CINERARIA; PROSOPIS JULIFLORA; ZIZIPHUS; ECONOMICS; SILVOPASTORAL SYSTEMS; CROPS; ARID ZONES; WOODLANDS; GRAZING; TREE CROPS; MARGINAL LANDS;

00165
02965
HAWKE, M.F.; BOND, D.J.; PERCIVAL, N.S.
PROGRESS IN EVALUATING FOREST FARMING
PROC NZ GRASSL ASSOC; Vol: 41, (1980); EN
XP/NZ; pg 72-79
The paper reports on progress in evaluating the effects of tree density and spatial arrangement on numbers and performance of livestock and availability of pasture in a forest farming area. Five years after planting Pinus radiata in the pasture there were large reductions in carrying capacity with increasing tree density, and it is apparent that a tree management regime leading to a final crop of 400 trees/ha is unsuitable for combining with productive livestock rearing. Individual livestock performance as measured by both live weight change and wool production was poorer under trees. A possible explanation is given. Availability of pasture to livestock was affected by a reduction in dry matter produced along with increasing tree density. The effects on livestock management of covering the ground with thinning and pruning debris on managing livestock under trees are discussed.
PINUS RADIATA; FARM FORESTRY; LIVESTOCK; WOOD; [illegible]NG;

00166
05326
HITCHCOCK, D.K.
GOAT RAISING IN ZAMBOANGA DEL SUR
(1985); EN
XP/PH; pg 1-67
This special guide for goat raising in Zamboaga del Sur in the Philippines describes the various goat-raising techniques that have been successfully used by farmers in the region. Important sections covered include 1) pasture establishment and fencing, 2) goat house construction, 3) the purpose of goats, 4) feeding and breeding, 5) routine management and goat health.
GOATS; ANIMAL PRODUCTION; ZOOTECHNY; PASTURES; ANIMAL HOUSING; ANIMAL DISEASES;

00167
05333
LEWIS, C.E.
PLANTING SLASH PINE IN A DENSE PASTURE SOD
AGROFOR SYST; Vol: 3, (1985); EN
XN/US; pg 267-274
Recommendations for planting pines usually include providing a competition-free site to assure establishment and good early growth. When combining pines and pasture in agroforestry systems, planting the pines directly into pasture sod without site treatment would be economically desirable. In South Georgia, Pinus

elliottii was planted into pasture sod on well-disked sites, both with and without annual fertilization. Partial weed control was maintained in subsequent years on the cultivated treatments and the pasture sod was mowed periodically. Slash pine establishment and growth rate through five years generally was not different among treatments. Survival was 86 per cent after five years. The pines grew rapidly with no measurable advantage from cultivation or fertilization.
PINUS ELLIOTTII; PASPALUM NOTATUM; PASTURES; AGROFORESTRY; SITE PREPARATION;

00168
04337
LEWIS, C.E.; BURTON, G.W.; MONSON, W.G.; MCCORMICK, W.C.
INTEGRATION OF PINES AND PASTURES FOR HAY AND GRAZING
AGROFOR SYST; Vol: 2, (1984); EN
XN/US; pg 31-41
This study examines the production of hay by two commonly used pasture grasses, Paspalum notatum and Cynodon dactylon, until pines planted in the pasture were large enough to safely begin grazing by cattle. The trees were planted in widely spaced rows to allow operation of hay-making machinery during the three years before grazing. Wide row spacings permitted haying operations, but tree rows and turning areas removed 5-8 of the area from production. Slash pine planted in the fertilized pastures survived and grew rapidly. Wide row-spacing of the pines permitted harvesting forage for hay while waiting for the trees to become large enough to permit grazing.
PINUS ELLIOTTII; PASPALUM NOTATUM; CYNODON DACTYLON; AGROFORESTRY; CATTLE; PASTURES; FOREST GRAZING; HAY; PULPWOOD; ANIMAL PRODUCTION;

00169
02957
MCQUEEN, I.P.M.; KNOWLES, R.L.; HAWKE, M.F.
EVALUATING FOREST FARMING
PROC NZ GRASSL ASSOC; Vol: 37, No: 2; (1977); EN
XP/NZ; pg 203-207
Agricultural and forestry aspects of forest farming are discussed with particular reference to the basic conditions necessary for success. Forest farming is defined as an integrated association of trees and pastures where the combined production provides a greater average net profit than does either forest or pasture alone. To determine the level at which the stocking rate makes animal and timber production optimal, the paper describes research under way in Tikitere, near Rotorua, New Zealand. A number of aspects are being examined relative to increased density of Pinus radiata.
PINUS RADIATA; FARM FORESTRY; WINDBREAKS; WOODLOTS; ANIMAL PRODUCTION; RESEARCH;

00170
06097
PENALOZA, R.; HERVE, M.; SOBARZO, L.
APPLIED RESEARCH ON MULTIPLE LAND USE THROUGH A SILVOPASTORAL

SYSTEM IN SOUTHERN CHILE
AGROFOR SYST; Vol: 3, No: 1; (1985); EN
XL/CL; pg 59-77
In 1977 a silvopastoral system was started on a 8.5 ha farm with the typical soil characteristics of the coastal ranges of southern Chile. The farm was planted with radiata pine (Pinus radiata D.Don) 2/0, with a 2.5 m x 7 m spacing. The sheep management system began in June 1979. The stocking rate varied from 6 to 8 sheep per ha; the ewe breeds were Romney, Suffolk x Romney, with Suffolk or Romney rams. During the 1979-1982 period, rotational grazing in four paddocks with native pasture and subterranean clover was used. Starting from June 1982, the pasture area was increased to 12 ha. Forage was not conserved. Overnight, sheep were kept loose on a slatted floor sheep house. D.m./ha availability, sheep and lamb weight, and reproduction and growth of lambs show that the system is feasible and practical. The 1980 production was 214 kg of live weight/ha; 248 kg/ha in 1981; 171 in 1982, and 207 in 1983. During these years the mean wool production was between 3.5 kg and 4 kg per sheep. The economic results of the system are attractive as a means to improve farmers' income; the system also prevents erosion and promotes development of an important area in southern Chile. The research project is still in progress.
PINUS RADIATA; SILVOPASTORAL SYSTEMS; LAND USE; APPLIED RESEARCH; SHEEP; MEDITERRANEAN CLIMATE;

00171
05021
PRATT, D.J.; DE HAAN, C.
CROP AND LIVESTOCK INTEGRATION IN THE SEMI-ARID TROPICS
INT SYMP ON DEV & TRANSFER OF TECHNOLOGY FOR RAINFED AGRIC & THE SAT FARMER; (1979); EN
XA/XL/XP; pg 1-8
This paper focuses on some of the interactions that exist between livestock and cropping in semi arid areas and discusses some of the trends affecting these interactions. It can be expected that more integrated production systems will emerge through a combination of political and administrative measures and biological innovations aimed especially at increasing the quality and quantity of dry season feed. Systems research of the International Livestock Centre for Africa (ILCA) suggests that the development approach will need to combine a number of components to be successful. It is in the nature of farming systems that the key to improved livestock production may be interventions that increase the yield of subsistence crops. Equally, manipulation within the livestock component may offer means to improve crop production.
SEMI ARID ZONES; TROPICS; CROP PRODUCTION; LIVESTOCK; INTEGRATION; SMALL SCALE FARMING;

00172
02801
REYNOLDS, S.G.
GRAZING TRIALS UNDER COCONUTS IN WESTERN SAMOA
TROP GRASSL; Vol: 15, No: 1; (1978); EN
XP/WS; pg 3-10

The paper describes second-stage evaluation of various species under grazing conditions. Six grazing trials were carried out between August 1974 and May 1978; the findings of four of these trials are presented. The alternative combinations of the trials are described and the results tabulated. The results show that in the long term, coconut yields can be maintained or even increased under improved pastures.
PANICUM MAXIMUM; BRACHIARIA HUMIDICOLA; MIMOSA PUDICA; CENTROSEMA PUBESCENS; COCOS NUCIFERA; SILVOPASTORAL SYSTEMS; PASTURES; WEEDS; SOIL PHYSICOCHEMICAL PROPERTIES; CLIMATE; SPECIES LIST; FEED CROPS; PRODUCTION; MANAGEMENT;

00173
02969
REYNOLDS, S.G.
CATTLE UNDER COCONUTS BIBLIOGRAPHY
LIVESTOCK AND PASTURE AGRONOMY REP NO 31, DEPT AGRIC, APIA, WESTERN SAMOA; (1978); EN
XP/WS; pg 1-50
This bibliography of 328 references brings together relevant materials on cattle-coconut systems. References have been alphabetically listed under a number of theme headings, which may help in the location of material on particular subjects. Some material, however, is outside the main theme, such as sheep under coconuts, small ruminants and rubber, and cattle and forests. Brief summaries have been included for some references. A final section lists organizations and individuals who are active in coconut and cattle intercropping research.
COCOS NUCIFERA; NUTRIENTS; SOIL WATER CONTENT; CANOPIES; INTERCROPPING; RESEARCH; WEEDS; CARRYING CAPACITY; LEGUMES; GRASSES; FEED CROPS; PRODUCTION; MANAGEMENT; BIBLIOGRAPHIES;

00174
02784
RICA, I.K.; NITIS, I.M.; HUMPHREYS, L.R.
EFFECTS OF STOCKING RATES ON CATTLE GROWTH, PASTURE PRODUCTION AND COCONUT YIELD IN BALI
TROP GRASSL; Vol: 15, No: 3; (1981); EN
XP/ID; pg 149-157
This paper describes an experiment that was carried out to determine the effects of variation in stocking rate on botanical composition of mixed pasture, coconut yield and animal output. A pasture mixture of three grasses and five legumes of various habits was sown to help identify the species best adapted to the local environment and to particular grazing conditions. The experimental design is described. A number of changes were recorded during the experiment. Substantial changes occurred in botanical composition of pasture grasses two years after sowing. The influence of time and of stocking rate on the main groups of species was shown to vary among them. Botanical composition was shown to be independent of stocking rate; however, the sown legume component decreased. The contribution of volunteer grasses and of broadleaf species increased in all treatments and this increase was positively related to the stocking rate. The amount and height of pasture on offer were negatively related to the stocking rate. The yield of coconut increased with a higher stocking rate. The

rate of liveweight gain was higher on sown pastures than under a local feeding system of cut natural pasture and crop residues and was linearly related to the stocking rate.
IMPERATA CYLINDRICA; PANICUM MAXIMUM; CENTROSEMA PUBESCENS; STYLOSANTHES GUIANENSIS; LOTONONIS BAINESII; PASPALUM PLICATULUM; BRACHIARIA MILIIFORMIS; PASTURES; SPECIES LIST; BOTANY; LEGUMES; BIOMASS; ANIMALS; EXPERIMENTS; GRAZING; CROP RESIDUES;

00175
05025
ROATH, L.R.; KRUEGER, W.C.
CATTLE GRAZING AND BEHAVIOUR ON A FORESTED RANGE
J RANGE MANAGE; Vol: 35, No: 3; (1982); EN
XN/US; pg 332-338
Environmental and topographic parameters on a mountainous forested range were analysed to establish causes of cattle behavioural responses. District home range groups of cattle were identified through examination of quality and patterns of forage use, cattle distribution, herd social structure and cattle activities. The home range of one group encompassed only upland areas Water and vegetation type were important parameters in determining area and degree of use. Vertical distance above water was the most important factor in determining vegetation utilization on moderately steep slopes. Time after sunrise and relative humidity factors were key factors in determining kind and timing of cattle activity.
CATTLE; ANIMAL BEHAVIOUR; GRAZING; RANGELANDS;

00176
02961
SINGH, D.; MANNIKAR, N.D.; SRIVAS, N.C.
EFFECT OF SILVIPASTURE SYSTEMS ON CHANGES IN SOIL FERTILITY
J INDIAN SOC SOIL SCI; Vol: 27, No: 4; (1979); EN
XP/IN; pg 486-488
The paper reports an investigation to study the changes in surface soil fertility in two silvopastoral systems. Forest and forage resources of India fall short of the requirements. They could however be increased through silvopastoral system where grasses are grown in the interspaces of fodder-cum-fuel trees. This silvopastoral system is suited to marginal and sub-marginal lands that have low soil fertility.
SOIL FERTILITY; SILVOPASTORAL SYSTEMS; MARGINAL LANDS;

00177
01550
SRIVASTAVA, B.P.
ECOLOGICAL ASPECTS OF AGROFORESTRY IN MOUNTAIN ZONES: THE HIMALAYAN REGION
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.) ; (1979); EN
XP/IN; pg 53-67
The Himalayan belt is an ecosystem highly susceptible to degradation, if proper land management practices are not applied. If agroforestry can be defined as the growing of trees in combination with food crops, then it is a dominant land use type

in the western Himalayas and to a great extent in the valley bottoms of eastern Himalayas. Farmers grow species of Grewia, Celtis, Salix, and Morus on the field boundaries mainly for fodder and fuel. Other fodder trees grown are Grewia oppositifolia, Bauhinia, Ficus spp., and Sulmalia. However, the ecological stability is still threatened and more effort to improve the efficiency and sustainability of these ecosystems is needed. A number of constraints and problems will have to be overcome before a full scientifically operative agroforestry system is realized. These are sociocultural, lack of incentives and motivation, lack of information, large livestock population, and lack of research. The taungya method of agrisilviculture is well known to India's foresters and hence with increased training, education and research, the practices will be adopted quickly.
BREWIA OPPOSITFOLIA; CELTIS; SALIX; MORUS; AGROFORESTRY; ECOLOGY; HIMALAYAS; ECONOMICS; SOCIAL UNREST; TAUNGYA SYSTEMS; SPECIES LIST;

00178
05398
STEELE, K.W.; PERCIVAL, N.S.
NITROGEN FERTILIZER APPLICATION TO PASTURES UNDER PINUS RADIATA
NZ J AGRIC RES; Vol: 27, (1984); EN
XP/NZ; pg 49-55
This paper reports a series of experiments conducted during spring 1981, investigating pasture response to fertilizer N under different tree stockings and the extent of competition for N between pasture and trees. Pasture dry matter production following a single application of urea (at 0, 25, 50, 75, 100, 125, 150 and 200 kg N/ha was measured for 12 weeks under three stockings of Pinus radiata (0, 200 and 400 trees/ha). Urea enriched with 15 N was used to measure fertilizer N in soil. A 15 N dilution technique was used to determine the Trifolium repens herbage. Results are presented.
PINUS RADIATA; TRIFOLIUM REPENS; AGROFORESTRY; NITROGEN FERTILIZERS; FOREST GRAZING; LIVESTOCK; SILVOPASTORAL SYSTEMS;

00179
06053
TAJJUDIN, I.
INTEGRATION OF ANIMALS IN RUBBER PLANTATIONS
AGROFOR SYST; Vol: 4, No: 1; (1986); EN
XP/MY; pg 55-66
This paper describes an unusual agroforestry approach of integrating animals (sheep, poultry and bees) in smallholder rubber plantations. The approach is based on the existence of surplus family labour, the utilization of interspaces between the rows of rubber, the availability of cheap and nutritious animal feed, and the presence of a favourable microclimate for animal growth under rubber. Results of trials carried out by the Rubber Research Institute of Malaysia since the 1970s are presented. A rotational system of broiler production under rubber was found to be technically, socially, and economically feasible, providing a net return on family labour of M$370-M$825 per consignment of rearing 500 birds. Sheep rearing under rubber also appeared to be very attractive and practical; apart from producing meat for sale

it also served as a biological weed control measure. Cost of controlling the weeds commonly found under rubber plantations could be reduced by about 21 per cent over the usual method by using sheep grazing for weed control. The internal rate of return (IRR) from sheep rearing can be as high as 44 per cent. Details of operation and management aspects of sheep integration under rubber are given. Bees kept under rubber feed on nectar produced by inflorescence and tips of young rubber shoots and also on flowers of intercrops and weeds. The Apis cerana species was found to be suitable, producing about 3 kg of honey per colony per harvest.
HEVEA BRASILIENSIS; SMALL SCALE FARMING; RUBBER; ANIMAL INTEGRATION; BIOLOGICAL CONTROL; WEED CONTROL; LIVESTOCK; BEE KEEPING; SILVOPASTORAL SYSTEMS; SHEEP; POULTRY; AGROFORESTRY; HUMID TROPICS;

00180
04842
TORRES, F.
ROLE OF WOODY PERENNIALS IN ANIMAL AGROFORESTRY
AGROFOR SYST; Vol: 1, (1983); EN
XZ; pg 131-163
Two main roles of woody perennials are identified in the review: the productive one and the service one. In their productive role, trees and shrubs may support fodder in browsing systems or may produce industrial material, wood products and food in forest and plantation grazing systems. Service roles arise mainly from relationships between woody perennials and the herbaceous vegetation growing in the vicinity. As a fodder source, the relatively low productivity and palatability of high-protein-content foliage from most woody perennials would indicate a supplementary role, particularly during dry seasons in arid and semi arid zones. In these types of lands, pod-bearing trees seem to have a greater potential for improving fodder production in silvopastoral systems. The negative effect of trees on pasture production in forest and plantation grazing is compensated for by their contribution to the system through other products. Available data would support the potential of certain species of woody perennials to foster pasture growing underneath, mainly through soil enrichment. Windbreaks can also indirectly benefit pasture growth by decreasing water loss from the soil. It is postulated that research efforts in animal agroforestry should be focused on woody perennials for browsing systems, particularly on pod-bearing trees with beneficial effects on the herbaceous layer growing underneath.
WOODY PLANTS; PERENNIALS; AGROFORESTRY; FODDER; FOOD; SOIL FERTILITY; GRAZING SYSTEMS; SILVOPASTORAL SYSTEMS; SPECIES LIST;

00181
01831
TUSTIN, J.R.; KNOWLES, R.L.
INTEGRATED FARM FORESTRY
NZ J FOR; Vol: 20, (1975); EN
XP/NZ; pg 83-88
Combined forestry and pastoral farming in New Zealand has been shown to be a feasible land use practice. Although extensive economic viability studies are yet to be done, there are positive

indications of the beneficial effects that may accrue to land users. This system has the merits of raising production, reducing market and biological risk, promoting soil stability, ameliorating the microclimate and providing ready income to the farmers. A number of management constraints envisaged are outlined. Similarly, current research activities in respect to these systems are examined.
PINUS RADIATA; FARM FORESTRY; MANAGEMENT; CONSERVATION; ROTATIONAL GRAZING; SILVICULTURE; SPACING; SHADING; MICROCLIMATE; PASTURES; LAND USE; LEGISLATION; TENURE; RESEARCH;

00182
01967
VON MAYDELL, H.J.
AGROFORESTRY: A COMBINATION OF AGRICULTURAL, SILVICULTURAL AND PASTORAL LAND USE
PLANT RES DEV ; Vol: 9, (1979); EN
XZ; pg 17-23
Success or failure of different land use systems depends largely on the prevailing site quality. Some sites are more suited for forestry while others offer better yields under agriculture or range management. However, large part of the world's potentially productive lands can be used for either forestry, agriculture or pastoralism. The author in this paper discusses the application of combined management practices to these lands in order to increase yields on a sustained basis. In the tropics and subtropics productivity may be affected by soil erosion, degradation and destruction of the existing natural resources; therefore, integration of land use practices is most likely the only means of avoiding these detrimental effects.
ACACIA ALBIDA; CORDIA ALLIODORA; AGROFORESTRY; SILVICULTURE; PASTORALISM; LAND USE;

00183
01759
WAN MOHAMED BIN WANG EMBONG
<THE> CONCEPTS AND POTENTIALS OF INTEGRATED FARMING WITH RUBBER
PROC SEMINAR ON INTEGRATION OF ANIMALS WITH PLANTATION CROPS, MALAYSIA; (1978); EN
XP/MY; pg 49-60
The paper discusses a farming system in which food crops, tree crops (rubber) and animals are integrated under one management unit to maximize resource utilization. The potential of this system on smallholder farms is discussed with respect to labour availability, farm sizes and sources of animal feed. A number of possibilities are presented in which animal fodder can be grown between the rubber rows. A specific on-farm trial tested the performance of the various intercrops. The results are tabulated. The author has discussed potential problems likely to be encountered before the system is well adapted to the farm environment. Hence he recommends intensified research on technical feasibility, economic viability and social acceptability - that is, a search into the common facets between existing and intended farm practices.
PANICUM MAXIMUM; PENNISETUM PURPUREUM; BRACHIARIA MUTICA; HEVEA BRASILIENSIS; FARMING SYSTEMS; INTERCROPPING; RESEARCH;

MANAGEMENT; ANIMALS; EXPERIMENTS; AGROSILVOPASTORAL SYSTEMS;

00184
04716
WIERSUM, K.F.
TREES IN AGRICULTURAL AND LIVESTOCK DEVELOPMENT
IX WORLD FORESTRY CONGRESS, MEXICO; (1985); EN
XZ; pg 1-11
This paper discusses the role of trees in traditional farming systems and agricultural development in tropical countries. The importance of farm trees for agricultural and livestock development stems from their potential to produce essential tree products for people living away from the vicinity of forests, and their ability to sustain the agricultural production capacity because of their service functions in improving the microclimate and protecting and ameliorating the soil. Rural people have long been aware of these functions and many traditional systems integrate trees with agricultural crops and pasture management. Several distinctive management practices are used in those systems and the prevalent trees are often characterized by their multipurpose functions and relatively high production capacity. Unfortunately heavy demands for tree resources and changing rural conditions result in over-exploitation of these systems. There is scope for programmes to stimulate the proper incorporation of compatible trees on farm and pasture lands as a means to counter this loss of rural tree resources and to contribute to the improvement of land husbandry practices.
AGROFORESTRY; FARMING SYSTEMS; LIVESTOCK; TRADITIONAL FARMING; SOIL FERTILITY; SOIL CONSERVATION; MULTIPURPOSE TREES;

00185
04341
BOONKIRD, S.A.; FERNANDES, E.C.M.; NAIR, P.K.R.
FOREST VILLAGES: AN AGROFORESTRY APPROACH TO REHABILITATING FOREST LAND DEGRADED BY SHIFTING CULTIVATION IN THAILAND
AGROFOR SYST; (1985); EN
XP/TH; pg 87-102
The forest village scheme was introduced by the Forest Industries Organisation (FIO) of Thailand in 1967 to stop further spread of the rapidly increasing shifting cultivation and deforestation in the country. The underlying principle of the scheme is to relate reforestation to the social welfare of the people involved in what is essentially a modification of the traditional taungya method of plantation establishment. The salient aspect of the scheme is to induce the shifting cultivators to settle down in villages where each family is given tenure over a plot of land on which to construct a house and develop a home garden. The farmers are required to help establish and maintain forest plantations, in which they are permitted to raise agricultural crops during the first three years of establishment. They are given free medical and educational facilities, and technical advice on crop and livestock husbandry. They can also earn cash rewards for successful plantation establishment. Although the scheme has not achieved its full target in terms of area covered and numbe of families settled, it is proving to be a successful method of luring people away from destructive shifting cultivation. The

approach is applicable to other countries and regions with similar land use problems and sociocultural background. The paper also examines the constraints to the effective working of the scheme, provides some simple suggestions for improving its functioning, and identifies some of the issues that can easily be tackled by research.
TECTONA GRANDIS; EUCALYPTUS CAMALDULENSIS; MELIA AZEDARACH; PARKIA SPECIOSA; PARKIA JAVANICA; ANACARDIUM OCCIDENTALE; HEVEA BRASILIENSIS; FORESTS; VILLAGES; SHIFTING CULTIVATION; AGROFORESTRY; HOME GARDENS; AFFORESTATION; SPECIES LIST; AGROSILVOPASTORAL SYSTEMS; SMALL SCALE FARMING;

00186
05241
ESCALANTE, E.E.
PROMISING AGROFORESTRY SYSTEMS IN VENEZUELA
AGROFOR SYST; Vol: 3, No: 2; (1985); EN
XL/VE; pg 209-221
The main agroforestry systems in Venezuela are the multispecies plant associations in an 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 fencing in big coffee plantations, whereas in small units with a production pattern, coffee is tied along with other species, often constituting a three- to four-layer canopy. Available data are presented on the production as well as some socioeconomic aspects. The silvopastoral systems are found in the tropical dry forest (savannas) and in the very dry tropical forest of the semi arid zones of the country. A large number of trees and shrubs are found in these pastoral areas where they play both productive (fodder and feed) and service (shelter) roles. Although both these systems are practiced over large areas of the country, practically no research has been done to improve them. To strengthen national capability to undertake such research, international support as well as technical advice is needed.
COFFEA; ERYTHRINA; AGROFORESTRY; BROWSING; FODDER CROPS; SILVOPASTORAL SYSTEMS; AGRISILVICULTURE; SPECIES LIST; TROPICS;

00187
06047
EVANS, P.T.; ROMBOLD, J.S.
PARAISO (MELIA AZEDARACH VAR. GIGANTE) WOODLOTS: AN AGROFORESTRY ALTERNATIVE FOR THE SMALL FARMER IN PARAGUAY
AGROFOR SYST; (1985); EN
XL/PY; pg 199
This paper describes the salient aspects and analyses the potential of the paraiso woodlot system, which is becoming popular as an agroforestry alternative to agricultural land use in the degraded acid sandy soils of the humid sub-tropical Guayaybi area of Paraguay. The system consists of a combination of paraiso (Melia azedirach var gigante) with other trees, especially Leucaena leucocephala, and annual crops. The fast growth habit, deep root system, addition of large quantities of organic matter

through leaf and litter fall, compatibility with agricultural crops, high value of the sawlogs, and production of substantial quantities of poles and firewood make paraiso an excellent species for agroforestry combination. Preliminary results of the trials indicate that the woodlots are successful and with increasing efforts of the extension agencies, they are being accepted as a viable alternative to traditional agricultural systems. Besides discussing the potential of these woodlots based on initial results, the paper identifies the constraints of the system and highlights the priority research areas.
LEUCAENA LEUCOCEPHALA; MELIA AZEDARACH; CORDIA TRICHOTOMA; ENTEROLOBIUM CONTORTISILIQUA; PTEROGYNE NITENS; PELTOPHORUM DUBIUM; AGROFORESTRY; FARM WOODLANDS; AGROSILVOPASTORAL SYSTEMS; SMALL SCALE FARMING; HUMID SUBTROPICS;

00188
05097
FONZEN, P.F.; OBERHOLZER, E.
USE OF MULTIPURPOSE TREES IN HILL FARMING SYSTEMS IN WESTERN NEPAL
AGROFOR SYST; Vol: 2, No: 2; (1985); EN
XP/NP; pg 187-197
A large number of multipurpose trees and shrubs are deliberately retained or incorporated on farms in the subsistence farming systems on the steep slopes in parts of Nepal. Woody perennials are maintained in contour strips across the slopes and around the fields. The contribution of these trees is the production of fodder and firewood and their protective function in reducing the erosion hazards, thereby making crop production possible on steep slopes where profitable cropping would otherwise be extremely difficult. Based on a case study in two villages of the Western Development Region, this paper presents some data on basic farm management aspects, production of crops and other components of the system. The performance of the system is assessed and its merits and weaknesses highlighted. Although the hill farming system extends over a large area and accounts for a large portion of Nepal's population, it has not received any research attention or benefited from scientific innovations. Improvement possibilities in terms of component technologies as well as farming systems including the incorporation of several locally available medicinal plants are indicated.
SHOREA ROBUSTA; PINUS ROXBURGHII; AGROFORESTRY; MULTIPURPOSE TREES; HILL FARMING; EROSION CONTROL; MEDICINAL PLANTS; FODDER CROPS; FUELWOOD; SPECIES LIST; AGROSILVOPASTORAL SYSTEMS; SMALL SCALE FARMING;

00189
06049
JOHNSON, D.V.; NAIR, P.K.R.
PERENNIAL CROP-BASED AGROFORESTRY SYSTEMS IN NORTHEAST BRAZIL
AGROFOR SYST; Vol: 2, No: 4; (1985); EN
XL/BR; pg 281-292
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, and babassu palm. The common feature that links these crops is the silvopastoral system of livestock (chiefly cattle, sheep and donkeys) grazing under

them. Agrisilvicultural 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 management, production, rate of growth, economic importance, etc., of these agroforestry systems involving cashew, coconut and carnuaba palm. These systems are of considerable merit in the environmental, agricultural and socioeconomic conditions of Northeast Brazil. However, practically no research nor even systematic data collection has been done so there is an almost total lack of information on the systems. To improve them, they should be studied in detail and research undertaken on various components (crops, trees and livestock) individually as well as on the system as a whole. Selection of suitable species of grass and other herbaceous crops, appropriate management techniques for both overstorey and understorey species in relation to the age of the overstorey species, optimal stocking rates of animals, etc., have to be determined to enable plantation owners and operators to realize the full potential of these systems.
ANACARDIUM OCCIDENTALE; COCOS NUCIFERA; ORBIGNYA MARTIANA; THEOBROMA CACAO; COPERNICIA PRUNIFERA; ELAEIS GUINEENSIS; AGROFORESTRY; SILVOPASTORAL SYSTEMS; PERENNIALS; CROPS; AGROSILVOPASTORAL SYSTEMS; LIVESTOCK; TROPICS;

00190
06048
DE LIYANGE, M.S.; TEJWANI, K.G.; NAIR, P.K.R.
INTERCROPPING UNDER COCONUTS IN SRI LANKA
AGROFOR SYST; Vol: 2, No: 3; (1985); EN
XP/LK; pg 215-228
Coconut is a major commercial crop of Sri Lanka. Growing a number of other crops in association with coconuts is a widespread practice in all coconut-growing areas of the country. The rationale for the practice is that other crops can profitably be grown between or under the coconuts during the different growth stages of the palms and thus the overall productivity of the land under this long-duration crop can substantially be increased. The paper gives a concise account of the practice in Sri Lanka, indicating the crops most commonly grown as intercrops, arrangement of different crops, and early research results on the productivity of the intercrops and their effect on coconuts. Adequate supplies of water and labour are the two major inputs needed for the success of the system. Drought, lack of funds, price instability, lack of technical know-how on intercrop management and problems of timely availability of inputs are the major constraints experienced by farmers in expanding intercropping. Research on both biological and socioeconomic aspects is needed to overcome these constraints and extend this potentially attractive system.
COCOS NUCIFERA; AGROFORESTRY; COCONUTS; INTERCROPPING; AGROSILVOPASTORAL SYSTEMS;

00191
B02902
SUMBERG, J.E. (ED.); CASSADAY, K. (ED.)
SHEEP AND GOATS IN HUMID WEST AFRICA: PROCEEDINGS OF THE WORKSHOP

ON SMALL RUMINANT PRODUCTION SYSTEMS IN THE HUMID ZONE OF WEST AFRICA, HELD IN IBADAN, NIGERIA, 23-26 JANUARY 1984
(1985); EN
XA; pg 1-74
This volume contains a selection of papers presented at a workshop, Small Ruminant Production Systems in the Humid Zone of West Africa. The proceedings summarize the results of research on production of dwarf sheep and goats. Among the topics discussed are disease profiles of village sheep and goats; feed intake; growth and reproduction rates of West African dwarf goats; integration of the small ruminant enterprise into the wider farming systems of the zone; and the economics of the improved production systems for ruminants. One important sub-topic discussed is alley cropping, with cut-and-carry browse to feed the livestock.
WEST AFRICA; HUMID CLIMATE; SHEEP; GOATS; ANIMAL PRODUCTION; FARMING SYSTEMS; ECONOMICS; RUMINANTS; FEEDS; MARKETING; HUMID TROPICS;

00192
B01682
USAID
LEUCAENA LEUCOCEPHALA: A TREE THAT DEFIES THE WOODCUTTER
(1979); EN
USAID; XZ; pg 22
Leucaena leucocephala has been voted as one among a few valuable tree species that has great potential for ameliorating problems of fuelwood, fodder, food and environmental degradation. Various Leucaena strains are discussed. The book highlights the merits and demerits of Leucaena with respect to their utility and growth characteristics. Detailed excerpts on establishment methods, environmental requirements and sources of seeds have been prepared. Current experiments on Leucaena strains in various parts of the world have been highlighted.
LEUCAENA LEUCOCEPHALA; AGROFORESTRY; FARMING SYSTEMS; LAND USE; NUTRITIVE VALUE; CHARCOAL; FUELWOOD; FODDER; MANAGEMENT; TECHNOLOGY; LEAVES; MULCHING; DESERTIFICATION; IRRIGATION; LEACHING; ECOSYSTEMS: FOREST LITTER; NITROGEN; SYMBIOSIS;

00193
02855
AMARE GETAHUN
AGROFORESTRY TRIALS
(1981); EN
XA/NG; pg 1-41
This review of agroforestry research activities includes an inventory of appropriate tree species, shrubs and fodder crops. Results of a number of agroforestry trials from Onne, Ibadan, and Ife are given. The experiments include monitoring changes in soil fertility and species performance, including light interception and biological weed control. The trials single out a number of useful agroforestry tree species suitable to the various ecological zones, among them Leucaena, Gliricidia sepium, Sesbania grandiflora, etc. A total of 38 woody species were under examination. At the end of each section of the review, results, conclusions and recommendations are given, accompanied by a set of

tables, charts, graphs and statistical data.
GLIRICIDIA SEPIUM; FLEMINGIA CONGESTA; ACIOA BARTERII; ALCHORNEA CORDIFOLIA; SESBANIA GRANDIFLORA; LEUCAENA LEUCOCEPHALA; GMELINA ARBOREA; PARKIA CLAPPERTONIANA; TRECULIA AFRICANA; CASSIA SIAMEA; ALLEY CROPPING; SHIFTING CULTIVATION; TAUNGYA SYSTEMS; MULTIPURPOSE TREES; WOODY PLANTS; RESEARCH; AGROFORESTRY;

00194
04881
ANON
PLANTS FOUND IN AFRICA WHICH PROVIDE WOOD PRODUCTS AND ARE OF CONSERVATION VALUE
(1985); EN
XA; pg 1-34
This list of plants found in Africa that provide wood products and are of conservation value gives the description, environmental requirements, uses and distribution of each.
SPECIES LIST; DESCRIPTIONS; WOOD; CONSERVATION;

00195
01849
BAGLEY, W.T.
MULTIPURPOSE TREE PLANTATION
EIGHTH WORLD FORESTRY CONGRESS, JAKARTA, 16-28 OCTOBER 1978; (19 78); EN
XN/US; pg 7
Estimates of the fuel demand for both domestic and industrial purposes are indicative of a trend that can only lead to shortages of wood and fibre. The tree-harvest concept advanced for increasing forest productivity only adds to the rate of deforestation and environmental degradation. Combining protection with production of raw materials may be the solution to building up the inventory of trees enough to attract using industries to regions where trees are scattered. The author has stressed the need for research on tree crops.
CERATONIA SILIQUA; PROSOPIS JULIFLORA; GLEDITSIA TRIACANTHOS; JUGLANS NIGRA; CARYA PECAN; ENERGY; FOOD; RENEWABLE RESOURCES; SILVICULTURE; RESEARCH; GENOTYPES; CONSERVATION; MANAGEMENT; PASTURES; WOOD; FRAGILE ECOSYSTEMS; ORGANIC MATTER; PLANTATIONS; ARID ZONES; WINDBREAKS; ROTATIONAL CROPPING;

00196
03460
BENGE, M.D.
CASUARINAS, THE BEST FIREWOOD IN THE WORLD: RESOURCES FOR CHARCOAL, CONSTRUCTION OF POLES, WINDBREAKS AND SHELTERBELTS AND SOIL EROSION AND SANDUNE STABILIZATION
TECH SER NO 10 USAID WASHINGTON D.C.; (1982); EN
A detailed compilation of information about casuarina species presented in eight sections. Section 1 is composed of notes on 15 Australian casuarina species and subspecies about their value and potential for planting. Included is a map showing their geographical distribution. Section 2 reports on Casuarina digodon, a species found mainly in the Eastern Highlands Province of Papua New Guinea. Section 3 carries excerpts from a NAS publication on

casuarinas. Section 4 discusses casuarina species in Florida (U.S.A.) and some Caribbean Islands. Section 5 is a review of the published literature on nodulation and dinitrogen fixation in casuarina. An assessment is made of experimental and practical measures which should be taken to understand the symbiosis better and to improve the contributions made by casuarina to agriculture and forestry. Section 6 is a contribution on inoculation methods in casuarinas and section 7 summarizes by indicating sources of casuarina seeds in Australia.
CASUARINA EQUISETIFOLIA; LEUCAENA LEUCOCEPHALA; GMELINA ARBOREA; CASUARINA FRASERANA; CASUARINA JUNGHUHNIANA; CASUARINA DECAISNEANA; EUCALYPTUS; EROSION CONTROL PLANTS; SOIL FIXATION; DUNES; WINDBREAKS; LEAVES; SHADINC; SEEDLINGS; BROWSING; PHYSIOLOGY; FUELWOOD; CHARCOAL; SYMBIOSIS; LEGUMES; NODULATION; MULTIPURPOSE TREES;

00197
00623
BENGE, M.D.
BAYANI (GIANT IPIL-IPIL) LEUCAENA LEUCOCEPHALA: A SOURCE OF FERTILIZER, FEED AND ENERGY FOR PHILIPPINES
(1977); EN
USAID; XP/PH; pg 1-22
Available information on Leucaena leucocephala is fragmentary. The author of this paper has reviewed all data available to him at the time and has condensed the information considered pertinent to present economic development trends. In addition to scientific findings based on experiments, empirical observations by the author are included. Most of the comprehensive research information on this species covers production and processing, establishment methods, culture, and utilization as forage. Particular mention is made of economic and ecological benefits. As a legume, leucaena is nitrogen-fixing; it provides animal fodder, is a fast-growing fuelwood tree, and has a variety of industrial uses.
LEUCAENA LEUCOCEPHALA; LEUCAENA LATISILIQUA; LEUCAENA PULVERULENTA; ALBIZIA FALCATARIA; LEGUMES; BIOLOGICAL PRODUCTION; WEEDS; RESEARCH; DRY MATTER CONTENT; PASTURES; CARRYING CAPACITY; MANAGEMENT; GREEN MANURES; FUELWOOD; CHARCOAL; FODDER CROPS; EROSION; AFFORESTATION; PESTS; BROWSE PLANTS; LEAVES;

00198
01636
BREWBAKER, J.L.
<THE> WOODY LEGUMES, LEUCAENA: PROMISING SOURCE OF FOOD, FERTILIZER AND FUEL IN THE TROPICS
PRODUCION DE FORAJES: MEM SEMIN INTERNACIONAL DE GENDEVIA TROPICAL, ACAPULCO; (1976); EN
XZ; pg 13-17
The origin of various Leucaena strains and other species which have been suggested as synonyms is outlined. There are about 344 known Leucaena strains and about 80 of these are indistinguishable. Not enough study so far has been done on these varied strains; however, the Hawaiian type which originated in Philippines has been intensively studied. The genus leucaena is of Mexican and Central American origin. It includes 51 reported

species of which 10 are discussed in this paper, indicating origin other characteristic attributes. Another list of 41 major species of the genus indicates uses, such as provision of fodder, fuelwood, food and fertilizers.
LEUCAENA LEUCOCEPHALA; PROSOPIS JULIFLORA; LEUCAENA DIVERSIFOILA; LEUCAENA PULVERULENTA; LEUCAENA LANCEOLATA; LEUCAENA ESCULENTA; NITROGEN FIXING TREES; SHRUBS; SPECIES LIST; SEEDLINGS; SHADE TREES; TAXONOMY; CANOPIES; EROSION; AFFORESTATION; BROWSE PLANTS; NITROGEN; FUELWOOD; FODDER; LEGUMES; TROPICS;

00199
04887
BUDOWSKI, G.; KASS, D.C.L.; RUSSO, R.O.
LEGUMINOUS TREES FOR SHADE
PESQUI AGROPECU BRAS; Vol: 19, (1984); EN
XZ; pg 205-222
This paper considers the factors that might influence the choice of leguminous as opposed to non-leguminous trees to provide shade. It describes various associations to elucidate some of the ecological interrelationships that are probably reflected in traditional agroforestry practices. The authors conclude that the selection of leguminous trees for shade is made not only to improve nitrogen nutrition, but also because of characteristics like the type of shade the trees provide, their coppicing ability, and ease of husbandry.
THEOBROMA CACAO; COFFEA ; ERYTHRINA POEPPIGIANA; GLIRICIDIA SEPIUM; CALLIANDRA; LEUCAENA; LEGUMES; SHADE TREES; NITROGEN FIXATION; AGROFORESTRY; TREE CROPS; HEDGING PLANTS; TROPICS;

00200
01888
BURLEY, J.; NAMKOONG, G.
CONSERVATION OF FOREST GENETIC RESOURCES
11TH COMMONWEALTH FORESTRY CONFERENCE, TRINIDAD, SEPTEMBER 1980; (1980); EN
XL; pg 25
The needs for conservation of forest genetic resources are reviewed in relation to moral commitments to future generations and to future markets and technical requirements. Techniques of in situ and ex situ conservation are described together with consideration of areas and numbers of individuals required for conservation of genes, gene frequencies and genotypes with species and populations. The links between national and international programmes are related to exploration, evaluation and conservation of genetic resources, and the increasing importance of hitherto lesser-known species is stressed. References are also made to the need for formal training at professional and technical levels.
POPULUS; SALIX; DIPTEROCARPUS; TECTONA GRANDIS; GMELINA ARBOREA; PINUS CARIBAEA; EUCALYPTUS; PINUS RESINOSA; RENEWABLE RESOURCES; CONSERVATION; ECOSYSTEMS; EDUCATION; FOREST RESOURCES; FARMING SYSTEMS; ECONOMICS; GERMPLASM; GENETICS;

00201
00478
DOUGALL, H.W.; BOGDAN, A.V.

BROWSE PLANTS IN KENYA WITH SPECIAL REFERENCE TO THOSE OCCURRING IN SOUTH BARINGO
EAST AFR AGRIC J; Vol: 23, No: 4; (1957); EN
XA/KE; pg 236-245
This paper contains a list of browse species found in arid and semi arid regions of Kenya. The authors have described the physiognomic characteristics of each species and its environmental requirements. In total, 33 species are listed, some of which are Acacia brevispica, A. gerrardii, A. mellifera, A. seyal bel, A.tortilis, A. nilotica and A. nubica. A table with an analysis of the chemical composition of the browse plants of Kenya is included.
PERENNIALS; GRASSES; BROWSE; FEED CROPS; SPECIES LIST; COMPOSITION; ARID ZONES; SEMI ARID ZONES;

00202
B00135
FELKER, P.; CANNELL, G.H.; CLARK, P.R.; OSBORN, J.F.; NASH, P.
SCREENING PROSOPIS (MESQUITE) SPECIES FOR BIOFUEL PRODUCTION ON SEMI ARID LANDS
(1981); EN
XN/US; pg 226
Mesquite (Prosopis spp.) is a drought- and heat-resistant, nitrogen-fixing leguminous tree that occurs in arid zones. This report is the result of the work initiated under the U.S. Department of Energy, through greenhouse and field plot research and through economic-cost considerations, to evaluate Prosopis as an energy crop. A germplasm collection of 900 accessions from North and South America and Africa was assembled. Eighty accessions were chosen for field studies. Representative accessions were screened for growth rate, biomass production, heat/drought tolerance, cold/frost tolerance, response to irrigation, and pod production. Thirteen Prosopis species were found to nodulate, reduce acetylene to ethylene, and grow on nitrogen-free media in greenhouse experiments. Salinity had no effect on growth rate. Prosopis species of S. American origin had the highest dry matter production. Cold/frost tolerance of 30 Prosopis accessions was determined with field planting at 1520 m altitude. All the data have been statistically analyzed and the results are given in tables.
LEUCAENA LEUCOCEPHALA; PARKINSONIA ACULEATA; CERCIDIUM FLORIDIUM; LENEYA TESOTA; PROSOPIS; TAXONOMY; GERMPLASM; BIOMASS; IRRIGATION; LEGUMES; WEED CONTROL; PLANT PHYSIOLOGY; SALINITY; NITROGEN FIXATION; ECONOMICS; DRY MATTER CONTENT; ROOT NODULATION; EXPERIMENTS; DUNES; SEEDLINGS; CYTOLOGY; GENETICS;

00203
02768
FELKER, P.
MESQUITE (PROSOPIS SPP.): AN ALL PURPOSE ARID LAND LEGUMINOUS TREE
NEW AGRICULTURAL CROPS: AAAS SYMP NO 38 (RITCHIE, G.A. ED.); (19
79); EN
XN; pg 89-132
Mesquite (Prosopis glandulosa) is a marvelously productive and useful plant for desert areas, thriving where few other plants can subsist. Its pods contain 13 per cent protein and up to 30 per

cent sucrose. Requiring little water and no tillage, mesquite is a nitrogen-fixing legume and therefore increases soil nitrogen. Various aspects that bear on the development of mesquite as a useful plant for wood and firewood, for increasing soil fertility, and for providing livestock and human food are discussed. Besides, an orchard of mesquite trees would obviate the need for tillage and prevent wind and soil erosion.
ACACIA GREGGII; PROSOPIS; ACACIA SENEGAL; ACACIA ANEURA; CERATONIA SILIQUA; CERCIDIUM MICROPHYLLUM; ACACIA ALBIDA; LEUCAENA LEUCOCEPHALA; PARKIA CLAPPERTONIANA; ALBIZIA LEBBEK; SIMMONDSIA CHINENSIS; EROSION; ROOT NODULATION; FOOD; ECOSYSTEMS; TAXONOMY; ECOLOGY; SOIL FERTILITY; LEGUMES; FUELWOOD; NITROGEN FIXATION; NUTRITIVE VALUE; EXPERIMENTS; GENETICS; IRRIGATION; MANAGEMENT; SALINITY; BIOMASS; WOODLANDS;

00204
02851
FELKER, P.
USES OF TREE LEGUMES IN SEMI ARID REGIONS
ECON BOT; Vol: 35, No: 2; (1981); EN
XZ; pg 174-186
This paper analyses scientific discoveries of the various uses of legumincus species. Prosopis is the tree legume genus most extensively used as human food. Prosopis tamarugo, P. glandulosa, P. juliflora and Leucaena leucocephala are the major livestock food-producing tree legumes. Acacia and Prosopis species are recommended for practically every semi arid region to curb desertification. Also, Acacia and Prosopis to nodulate and fix nitrogen. Therefore, these species can be used in place of nitrogen fertilizers, thus reducing the cost of food production and stabilizing the environment. A list is provided of useful fuelwood species plus species for other uses such as confectionaries and paper sizing.
PROSOPIS; LEUCAENA LEUCOCEPHALA; ACACIA ALBIDA; CERATONIA SILIQUA; PARKIA BICOLOR; PROSOPIS CINERARIA; SPECIES LIST; LEGUMES; BIOLOGICAL PRODUCTION; SEMI ARID ZONES; AFFORESTATION; DESERTIFICATION; AGRONOMY; CLIMATE; SYMBIOSIS; SEEDS; GERMPLASM; GENETICS; NITROGEN FIXATION; ECONOMICS; FUELWOOD; FOOD; TROPICS;

00205
00064
GIFFARD, P.L.
THE POSSIBILITIES OF ACACIA ALBIDA FOR REFORESTATION IN SENEGAL (LES POSSIBILITES DE REBOISEMENT EN ACACIA ALBIDA AU SENEGAL)
BOIS FOR TROP; Vol: 95, (1964); FR
CTFT; XA/SN; pg 21-33
The author examines the role that Acacia albida can play in reforestation in Senegal. He describes the species, its botanical, technological and ecological characteristics, and discusses its effects on soil and its value as fodder. From the forestry point of view, artificial regeneration trials have often ended up in failure, but an effective method has now been developed. There follows a description of natural tree growth in Senegal and possibilities of afforestation. The author shows how Acacia albida would be advantageous in the development of the Niayes region and the groundnut basin.

ACACIA ALBIDA; COMBRETUM GLUTINOSUM; ADANSONIA DIGITATA; STERCULIA SETIGERA; TAMARINDUS INDICA; PROSOPIS; ACACIA RADDIANA; ZIZIPHUS JUJUBA; PARKIA BIGLOBOSA; AFFORESTATION; SOIL FERTILITY; FODDER CROPS; MULTIPURPOSE TREES; NITROGEN FIXATION;

00206
01925
GRAY, S.G.
<THE> PLACE OF TREES AND SHRUBS AS SOURCES OF FORAGE IN TROPICAL AND SUB-TROPICAL PASTURES
TROP GRASSL; Vol: 4, No: 1; (1970); EN
XP/AU; pg 57-62
The coming of humans on the ecological scene has disrupted the natural ecobalance. Humans have brought innumerable changes into the ecosystems, Each of which has had repercussions on the grassland-grazing-animal relationship, and the best land has been gradually converted from grazing to cropping. A realization and a concern over the dangers associated with such trends have led to the need for pasture improvement. The author has included a number of browse trees and shrubs that have recognized potential for pasture improvement. The need for research into identifying more browse species has been underlined.
BRACHYCHITON POPULNEUM; ACACIA ANEURA; CERATONIA SILIQUA; GLEDITSIA TRIACANTHOS; LEUCAENA LEUCOCEPHALA; DESMODIUM GYROIDES; ACACIA ALBIDA; ERYTHRINA; CROTALARIA; INDIGOFERA; BROWSING; GRAZING; PASTURES; EVOLUTION; ECOSYSTEMS; GRAZING LANDS; WOODLANDS; SYMBIOSIS; VEGETATION; ECOLOGY; FODDER; TREES; NUTRITIVE VALUE; WOODY PLANTS; MANAGEMENT; TROPICS;

00207
01288
HANS, A.S.; PARKER, E.J.; KUMAR, V.
POTENTIALITIES OF ZAMBIAN FOREST FRUIT TREES
EIGHTH WORLD FORESTRY CONGRESS, JAKARTA, INDONESIA, 16-28 OCTOBER 1978; (1978); EN
XA/ZM; pg 1-6
The indigenous forest fruit trees of Zambia provide a variety of products to the local people. Fruit pulp and seeds from wild fruit trees are a good source of food. Trees are also utilized for fuelwood. The Food Technology Research Unit of N.C.S.R. selected four species for intensive research to determine their beverage and conserve-making qualities: Anisophyllea boehmii, Parinari curatellifolia, Ricinodendron rautanenii and Uapaca kirkiana. This was to provide the basis for tree improvement programmes which would include studies of ecology, genetics, physiology, diseases and pests for the selected genera. It is from these research results that plans for future rural development based on indigenous fruit trees are to be built. The authors discuss problems presented by the genetic and physical characteristics of these wild fruit trees, as a building step to extended research.
ANISOPHYLLEA BOEHMII; PARINARI CURATELLIFOLIA; UAPACA KIRKIANA; TAMARINDUS INDICA; ADANSONIA DIGITATA; PARKIA FILICOIDEA; RICINODENDRON RAUTANENII; FRUIT TREES; ECOLOGY; PHYSIOLOGY; CONSERVATION; RURAL DEVELOPMENT; WOOD; SPECIES LIST; TECHNOLOGY; PESTS; BREEDS; COMPOSITION; GENETICS; RESEARCH;

00209
06066
HUXLEY, P.A.
SOME CHARACTERISTICS TO BE CONSIDERED IN AGROFORESTRY
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED); (1981); EN
XL; pg 3-12
A hierarchical approach to examining agroforestry land use is outlined and the need to evaluate the role of trees and shrubs as the dominant overstorey plant components in any agroforestry association is stressed. Appreciation of the environmental biological processes that occur at the interface between two or more plant components is the key to understanding agroforestry systems. This paper addresses to those characteristics relating to trees and shrubs and a list is given of points to consider in relation to 1) germplasm, 2) propagation, 3) planting, 4) the juvenile phase of growth, 5) mature growth, and 6) senescence and replanting.
AGROFORESTRY; LAND USE; ECOZONES; WATER CONSERVATION; MANAGEMENT; SOCIOECONOMIC ASPECTS; GERMPLASM; WOODY PLANTS; MULTIPLE USE; BIOLOGICAL FACTORS; PHENOLOGY; SOIL CONSERVATION;

00210
06113
HUXLEY, P.A.
<THE> BASIS OF SELECTION, MANAGEMENT AND EVALUATION OF MULTIPURPOSE TREES: AN OVERVIEW
ICRAF WORK PAP NO 25; (1984); EN
XZ; pg 1-100
This overview gives the basis for selection, management and evaluation of multipurpose trees (MPTs). It discusses the key issues in 1) selecting, managing and evaluating MPT species and presents some important characteristics to be considered - mainly general growth, flowering and fruiting attributes, and adaptability; 2) using multipurpose trees as crops - with emphasis on ideotypes, plant density and rectangular arrangements; 3) using multipurpose trees in managed mixtures of species and considering the space-time factor, optimum populations, and degrees of intimacy in management in tree crop mixtures; and 4) research priorities, and listing the major ones.
MULTIPURPOSE TREES; MANAGEMENT; SELECTION;

00211
06066
HUXLEY, P.A.
SOME CHARACTERISTICS OF TREES TO BE CONSIDERED IN AGROFORESTRY
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1984); EN
XZ; pg 1-12
As dominant overstorey plants, trees and shrubs play a key role in agroforestry systems. Agroforestry land use practices can be at various levels of scale but a key to understanding agroforestry systems starts with an appreciation of the environmental and biological processes that occur at the interface between two or more plant components, at least one of which is a woody perennial. To do this satisfactorily, one must have an understanding of the relevant characteristics of the various plant components.

Characteristics to consider concern germplasm, propagation, planting out, the juvenile phase of growth, mature growth and senescence, and replanting - all in relation to technical, managerial and socioeconomic considerations.
AGROFORESTRY; TREES;

00213
06054
JAMBULINGAM, R.; FERNANDES, E.C.M.
MULTIPURPOSE TREES AND SHRUBS ON FARMLANDS IN TAMIL NADU STATE (INDIA)
AGROFOR SYST; Vol: 4, No: 1; (1986); EN
XP/IN; pg 17-32
Farmers in Tamil Nadu State integrate numerous species of multipurpose trees and shrubs on their farmlands in close association with agricultural crops and livestock. The dominant among them are Borassus flabellifer, Tamarindus indica, Ceiba pentandra, Acacia leucophloea and A. nilotica. These woody perennials are able to cope with poor growing conditions. Their increasing integration on farmlands represents a strategy to minimize risk of crop failure. Some species (e.g. Prosopis juliflora and Delonix elata) are deliberately used to ameliorate infertile or saline soils to permit growing annual crops. In addition to producing fuelwood, charcoal, fruit, and fodder, and providing many services and functions, these species require few inputs and give the farmer a choice of management options in the event of poor crop growth. The productivity of these traditionally managed and little-studied agroforestry systems can be improved considerably by scientific interventions.
BORASSUS FLABELLIFER; TAMARINDUS INDICA; CEIBA PENTANDRA; ACACIA LEUCOPHLOEA; ACACIA NILOTICA; AGROFORESTRY; AGRISILVICULTURE; MULTIPURPOSE TREES; ECONOMICS; FALLOW SYSTEMS; GREEN MANURES; AGROSILVOPASTORAL SYSTEMS; TROPICS;

00214
02780
MANN, H.S. (ED.); SAXENA, S.K. (ED.)
KHEJRI (PROSOPIS CINERARIA) IN THE INDIAN DESERT: ITS ROLE IN AGROFORESTRY
CAZRI MONOGRAPH NO 11; (1980); EN
XP/IN; pg 1-78
Forestry and tree plantations have attracted worldwide attention, particularly in the context of energy crisis, fuelwood shortage, environmental pollution and conservation of natural resources. A commonly and naturally growing tree, Prosopis cineraria (khejri), as it is discussed here is an important constituent of the vegetation system and a source of top feed, fuel and timber. Khejri integrates with and complements the crops under its shade. Its pods are used as a vegetable. Being a legume,it improves soil fertility. It is well adapted to arid conditions and stands up well to the adverse vagaries of climate and browsing by animals. Considering present role and potential of khejri, CAZRI has investigated its botany, physiology and silviculture and its direct and indirect effects on soil. The scientific knowledge so far gained, compiled in this volume, is of value for planning, studies and investigations in agroforestry and silvopastoral

systems in which khejri is one of the components. A total of 14 papers covering different aspects of Prosopis cineraria are presented.
PROSOPIS CINERARIA; ACACIA TORTILIS; PROSOPIS JULIFLORA; ZIZIPHUS NUMMULARIA; CAPPARIS DECIDUA; CASSIA AURICULATA; ACACIA NILOTICA; AZADIRACHTA INDICA; EUPHORBIA CAUDICIFOLIA; CALOTROPIS PROCERA; ACACIA SENEGAL; BROWSING; SILVOPASTORAL SYSTEMS; NUTRITIVE VALUE; TREES; AGROFORESTRY; MANAGEMENT; ENERGY; FUELWOOD; CONSERVATION; ARID ZONES; PHYSIOLOGY; SILVICULTURE; BOTANY; AFFORESTATION; LEGUMES; SOIL FIXATION; DUNES;

00215
06050
MAY, P.H.; ANDERSON, A.B.; FRAZAO, J.M.; BALLICK, M.J.
BABASSU PALM IN THE AGROFORESTRY SYSTEMS OF BRAZIL'S MID-NORTH REGION
AGROFOR SYST; Vol: 3, No: 4; (1985); EN
XL/BR; pg 275-295
Babassu palms (Orbignya spp.) cover nearly 200 000 sq km in Brazil, providing cash income, fuel, fiber, edible oil and food to a large number of tenant farm households. 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 by 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 hectare, 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 home and nutrients for the soil. However, reduced fallow cycles caused by pasture conversion threaten babassu as well as crop productivity.
ORBIGNYA; TENURE; SHIFTING CULTIVATION; PALMAE; FUELS; FOOD; AGROSILVOPASTORAL SYSTEMS;

00216
06055
MIEHE, S.
ACACIA ALBIDA AND OTHER MULTIPURPOSE TREES ON THE FUR FARMLANDS IN THE JEBEL MARRA HIGHLANDS, WESTERN DARFUR, SUDAN
AGROFOR SYST; Vol: 4, No: 2; (1986); EN
XA/SD; pg 89-119
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 Marra massif, Sudan. The basic agrosilvopastoral system consists of terraced village fields, where semi-permanent rain-fed cropping of staple millet and other subsistence crops takes place under stands of multipurpose trees dominated by Acacia albida, Cordia abyssinica and Zizyphus spina-christi. Trees have been retained primarily for foods, wood and fodder. Thorn from cut and browsed branches makes good fencing material. This system has been able to sustain self-sufficiency of a densely settled population

over centuries. However, recent out-migration of people from the montane dry-farming areas has caused gradual return to shifting cultivation. As a consequence, the present-day subsistence farming in the region is characterized by a general level of carelessness and exploitative management, reflected in a successive decrease of the tree cover. The evaluation of the agroforestry practices described includes a discussion of their regional importance and if it is possible to extrapolate the practices to similar situations, especially in Africa, emphasis being given to mountain and highland conditions. The outstanding potential for agroforestry systems based on Acacia albida and for spreading them over areas varying from semi arid to semi humid Africa is highlighted by illustrating their ecologic and economic variability.
ACACIA ALBIDA; CORDIA ABYSSINICA; ZIZIPHUS SPINA-CHRISTI; TROPICS; HIGHLAND; AGROFORESTRY; MULTIPURPOSE TREES; AGROSILVOPASTORAL SYSTEMS; FARMLAND; SEMI ARID ZONES;

00217
06075
NAIR, P.K.R.; FERNANDES, E.C.M.; WAMBUGU, P.N.
MULTIPURPOSE LEGUMINOUS TREES AND SHRUBS FOR AGROFORESTRY
AGROFOR SYST; Vol: 2, No: 3; (1985); EN
XA/KE; pg 145-163
There are various ways in which farmers deliberately incorporate trees and shrubs in farm production fields. Many of the species so incorporated are legumes. The role of such woody perennials in agroforestry systems may be productive or protective or both. Legumes offer by far the maximum range of choice of woody species for agroforestry in terms of their economic uses as well as ecological adaptability. In addition to the several leguminous woody species that are well known in agroforestry, there are many more whose potentials have not yet been fully understood. An evaluation is presented of the agroforestry potential of a few leguminous species from the point of view of their growth characteristics, ecological adaptability, ability to grow in combination with other species and, uses and functions. As the science of agroforestry is still in its infancy, there exist no research data on the various management aspects of this potentially promising group of plants. ICRAF, in its capacity as an international research council, has assembled several multipurpose leguminous trees and shrubs of agroforestry potential at its recently established field station in Machakos, Kenya, primarily for demonstration and training purposes. Initial results from these trials are presented in the paper.
MULTIPURPOSE TREES; SHRUBS; AGROFORESTRY; TREES; LEGUMES; TROPICS;

00218
B00266
NAIR, P.K.R.
AGROFORESTRY SPECIES: A CROP SHEETS MANUAL
(1980); EN
XZ; pg 1-335
This manual brings together useful information on selected plant materials that can be used in agroforestry. It presents crop sheets of species that are suited to tropical conditions and gives

their suitability for agroforestry. The manual is arranged in three parts: Part 1 deals with the general principles and concepts of agroforestry in the context of tropical land use patterns. Part 2 contains crop sheets of 40 species that are widely cultivated and whose production potentials have been relatively well exploited. The information is grouped under scientific and common names in English, French and Spanish; uses; economic importance; origin and distribution; plant characteristics; physiology; composition; agronomy; yield; pests and diseases; and it includes a brief account of the agroforestry potential of each species. It also includes a list of institutions carrying out research on the crops in developing countries. Part 3 includes short notes of 50 under-exploited species and general references.
AGROFORESTRY; SPECIES LIST; DEVELOPING COUNTRIES; LAND USE; CROPS; UNDER EXPLOITED PLANTS; TROPICS;

00219
B00097
NATIONAL ACADEMY OF SCIENCES
LEUCAENA: PROMISING FORAGE AND TREE CROP FOR THE TROPICS
(1977); EN
NAS; XZ; pg 1-115
Leucaena leucocephala is a versatile legume whose full potential is thus far untapped. An exhaustive description of the various uses of this tree is given, touching on its potential for alleviating defined land use problems within a given social economic framework. No specific considerations or prescriptions have been made to assess Leucaena's merits or limitations for specific regions, countries or localities. A programme for research and action that will help determine the potential of Leucaena to alleviate major feed, wood and fuel shortages, as well as deforestation problems in the tropics, has been added in chapter 8. The appendix carries a list of researchers working with Leucaena and sources of Leucaena seeds, inoculum and wood.
LEUCAENA LEUCOCEPHALA; LEUCAENA PULVERULENTA; IMPERATA CYLINDRICA; LEGUMES; FUELWOOD; WINDBREAKS; SHADING; FEED CROPS; WEEDS; RHIZOBIUM; ROOT NODULATION; NITROGEN FIXATION; SOIL WATER CONTENT; LOWLANDS; NUTRITIVE VALUE; WOOD; GREEN MANURES; AFFORESTATION; IRRIGATION; BROWSING;

00220
B00138
NATIONAL ACADEMY OF SCIENCES
FIREWOOD CROPS: SHRUB AND TREE SPECIES FOR ENERGY PRODUCTION
REPORT ON AN AD HOC PANEL OF THE ADVISORY COMMITTEE ON TECH INNOVATION, BOARD OF SCI & TECH FOR; Vol: 1, (1980); EN
XZ; pg 1-237
A list is given of aggressive and quick-growing fuelwood tree species that are multipurpose in nature, adopt well to different sites, are easy to establish, require minimal care, and can survive in difficult environments. Other characteristic attributes are that they coppice, fix nitrogen, grow rapidly, and produce wood of high calorific value. Of the 60 species listed, sixteen are suitable for the humid tropics, nine for tropical highlands and 35 for arid and semi-arid regions.
TREES; SPECIES LIST; FUELWOOD; HUMID TROPICS; ARID ZONES;

HIGHLAND; ENERGY;

00221
B00285
OAKES, A.J.
LEUCAENA BIBLIOGRAPHY
(1982); EN
XZ; pg 1-117
The widespread interest in Leucaena as a renewable source of energy, feed, fertilizer, food and fuel has resulted in accelerated research with the crop during recent decades. Research with the widely adapted, fast-growing, nitrogen-fixing leguminous tree has resulted in voluminous literature. The multifarious utilization made of Leucaena throughout the tropics and the subtropics has resulted in literature in obscure publications with limited distribution. The purpose of this bibliography is to stimulate further Leucaena research and interest in the crop.
LEUCAENA LEUCOCEPHALA; RENEWABLE RESOURCES; ENERGY; FOOD; FUELS; FERTILIZERS; RESEARCH; MULTIPURPOSE TREES;

00222
B01270
OKAFOR, J.C.
PROMISING TREES FOR AGROFORESTRY IN SOUTHERN NIGERIA
AGROFORESTRY IN THE AFRICAN HUMID TROPICS (MACDONALD, L.H. ED.); (1981); EN
XA/NG; pg 103-107
Several tropical trees are suitable for agroforestry because of their multiple uses of food, animal feed, timber, firewood, stakes, chewing sticks and soil fertility restorers. Adequate information on the suitability of different species, however, is lacking or is not readily available. The work reported here is a basis for selecting some tree species that are given in two broad categories of 1) fruit and food trees and 2) non-food trees. Suitable species are suggested for each category, for both compound and outlying farm types, within the tropical forests and derived savanna. An on-going study of natural fallow to ascertain its efficiency in restoring soil fertility in south-eastern Nigeria is briefly mentioned.
NAPOLEANA IMPERIALIS; BLIGHIA SAPIDA; RAPHIA; IRVINGIA GABONENSIS; PENTACLETHRA MACROPHYLLA; TRECULIA AFRICANA; AGROFORESTRY; SPECIES LIST; COMPOUND FARMS; FRUITS; SAVANNAS; FARMING SYSTEMS; MULTIPLE USE; AGRISILVICULTURE; ECOSYSTEMS; SOIL FERTILITY; LAND USE;

00223
06046
OKTINGATI, A.; MAGHEMBE, J.A.; FERNANDES, E.C.M.; WEAVER, G.H.
PLANT SPECIES IN THE KILIMANJARO AGROFORESTRY SYSTEM
AGROFOR SYST; (1985); EN
XA/TZ; pg 177-186
An inventory of plant species was conducted on farms, farm boundaries and homesteads in the Kilimanjaro agroforestry system. The survey covered 30 farms in six villages in Hai District on the slopes of Mount Kilimanjaro, Tanzania. Over 100 plant species spread over 40 families were identified and their uses obtained

through interviews with farmers. The species identified include 53 tree species, 29 food crop species, 21 non-woody plants of economic value and 8 weed species. The food crops, trees and other economically useful plants are carefully chosen by the local farmers and intimately intercropped on the same unit of land. In most cases the plants had two or more uses of which food, fuelwood, medicine, poles, timber and fodder were the most important.
AGROFORESTRY; MULTIPURPOSE TREES; SHRUBS; MULTIPLE CROPPING; HOME GARDENS; SPECIES LIST; TREES; USES; TROPICS;

00224
01320
OPENSHAW, K.
ANIMALS AND TREES: FOOD FOR THOUGHT
TANZANIA VET BULL, DIV FOR, FAC AGRIC AND VET SCI, MOROGORO; Vol: 1, No: 3; (1979); EN
XA/TZ; pg 2-8
The advantages drawn from combined tree growing and animal rearing are discussed from the viewpoint of provision of shade, animal fodder and timber for fuel and building. Grazing animals among trees reduce the fire hazard from ground vegetation and improve soil fertility through droppings. Specific tree species are described, some of which may be used as fodder trees and others a source of medicine. Acacia albida, Prosopis cineraria, P. chilensis, Leucaena leucocephala and Ailanthus excelsa are discussed as promising fodder trees. An appendix with 21 other trees suitable for fodder and medicine is included.
ACACIA ALBIDA; ACACIA TORTILIS; ACACIA SENEGAL; ATRIPLEX NUMMULARIA; AZADIRACHTA INDICA; BROSIMUM ALICASTRUM; CASSIA SIAMEA; CASSIA STURTII; LAND USE; EROSION; SOIL FERTILITY; BROWSING; WOODLANDS; FORESTS; GRAZING; FODDER CROPS; SHADING; MICROCLIMATE; DRUG PLANTS; VEGETATION; FUELWOOD; CARRYING CAPACITY; DESERTIFICATION; FARMLAND; TREES; SPECIES LIST;

00225
06094
PALMBERG, C.
SELECTION AND GENETIC IMPROVEMENT OF INDIGENOUS AND EXOTIC MULTIPURPOSE TREE SPECIES FOR DRY ZONES
AGROFOR SYST; (1986); EN
XZ-127
This paper discusses the role of tree improvement in dry zone forestry and stresses the importance of selection and genetic improvement of indigenous and exotic multipurpose species. It describes the present status of seed procurement and tree improvement. It identifies the availability of quality seed as the main bottleneck in planting programmes followed by scarce information on seed handling and treatment. Also given are recommended activities to remedy this situation and recommendations for future action.
MULTIPURPOSE TREES; SHRUBS; SELECTION; BREEDING; ARID ZONES; SEMI ARID ZONES;

00226
00732
PANDAY, K.K.
IMPORTANCE OF FODDER TREES AND TREE FODDERS IN NEPAL
(1975); EN
XP/NP; pg 1-74
The paper reports a study conducted in Nepal region to determine important fodder trees and shrubs for fodder production. A systematic list of 120 known tree fodder plants is included. A number of observations on species occurrence, production, utilization and propagation methods are made. A sample of 15 fodder trees was selected and an intensive experiment performed on them to determine dry matter content, chemical composition and nutritive value. All the information collected was compiled in tables. As only a few local species were chemically analysed, only provisional recommendation were made.
FICUS; BAUHINIA PURPUREA; ALBIZIA; QUERCUS LAMELLOSA; ALNUS NEPALENSIS; GREWIA OPPOSITIFOLIA; ERYTHRINA VARIEGATA; TERMINALIA TOMENTOSA; MANGIFERA INDICA; ZIZIPHUS JUJUBA; MULTIPURPOSE TREES; BROWSING; LOPPING; FODDER CROPS; DRY MATTER CONTENT; MANURES; FUELWOOD; FOREST GRAZING; MANAGEMENT; LEGUMES; FARMLAND; CLIMATE; NUTRITIVE VALUE; SPECIES LIST;

00227
05383
PANDAY, K.K.; NOSBERGER, J.
GROWTH AND DEVELOPMENT OF SAPLINGS OF THE FODDER TREE ARTOCARPUS LAKOOCHA ROXB. AT THREE ALTITUDES IN NEPAL
INT TREE CROPS J; Vol: 3, No: 1958; (1985); EN
XP/NP; pg 125-134
The paper describes an experiment to investigate environmental effects on the growth response and leaf production of saplings of Artocarpus lakoocha and to determine whether the differences observed can be explained by the effect of altitude. Artocarpus lakoocha is cultivated in Nepal as a fodder tree. The growth and development of one-year-old saplings were examined over a two-year period at altitudes of 800 m, 1200 m and 1550 m. Artocarpus lakoocha was found to be better adapted to the lower areas.
ARTOCARPUS LAKOOCHA; FODDER CROPS; ALTITUDE; PLANT PRODUCTION; GROWTH; LEAVES;

00228
06056
POSCHEN, P.
AN EVALUATION OF THE ACACIA ALBIDA BASED AGROFORESTRY PRACTICES IN THE HARARGHE HIGHLANDS OF EASTERN ETHIOPIA
AGROFOR SYST; Vol: 4, No: 2; (1986); EN
XA/ET; pg 129-143
Growing Acacia albida as a permanent crop on farmland 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 nor are there 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 the yield of maize (Zea mays L.) and sorghum (Sorghum bicolor L. Moench). In a 40 km

radius around the Alemaya College of Agriculture, 27 plot pairs, each consisting of one plot underneath the A. albida foliage cover and the other in open, away from tree-on farmers' fields, were sampled and the yield components analyzed. A statistical significance in crops yields by 56 on average was found for the crops under the tree canopies compared to those away from the trees. This increase was caused by the improvement in 1000 grain weight and number of grains of plants under trees, indicating that trees enhanced the fertility status of the soil and improved its physical conditions in terms of crop growth. Additional benefits of A. albida included supply of fuelwood and fodder. Quantitative estimates of these outputs as well as their monetary values are presented in the paper. However, in order to realize these benefits to a discernible extent, higher stand densities of the tree are required.
ACACIA ALBIDA; CATHA EDULIS; SORGHUM BICOLOR; ZEA MAYS; AGROFORESTRY; FUELWOOD; HIGHLAND; FOOD CROPS; CEREALS; LAND USE; FODDER; TROPICS;

00229
02862
POULSEN, G.
MALAWI: THE FUNCTION OF TREES IN SMALL FARMER PRODUCTION SYSTEM
(1981); EN
FAO/SIDA; XA/MW; pg 65
This publication discusses problems and constraints facing smallholder farmers in Malawi. Farmers' basic needs for food, wood and cash are not adequately met because of poor land management systems coupled with rigid land tenure practices. Deforestation and soil erosion are two characteristic causes of low returns to investments on the farm. The author has suggested a holistic approach to land use with an addition of suitable tree species. A proposal for a development project aimed at introducing the concept of agroforestry is briefly outlined. Research objectives should aim at identifying promising species for agroforestry. The need for education at all levels in the principles of sound farming is stressed. Finally, the author has included a list of suitable tree species and their ecological requirements.
ACACIA ALBIDA; GMELINA ARBOREA; EUCALYPTUS; CASSIA SIAMEA; TOONA CILIATA; AZADIRACHTA INDICA; BAMBUSA VULGARIS; PINUS PATULA; LEUCAENA LEUCOCEPHALA; PENNISETUM PURPUREUM; SETARIA SPLENDIDA; ALNUS ACUMINATA; NITROGEN FIXING TREES; SHRUBS; ECOLOGY; FARMING SYSTEMS; ECOSYSTEMS; LAND USE; BIOLOGICAL COMPETITION; SYMBIOSIS; SPECIES LIST; EXTENSION ACTIVITIES; EDUCATION; RESEARCH; AGROFORESTRY;

00230
B02858
POUND, B.; CAIRO, M.
LEUCAENA: ITS CULTIVATION AND USES
(1983); EN
XZ; pg 1-287
This book summarizes the most important work on Leucaena to date and promotes the plant as a multipurpose crop for the tropics. The book is divided into seven principal parts: 1) description of the plant, 2) agronomy, 3) utilization as livestock feed, 4)

utilization as a forestry tree, 5) farming forestry systems, 6) minor uses, 7) conclusions and recommendations. The authors also give the limitations of the crop.
LEUCAENA LEUCOCEPHALA; DESCRIPTIONS; CLASSIFICATION; ECOLOGY; RHIZOBIUM; SEED TREATMENT; AGRONOMY; FERTILIZERS; IRRIGATION; BREEDING; IRRIGATION; YIELDS; SOIL PHYSICOCHEMICAL PROPERTIES;

00231
05002
PRADHAN, P.R.
EFFECT OF MULCH, FARM YARD MANURE AND FERTILIZER ON THE INITIAL GROWTH OF FODDER TREE
(1982); EN
XP/NP; pg 1-4
Ficus lacor was used to investigate the effect of mulch, farm yard manure and chemical fertilizers on the initial establishment and growth rate of the young fodder tree. Results indicated that the effect of these treatments was quicker growth, but only with chemical fertilizer did the plants show significantly more height than did the control.
FICUS LACOR; FODDER CROPS; MULCHES; FARMYARD MANURE; FERTILIZERS; GROWTH;

00232
00609
RADWANSKI, S.A.
<THE> NEEM TREE
WORLD CROPS; (1977); EN
XZ; pg 1-8
The neem is a fast-growing, sturdy tree well suited to arid zones. It flourishes well on poor shallow, stony or sandy soils where agricultural crops would otherwise have failed or given very low yields. A valuable timber, fuel, fodder and medicinal plant, the neem tree is an outstanding example of a plant with many commercially exploitable properties. The author has indicated the botanical and ecological characteristics of this tree, its possible uses in industry and agriculture and its remarkable contribution to soil nutrient status. Recommendations are made regarding the development of this tree in hot and dry regions of the world.
AZADIRACHTA INDICA; MELIA INDICA; ACACIA ARABICA; MEDICINAL PLANTS; FODDER CROPS; CULTIVATION; ECOSYSTEMS; FUELWOOD; WOOD; SEEDLINGS; WEEDS; SPACING; IRRIGATION; ARID ZONES; ROTATIONAL CROPPING; APICULTURE; RENEWABLE RESOURCES; NUTRIENTS; EXPERIMENTS; LEAVES;

00233
02920
RAINTREE, J.B.
CONSERVATION FARMING WITH SOIL IMPROVING LEGUMES: A FARMING SYSTEMS APPROACH TO TROPICAL AGROFORESTRY
IITA AGRIC ECON DISCUSS PAP NO 980; (1980); EN
XP/ID; pg 1-18
Agroforestry systems have potential for mitigating problems pertaining to declining productivity and stability of smallholder

farming systems, diminishing forest resources, environmental deterioration, and low adoption rates of new technology. The integration of multipurpose leguminous trees in smallholder farming systems offers substantial benefits which simultaneously address the major problems cited. The integration of multipurpose tree legumes into existing arable crop farms is dependent on space and time. Within this framework, the author identifies the following possibilities: planted fallows, alley cropping, and multistorey intercropping. The rest of the paper addresses these three featured techniques and gives a list of criteria for identifying suitable woody legumes and a short list of some of the most promising species.
LEUCAENA LEUCOCEPHALA; SESBANIA GRANDIFLORA; IMPERATA; PROSOPIS; ACACIA AURICULIFORMIS; ALBIZIA FALCATARIA; CALLIANDRA CALOTHYRSUS; CASSIA; CROTALARIA JUNCEA; GLIRICIDIA SEPIUM; ACACIA ALBIDA; AGROFORESTRY; FALLOW SYSTEMS; ALLEY CROPPING; INTERCROPPING; LEGUMES; HUMID TROPICS;

00234
B01309
RITCHIE, G.A. (ED.)
NEW AGRICULTURAL CROPS
AAAS SEL SYMP NO 38; (1979); EN
XZ; pg 1-259
Current and projected worldwide shortages of energy, fertilizer and irrigation water, coupled with a rapidly expanding population, are prompting agricultural scientists to seek, identify and develop new crop species. Such crops should be energy and water efficient, well adapted to marginal lands, suited for intensive culture, and productive of marketable food, fiber and other useful products. This book introduces a variety of new crop species that display exceptional promise in these areas. While almost all of them are in a pre-commercial stage of development, they are the focus of active research in the United States and other countries.
PSOPHOCARPUS TETRAGONOLOBUS; AMARANTHUS; CUCURBITA FOETIDISSIMA; PROSOPIS; ATRIPLEX; CASSIA; SIMMONDSIA CHINENSIS; LEUCAENA LEUCOCEPHALA; TREES; SPECIES LIST; GERMPLASM; ROOT NODULATION; TAXONOMY; CYTOLOGY; NUTRITIVE VALUE; FOOD; FUELWOOD; FODDER; MEDICINAL PLANTS; RESEARCH; CROPPING SYSTEMS; LEGUMES; ARID ZONES; WEED CONTROL; MANAGEMENT; HARVESTING;

00235
00614
RUSSELL SMITH, J. (ED.)
<A> STOCK FOOD TREE, THE KEAWE OR HAWAIIAN ALGAROBA (CH 5); THE HONEYLOCUST (CH 7) AND THE MESQUITE (CH 8); A PEEP AT THE TROPICS (CH 22)
TREE CROPS: A PERMANENT AGRICULTURE; (1953); EN
XL; pg 37-45
Three chapters of this book are devoted to a detailed discussion and analysis of three valuable tree species: Hawaiian algaroba (Prosopis chilensis), honey locust (Gleditsia triacanthos) and mesquite (Prosopis julifiora). These species have a potential role to play in agroforestry systems. They all can be utilized for animal feed, fuelwood, timber, human food, and being legumes, have a high nitrogen-fixation capacity. They have in addition other

useful industrial purposes. Chapter 22 of this book constitutes a discussion on the potential role of some tropical trees and palms in meeting a variety of food, cash and other economic needs of people in the tropics. The enormous potential and opportunities for research existing in the tropics are highlighted.
PROSOPIS GLANDULOSA; PROSOPIS VELUTINA; PROSOPIS PALMERI; PROSOPIS JULIFLORA; GLEDITSIA TRIACANTHOS; FEED CROPS; SEEDLINGS; LOWLANDS; FUELWOOD; LEGUMES; SHADING; CHARCOAL; FRUITS; PASTURES; NUTRITIVE VALUE; CULTIVATION; SPACING; ARID ZONES; CLIMATE; IRRIGATION; WOOD; SPECIES LIST; VEGETATION; RESEARCH; TROPICS;

00236
04356
SAGWAL, S.S.
SILVER OAK: A TREE OF MANY USES
INDIAN FARMING; Vol: 34, No: 3; (1984); EN
XP/IN; pg 29-32
The paper briefly describes the silver oak (Grevillea robusta), its habitat, climatic requirements, adaptability and many uses. Grevillea robusta produces excellent wood for cabinet work and the timber is used in making plywood, panelling air-freight cases, for railroad ties, for parquetry, and for tannery. The plant is also used for shade and as green manure in coffee and tea plantations. The author gives silver oak's mode of propagation, management practices, management under agroforestry and social forestry, and lastly the limitations of the tree.
GREVILLEA ROBUSTA; MULTIPURPOSE TREES; USES; DESCRIPTIONS; MANAGEMENT; AGROFORESTRY; SOCIAL FORESTRY; PESTS;

00237
B02933
SHEA, K.R. (COMP.); CARLSON, L.W. (COMP.)
INCREASING PRODUCTIVITY OF MULTIPURPOSE TREE SPECIES: A BLUEPRINT FOR ACTION
IUFRO PLANNING WORKSHOP FOR ASIA, KANDY, SRI LANKA, 16-28 JULY 1984; (1984); EN
XP; pg 1-100
The proceedings of the Kandy Workshop are addressed to problems relating to firewood, rehabilitation of watersheds, income and employment, rehabilitation of degraded lands, and agricultural settlement in tropical rain forests. They also determine the species that are most suitable for study and use in land management practices. The participants planned a programme of research, development and application for multipurpose tree species, and the blueprint for action is presented.
MULTIPURPOSE TREES; SPECIES LIST; FOREST; RESEARCH; TECHNOLOGY TRANSFER; SEMI ARID ZONES; ARID ZONES; HIGHLAND; HUMID CLIMATE;

00238
06076
TORRES, F.
POTENTIAL CONTRIBUTION OF LEUCAENA HEDGEROWS INTERCROPPED WITH MAIZE TO THE PRODUCTION OF ORGANIC NITROGEN AND FUELWOOD IN THE LOWLAND TROPICS
AGROFOR SYST; Vol: 1, No: 4; (1984); EN

XZ; pg 323-333
Available information is applied to formulate quantitative hypotheses on the impact of intercropping Leucaena hedgerows with maize upon the physical productivity of grain and fuelwood. Data would indicate that productivity of organic nitrogen (N) by Leucaena hedgerows, cut approximately every 8 weeks at a height of 15-30 cm and planted at a distance between rows wider than 150 cm, is 45 g per m per year. When soil nitrogen availability is the limiting factor, utilization of Leucaena N by the maize crop appears to be negatively related to baseline maize production. The grain : Leucaena N ratio declines from 20:1 when maize productivity is in the order of 500 kg per ha to 3:1 when the 4000 kg level is achieved. Hedgerow N productivity, N utilization by the maize crop, and proportion of land planted to maize were used to derive yield estimates per area of intercropped land under different intercropping arrangement. It seems that the impact of hedge intercropping on maize productivity, although substantial, would be limited to systems where existing production levels of maize are lower than 1500 kg per hectare. As expected, production per ha decreases as spacing between leucaena hedgerows increases. For a 1000 kg per ha baseline, hypothetical increments expressed as percentage of baseline production range from 112 to 28 for between-hedgerow spacings of 1.5 m and 6 m respectively. Information analyzed would indicate a potential for Leucaena hedgerow intercropping to increase maize productivity. Research required to substantiate the formulated hypotheses is discussed.
LEUCAENA LEUCOCEPHALA; ZEA MAYS; ALLEY CROPPING; NITROGEN; FUELWOOD; TROPICS;

00239
02170
TOUTAIN, B.
<THE> ROLE OF BROWSE PLANTS IN ANIMAL PRODUCTION IN THE SUDANIAN ZONE OF WEST AFRICA
BROWSE IN AFRICA: THE CURRENT STATE OF KNOWLEDGE (LE HOUEROU, H.N. ED.); (1980); EN
XA; pg 103-108
Livestock development in the savanna region of West Africa will depend on the availability of palatable plant species - local and exotic. This article has a list of 24 browse species, of which seven are found in the rural areas, four are present in bush but also found in rural areas, four are common to the savanna, and nine that are much browsed but scarce. Another 12 species are said to be unpalatable but have other economic or ecological benefits. The characteristic attributes of each group of species is discussed. Of particular concern are those species that provide multiple benefits, especially when intercropped with food crops. Noted here are Acacia albida and Leucaena leucocephala.
ACACIA ALBIDA; PROSOPIS CHILENSIS; LEUCAENA LEUCOCEPHALA; ALBIZIA LEBBEK; ADANSONIA DIGITATA; MANGIFERA INDICA; FICUS GNAPHALOCARPA; PERENNIALS; GRASSES; BROWSING; SAVANNAS; FODDER CROPS; ARID ZONES; NUTRITIVE VALUE; AGROPASTORAL SYSTEMS; MICROCLIMATE; SPECIES LIST; BIOMASS; NOMADISM; GRASSLAND MANAGEMENT; LIVESTOCK; FALLOW SYSTEMS;

00240
B02398
TOUTAIN, B.; BORTOLI, L.; DULIEU, D.; FORGIARINI, G.; MENAUT, J.; PIOT, J.
LIGNEOUS AND HERBACEOUS SPECIES IN THE SAHELIAN RANGELANDS ECOSYSTEMS OF UPPER VOLTA
(ESPECES LIGNEUSES ET HERBACEES DANS LES ECOSYSTEMES SAHELIENS DE HAUTE VOLTA. SYNTHESE DES RESULTATS)
ACC - GRIZA (LAT). GROUPE DE RECHERCHES INTERDISCIPLINAIRES EN ZONE ARIDE; (1983); FR
XA/HV; pg 124
Dans une premiere partie, cette etude en Sahel voltaique (region de Dori) montre la place et l'importance des especes ligneuses et herbacees dans un ecosysteme pature en appliquant des methods d'analyse structurale, de production de biomasse et de productivite. En outre, une etude particuliere de Pterocarpus lucens, ligneux fourrager tres fortement represente, et une breve analyse, de l'influence de la strate ligneuse (A. laeta, A. seyal, A. raddiana) sur la strate herbacee sont donnees. La seconde partie traite de l'evolution de la vegetation a partir de methodes de photo-interpretation et de releves effectues dans le temps sur le terrain - l'influence de mise en defens et les operations de regeneration enterprises contribuent a la comprehension de la dynamique de la vegetation sahelienne. Les conclusions accordent a cette derniere une bonne capacite de regeneration et une bonne aptitude a l'exploitation pastorale mais aussi constatent sa tres rapide degradation (appauvrissement de la floe dans toute la region) en raison du surpaturage.
PTEROCARPUS LUCENS; ACACIA LAETA; ACACIA SEYAL; ACACIA RADDIANA; BALANITES AEGYPTIACA; ARID ZONES; PASTORALISM; FEED RESOURCES; GRASSES; SHRUBS; TREES; FODDER PRODUCTION; PLANT POPULATION; ENVIRONMENTAL CONDITIONS; OVERGRAZING; PLANT PROTECTION; REMOTE SENSING;

00241
01754
VON MAYDELL, H.J.
TREE AND SHRUB SPECIES FOR AGROFORESTRY SYSTEMS IN THE SAHELIAN ZONE OF AFRICA
PLANT RES DEV; Vol: 7, (1978); EN
XA; pg 44-59
The paper discusses the problem of desertification in the Sahel region. Besides the natural phenomenon of climate and soils, human economic activities have had far-reaching effects on desert ecosystems. The author has discussed a number of practical measures that can be applied to ameliorate this hazardous situation. With special reference to Acacia species, the author has proposed experimentation on a number of other suitable species that can be used for afforestation programmes. Past afforestation programmes have left a lot of gaps, thus rendering low success. Agroforestry is seen as an afforestation scheme that involves the farmer rather than just the forester. Establishment methods, advantages and limitations of Acacia albida are discussed together with the need for further research and development. Other species with high potential that are being experimented with include Acacia senegal, A. nilotica and A. tortili. Exotic species such as Eucalyptus spp., Prosopis juliflora, Azadirachta indica, Ceratonia

siliqua, Conocarpus lancifolius, Haloxylon spp., and Pinus spp. are discussed, giving their merits and environmental requirements.
ACACIA ALBIDA; ACACIA SEYAL; ACACIA SENEGAL; ACACIA NILOTICA; EUCALYPTUS; PROSOPIS JULIFLORA; CERATONIA SILIQUA; CONOCARPUS LANCIFOLIUS; HALOXYLON; PINUS ELDARICA; AGROFORESTRY; LAND USE; DESERTIFICATION; DRY FARMING; FODDER; ENVIRONMENTAL AMELIORATION; FORESTS; VEGETATION; AGROSILVOPASTORAL SYSTEMS; EXOTIC PLANTS; SILVICULTURE; SHIFTING CULTIVATION; ARID ZONES;

00242
02011
WILSON, R.T.
FUELWOOD CONSUMPTION IN A CENTRAL MALIAN TOWN AND ITS EFFECTS ON BROWSE AVAILABILITY
BROWSE IN AFRICA: THE CURRENT STATE OF KNOWLEDGE (LE HOUEROU, H.N. ED.); (1980); EN
XA/ML; pg 473-476
Fuelwood is a reliable and cheap source of energy for most people in developing countries. In the Niono region of Mali, it has been estimated that over 6000 metric tons year of fuelwood are consumed locally. This is equivalent to 400 kg per inhabitant. The principal effects on browse of this high consumption of fuelwood is the direct one of destruction of vegetation. Animal trampling causes soil erosion and increased donkey population exerts severe competition for some preferred browse species such as Leptadenia hastata. It is argued that degradation by overgrazing and fuelwood cutting causes reduction in total cover of Plerocarpus lucens from 15 per cent to 2 per cent and in relative cover from 68 per cent to 8 per cent. The observations reported in this paper were made over a 20-year period.
ACACIA SEYAL; ACACIA SENEGAL; BALANITES AEGYPTIACA; BOSCIA SENEGALENSIS; COMMIPHORA AFRICANA; GREWIA BICOLOR; PTEROCARPUS; ZIZIPHUS MAURITIANA; ARISTIDA ; PENNISETUM ; FUELWOOD; SPECIES LIST; BROWSING; ANIMALS; GRASSES; RANGELANDS; NUTRITIVE VALUE; CARRYING CAPACITY; FODDER; FUELS; CROPS; DRY MATTER CONTENT;

00243
04026
WOLFGANG GSCHLADT
PALMYRA IN THE DALLOL MAOURI,NIGER
(LE RONIER AU DALLOL MAOURI, NIGER)
BOIS FOR TROP; Vol: 145, (1972); FR
CTFT; XA/NE; pg 3-16
L'article contient des observations botaniques et une liste des utilisations traditionnelles de la palmeraie de roniers du Dallol Maouri, dans une vallée fossile du Niger. Bien que cette palmeraie soit toujours en place, sa productivité feuilles et bois de ronier. Ce bois, très durable, est d'un usage fondamental dans la construction des cases; le nombre considérable d'usages tirés des differentes parties du ronier montre son importance, dans l'économie rurale de la région. Les grandes lignes d'un plan simple d'aménagement proposent une valorisation immediate de la situation présente en prenant en considération les données socioéconomiques (pauvreté de la population, integration, interets de celle-ci a l'aménagement de la ronier.
BORASSUS AETHIOPICUM; BOTANICAL DESCRIPTION; TRADITIONS;

MULTIPURPOSE TREES; EXTRACTION; MARKETING; MANAGEMENT; PALMAE;

00244
06111
YOUNG, A.
SITE SELECTION FOR MULTIPURPOSE TREES
ICRAF WORK PAP NO 23; (1984); EN
XZ; pg 1-30
As applied to forestry plantations, the method of land evaluation provides answers to the questions: 1) where should trees be planted? 2) what species should be chosen? 3) what methods of management are necessary to overcome site-specific environmental limitations? 4) how does forestry compare with use of the same land for other purposes? Land evaluation consists essentially of comparison between the environmental requirements of different kinds of land use (here multipurpose trees) and properties possessed by different areas of land. Requirements can be grouped into those for tree growth, management and conservation. The results of an evaluation include a mapped land suitability classification, site-specific management recommendations, and estimates of inputs, outputs, environmental impact, social consequences and economic analysis. Research is needed to widen the range of choice of multipurpose species, and to determine their growth requirements, particularly tolerance to adverse conditions. Recommendations for regional research for tropical Asia are 1) the systematic assembly of available data (in conjunction with the ICRAF world survey); 2) trials along selected environmental gradients; 3) the recording of all trial sites on a standardized environmental data base.
MULTIPURPOSE TREES; SITES; SELECTION; LAND EVALUATION; LAND CLASSIFICATION;

00245
00453
ANON
OUTPUT OF TASK FORCE NO 1 (VARIETAL INTRODUCTION, HYBRIDIZATION SELECTION AND SEED PRODUCTION TECHNOLOGY)
INT CONSULTATION ON IPIL-IPIL RESEARCH CEC, UPLB, COLLEGE, LAGUNA, PHILIPPINES, 1976; (1976); EN
XZ
Details of the origin of Leucaena are given. The major species of the genus are also listed. The breeding and improvement of this multipurpose tree is discussed. A section on seed production and management is also included.
LEUCAENA LEUCOCEPHALA; HYBRIDIZATION; BREEDING; SELECTION; SEED COLLECTION;

00246
B02722
AYLING, R.D. (ED.)
PROCEEDINGS OF A WORKSHOP TO DISCUSS THE ESTABLISHMENT OF A REGIONAL FOREST SEED CENTRE, HARARE, ZIMBABWE, 11-13 JANUARY 1984
IDRC MR111E; (1985); EN
IDRC; XA/MW/TZ/BW/ZM
The problems of seed collection, storing and handling within the

region were identified and discussed by delegates. The proposal to establish a regional forest seed centre was unanimously accepted. The long term objective to provide authenticated, certified seed was accepted by all participants, as were the immediate objectives. Items and activities requiring immediate action were developed.
SEED COLLECTION; FOREST TREES; SEED PRODUCTION;

00247
00316
BAVAPPA, K.V.A.; RAMCHANDER, P.R.
SELECTION IN ARECANUT PALM (ARECA CATECHU L.)
TROP AGRIC; (1967); EN
XP/IN; pg 25-31
The authors describe studies on the heritability of different characters and their correlation with yield. Age at first bearing was found to have high heritability and significant correlation with yield during the first four years of bearing. Selection of seedlings for number of leaves, girth at collar and number of nodes at the appropriate stages was found to eliminate totally the late-bearing plants. A selection programme initiated for arecanut is outlined and a modified mass-pedigree system for out-bred seed-propagated perennial crops is suggested.
ARECA CATECHU; SELECTION; PALMAE; PLANT PROPAGATION;

00248
03458
BENGE, M.D.
SELECTED TREE SEED SOURCES IN AUSTRALIA, INDIA, HOLLAND AND THE UNITED STATES
TECH SER NO 1 USAID WASHINGTON D.C.; (1982); EN
XN/XE/XP/US/NL
A list of tree seed sources is compiled from a number of countries. Prices prevailing at the time are quoted for a given quantity of seeds.
EUCALYPTUS; ACACIA; CASUARINA; CALLISTEMON; MICROCLIMATE; AFFORESTATION; GERMINATION; LEGUMES; SPECIES LIST; SEEDS; SEED COLLECTION;

00249
04840
BERGER, M.R.; HABS, M.; JAHN, S.A.A.; SCHMAHL, D.
TOXICOLOGY ASSESSMENT OF SEEDS FROM MORINGA OLEIFERA AND MORINGA STENOPETELA, TWO HIGHLY EFFICIENT PRIMARY COAGULANTS FOR DOMESTIC WATER TREATMENT OF TROPICAL RAW WATERS
EAST AFR MED J; Vol: 61, No: 9; (1984); EN
XN; pg 1-5
Experiments carried out to determine the toxicity of Moringa seeds are described. Moringa oleifera and Moringa stenopetala seeds (two highly efficient primary coagulants for domestic water treatment) were pounded and applied perorally to rats over a period of six weeks. No toxic effects were observed during the observation period. It is concluded that there seems to be no reason to discard the use of Moringa seeds for production of tap water from a toxicological point of view.

MORINGA OLEIFERA; MORINGA STENOPETALA; WATER; TOXICITY; COAGULANTS; WATER SUPPLY; SEEDS;

00250
03552
BOWEN, M.R.
ACACIA MANGIUM: NOTES ON SEED COLLECTION, HANDLING AND STORAGE TECHNIQUES INCLUDING SOME EXPERIMENTAL DATA AND INFORMATION ON A. AURICULIFORMIS AND THE PROBABLE HYBRID
FAO OCCAS TECH SCI NOTES, SEED SER NO 3; (1981); EN
XP/MY; pg 1-18
The aim of this paper is to provide concise information on seed-handling techniques for Acacia mangium, as little or no published information is available. The notes are based on observations and experiments. Various stages from flowering and fruiting to nursery germination are described.
ACACIA MANGIUM; ACACIA AURICULIFORMIS; SEED COLLECTION; FLOWERING; HARVESTING; SEED STORAGE; SEED TREATMENT; MULTIPURPOSE TREES; GERMINATION; NURSERY MANAGEMENT;

00251
06099
BUCK, L.E.
KENYA AGROFORESTRY TREE SEED PROJECT REPORT
ICRAF WORK PAP NO 4; (1983); EN
XA/KE
The activities and findings of ICRAF's Kenya agroforestry tree project are described. Background information on the purpose and organizational structure of the seed project as well as the functional relationships between participating institutions are presented. A brief overview is provided on the issue of NGO access to tree seed. Institutions and interested groups are identified; their roles and perceptions of the problem are given. Three sections are devoted to the issue of seed requirements, sources and storage. The rest of the sections are devoted to descriptions of propagation techniques, current projects and experiments, and seed distribution activities initiated through the project. Addresses and a brief synthesis of the project's activities and findings are included.
ACACIA ALBIDA; ACACIA HOLOSERICEA; ACACIA MELANOXYLON; ACACIA NILOTICA; ACROCARPUS INDICA; CASSIA SIAMEA; CASUARINA EQUISETIFOLIA; GREVILLEA ROBUSTA; LEUCAENA LEUCOCEPHALA; PROSOPIS CHILENSIS; ZIZIPHUS JUJUBA; AFFORESTATION; TECHNOLOGY; SEEDS; SPECIES LIST; WINDBREAKS; CONSERVATION; MANAGEMENT; SHADING; FUELWOOD; EROSION CONTROL; FOOD; FODDER; CLIMATE; ENVIRONMENTAL CONDITIONS;

00252
04055
CHANDRA, V.; FAROOQI, M.I.H.
DHAINCHA FOR SEED GUM
ECON BOT INF SERV EXT BULL NO 1; (1979); EN
XP/IN
Sesbania bispinosa, commonly known as dhaincha, is a legume that provides green manure and fodder, yields cheap fiber, paper pulp,

and is employed as fuel. Recent investigations show that the seeds are a possible source of commercial gum. This publication gives a comprehensive account of the work carried out at the Indian National Botonical Research Institute at Lucknow on agronomical and chemical studies on dhaincha.
SESBANIA BISPINOSA; GREEN MANURES; FODDER CROPS; GUMS; OIL MEALS; SALINE SODIC SOILS; CROP ROTATION; PESTS; COMPOSITION; DISEASES; MULTIPURPOSE TREES;

00253
01508
COLE, D.E.
FOREST DEVELOPMENT AND RESEARCH: BRAZIL TREE IMPROVEMENT FOR THE AMAZON, 1975-2000
UNDP/FAO - PRODEPEF RES NOTE NO 18; (1977); EN
XL/BR
The author gives a brief account of what is required as a tree improvement programme for the Amazon. The major species discussed are the tropical pines and some eucalyptus. Resources required to develop such a programme are the major problem and it is indicated that the limited resources available should be concentrated on species with characteristics that make them suited to a tree improvement programme.
PINUS; EUCALYPTUS; TREES; BREEDING; RESOURCES; AMAZONAS; PROVENANCE;

00254
03254
DELWAULE, J.C.
FOREST PLANTATION IN DRY TROPICAL AFRICA
(PLANTATIONS FORESTIERES EN AFRIQUE TROPICALE SECHE)
BOIS FOR TROP; (1979); FR
CTFT; XA; pg 3-30
This fourth installment in the same title concerns the choice of species to be planted. Before reviewing those that have been introduced, the author examines the research process by which their study, their introduction and their diffusion in case of success is tackled. He describes tests on the elimination of species, provenance tests, and conservation plantations and poses the problem of obtaining seeds for industrial plantations. Lastly the author comments on the results obtained with a list of species ranging from the acacias to Erythrophleum guineense.
ACACIA; EUCALYPTUS; ACACIA SENEGAL; ALBIZIA; ANACARDIUM OCCIDENTALE; AZADIRACHTA INDICA; BALANITES AEGYPTIACA; BAUHINIA; BORASSUS AETHIOPICUM; BUTYROSPERMUM PARADOXUM; CASSIA; DALBERGIA; SPECIES LIST; SPECIES SELECTION; ARID ZONES; FOREST PLANTATIONS; PROVENANCE TRIALS; MULTIPURPOSE TREES; GUM ARABIC;

00255
03315
DORAN, J.C.; TURNBULL, J.W.; BOLAND, D.J.; GUNN, B.V.
<A> HANDBOOK ON SEEDS OF DRY-ZONE ACACIAS
(1983); EN
FAO; XZ
The handbook begins with a brief account of the acacias, the state

of acacia taxonomy, the origin and occurrence of the genus, and some aspects of ecology. This information is intended to provide an understanding of the general background of acacias, which will assist those concerned with more practical operations. The rest of the book describes the reproductive biology, seed collections, seed extraction and cleaning, storage, treatments to promote germination, and lastly a chapter of references. This handbook will serve as a guide to operational personnel involved in the collection and handling of dry-zone acacias with particular reference to Acacia albida, A. aneura, A. caven, A. nilotica, A. senegal and A. tortilis.
ACACIA; TAXONOMY; HABITATS; ECOLOGY; SEED COLLECTION; SEED STORAGE; SEED TREATMENT;

00256
B02663
FAULKNER, R. (ED.)
SEED ORCHARDS
FOR COMM BULL NO 54; (1975); EN
XZ; pg 1-149
This book was written as a result of the realization by IUFRO of the urgent need to raise the production of wood in future afforestation schemes. This need can only be achieved through the correct choice of species, seed source and silvicultural treatment. The book is divided into fourteen chapters, each one of which can be regarded as an essay. The chapters discuss seed orchards in terms of planning, designing, breeding, propagation, protection, flowering and seed production, and seed certification, and they contain notes on various species of the tropics other than eucalyptus and teak. This book will provide a useful source of reference for practicing orchardists; it is also a general textbook for university forestry courses that include tree breeding as a subject in their curriculum.
SEEDS; SEED COLLECTION; BREEDING; ORCHARDS; PLANT PROPAGATION; PLANT PROTECTION; FLOWERING; SPECIES LIST;

00257
01793
FELKER, P.; BANDURSKI, R.S.
PROTEIN AND AMINO ACID COMPOSITION OF TREE LEGUME SEEDS
J SCI FOOD AGRIC; (1977); EN
XZ; pg 791-797
Pods and seeds of tree legumes are widely used as food in the tropics since the tree legumes can be grown with minimal inputs of capital and energy. The data presented in this paper show that the protein content of the seed of different legumes ranges from 16-69 per cent of the dry weight, and methionine, cystine and tryptophan content ranges are 44-121 mg N, 14-156 mg N and 40-109 mg N respectively. The chemical source of the protein from Pithecellobium lobafum was 0.79, which compared to 0.58 and 0.47 for casein and soy protein respectively. This variability in protein content and in amino acid composition indicates that there is sufficient genetic variability in the family to permit improvement by selection and breeding. Experiments on chemical analysis are described.
TREES; LEGUMES; AMINO ACIDS; PROTEINS; SPECIES LIST; CHEMICAL

ANALYSIS; COMPOSITION;

00258
04379
FLAG
SCREENING OF BROWSE ACCESSIONS AT SEMI ARID AND SUB HUMID MEDIUM ALTITUDE SITES IN ETHIOPIA
(1984); EN
XA/ET
Browse germplasm is of particular potential for African small farming systems, not only as fodder but also as fuel, for erosion control and for maintaining soil fertility. Research on the forage potential of palatable trees and shrubs has been carried out in Africa and elsewhere, but very little systematic long term work has been attempted. The aim of this screen exercise was thus to assess as simply as possible a wide range of species and lines that are reported to have forage potential, to describe them agronomically, and to produce seed for other scientists on request. A list of various species screened at the International Livestock Centre for Africa (ILCA) is included.
FODDER CROPS; SEMI ARID ZONES; HUMID CLIMATE; GERMPLASM; SPECIES LIST;

00259
03553
GIBSON, I.A.S.
SEED SOURCE ESTABLISHMENT AND TREE IMPROVEMENT - SABAH (MALAYSIA)
FAO/UNDP - MAL78009 REP ON VISIT OF CONSULTANT; (1981); EN
XP/MY; pg 1-26
Recognizing the importance of microbial root symbionts in the successful establishment of exotic tree species and the potential threat posed to these crops by pests of all kinds, the author appraises these factors in relation to the more important trees of Sabah plantations: Acacia mangium, Albizia falcataria, Eucalyptus deglupta, Gmelina arborea, Araucaria cunninghamii, A. hunseeinii, Pinus caribaea and P. oocarpa. It is recommended that a forest pathologist be provided to advise on these problems and organize research. Several diseases are noted and priority is recommended for heart rot research.
ACACIA MANGIUM; GMELINA ARBOREA; EUCALYPTUS DEGLUPTA; ALBIZIA FALCATARIA; PROVENANCE; RHIZOBIUM; ROOT NODULATION; SYMBIOSIS; DISEASES; FOREST PLANTATIONS; MYCORRHIZAE; HUMID TROPICS;

00260
01657
GILLET, J.B.
SESBANIA IN AFRICA (EXCLUDING MADAGASCAR) AND SOUTHERN ARABIA
KEW BULL; Vol: 17, No: 1; (1963); EN
XA: pg 91-159
The paper describes the Sesbania species found in Africa under the following headings: nomenclature, genetic characters, genetic limitations, ecology, seed viability, germination, chromosome numbers, interspecific hybridization, economics, difficulties, techniques, geographical distribution, species list. The multipurpose nature of the species is also discussed.

SESBANIA; NOMENCLATURE; GENETICS; GERMINATION; ECONOMICS; NATURAL DISTRIBUTION;

00261
04323
GOLD, M.A.
GENETICS OF HONEYLOCUST
GENETICS OF HONEYLOCUST (GOLD, M.A. ED.); (1981); EN
XN/US; pg 4-45
This first chapter of a book by the same title gives details of genetic variation in the various species of Gleditsia as well as a background history of the genus. Its importance as an agroforestry tree is highlighted. Breeding and reproduction of this multipurpose tree are discussed, and it is concluded that breeding honeylocust is feasible and that the tree will be used in improvement programmes to upgrade and combine traits for superior selections.
GLEDITSIA; GENETICS; BREEDING; MULTIPURPOSE TREES; AGROFORESTRY;

00262
B02411
GUNN, C.R.
FRUITS AND SEEDS OF A GENERA IN THE SUBFAMILY MIMOSOIDEAE (FABACEAE)
USDA - ARS TECH BULL NO 1681; (1984); EN
XZ; pg 194
Technical identification of fruits and seeds of the economically important legume family Fabaceae or (Leguminoseae) is often required of agricultural scientists. This bulletin provides relevant information on the mimosoid legumes. Data are derived from extensive sampling of the species of all 64 genera of mimosoid legumes. Three keys provide for 1) the differentiation of mimosoid seed from other legume seeds, 2) the identification of mimosoid genera based on fruit and seed characters, and 3) the identification of mimosoid genera based on seeds alone. An updated explanation and discussion of fruit and seed characters precedes the genetic descriptions. The information on fruit characters extends and corrects that presently in the literature. Nearly all descriptive data on seeds are new.
FRUITS; SEEDS; LEGUMES; MORPHOLOGY; LEGUMES;

00263
04698
HALLIDAY, J.; BILLINGS, D.
LEUCAENA SEED PRODUCTION SYSTEMS FOR THIRD WORLD COUNTRIES
; EN
XZ; pg 1-7
The paper describes the procedures to be followed when establishing a seed orchard for the production of seeds and biomass from Leucaena. The stages from field preparation, seed inoculation, and maintenance to harvesting are described. The collection of leguminous-tree root nodules for inoculum is also discussed.
LEUCAENA LEUCOCEPHALA; SEED PRODUCTION; DEVELOPING COUNTRIES; SEED TREES; INOCULATION; ROOT NODULATION; PLANTING; HARVESTING;

00264
05108
SHARMA, K.K.; NAITHANI, K.C.; SANGAL, P.M.
EFFECT OF HIGH TEMPERATURES ON SEEDS: RESULTS OF A STUDY WITH LEUCAENA LEUCOCEPHALA
INDIAN FOR; Vol: 111, No: 4; (1985); EN
XP/IN; pg 182-194
This paper discusses the results of a pilot laboratory trial on seeds of Leucaena leucocephala in india, to find out the effect of high temperatures on the seeds. Results obtained indicated that dry-heat treatment of 75-80 degrees celsius for 5 minutes increased the germination, whereas temperature range of 125-130 degrees celsius for 5 minutes proved lethal for these seeds.
LEUCAENA LEUCOCEPHALA; TEMPERATURE; SEED TREATMENT; GERMINATION;

00265
04972
YAP, S.K.; WONG, S.M.
SEED BIOLOGY OF ACACIA MANGIUM, ALBIZIA FALCATARIA, EUCALYPTUS SPP., GMELINA ARBOREA, MAESOPSIS EMINII, PINUS CARIBAEA AND TECTONA GRANDIS
MALAY FOR; Vol: 46, No: 1; (1983); EN
XP/MY; pg 26-45
Methods of collecting seeds of Acacia mangium, Albizia falcataria, Eucalyptus spp., Gmelina arborea, Maesopsis eminii, Pinus caribaea and Tectona grandis are discussed. The strategy is to use seeds from locally established trees supplemented by seed importation until enough trees become seed producers to ensure self-sufficiency. Trees of good quality are selected in the existing plots and the less desirable ones are culled. Field characteristics, methods of germination and pretreatment, seed viability, and storage characteristics are reported for each species.
ACACIA MANGIUM; ALBIZIA FALCATARIA; EUCALYPTUS; GMELINA ARBOREA; MAESOPSIS EMINII; PINUS CARIBAEA; TECTONA GRANDIS; SEED COLLECTION; SEED LONGEVITY; GERMINATION; SEED TREATMENT; SEED STORAGE; FOREST PLANTATIONS;

00266
05010
AGAMUTHU, P.; BROUGHTON, W.J.
NUTRIENT CYCLING WITHIN THE DEVELOPING OIL PALM - LEGUME ECOSYSTEM
AGRIC ECOSYST & ENVIRON; Vol: 13, (1985); EN
XP/MY; pg 111-123
Oil palms (Elaeis guineensis) are normally planted in fields stripped of all other vegetation and leguminous cover crops are planted simultaneously to prevent erosion and provide other less tangible benefits. Nutrient cycling, especially of nitrogen, followed in a commercial oil palm plantation showed that 1) legumes contribute nitrogen to the system through nitrogen fixation; 2) during the early stages of oil palm growth the legumes absorb some nitrogen from the soil; 3) litterfall from legumes contribute a tremendous amount of nitrogen; 4) leguminous covers reduce leaching losses of nitrogen. Thus, when the rooting

system of the oil palms has grown under the interrows, competition for nutrients causes a gradual decline in the cover crop. Nutrients deposited in the legumes are then slowly re-released, stimulating root growth and general development of the oil palm.
ELAEIS GUINEENSIS; OIL CROPS; LEGUMES; COVER PLANTS; CYCLING; NITROGEN FIXATION; HUMID TROPICS;

00267
05107
SINGH, R.P.; SHARMA, K.C.; MATHUR, H.N.; GUPTA, M.K.; GUPTA, A.K.
INTERCEPTION STUDIES IN CEDRUS DEODORA LOUDON PLANTATION IN HIMACHAL PRADESH
INDIAN FOR; Vol: 109, No: 5; (1983); EN
XP/IN; pg 261-266
The present investigations deal with the throughfall, stemflow and interception loss in a Cedrus deodora plantation (94.5 per cent crown density) of about 35 years age at Shillaroo, Kotgarh Forest Division (Himachal Pradesh). Of the total rainfall (1850.1 mm), 2.9 per cent (55.3 mm) stemflow, 71.8 per cent (1328.5 mm) throughfall and 25.2 per cent (466.2 mm) interception loss were recorded for the whole study period. The minimum interception loss (18.7 per cent) was observed in the month of July 1980, which had the maximum (370.2 mm) rainfall. The highest interception (69.1 per cent) was recorded in the month of February 1980, which had the lowest (7.0 mm) rainfall. Interception loss decreased with the increasing amount of precipitation.
CEDRUS DEODARA; FOREST PLANTATIONS; CANOPIES; RAIN;

00268
05024
ZECH, W.
INVESTIGATIONS ON THE OCCURRENCE OF POTASSIUM AND ZINC DEFICIENCIES IN PLANTATIONS OF GMELINA ARBOREA, AZADIRACHTA INDI AND ANACARDIUM OCCIDENTALE IN SEMI ARID AREAS OF WEST AFRICA
POTASH REV 22.31; (1984); EN
XA; pg 1-5
This paper describes the occurrence of potassium and zinc deficiencies in Gmelina arborea, Azadirachta indica (neem) and Anacardium occidentale (cashew) in West Africa. K deficiency symptoms occur on the sandy soils derived from the so-called continental terminal, evidenced by reduced growth and chlorosis of leaf tips and leaf margins, particularly on the older leaves. The cause of the deficiency is low K supply from the soil. Visual symptoms of Zn deficiency were also recorded in all three species. The symptoms occurred particularly on areas where the cover had been burned in the past (so-called ash beds) and the case is reduction in Zn availability by increase in the pH and increased Ca ion activity. This holds particularly for soils which are naturally low in Zn.
ANACARDIUM OCCIDENTALE; AZADIRACHTA INDICA; GMELINA ARBOREA; WEST AFRICA; FAST GROWING TREES; NUTRIENT DEFICIENCIES; SEMI ARID ZONES; ZINC; POTASSIUM; FOREST PLANTATIONS;

00269
B00827
AKKERMANS, A.D.L.; VAN DIJK, C.
NON-LEGUMINOUS ROOT NODULE SYMBIOSIS WITH ACTINOMYCETES AND RHIZOBIUM
NITROGEN FIXATION: VOL 1 ECOLOGY (BROUGHTON, W.J. ED.); (1981); EN
XZ; pg 57-103
The article contains an extensive review of literature on non-leguminous nodulating trees and shrubs. Special attention is paid to the occurrence of Alnus-type and Parasponia-type nodules, their ecological importance and the extra nodular behaviour of Frankia. A list of all trees and shrubs examined and surveyed for nodulation is provided and an extensive bibliography included.
ALNUS; CASUARINA; DATISCA; PINUS; PURSHIA; PROSOPIS GLANDULOSA; CEANOTHUS; HIPPOPHAE ; ROOT NODULATION; LEGUMES; TREES; SHRUBS; SPECIES LIST; NUTRIENT CONTENT; PHENOLOGY; ECOSYSTEMS; NITROGEN FIXATION;

00270
02108
BEALE, I.F.
TREE DENSITY EFFECT ON YIELDS OF HERBAGE AND TREE COMPONENTS IN SOUTH WEST QUEENSLAND MULGA (ACACIA ANEURA F. MUELL) SCRUB
TROP GRASSL; Vol: 7, No: 1; (1973)
AU/XP; pg 135-142
This paper summarizes results of studies in South West Queensland aimed at evaluating the effect of different mulga tree densities on productivity of the plant communities. At the two sites under investigation it was shown that reduction in tree density increased herbage yield but decreased tree foliage and litter yields and total tree basal area. Some community management factors are discussed.
ACACIA ANEURA; FOREST LITTER; WOODLANDS; ECOSYSTEMS; CANOPIES; BIOMASS; THINNING; HARVESTING; ANIMALS; LEAVES; OVERGRAZING; RESEARCH; PLANT COMMUNITIES; SPECIES LIST; TROPICS;

00271
04870
BEER, J.W.
NITROGEN FIXATION AND LITTER PRODUCTION IN AGROFORESTRY COMBINATIONS OF COFFEE AND CACAO
CATIE DEPT RENEWABLE NATURAL RESOURCES; (1985); EN
XL/CR; pg 1-12
In Central America, Erythrina poeppigiana and Cordia alliodora are the best known shade tree species. Whereas C. alliodora produces high-value timber, E. poeppigiana can fix 40-60 kg N/ha/yr. Litterfall from these trees in cacao or coffee plantations is important in the recycling of P, K, Ca and Mg. Shade tree prunings also provide more rapid nutrient cycling and increase total annual litter inputs, which reduce leaching losses and permit more efficient use of inorganic fertilizers applied in coffee plantations. C. alliodora litter, however, decomposes more slowly and further studies are needed on nutrient release from litter. A combination of both E. poeppigiana and C. alliodora may thus provide high organic material inputs as well as some timber

production.
COFFEA; THEOBROMA CACAO; CORDIA ALLIODORA; ERYTHRINA POEPPIGIANA; INGA JINICUIL; NITROGEN FIXATION; TREE CROPS; SHADE TREES; AGROFORESTRY; NUTRIENTS; CYCLING; FOREST LITTER; FERTILIZERS; PRUNING;

00272
03706
CORNET, F.; DIEM, H.G.
A COMPARATIVE STUDY OF STOCKS OF ACACIA RHIZOBIUM ISOLATED FROM SENEGALESE SOILS AND THE EFFECT OF THE DOUBLE SYMBIOSIS RHIZOBIUM-GLOMUS MOSSEAE ON THE GROWTH OF ACACIA HOLOSERICEA AND ACACIA RADDIANA
(ETUDE COMPARATIVE DE L'EFFICACITE DES SOUCHES DE RHIZOBIUM D'ACACIA ISOLEES DE SOLS DU SENEGAL ET EFFET DE LA DOUBLE SYMBIOSE RHIZOBIUM-GLOMUS MOSSEAE SUR CROISSANCE DE ACACIA HOLOSERICEA ET RADDIANA)
BOIS FOR TROP; Vol: 198, No: 4; (1982); FR
CTFT; XA/SN; pg 3-15
After a brief review of the economic interest of acacia and the effect of Rhizobium and endomycorrhizae on the growth of legume trees growing under semi arid tropical conditions, the authors have studied the effectiveness of strains of Rhizobium, mainly isolated from Senegalese soils, by comparing their effect on the growth and nitrogen content of Acacia holosericea and A. raddiana. On a sterile and phosphorus-deficient soil, inoculation of these species of acacia with an endomycorrhizal fungus (Glomus mosseae) greatly stimulated their growth and nodulation, but the response of A. holosericea to inoculation was more distinct and rapid than that of Acacia raddiana. The beneficial effect of Glomus mosseae was also expressed by the increased weight of the roots of mycorrhizal plants and by their higher percentage of opened stomata when there was low hygrometry.
ACACIA HOLOSERICEA; ACACIA RADDIANA; RHIZOBIUM; LEGUMES; TREES; INOCULATION; SEMI ARID ZONES; TROPICS;

00273
04992
DENARIE, J.; TRUCHET, G.
THE RHIZOBIUM LEGUME SYMBIOSIS: RESPECTIVE PARTNER ROLES
(LA SYMBIOSE RHIZOBIUM LEGUMINEUSES: ROLES RESPECTIFS DES PARTENAIRES)
PHYSIOL VEG; Vol: 17, No: 4; (1979); FR
XZ; pg 643-667
The rhizobium-legume symbiosis is reviewed in the light of recent advancements. The specific binding of bacteria onto the roots appears to involve a glycoprotein (lectin) of the host. The organogenesis of nodules is then induced by a triggering signal produced in the infection threads, i.e. outside the host cytoplasm. In contrast, the immediate presence of bacteria within the membrane envelope in the host cytoplasm seems to be necessary for the induction of differentiation of the central tissue of the nodules. In some rhizobium strains nitrogenase synthesis can be induced in the absence of the host. Such an induction is accompanied by the appearance of biochemical characteristics typical of bacteroids.

RHIZOBIUM; LEGUMES; BIOLOGICAL NITROGEN FIXATION; SYMBIOSIS; ROOT NODULATION;

00274
02004
FELKER, P.; CLARK, P.R.; OSBORN, J.F.; CANNELL, G.H.
NITROGEN CYCLING - WATER USE EFFICIENCY INTERACTIONS IN SEMI ARID ECOSYSTEMS IN RELATION TO MANAGEMENT OF TREE LEGUMES (PROSOPIS)
BROWSE IN AFRICA: THE CURRENT STATE OF KNOWLEDGE (LE HOUEROU, H.N. ED.); (1980); EN
XN/US; pg 215-222
Nitrogen inputs provided by rainfall, blue-green algae - lichen crusts, non-symbiotic nitrogen fixers, and tree legumes in semi arid ecosystems are reviewed along with the ranges of water-use efficiency typical of grasses and legumes. Given these nitrogen and water-use inputs, the plant productivity (forage potential) is estimated for various rainfall regimes with and without exogenous nitrogen sources. It is concluded that all non-legume sources combined contribute no more than 4 kg N/ha/yr. Leguminous trees have been shown to fix 200-550 kg/ha/yr and a nitrogen fixation rate of 100 kg/ha/yr is postulated for annual rainfall of 500 mm. Water-use efficiencies by legumes and non-legumes have been reviewed where ranges of 220-400 kg water per kg dry mater and 570-930 kg water per kg dry matter have been found for C-4 plants and legumes respectively. By taking these water-use efficiencies, nitrogen inputs and low fertility of semi arid soils into consideration, a sustained dry matter removal greater than 300 kg N/ha/yr is predicted without legumes because of nitrogen limitations. Sustained dry matter removals in the range 2000-6000 kg N/ha/yr are possible with nitrogen fixing legumes. Assuming a harvest index of 60 per cent, a pod yield of 4000 kg N/ha is predicted for Prosopis.
PROSOPIS TAMARUGO; LEUCAENA LEUCOCEPHALA; ACACIA MEARNSII; PROSOPIS VELUTINA; PROSOPIS CHILENSIS; PROSOPIS ALBA; NITROGEN FIXATION; YIELDS; PHOTOSYNTHESIS; MANAGEMENT; WATER REQUIREMENTS; ARID ZONES; SEMI ARID ZONES;

00275
01867
FELKER, P.
SCREENING PROSOPIS (MESQUITE) GERMPLASM FOR BIOMASS PRODUCTION AND NITROGEN FIXATION
INT CONGR FOR STUDY OF SEMI ARID AND ARID ZONES, LA SERENA, CHILE; (1980); EN
XN/XA/XL; pg 1-21
This paper describes an experiment with Prosopsis species in semi arid and arid lands A germplasm collection of over 500 accessions is established, among which 70 accessions representing 14 taxa are being experimented with under field conditions and 13 Prosopis taxa under greenhouse experiment. South American P. chilensis and P. alba species were established to have as much as 30 times biomass production capacity as species native to the ranges of North America. The most productive accession averaged 2.5 m growth in height and 5.0 cm growth in diameter. Fifty-five tree legumes screened gave productivity ranges of 0.2 to 9.7 kg/tree. Leucaena leucocephala had the highest average biomass per accession. Five

Prosopis accessions revealed individual tree biomass production greater than the largest Leucaena. Tolerance levels to freeze was -5 degrees Celsius for North American native species, but P. chilensis and P. alba are easily damaged by such a freeze. Likewise Hawaiian and West African varieties did not tolerate freeze conditions at -5 degrees Celsius. Mature, fast-growing trees of South American origin withstood -8.9 degrees Celsius without apparent damage. The fast-growing nitrogen fixation as demonstrated in numerous Prosopis species merits them as useful soil fertility-improving species for arid and semi arid zones.
PROSOPIS NIGRA; PROSOPIS ARTICULATA; PROSOPIS CHILENSIS; PROSOPIS VELUTINA; LEUCAENA LEUCOCEPHALA; PARKINSONIA; BIOLOGICAL PRODUCTION; MULTIPURPOSE TREES; SHRUBS; BIOLOGICAL COMPETITION; SPECIES LIST; IRRIGATION; GERMPLASM; FUELWOOD; FOOD; SEMI ARID ZONES;

00276
B00885
GIBSON, A.H.; NEWTON, W.E.
CURRENT PERSPECTIVES IN NITROGEN FIXATION
PROC 4TH INT SYMP ON NITROGEN FIXATION, 1-5 DECEMBER 1980; (1981) ; EN
XZ; pg 1-544
They include papers, discussion reports and poster papers dealing with current perspectives in nitrogen fixation with special reference to 1) the chemistry of nitrogen fixation, 2) mechanism of nitrogenase action, 3) Photosynthesis and nitrogen fixation, 4) host determinants in symbiotic nitrogen fixation, 5) microbiology and physiological ecology of diazotrophs, and 6) free-living and associative nitrogen fixation.
NITROGEN FIXATION; RESEARCH; PLANT PHYSIOLOGY; SYMBIOSIS;

00277
B00827
HENZELL, E.F.
FORAGE LEGUMES
NITROGEN FIXATION: VOL 1 ECOLOGY (BROUGHTON, W.J. ED.); (1981); EN
XZ; pg 264-289
The paper reviews the main ecological factors that influence the growth and nitrogen fixation of pasture and fodder legumes. The methods available for measuring nitrogen fixation in the field, such as the acetylene reduction method, are examined. The paper also carries a review of the published estimates of the amount fixed.
INDIGOFERA SPICATA; ACACIA; VICIA HIRSUTA; MEDICAGO SATIVA; PANICUM MAXIMUM; STYLOSANTHES GUIANENSIS; GLYCINE WIGHTII; TRIFOLIUM REPENS; DESMODIUM INTORTUM; NITROGEN FIXATION; LEGUMES; PASTURES; FODDER; MONOCULTURE; GRASSES; ROOT NODULATION; WEEDS; ECOLOGY; RHIZOBIUM; SYMBIOSIS; GRAZING; WOODY PLANTS; IRRIGATION; MANAGEMENT;

00278
B00827
LIE, T.A.

ENVIRONMENTAL PHYSIOLOGY OF THE LEGUME-RHIZOBIUM SYMBIOSIS
NITROGEN FIXATION: VOL 1 ECOLOGY (BROUGHTON, W.J. ED.); (1981); EN
XZ; pg 104-134
The paper examines some of the limiting factors to symbiotic associations imposed by environmental stresses, the most important of which are soil moisture, temperature and light. To alleviate some of these stresses, the author has proposed better management procedures such as irrigation and drainage, liming and application of fertilizers. However, some climatic factors cannot be easily modified and therefore the selection of symbiotic systems adapted to the prevailing conditions is the only feasible solution. The use of genetic variability to overcome some environmental stresses is demonstrated.
VICIA FABA; ARACHIS HYPOGAEA; ALNUS GLUTINOSA; HIPPOPHAE RHAMNOIDES; CASUARINA CUNNINGHAMIANA; SOIL WATER CONTENT; IRRIGATION; PHOTOSYNTHESIS; RHIZOBIUM; ROOT NODULATION; PLANT PHYSIOLOGY; SYMBIOSIS; LEGUMES; SEEDLINGS;

00279
B00885
MINCHIN, F.R.
PHYSIOLOGICAL FACTORS AFFECTING FIELD NODULATION AND NITROGEN FIXATION
CURRENT PERSPECTIVES IN NITROGEN FIXATION (GIBSON, A.H., & NEWTON, W.E. EDS.); (1981); EN
XZ; pg 260-264
The paper discusses some of the physical and biological environmental aspects influencing nitrogen fixation under diverse field conditions. The individual environmental component does not exert its influence in isolation, rather it works in an interplay with many other components to influence an activity. Understanding the single component renders greater understanding of the whole. In this discussion the following aspects have been singled out: waterlogging and water stress, temperature and light, pH, and mineral nutrition.
LEUCAENA; VIGNA; MIMOSA; SESBANIA; SYMBIOSIS; ROOT NODULATION; RHIZOBIUM; PHOTOSYNTHESIS; FLOODING; CROPPING PATTERNS; IRRIGATION; RHIZOSPHERE; NITROGEN FIXATION; PLANT PHYSIOLOGY;

00280
05234
NESME, X.; NORMAND, P.; TREMBLAY, F.M.; LALONDE, M.
NODULATION SPEED OF FRANKIA SPP. ON ALNUS GLUTINOSA, ALNUS CRISPA AND MYRICA GALE
CAN J BOT; Vol: 63, No: 7; (1985); EN
XN/CA; pg 1292-1295
The question of compatibility between actinorhizal host plants and Frankia spp. was addressed using nodulation speed on Alnus spp. seedlings and Myrica gale seedlings. It was found that the speed of nodulation, defined as the mean time taken for the formation of the first pre-nodule, was a stable phenotype of both the Frankia strains and the host plants and that a distinction between slow, medium and fast-nodulating Frankia strains did not appear to be positively correlated with the Frankia strain or with the host plant species used for inoculation. Some optimal host plant

endophyte combinations were thus defined. Pure spore inocula of Frankia and in vitro propagated Alnus glutinosa plantlets were used to confirm that both the host plant and the microbial partners genetically influenced the nodulation process.
FRANKIA; ALNUS GLUTINOSA; ALNUS CRISPA; MYRICA GALE; ROOT NODULATION; HOSTS; EXPERIMENTS;

00281
B00885
QUISPEL, A.; BURGGRAFF, A.J.P.
FRANKIA, THE DIAZOTROPHIC ENDOPHYTE FROM ACTINORHIZA'S
CURRENT PERSPECTIVES IN NITROGEN FIXATION (GIBSON, A.H., & NEWTON, W.E., EDS); (1980); EN
XZ; pg 229-236
In this paper different methods used for isolation and cultivation of the root nodules formed by Frankia species are discussed. A description is given of the cultivated strains as compared with their morphology inside the nodules and the differences between the growth requirement of some typical strains. Special attention is given to the remarkable role of certain lipids in the nutrient exchange between host and endophyte.
FRANKIA; ALNUS GLUTINOSA; ALNUS RUBRA; SHEPHERDIA ARGENTEA; CEONOTHUS AMERICANA; COMPTONIA PEREGRINA; ELAEAGNUS UMBELLATA; LEGUMES; ROOT NODULATION; NITROGEN FIXATION; CULTIVATION; CULTURES; PHYSIOLOGY; RESEARCH; SYMBIOSIS;

00282
03783
ROSKOSKI, J.P.
NITROGEN FIXATION IN A MEXICAN COFFEE PLANTATION
PLANT SOIL; Vol: 67, (1982); EN
XL/MX; pg 283-291
Fertilizer studies in Mexico indicate that coffee production can be stimulated by adding nitrogen. One traditional method of coffee cultivation employs leguminous trees for shade, but these species may also play an important role in coffee production by biologically fixing nitrogen. The presence and importance of nitrogen fixation was evaluated in four systems: coffee only, coffee plus the leguminous shade tree Inga jinicuil Scheletchter, coffee plus the leguminous tree Inga vera H.B. and K., and coffee plus banana and orange trees. In all systems coffee leaves with epiphylls, wood litter, soil, roots, and root nodules were assayed for nitrogen-fixing activity with the acetylene reduction technique. All components of these systems except roots exhibited activity. Total apparent fixation was highest in the Inga jinicuil site and equivalent to >40 kg/ha/yr assuming a 3:1 C_2H_2:N_2 ratio. The activity was primarily associated with Inga jinicuil nodules. Apparent fixation in the other three sites was less than 1 kg ha/yr. Nitrogen fixed in the I. jinicuil nodules site was 53 per cent of the average amount of fertilizer nitrogen applied annually, suggesting that fixation by non-crop legumes can be an important nitrogen source for coffee agro-ecosystems.
MUSA; COFFEA; INGA JINICUIL; INGA VERA; CITRUS; CYCLING; NITROGEN FIXATION; PLANTATIONS; CROPS; SHADE TREES; METHODS; ROOT NODULATION; PHOSPHORUS; PHENOLOGY; HUMID TROPICS; SEMI ARID ZONES;

00283
05259
ROSKOSKI, J.P.; VAN KESSEL, C.
ANNUAL, SEASONAL AND DIEL VARIATION IN NITROGEN FIXING ACTIVITY BY INGA JINICUIL, A TROPICAL LEGUMINOUS TREE
OIKOS; Vol: 44, (1985); EN
XL/MX; pg 306-312
Woody legumes can provide high-protein forage, fodder, nitrogen-rich green manure, fuel, timber and other wood products, hence the recently increased interest in tree legumes. Little information exists on temporal variations in nitrogen-fixing activity. This paper quantifies annual nitrogen inputs to the coffee ecosystem from nitrogen fixation by a leguminous shade tree (Inga jinicuil Schl). Some quantification of annual fixation required data on temporal variations in both nodular biomass and activity. Studies that assessed annual, seasonal, and diel variation in nitrogen-fixing activity by I. jinicuil were carried out. The authors present the results of those studies.
INGA JINICUIL; COFFEA; NITROGEN FIXATION; LEGUMES; TREES; TROPICS; SHADE PLANTS; ACETYLENE REDUCTION; HUMID TROPICS;

00284
B02771
SSALI, H. (ED.); KEYA, S.O. (ED.)
BIOLOGICAL NITROGEN FIXATION IN AFRICA: PROCEEDINGS OF THE FIRST CONFERENCE OF THE AFRICAN ASSOCIATION FOR BIOLOGICAL NITROGEN FIXATION (AABNF) HELD IN NAIROBI, KENYA, 23-27 JULY 1984
(1985); EN
XA; pg 1-540
The proceedings of the First Conference of the African Association for Biological Nitrogen Fixation (BNF) focuses on the efficient exploitation of BNF in the farming systems in Africa. The important topics discussed include 1) culture collection and preservation; 2) inoculant production; 3) factors affecting BNF; 4) BNF in grain legumes; 5) BNF in pasture and in trees; 6) non-symbiotic BNF systems; 7) field applications of BNF technology, and 8) a discussion on the coordination and dissemination of BNF technology. There is heavy emphasis on the legume-rhizobium symbiosis and emphasis for more research on the effects of mineral nutrition, cultural practices and traditional farming practices.
NITROGEN FIXATION; INOCULATION; BIOLOGICAL NITROGEN FIXATION; CULTURES; GRAIN LEGUMES; PASTURES; TREES; RHIZOBIUM;

00285
04898
ZHOU XIANGQUAN
RECENT ADVANCES IN SYMBIOTIC NITROGEN FIXATION OF LEGUMES
J NANJING TECH COLL FOR PROD; Vol: 4, (1983); CH
XZ; pg 88-99
The present study discusses some aspects of legume nitrogen fixation, tree legumes in particular. The Caesalpiniaceae are largely non-nodulated while the Papilionaceae and Mimosaceae are mostly nodulated. Major emphasis is laid on Rhizobium genetics research in the past two decades, in which there was a rapid

expansion of interest and publication. Many of the current concepts are discussed in the article. There are also several reviews concerning more detailed information on nitrogen fixation of Rhizobium in a free-living state.
TREES; LEGUMES; RHIZOBIUM; NITROGEN FIXATION; SYMBIOSIS;

00286
04899
ZHOU XIANGQUAN; HAN SHUFENG
STUDIES ON SYMBIOTIC SYSTEM OF NODULE BACTERIA AND TREE LEGUME: 1. NODULATION, ISOLATION AND RECIPROCAL CROSS INOCULATION
J NANJING TECH COLL FOR PROD; Vol: 2, (1984); CH
XP/CN; pg 32-44
Twenty-one species of tree legumes that belong to the genera Cassia, Cercis, Delonix, Gymnocladus, Gleditsia, Albizia, Samanea, Calliandra, Pithecellobium, Acacia, Adenanthera, Robinia, Amorpha, Wisteria, Sophra, and Dalbergia have been examined for nodulation. Twelve were found to be nodulated, whereas the sub-family Caesalpinioideae nodulated in neither field nor pot culture conditions.
TREES; LEGUMES; RHIZOBIUM; ROOT NODULATION; INOCULATION; SPECIES LIST;

00287
04910
ARKCOLL, D.B.
<A> COMPARISON OF SOME FAST GROWING SPECIES SUITABLE FOR WOODLOTS IN THE WET TROPICS
PESQUI AGROPECU BRAS; (1984); EN
XA/NG/XL/BR; pg 61-68
An interest in ways of reducing the area of and cycle time for shifting cultivation has led to a brief look at some fast-growing forestry species for fuel. Eucalyptus deglupta, Cedrelinga catnaeformis and Jacaranda copaia were compared on a poor ultisol with Inga edulis used locally as a quick-growing cocoa shade. Comparisons were made of mean dry stem wood, response to NPK, first crop yield, second crop yield, and disease and pest problems. E. deglupta was the species chosen for large well managed plantations on better soil, and I. edulis was chosen as a woodlot species suitable for shifting cultivation.
EUCALYPTUS DEGLUPTA; CEDRELINGA CATENAEFORMIS; JACARANDA COPAIA; INGA EDULIS; TROPICAL RAIN FORESTS; LEGUMES; TREES; ULTISOLS; NITROGEN FIXATION; FAST GROWING TREES; WOODLOTS; SHIFTING CULTIVATION; HUMID TROPICS;

00288
03519
BAGGIO, A.; HEUVELDOP, J.
INITIAL PERFORMANCE OF CALLIANDRA CALOTHYRSUS MEISSM. IN LIVE FENCES FOR THE PRODUCTION OF BIOMASS
AGROFOR SYST; Vol: 2, No: 1; (1984); EN
XL/CR; pg 19-29
An experiment was carried out with seedlings of the species Calliandra calothyrsus planted in lines with four different spacings within the lines. The main objective was to investigate

quantitatively initial growth rates and biomass production. At 5 and 10 months all plants were cut back to the height of 1 m. The cut material was weighed and samples were analyzed for crude protein content and digestibility. Closer spacings produced more biomass in the time tested.
CALLIANDRA CALOTHYRSUS; BIOMASS; HEDGING PLANTS; TROPICS;

00289
04930
HALL, D.O.; DE GROOT, P.J.
BIOMASS FOR FUEL AND FOOD: A PARALLEL NECESSITY
(1985); EN
XZ; pg 1-166
The overuse and undersupply of biomass is currently a serious problem and there is potentially a far greater long-term danger from deforestation and desertification than from ready lack of food. Oil prices continue to be a serious problem. Worldwide government expenditure on biomass energy is more than $2bn a year while the cost of subsidies of surplus food production is greater than $60bn a year in the USA and Europe alone. The world produces more food than is required to feed its 4.5 billion people. How then can we achieve both food and biomass fuel production locally on a sustainable basis? Whereas local conditions of energy and food requirements related to land use patterns are predominant factors in planning biomass energy systems, and the productivity of biomass-for-energy species can be dramatically increased, more support of research and development, training, and firm establishment of great priority to agriculture and forestry are essential.
BIOMASS; FUELWOOD; TREES; PLANTING; FOOD PRODUCTION; AGROFORESTRY; FUELS; FEEDS; YIELDS; POVERTY; EROSION; SOILS; CROPS; RESEARCH; AGRICULTURE;

00290
03645
MACLAURIN, A.R.; BRANSBY, D.I.; TAITON, N.M.
<THE> INFLUENCE OF CUTTING HEIGHT, PLANTING DENSITY, HARVESTING FREQUENCY AND FERTILIZATION OF EDIBLE DRY MATTER YIELD OF LEUCAENA LEUCOCEPHALA (LAM.) DE WIT
PROC GRASSLD SOC S AFR; Vol: 17, (1982); EN
XA/ZA; pg 61-64
Leucaena leucocephala was evaluated to determine its agronomic and management requirements in Natal. The objectives were to test the effect of maintaining hedgerows at different heights and to investigate the effect of different densities, harvest intervals, and fertilization of edible dry matter (EDM) production of L. leucocephala plants grown in the pure stand situation. Cutting plants in hedgerows at 0.3, 0.6, 0.9, 1.2 and 1.5 m resulted in significant increases in yield of EDM with increases in height which ranged from 2.3 to 3.1 t/ha. By increasing the density of plants from 12 346 to 444 444 plants per hectare, a significantly greater production of EDM was obtained. A harvest interval of 6 weeks was significantly better than 4- and 8-week intervals. Fertilization increased production to a greater extent with a shorter cutting interval. Yields ranged from 1.6 to 5.7 t/ha for the pure stand situation.

LEUCAENA LEUCOCEPHALA; HEDGEROW PLANTING; SPACING; TREES; LEGUMES; FERTILIZERS; RHIZOBIUM; INOCULATION; FODDER CROPS;

00291
06062
HUXLEY, P.A.
PHENOLOGY OF TROPICAL WOODY PERENNIALS AND SEASONAL CROP PLANTS WITH REFERENCE TO THEIR MANAGEMENT IN AGROFORESTRY SYSTEMS
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1984); EN
XZ; pg 503-525
A knowledge of phenological mechanisms and responses is of practical value in agroforestry systems. Recording plant phenophases in relation to environmental change in natural conditions provides information on adaptability and possible phenological complementarity. Rest onset for tropical woody species is decided by ageing of leaves and is regulated by any environmental or endogenous stresses that hasten leaf senescence like drought or fruiting. Renewed vegetative growth can therefore be centered on times when the environment best suits it. Plant modifications can be carried out to modify phenology. Manipulations for woody perennials are however limited to relatively few processes, e.g. removal of plant parts at appropriate times in order to entrain subsequent phases of growth and flowering. Tropical herbaceous species or cultivars thus need to be selected for particular growing seasons and with special reference to the water budget and day/night temperatures. Matching the woody and herbaceous components then becomes the final stage of finding effective plant combinations.
WOOD; MANAGEMENT; AGROFORESTRY; CROPS; PHENOLOGY; TROPICS;

00292
05017
VASHISHTHA, B.B.; PAREEK, O.P.
FLOWER MORPHOLOGY, FRUIT SET AND FRUIT DROP IN SOME BER (ZIZYPHUS MAURITIANA LAM.) CULTIVARS
ANN ARID ZONE; Vol: 18, No: 3; (1979); EN
XP/IN; pg 165-169
This paper presents information on ber's floral morphology. Ber (Zizyphus mauritiana Lam.) is a major fruit crop of arid regions. A study conducted on seven ber cultivars (Seb, Gola, Jogia, Aliganj, Ponda Mundia and Ilaichi) showed that anthesis occurred from 7.30 a.m. in all cultivars except Gola and Mundia, in which it took place between 12.00 noon to 1.30 p.m. The dehiscence was completed in an hour after anthesis. Fruits did not set when flowers were covered. Open pollination by insects was found to be necessary and fruit drop was maximum during a fortnight after set in all the cultivars except in Ilaichi, in which it was maximum one month after set.
ZIZIPHUS MAURITIANA; FLOWERING; FRUITING; ARID ZONES; PLANT MORPHOLOGY; PLANT PHYSIOLOGY;

00293
03647
ALCANTARA, P.B.; ALCANTARA, V.B.G.; ABRAMIDES, P.L.G.
PRELIMINARY STUDIES ON LEUCAENA LEUCOCEPHALA (LAM.) DE WIT

PROPAGATION BY CUTTINGS
(ESTUDOS PRELIMINARES DE PROPAGACAO DA LEUCAENA LEUCOCEPHALA (LAM.) DE WIT POR ESTAQUIA (1))
ZOOTECNIA ; Vol: 20, No: 1; (1982); PT
XL/BR; pg 5-15
The present study was carried out at Estacao Experimantal Central of the Instituto de Zootecnia in March 1980. Eight treatments were compared with the aim of obtaining the rooting and vegetative growth of the aerial part of Leucaena's cuttings with and without leaves. The products utilized were two auxins: IAA and IBA in three levels (50, 100 and 200 ppm); a commercial stimulant product (Vitaflor); and water as a control. The technology showed some viability being the leafless cuttings superior to the others in number and dry weight of buds. The inductors used did not differ in terms of bud development (no statistical significance), however, Vitaflor presented more uniformly of bud development. Inductions.
LEUCAENA LEUCOCEPHALA; CUTTINGS; GROWTH REGULATORS; VEGETATIVE PROPAGATION; ROOTING;

00294
05319
DJIMDE, M.
OPUNTIA SPECIES AS FODDER CROPS
ICRAF DATA TEAM PUBL; (1985); EN
XA; pg 1-8
Information on the morphological features, adaptations ecology, management, nutritive value, and composition of Opuntia spp. is given. Data on the chemical composition of the spineless cacti are presented and the importance of the species as a fodder crop in the arid zones is shown.
OPUNTIA; SEMI ARID ZONES; FODDER CROPS; NUTRITIVE VALUE; DROUGHT RESISTANCE; MORPHOLOGY; COMPOSITION; SOUTHERN AFRICA;

00295
05168
POSEY, D.A.
INDIGENOUS MANAGEMENT OF TROPICAL FOREST ECOSYSTEMS: THE CASE OF THE KAYAPO INDIANS OF THE BRAZILIAN AMAZON
AGROFOR SYST; Vol: 3, No: 2; (1985); EN
XL/BR; pg 139-158
The Kayapo Indians of Brazil's Amazon Basin are described as effective managers of the tropical forest, utilizing an extensive inventory of native plants that are concentrated by human activity in special forest areas (resource islands, forest fields, forest openings, tuber gardens, agricultural plots, old fields, and trailsides). Long-term transplanting and selection of plants suggest semi-domestication of many species. The overall management strategies of forests also include many manipulated animal species (birds, fish, bees, mammals) utilized as food and game. Forest patches (apete) are created by Indians from campo/cerrado using planting zones made from termite and ant nests mixed with mulch. Formation and development of these is briefly discussed, including the implication for new ideas concerning reforestation and campo management. Finally an integrative cognitive model is presented showing the relationships between variants of forest and savanna

recognized by the Kayapo. Indigenous knowledge of subtle similarities between conceptually distinct ecological units in the model allows for the interchange of botanical material between microclimates to increase biological diversity in managed areas. It is suggested that indigenous knowledge is extremely important in developing new strategies for forest and campo/cerrado conservation while improving productiveness of these ecological systems. Such knowledge is not only applicable for Amazonian Indians but also has far-reaching implications for human populations throughout the humid tropics.
AGROSILVOPASTORAL SYSTEMS; TROPICAL RAIN FORESTS; MANAGEMENT; INDIGENOUS PLANTS; HUMID TROPICS;

00296
05012
REDDELL, P.; MALAJCZUK, N.
FORMATION OF MYCORRHIZAE BY JARRAH (EUCALYPTUS MARGINATA DONN ESC SMITH) IN LITTER AND SOIL
AUST J BOT; Vol: 32, (1984); EN
XP/AU; pg 511-520
This study correlates the distribution of ectomycorrhizae with the depth and nature of the substrate in jarrah forest soil and the effect of litter and soil type on the formation of mycorrhizae in glasshouse experiments. Litter on the forest floor was the main site for the formation of the white and brown ectomycorrhizae. Removal of the litter layer by burning reduced these ectomycorrhizae by 90 per cent. Black ectomycorrhizae were dominant in the mineral horizons of soil and were unaffected by the type of surface litter. In glasshouse experiments, litter from Acacia pulchella was favourable for the formation of ectomycorrhizae but they were absent from Banksia grandis litter. Addition of nitrogen and phosphorus to these soils influenced the relative abundance of mycorrhizae. It is postulated that inoculum levels, nutrient status of litter and soil and the presence of compounds inhibitory to fungal growth are critical in determining the abundance of mycorrhizae formed by jarrah and the ecological implications of these results are discussed.
EUCALYPTUS MARGINATA; ACACIA PULCHELLA; MYCORRHIZAE; FOREST LITTER; FOREST SOILS; NUTRIENTS; CONTROLLED BURNING;

00297
05392
ZOHAR, Y.
ROOT DISTRIBUTION OF A EUCALYPT SHELTERBELT
FOR ECOL MANAGE; Vol: 12, (1985); EN
XW/IL; pg 305-307
Eucalyptus camaldulensis roots were examined at the edge of a cotton field, 10-15 cm from the shelterbelt. Most roots were concentrated at a depth of 40-80 cm. Fine roots with a diameter of 0.1-0.5 cm comprised the majority of the root system at all soil depths. It seems that frequent severing of roots close to the trees may reduce root competition with the crop, thereby increasing the beneficial effects of such trees as shelterbelts.
ROOT SYSTEM; WINDBREAKS; CROPS;

00298
05325
SHARMA, J.K.; SANKARAN, K.V.
RHIZOCTONIA WEB BLIGHT OF ALBIZIA FALCATARIA IN INDIA
EUR J FOR PATHOL; Vol: 14, (1984); EN
XP/IN; pg 261-264
Albizia falcataria is one of the better-growing plantation species in Kerala. This paper reports the detailed symptomatology of a disease, Rhizoctonia web blight, and the pathogenicity of Rhizoctonia solani - the causal organism. The disease, observed during the monsoon (Jun-Aug), caused high mortality of young Albizia seedlings.
ALBIZIA FALCATARIA; PLANT DISEASES; BACTERIA; SEEDLINGS;

00299
05008
AGAMUTHU, P.; CHAN, Y.K.; JESINGER, R.; KHOO, K.M.; BROUGHTON, W.J.
EFFECT OF DIPHENYL ETHER PRE-EMERGENCE HERBICIDES ON LEGUME COVER ESTABLISHMENT UNDER OIL PALM (ELAEIS GUINEENSIS JACQ)
AGRO-ECOSYSTEMS; Vol: 6, (1980); EN
XP/MY; pg 193-208
Two diphenyl ether pre-emergence herbicides, oxyfluorfen and nitrofluorfen, have been compared with manual weeding, as a means of establishing Centrosema pubescens and Pueraria phaseoloides cover crops under Elaeis guineensis. Oxyfluorfen was found to be the more effective treatment. Data on nutrient acquisition and nutrient re-cycling were obtained by comparison with plots containing naturally regenerating vegetation, fastidiously maintained bare soil, or hand-weeded legume plots in which the oil palms received extra fertilizer. Results showed that legumes established by herbicide application contributed greater quantities of nutrients to the developing oil palms.
ELAEIS GUINEENSIS; CENTROSEMA PUBESCENS; PUERARIA PHASEOLOIDES; COVER PLANTS; LEGUMES; WEED CONTROL; HERBICIDES; NUTRIENTS; CYCLING; REGENERATION; HUMID TROPICS;

00300
05007
AGAMUTHU, P.; CHAN, Y.K.; JESINGER, R.; KHOO, K.M.; BROUGHTON, W.J.
EFFECT OF DIFFERENTLY MANAGED LEGUMES ON THE EARLY DEVELOPMENT OF OIL PALMS (ELAEIS GUINEENSIS)
AGRO-ECOSYSTEMS; Vol: 6, (1981); EN
XP/MY; pg 315-323
The effects of Centrosema pubescens, Pueraria phaseoloides, Nephrolepis biserrata, and Paspalum conjugatum covers during the early stages of growth of oil palms. Growth was greatest in the bare plots and the first yields of fresh fruit bunches were significantly higher. Relative growth rates and net assimilation rates were higher in legume plots, particularly those established with oxyfluoren. This meant that the rate of growth of palms in legume-treated plots steadily overtook the rate of growth of those in bare plots.
ELAEIS GUINEENSIS; CENTROSEMA PUBESCENS; PUERARIA PHASEOLOIDES; NEPHROLEPSIS BISERRATA; PASPALUM CONJUGATUM; COVER PLANTS;

LEGUMES; HERBICIDES; WEED CONTROL; HUMID TROPICS;

00301
B02787
PERSLEY, G.J. (ED.)
TROPICAL LEGUME IMPROVEMENT: PROCEEDINGS OF A THAILAND-ACIAR PLANNING AND COORDINATION WORKSHOP, BANGKOK, 10-12 OCTOBER 1983
ACIAR PROC SER NO 8; (1985); EN
XP/TH; pg 1-77
The proceedings present an overview of food legumes in Thailand with papers on the current importance of food legumes and research in progress on varietal improvement, crop protection, legume nutrition, and rhizobium-legume symbiosis. Australian participants presented papers on legume improvement in Australia, diagnosis and correction of nutrient deficiencies, the effect of nutrient disorders on nitrogen fixation by legumes, and legume bacteriology. Also included is a summary of the working group reports.
GRAIN LEGUMES; BREEDING; CROP IMPROVEMENT; CROP PROTECTION; DISEASES; NUTRIENT DEFICIENCIES; RHIZOBIUM;

00302
04929
DUFOUR, O.; OLIVIN, J.
EVOLUTION OF SOILS IN OIL PALM PLANTATION IN THE SAVANNA (EVOLUTION DES SOLS DE PLANTATION DE PALMIERS A HUILE SUR SAVANE)
OLEAGINEUX; Vol: 40, No: 3; (1985); EN
XA; pg 113-123
Production from replanted palms at the Robert-Michaux oil palm plantation in the savanna was not what was hoped for. This phenomenon was however not peculiar to replanting but reflects the slow degradation of oil palm potential. It was observed that with age, potential protection production in extension diminishes, and that the replanting differential is reduced.
ELAEIS GUINEENSIS; PANICUM BREVIFOLIUM; PUERARIA; SOILS; WATER SUPPLY; TREE CROPS; OIL CROPS; NUTRIENTS; MULCHES; COVER PLANTS; FERTILIZERS;

00303
05028
ESSIAMAH, S.K.
<THE> UTILIZATION OF PALMS IN WEST AFRICA
PLANT RES DEV; Vol: 21, (1985); EN
XA; pg 45-58
This brief review states the economic importance of some palms, especially the oil palm. The author reviews the methods used in sapping palms, discusses the source of the palm sap, and directs attention to the danger of destroying the palm trees by inefficient sapping methods. Emphasis is laid on the need to find new suitable methods of sapping, so that the trees are not killed.
ELAEIS GUINEENSIS; PALMAE; USES; TROPICAL RAIN FORESTS; WEST AFRICA; SAP; OIL CROPS; FIBRE CROPS; SPECIES LIST; SOCIAL WELFARE; HUMID TROPICS;

00304
06052
ALVIM, R.; NAIR, P.K.R.
CONTRIBUTION OF CACAO WITH OTHER PLANTATION CROPS: AN AGROFORESTRY SYSTEM IN SOUTHEAST BAHIA, BRAZIL
AGROFOR SYST; Vol: 4, No: 1; (1986); EN
XL/BR; pg 3-15
Brazil accounts for about 20 per cent of the world's production of cocoa, and about 95 per cent of the cocoa produced in Brazil is from the south-eastern 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 been undertaken by the farmers with encouragement from the Brazilian government. As a part of a crop-diversification programme in the traditional cacao growing areas and their surroundings, extensive areas are being planted to other plantation crops, mainly clove and rubber, and to some extent coconut. Crop combinations have been adopted in some of these new plantings with cacao as the most important component of most of such combinations. Whereas several other crops are combined with clove trees, cacao is usually the only species grown with mature rubber trees. Young rubber trees are, however, interplanted with a number of other species. Productive coconut areas are found mostly in sandy soils along the coast, so there is little intercropping. However, scattered farms are found where coconuts are underplanted with guarana, black pepper, cacao, cashew, etc., as is done commonly in other parts of north-east Brazil. The paper presents some data on the performance of some of the combinations involving cacao and other plantation crops based on field survey; it discusses the potentials and constraints of extending the system to more areas in the region.
THEOBROMA CACAO; SYZYGIUM AROMATICUM; COCOS NUCIFERA; HEVEA BRASILIENSIS; PLANTATIONS; CROPS; AGROFORESTRY; CROPPING SYSTEMS; SHADE TREES; HUMID TROPICS;

00305
B01726
BORNEMISZA, E.
NITROGEN CYCLING IN COFFEE PLANTATIONS
NITROGEN CYCLING IN ECOSYSTEMS OF LATIN AMERICA & CARIBBEAN. DEVLOP IN PLANTS & SOIL SCI NO.6; (1982); EN
XL; pg 241-246
Nitrogen inputs of the coffee ecosystem are dominated by additions of fertilizer N (100-300 kg N per hectare per year). Small nitrogen inputs from rains and variable inputs from fixation by the leguminous shade trees can amount to 1-40 kg N per hectare per year. Organic matter mineralization can be an important nitrogen source also. Nitrogen losses from the system include removal of N in the harvest (15-90 kg N per hectare per year), the removal of coffee and shade tree prunings for firewood, losses from erosion, leaching losses, and gaseous losses. Unfortunately very little information exists about leaching and gaseous losses or the factors that regulate these processes. The overall nitrogen cycle in shaded coffee plantings includes three interrelated subsystems the coffee, the shade and the weed subcycles.
COFFEA; INGA JINICUIL; PLANTATIONS; CROPS; NITROGEN FERTILIZERS; CYCLING; SHADE TREES; MINERALIZATION; NITROGEN FIXATION; LEACHING;

HIGHLAND; REVIEW; MULTIPURPOSE TREES; SEMI ARID ZONES;

00306
00261
KHADER, K.B.A.; ANTHONY, K.J.
INTERCROPPING: A PAYING PROPOSITION FOR ARECA GROWERS - WHAT CROPS TO GROW
INDIAN FARMING; Vol: 18, No: 4; (1968); EN
XP/IN; pg 14-15
Opportunity costs associated with the growing of arecanuts forced growers to take up cultivation of intercrops like bananas, pepper, cardamom, tapioca, and yams. This practice helps the areca grower to fetch extra income during off seasons of the arecanut crop. The intercrops should be able to utilize the filtered light to the maximum. They should be crops that love shade or can withstand the canopy of the arecanut. It will also be an advantage if the root systems of the crops are confined to different zones, so that competition for moisture and nutrients is minimized. The author has outlined the cultural requirements for some of the crop plants that have proved experimentally suitable for intercropping.
PANICUM MAXIMUM; AMORPHOPHALLUS CAMPANULATUS; ARECA CATECHU; MUSA; ANANAS COMOSUS; INTERCROPPING; PERENNIALS; CROPS; CULTURES; LAND USE;

00307
01614
NAIR, P.K.R.; KHANNA, P.K.
POTASSIUM DYNAMICS IN THE SOIL PLANT SYSTEM OF TROPICAL PLANTATION CROPS
POTASSIUM IN SOILS AND CROPS (SEKHON, G.S. ED.); (1978); EN
XZ; pg 415-432
A survey of the literature on potassium nutrition and response of the major tropical plantation crops indicates that high amounts of K in the soil-plant system are essential for increasing the quality and quantity of their produce. The existing fertilizer recommendations for these crops in India are based on limited field experiments conducted in the country and on the foliar analysis and other investigations carried out in other countries. Such studies are static in nature and do not take into account the dynamic aspects of K cycling within the system. A series of dynamic processes is involved in the soil-plant cycling of potassium. To understand these processes precisely and to put ideas about them into practice, detailed information is needed on aspects concerning the functioning of the system with emphasis on the role of potassium. It is very difficult to obtain these data under field conditions and to consider all the available information simultaneously. Systems analysis enables us to compartmentalize the soil-plant system and quantify the avenues of input and output fluxes and turnover rates within the system. The field data required for such an evaluation and the gaps in the existing knowledge concerning potassium are indicated with the help of a potassium cycling model for the coconut-based ecosystem on the east coast of India.
COCOS NUCIFERA; CAMELLIA; THEOBROMA CACAO; PLANTATIONS; CROPS; MANAGEMENT; HARVESTING; LEACHING; SOIL WATER CONTENT; ORGANIC MATTER; RESEARCH; PERENNIALS; NUTRIENTS; RAIN; IRRIGATION;

CROPPING SYSTEMS; CANOPIES; ECOSYSTEMS; TROPICS;

00308
06119
NAIR, P.K.R.
FRUIT TREES IN TROPICAL AGROFORESTRY SYSTEMS
ICRAF/EWC WORK PAP NO 32; (1985); EN
XZ; pg 1-97
Farmers all over the tropics prefer using fruit trees to forest trees and foresters object to the use of non-forest trees from fear that hilly forest lands may be converted to agricultural lands. They also believe the wide spacing for fruit trees will reduce their protective role on sloping lands. The author clarifies some of these conflicting issues and indicates the productive and protective roles of fruit trees in agroforestry systems. The paper also examines the environmental and socioeconomic advantages of fruit trees in comparison to other woody perennials as components of tropical agroforestry systems and discusses the problems and prospects of popularizing such systems. It gives a summary account of the growth form and crop profiles of 30 fruit trees that are most commonly used in tropical agroforestry systems and presents a general account of the criteria in the choice of species, pattern and density of their planting and their management schedules.
FRUIT TREES; AGROFORESTRY; TREES; TROPICS;

00309
06087
NAIR, P.K.R.
AGROFORESTRY WITH COCONUTS AND OTHER TROPICAL PLANTATION CROPS
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1984); EN
XZ; pg 79-102
Smallholder farmers tend to adopt less well-studied integrated and intensive land use practices of combining perennial cash crops with food crops and livestock. The coconut palm is suited to small-scale production and to combination with other crops. Cattle graze under the extensive stands of palms and additional crops can be produced without impairing long-term productivity, hence resulting in higher income and land-equivalent ratios per farm. The author calls for more research in this area.
COCOS NUCIFERA; AGROFORESTRY; PLANTATIONS; CROPS; DEVELOPING COUNTRIES; TROPICS;

00310
B01726
ROSKOSKI, J.P.; BORNEMISZA, E.; ARANGUREN, J.; ESCALANTE, G.
REPORT OF THE WORKING GROUP ON COFFEE AND CACAO PLANTATIONS
NITROGEN CYCLING IN ECOSYSTEMS OF LATIN AMERICA & CARIBBEAN.
DEVELOP IN PLANT & SOIL SCI NO. 6; (1982); EN
XL/XP; pg 403-407
This report reconstructs nitrogen budgets for coffee and cacao cropping systems using existing data. Data on general climatic, vegetation cover and soil characteristics for these systems are presented in tabular form. The distribution of biomass nitrogen is also presented. Tree densities are discussed and nitrogen fluxes

in and out of these systems are shown. Research priorities include work on nitrogen fixation by leguminous shade trees.
COFFEA; THEOBROMA CACAO; PLANTATIONS; CROPS; NITROGEN; HUMID TROPICS; SHADE TREES; LEGUMES;

00311
B01726
SANTANA, M.B.M.; CABALA-ROSAD, P.
DYNAMICS OF NITROGEN IN A SHADED CACAO PLANTATION
NITROGEN CYCLING IN ECOSYSTEMS OF LATIN AMERICA & CARIBBEAN. DEVELOP IN PLANT & SOIL SCI NO. 6; (1982); EN
XL; pg 271-281
Studies of nitrogen mineralization and leaching were conducted in the cocoa-growing region in the south of Bahia, Brazil, on plots fertilized with N, P and K and on plots without fertilizer in plantations 30-40 years old on CEPEC soil (Tropudalf) over a period of one year. Mini lysimeters were installed at depths of 10, 20 and 40 cm and the leachate was collected weekly or after heavy rain. Net mineralization was measured in soil samples taken at depths of 0-5 and 5-15 cm and incubated for 30 days in plastic bags placed at the site of collection. The degree of leaching was correlated with the amount of rainfall and, although it is difficult to quantify the losses per unit area, we estimate that these losses are minor. Ammonification and nitrification were both high during most of the year; nitrification was very rapid and was especially intensive on the fertilized area. Analysis of Erythrina and cacao litter shows that these components make contribution to the nitrogen recycled in a cacao plantation. High concentrations of total nitrogen were detected in soil samples taken close to shade trees, and, on average, the soil of shaded areas had more nitrogen (480 mg N per kilogram of soil) than soil of non-shaded areas. Removal of nitrogen in harvest can also be considered. It is advisable to take nitrogen-cycle data into account when compiling tables of fertilizer recommendations.
THEOBROMA CACAO; ERYTHRINA; LEACHING; MINERALIZATION; CYCLING; NITRIFICATION; SHADE TREES; NITROGEN; METHODS; PLANTATIONS; CROPS; HUMID TROPICS;

00312
01241
ARNOLD, J.E.M.
WOOD ENERGY AND RURAL COMMUNITIES
EIGHTH WORLD FORESTRY CONGRESS, JAKARTA, 16-28 OCTOBER 1978; (19 78); EN
XZ; pg 1-31
The rural energy situation in developing countries is reviewed. Wood is the major source of energy in these countries, and in the rural areas millions of people depend on wood for cooking and warmth. In these areas the demand for fuelwood puts heavy and often destructive pressure on tree cover in the vicinity of populated areas. The declining woodfuel supplies lead to less vegetation cover, deterioration of environmental stability, diversion of agricultural and animal residues from agricultural use, increased expenditure of time and effort on fuel gathering, and eventually reduction on availability of cooked food. The poor are the most affected as there is no viable substitute for

firewood because of costs. Demand for woodfuels could be met in a number of ways: by substituting other fuels and other sources of energy which are likely to be a viable option (in the short term only) in processing and commercial agricultural uses, by using more efficient stoves, by producing fuel efficiently from existing resources, and by creating additional fuel sources.
FUELWOOD; ENERGY SOURCES; ENVIRONMENTAL CONDITIONS; RURAL COMMUNITIES; WOOD; ENERGY; DEVELOPING COUNTRIES;

00313
01964
BURLEY, J.
SELECTION OF SPECIES FOR FUELWOOD PLANTATIONS
COMMONW FOR REV; Vol: 59, No: 2; (1980); EN
XZ; pg 133-147
It has become an acknowledged fact that the world can no longer rely on non-renewable sources of energy. Wood is a renewable energy source which is widely used in developing countries. This paper provides detailed information on the selection of fuelwood species. Their physiological and biological suitability is given prominence. A list of 35 selected species for fuelwood, fodder, shelterbelts, soil stabilization and farm forestry is provided. Another list of species from World Bank-assisted pole-fuelwood projects in South Korea, Philippines, Tanzania, Nigeria, Burundi, Rwanda, Pakistan and Kenya is added. Together with these two lists of species is a NAS fuelwood panel's list of species classified on major climatic regions.
ACACIA ALBIDA; AZADIRACHTA INDICA; CERATONIA SILIQUA; EUCALYPTUS CAMALDULENSIS; LEUCAENA LEUCOCEPHALA; PROSOPIS SPICIGERA; GLEDITSIA TRIACANTHOS; ZIZIPHUS; GMELINA ARBOREA; CASUARINA; CASSIA SIAMEA; SPECIES LIST; DESERTIFICATION; CROPS; FUELWOOD; DEVELOPING COUNTRIES; FORESTRY; SPECIES SELECTION;

00314
04286
CATINOT, R.
WAYS OF HARVESTING TROPICAL FORESTS AS A SOURCE OF ENERGY, PROSPECTS ON PRESENT AND FUTURE POTENTIAL
(COMMENT UTILISER LES FORETS TROPICALES COMME SOURCE D'ENERGIE. PROSPECTIVES SUR LEURS POTENTIALITES ACTUELLES ET FUTURES)
BOIS FOR TROP; Vol: 184, (1979); FR
XZ; pg 3-30
The paper concerns the answers that tropical forests could give in the solution of energy problems. Wood can actually be transformed into energy by its combustion, carbonization, gasification or liquefaction. It is therefore necessary to be prepared for the future by maximizing the already important potentialities of this source. It is generally known how to renew this energy source without harming the natural environment, but it is yet to be discovered how to transform it with an acceptable yield into a form of energy both easy to manipulate and utilize. The author analyses the different aspects of the problem and emphasizes the role research will have to play in the ecological silvicultural and technological fields.
SPECIES LIST; WOOD; ENERGY; FUELWOOD; SILVICULTURE; ENVIRONMENT; TROPICS;

00315
03586
CHATTERJEE, S.; BISWAS, A.
ENERGY UTILIZATION IN RURAL INDIA
CAH OUTRE-MER; Vol: 34, No: 135; (1981); FR
ORSTOM; XP/IN; pg 273-298
The paper reviews the energy sources and uses in the rural areas of India, where the majority of the poor people live. The principle source of energy in the villages is firewood, including charcoal, crop residue and cow dung. Nearly all the firewood comes from either state or privately owned forests or from unrecorded sources like wastelands. Firewood accounts for nearly 65 per cent of the total energy source while cow dung and crop residues are 20 per cent and 15 per cent respectively. The principal energy use in rural India is related to agriculture, domestic activities, transportation and social amenities. Use of different energy sources are involved in combination for these economic activities. It is concluded that per capita energy used in the rural areas of India is higher when all sources of energy (commercial and non-commercial) are considered. It is obvious that the sophisticated technology of energy production will remain out of reach of the rural population. The rural people are active in the energy cycle and should be more effectively involved. They have to produce their own energy and therefore their development should be related to the development of programmes concerned with energy sources.
FUELWOOD; RURAL AREAS; ENERGY SOURCES; CROP RESIDUES;

00316
B01890
DENTON, F.H.
WOOD FOR ENERGY AND RURAL DEVELOPMENT: THE PHILIPPINES EXPERIENCE
(1983); EN
XP/PH; pg 1-232
This book has two objectives: 1) to present salient technical facts from the Philippine wood energy problem, and 2) to recount some of the history and adventure in responding to the challenge of a programme faced with so many unknowns. The wood energy programme is as much a social and rural development as it is a technical and energy entirety. The social and institutional aspects are addressed first in two chapters. One programme objective has been to benefit the landless poor, so one chapter is on the background of participating farmers exploring the benefits that are accruing or that will accrue to them. The second part of the book delves into the technical side of wood energy. The greatest area of the unknown was that of producing the wood. A lengthy chapter is devoted to tree farming technology touching also on the importance of fast-growing energy trees. The final part is devoted to a conceptual formulation covering a possible long-term wood energy programme for the Philippines. With the available evidence, there is every reason to believe that the Philippines can derive an important part of its energy from wood. If that course is followed, important rural development and environmental benefits will accrue from the establishment of a new cash crop to be farmed on marginal lands that are not used for

food production.
WOOD; ENERGY; PLANNING; TECHNOLOGY; FAST GROWING TREES; RURAL DEVELOPMENT; ENVIRONMENT;

00317
04287
DOAT, J.
TROPICAL WOODS POTENTIAL SOURCE OF ENERGY
(LES BOIS TROPICAUX, SOURCE POTENTIELLE D'ENERGIE)
BOIS FOR TROP; Vol: 181, (1978); FR
CTFT; XG; pg 41-56
Energy is one essential factor for the development of mankind and the world energy consumption is growing rapidly. The oil price rise has forced governments to look for alternative sources of energy in order to reduce their dependence on petroleum products. After reviewing traditional forms of energy and new sources, the author deals with the possibilities of treating the biomass in general and wood in particular for energy purposes: burning, carbonization, gasification, hydrolysis, fermentation, chemical synthesis, etc. Tropical forests, which account for about half the world's wooded surface, together with plantations of fast-growing tropical species, constitute a very valuable potential reserve for energy.
ENERGY SOURCES; WOOD; ENERGY; BIOMASS; FAST GROWING TREES;

00318
B02305
ECKHOLM, E.P.; FOLEY, G.; BARNARD, G.; TIMBERLAKE, L.
FUELWOOD: THE CRISIS THAT WON'T GO
(1984); EN
EARTHSCAN; XZ; pg 1-107
The authors review the fuelwood energy crisis in ten short chapters: 1) the underlying crisis, 2) fuelwood and deforestation, 3) getting and using wood, 4) why people grow trees, 5) why people don't grow trees, 6) helping people grow trees: farm forestry, 7) helping people grow trees: communal forestry, 8) making community forestry work, 9) improved cooking stoves, and 10) strategies for the future. It is concluded that firewood is not the cause of tropical deforestation and soil erosion, that community forestry rarely provides fuel for the really poor and may even make them worse off, and that local participation is no guarantee that firewood will reach those who need it most. But without community support the woodlots will die. Even when fuel is scarce, people often prefer to plant trees for shado, timber, fruit or livestock fodder rather than fuelwood. Improved cookstoves can make cooking more pleasant, healthy and safe, but they won't save forests and they don't save much fuel. The developing world's poor need far more fuel than village woodlots can ever provide. Much must be done to plant trees on farms, to get more wood from the existing forests, and to promote energy alternatives including coal and oil.
FUELWOOD; ENERGY CRISIS; EROSION; FARM FORESTRY; COOKING STOVES; TREES; PLANTING; TROPICS;

00319
04080
EL-LAKANY, M.H.
FUEL AND WOOD PRODUCTION ON SALT AFFECTED SOILS
SEMINAR ON FORAGE AND FUEL PRODUCTION FROM SALT AFFECTED WASTELANDS, W AUST 19-27 MAY; (1984); EN
XA/EG; pg 1-3
The author discusses the problem of wood and fuel production in arid and semi arid zones and that of soil salinization. The productivity of woody species on salt-affected soils has received very little attention in forestry research. Establishing energy plantations or biomass farms has been recommended and practised in several countries, although for different purposes. Reforestation and afforestation with salt-tolerant trees and shrubs on soils too saline to sustain crops or under irrigation with saline water can be undertaken to satisfy at least partially the needs for wood and fuel and as a means of soil rehabilitation. Mangrove species offer good material to select from, especially for planting along shorelines of many tropical countries. Besides being tolerant to salinity, species should have wood of high calorific value and preferably be multipurpose in nature.
SALINITY; FUELWOOD; SOILS; ENERGY; PLANTATIONS;

00320
B02271
FAO
WOOD FOR ENERGY
FAO FOR TOP REP NO. 1; (1983); EN
XZ; pg 1-40
The booklet describes the present problems and the promise the future holds in the field of energy forestry. More people depend on wood than on any other source of energy for their daily energy needs. Therefore wood is still the world's most important fuel, and unfortunately it is also in desperately short supply. The role trees can play in easing world energy problems is much broader than is generally realized. Fuelwood and charcoal have, until recently, been regarded simply as substitute fuels, but it is now clear that they are also fuels of the future. Fuelwood and charcoal are relatively cheap to produce compared to fossil fuels and are derived from renewable resources. Trees also offer a range of ecological, agricultural and social advantages which cannot be paralleled by any other energy source. The developed countries are reinvestigating the possibilities of mobilizing their forest biomass for energy, and in the developing countries, energy plantations may provide a novel and exciting springboard for development. This publication records some of the achievements of the FAO projects in energy forestry; it is also intended to encourage a greater use of FAO expertise in forestry for energy in the future.
ENERGY FORESTRY; FUELWOOD; CHARCOAL; ENERGY SOURCES,

00321
B02505
FAO
WOOD ENERGY DEVELOPMENT: REPORT OF THE FAO-ESCAP REGIONAL WORKSHOP, BANGKOK, 13-16 DECEMBER, 1983

(1984); EN
XZ; pg 1-116
This book reviews the current situation of wood energy development in Asia and the Pacific region. The discussion topics are 1) fuelwood in the region: current situation and programmes; 2) management of existing fuelwood resources for wood energy supply in Asia; 3) creation of new resources for fuelwood and wood energy, 4) improvement of wood energy use - problems and potentials in promoting charcoal manufacture: a case study from Indonesia; 5) substitution possibilities in relation to fuelwood and charcoal; 6) research and dissemination of research results in wood energy - prospects and problems; 7) regional cooperative measures of wood energy development.
WOOD; ENERGY; FUELWOOD; CHARCOAL PRODUCTION; RESEARCH; REGIONAL COOPERATION;

00322
01247
FLOOR, W.M.
ENERGY OPTIONS IN RURAL AREAS OF THE THIRD WORLD
EIGHTH WORLD FORESTRY CONGRESS; (1978); EN
XA/XL/XP; pg 1-12
The paper examines and assesses the use of energy in rural areas of the developing countries and compares the use of fuelwood with other forms of energy. The energy consumption pattern of rural areas shows that 95 per cent is derived from non-commercial energy sources. The major energy use in these areas is for cooking, and firewood is the most important energy source for this purpose. Alternatives are solar energy, biogas, electricity, gas, coal and kerosene. Most developing countries have to implement reforestation and anti-erosion programmes. This means that fuelwood will still be the most appropriate energy source for poor people, the more so if the thermal efficiency of fuelwood is increased by simple and cheap means. It is concluded that although this study was done for domestic activities, the conclusions reached also hold for industrial activities where fuelwood is used. In deciding what action should be taken, a distinction should be made between short-term, medium-term and long-term plans.
ENERGY; RURAL AREAS; DEVELOPING COUNTRIES; FUELWOOD; AFFORESTATION;

00323
02700
FRENCH, D.
<THE> ECONOMICS OF RENEWABLE ENERGY SYSTEMS FOR DEVELOPING COUNTRIES
(1979); EN
USAID; XA/XL/XP; pg 1-68
The report outlines the benefit-cost techniques that allow the renewable energy systems (e.g. solar pumps, biogas plants and solar cell arrays) to be evaluated from the standpoint of the individual buyer. Detailed benefit-cost analyses are provided for three systems: 1) a 40 hp solar thermal irrigation pump, Senegal, 2) a family-scale Indian biogas plant, 3) a 5.5 kw solar cell irrigation pump on the borders of Lake Chad. Neither the solar

thermal pump nor the family-scale biogas plant appears to be profitable. The solar cell pump has positive net benefits by economic measures but is unlikely to be competitive with diesel power. None of these systems shows any immediate promise for developmental application. Some of these devices will be of interest to people who are using a substantial amount of energy that is the relatively rich. Given these findings, organizations concerned about the poor might as well give renewed attention to meeting basic energy needs through less sophisticated systems: village woodlots, improved wood stoves, hand or pedal pumps and grinders, hydraulic ram pumps, etc.
COST BENEFIT ANALYSIS; RENEWABLE RESOURCES; FUELWOOD; VILLAGES; WOODLOTS; ENERGY SOURCES;

00324
02697
GELLER, H.S.; DUTT, G.S.
MEASURING COOKING FUEL ECONOMY DURING FUELWOOD SURVEYS
(1981); EN
FAO; ; pg 1-46
Fuelwood is used to a large extent in the rural areas of developing countries, where it is a principal energy source. Growing populations and inefficient use of this energy source have helped to create a shortage of fuelwood. The shortage is associated with problems like the substitution of agricultural and animal waste for firewood, increasing labour for obtaining fuel, and heavy expenditures for purchasing fuelwood. This paper discusses four points for evaluating cooking fuel economy during a fuelwood survey in developing countries. These are 1) the resources for testing the fuel economy of cookstoves, 2) the methods for measuring stove performance in the field and in the laboratory, 3) the procedures for conducting a series of tests, and 4) the techniques for interpreting test results.
FUEL ECONOMY; STOVES; FUELWOOD; POPULATION CHANGE; DEVELOPING COUNTRIES;

00325
01943
HALL, D.O.
SOLAR ENERGY THROUGH BIOLOGY: FUEL FOR THE FUTURE
ADVANCES IN FOOD PROCESSING SYSTEMS FOR ARID AND SEMI ARID LANDS (MANASSAH, J.T. & BRISKEY, E.J. ED); (1980); EN
XZ
The paper describes the biomass resource as well as conversion technologies and how they are being implemented in various countries. Biomass provides about one seventh of the world's energy. Most of this use occurs in developing countries and more so in the rural areas where heavy dependence on biomass is resulting in serious agricultural and ecological problems, especially in the arid areas. Biomass-for-energy programmes are currently being implemented and are under assessment in many countries. Each country or region should assess its own requirements, potentials, train the people required for implementation, and develop the necessary infrastructure. The possibility of mimicking the basic processes of photosynthesis vis-a-vis carbon and nitrogen fixation, water splitting, and

charge separation across membranes is discussed. It is concluded that since photosynthesis is the key process in the living world and will continue to be, the development of photobiological energy conversion systems has long-term implications. We might have an alternative way of providing ourselves with food, fuel, fibre and chemicals in the future.
SOLAR ENERGY; BIOLOGY; FUELS; BIOMASS; TECHNOLOGY; FOOD; FIBRE; CHEMICALS;

00326
01679
HALL, D.O.
NEW AND RENEWABLE SOURCES OF ENERGY
UN CONFERENCE ON NEW AND RENEWABLE SOURCES OF ENERGY. BIOMASS PANEL; (1981); EN
XZ; pg 1-85
This report contains an introductory summary on the conference topic. The need is expressed for developing and exploring new areas from which energy required for domestic and industrial use can be obtained. Summaries on national energy studies at both village and national levels are provided for a number of countries in the tropics. Basic energy statistics and energy balances of least developed countries retrieved from the OECD Report of 1967-77 are included. An extensive discussion on possible alternative ways of utilizing waste products as sources of renewable energy and the methods of processing industrial and other urban wastes are outlined. And finally a section of plantation energy sources is added. Trees and tree crops with eminent potentials are mentioned.
EUPHORBIA TIRUCALLI; ELAEIS GUINEENSIS; HEVEA BRASILIENSIS; BIOMASS; FUELWOOD; ENERGY; CLIMATE; PHOTOSYNTHESIS; TECHNOLOGY; RESEARCH; BIOGAS; AGROFORESTRY; HARVESTING; CHARCOAL; INTERCROPPING; BIOLOGICAL PRODUCTION; PHYSIOLOGY; TREES; RENEWABLE RESOURCES;

00327
03691
HOSIER, R.
SOCIAL BENEFIT-COST ANALYSIS OF FUELWOOD DEVELOPMENT PROJECTS IN KENYA
(1982); EN
BEIJER INSTITUTE; XA/KE; pg 1-55
The need for appropriate forest technology as a solution to the rural fuelwood shortage in developing countries is addressed. Appropriate fuelwood production systems should be developed, based on the principles of coppicing, pollarding, and short rotational periods, producing small-diameter fuelwood sticks. A hypothetical fuel-stick project is discussed to show not only that such systems are possible, but also that they can be economically superior to conventional solutions.
EUCALYPTUS; CALLIANDRA CALOTHYRSUS; SILVICULTURE; WOODLOTS; FUELWOOD; AGROFORESTRY; ECONOMIC ANALYSIS; SOCIOECONOMIC ASPECTS;

00328
03545
HOSKINS, M.W.
COMMUNITY PARTICIPATION IN AFRICAN FUELWOOD PRODUCTION: TRANSFORMATION AND UTILIZATION
ENERGY FOR AFRICA: SELECTED READINGS (FRENCH, D. & LARSON, P. EDS.); (1980); EN
XC; pg 135 187
The author explores issues raised when residents are included in the effort to solve local fuelwood needs through forestry for local community development programmes. It is acceptable that such a programme is not a very easy task but it might be the only viable option since top-forestry is not working. In this paper the author looked at various problems which donors, implementers and participants raise and at the possible approaches to programme design which mitigate some of these problems. Ideas given in this paper are not proven solutions to the problems, but they are rather offered to stimulate discussions while searching for better techniques in their field. In conclusion the author indicates that it is only through shared experiences, new ideas, documented failures and successes that one can hope to deal effectively with the issues and eventually reach the demonstration and dissemination stage. The community forestry programmes are still in the experimental stage; however, since a sound environment and the availability of forest products are vital to agriculture, industry and life itself the programme is potentially of great interest to the community.
FUELWOOD; LOCAL COMMUNITIES; RURAL DEVELOPMENT; DONORS; DESIGN; METHODS; COMMUNITY FORESTRY;

00329
04908
JONES, J.R.
SOCIOECONOMIC DIAGNOSIS ON THE CONSUMPTION AND PRODUCTION OF FUELWOOD IN THE PENINSULA OF AZUERO, PANAMA
(DIAGNOSTICO SOCIO-ECONOMICO SOBRE EL CONSUMO Y PRODUCCION DE LENA EN FINCAS PEQUENAS DE LA PENINSULA DE AZUERO, PANAMA)
CATIE SER TEC INF TEC NO 32; (1982); ES
XL/PA; pg 1-94
This report represents the results of 266 interviews carried out on the peninsula of Azuero, Panama, in order to define the firewood situation, especially the consumption and production by small farmers. Matayba spp. and Byrsonima were the most used and preferred species. Nearly all farms interviewed reported a forestry component, although in most cases on a small scale. Farms in Azuero reported limited sales of tree products, including fruit and wood products.
BYRSONIMA CRASSIFOLIA; FUELWOOD; SOCIOECONOMIC ASPECTS; SMALL SCALE FARMING; DEFORESTATION; WOODLOTS; SPECIES LIST; HUMID TROPICS;

00330
00714
KALLA, J.C.
STATISTICAL EVALUATION OF FUEL YIELD AND MORPHOLOGICAL VARIETIES FOR SOME PROMISING ENERGY PLANTATION TREE SPECIES IN WESTERN

RAJASTHAN
ANN ARID ZONE; Vol: 16, No: 1; (1977); EN
XP/IN; pg 117-126
Attempts are made to generate fuel yield prediction equations for the tree stands in arid areas. Five species, Acacia tortilis, Acacia nilotica, Azadirachta indica, Albizia lebbek and Prosopis juliflora, were selected for a series of experiments which were to culminate in the derivation of fuel-yield equations. The results revealed that collar diameter and height are the only properties that should be expected to have positive bearing upon fuel-yield prediction performance of these tree species. Some species, however, revealed that there is a need to consider other variables, which could be postulated to be more relevant for fuel-yield prediction. All the statistical data, the formulated equations, and analysis are tabulated.
ACACIA TORTILIS; ACACIA NILOTICA; AZADIRACHTA INDICA; ALBIZIA LEBBEK; PROSOPIS JULIFLORA; ENERGY; MANAGEMENT; PLANTATIONS; AFFORESTATION; ARID ZONES; SEEDLINGS; EXPERIMENTS; SPECIES LIST; FUELS; CROPS;

00331
05003
KORSMO, H.
CAN ENERGY PLANTATIONS BECOME BALANCED ECOSYSTEMS
PROGRAMME GROUP B: BIOMASS GROWTH & PRODUCTION REPT NO 8; (1983); EN
XZ; pg 1-40
This report deals with the possibilities of obtaining a sustainable yield from energy plantations as a balanced ecosystem. Examples taken from undisturbed and disturbed forest ecosystem are used to illustrate differences in nutrient budgets. Intensive energy plantations should be cultivated on fertile soil in the temperate zone, if whole tree harvesting does not cause serious depletion. The report ends with recommendations for research on factors that may have an effect on the energy plantations.
ENERGY; PLANTATIONS; TEMPERATE ZONES; SOIL FERTILITY; CYCLING; FAST GROWING TREES; NUTRIENT UPTAKE; FORESTS; ECOSYSTEMS;

00332
01948
LEDIG, F.T.
SILVICULTURAL SYSTEMS FOR THE ENERGY EFFICIENT PRODUCTION OF FUEL BIOMASS
ACS SYMP SERIES, NO 144: BIOMASS AS A NON-FOSSIL FUEL SOURCE; (1981); EN
XZ; pg 447-461
Production of biomass by forests is highly energy efficient. Purely exploitative schemes are more efficient than highly intensive silviculture. However, net energy yield increases with intensity of cultivation, so silvicultural systems approaching those of agricultural cropping should be favoured from an energy production standpoint. Efficiency can be further increased by breeding, an area neglected in forestry for centuries after it has become a proven asset in agriculture. The rate of production of biomass can be increased by breeding for rapid growth. Simultaneously, it should be possible to reduce energy inputs by

breeding for trees that do not require supplemental fertilization or by engineering new symbiotic relationships with nitrogen fixing organisms.
SILVICULTURE; BREEDING; FAST GROWING TREES; ENERGY SOURCES; FUELS; BIOMASS; AGRICULTURE; CROPS;

00333
05369
LEWIS, C.E.; TANNER, G.W.; TERRY, W.S.
DOUBLE Vs. SINGLE-ROW PINE PLANTATIONS FOR WOOD AND FORAGE PRODUCTION
SOUTH J APPL FOR; Vol: 9, No: 1; (1985); EN
XN/US; pg 55-61
To find planting patterns for growing high volumes of wood while maintaining forage for cattle and wildlife habitat, slash pine (Pinus elliottii Englem) was planted in various configurations to increase the open space between rows while holding tree density constant. Thirteen years after planting, there were few significant differences in survival, height and diameter; basal area and total wood volume were as good or greater in the 4 x 8 foot double-row configuration spaced 40 feet apart. Double row configurations produced more forage than single row. This configuration offers a high timber volume and forage mass alternative to the currently favoured 8 x 12 foot spacing used for dual resource management.
PINUS ELLIOTTII; FOREST PLANTATIONS; FOREST GRAZING; CATTLE; WILDLIFE; SPACING; WOOD; RESOURCE MANAGEMENT;

00334
B01350
LITTLE, E.L.
COMMON FUELWOOD CROPS: A HANDBOOK FOR THEIR IDENTIFICATION
(1982); EN
XZ; pg 1-354
The main objective of this handbook is to aid the identification of common trees and shrubs grown for fuelwood, mainly in the tropics. It contains botanical descriptions of 90 tree species. The book is designed to help in the recognition and naming of growing plants and specimens through non-technical descriptions and illustrations. The species described represent many environments.
SPECIES LIST; FUELWOOD; CROPS; BOTANICAL DESCRIPTION;

00335
B02364
MONTALEMBERT, M.R.; CLEMENT, J.
FUELWOOD SUPPLIES IN THE DEVELOPING COUNTRIES
FAO FOR PAP NO. 42; (1983); EN
XA/XL/XP; pg 1-125
The primary objective of this report is to draw the attention of governments concerned and of the international community to the seriousness of the problem of fuelwood supplies. Given the extent and diversity of the situations covered, this study is comparatively general in nature, but it should serve to sound the alarm wherever symptoms of deficit have been detected. The report

aims at promoting a realistic view of the energy problem of most of the people of the third world. The final purpose of this study was to promote a rapid mobilization of efforts and resources with a view to immediate large-scale action. Technical forestry solutions exist and can provide many benefits in addition to solving the problem of fuelwood supplies, e.g. stabilization of tho environment and provision of fodder, food and other products useful to domestic and rural communities. The success of these technical solutions depends, however, on the ability to adapt them to the specific needs of the people concerned, to get the people actively involved, and to make these efforts an integral part of the management of the natural resources and of the land for the benefit of the people. This illustrates the development potential of forestry programmes whose energy role constitutes an important aspect.
FUELWOOD; SUPPLY; DEVELOPING COUNTRIES; FOOD;

00336
B00339
MOSS, R.P.; MORGAN, W.B.
FUELWOOD AND RURAL ENERGY: PRODUCTION AND SUPPLY IN THE HUMID TROPICS
REPT UNU - NATURAL RESOURCE AND THE ENVIRONMENT SER VOL 4; (1981) ; EN
XA/XL/XP; pg 1-224
This book has its origin in a meeting held in Freiburg in 1977 to identify the key natural resources research fields in the humid tropics. One was the set of problems created by the dependence of a large number of people on fuelwood for cooking and heating. The book describes a rural energy research project supported by the United Nations University to study the problems of fuelwood availability and utilization. The study was to look into rural energy production and consumption, ecological constraints for fuelwood production, the relation with agriculture, alternative energy strategies, and the policy for research and development strategies. The authors concluded by indicating that a research framework to cope with the variety of problems identified during the study needed a great deal of coordination on both regional and international levels.
HUMID TROPICS; NATURAL RESOURCES; FUELWOOD; COOKING; RURAL AREAS; ENERGY SOURCES; RESEARCH; DEVELOPMENT STRATEGIES;

00337
03793
MUTHANA, K.D.
ENERGY PLANTATIONS FOR DRY ZONES
INDIAN FARMING; Vol: 33, No: 1; (1983); EN
XP/IN; pg 29-31
Wood as a source of energy is today gradually being supplemented with petroleum products, electricity, solar energy, biogas, etc.; but the supply of these products is below the total requirements. People have thus depended on forest products to meet their energy needs. In rural areas, there is an insufficient supply of firewood;, hence to meet the enormous demand, more trees have to be grown in areas unfit for crop production (dry zones). Silvopastoral systems are becoming increasingly popular. Under

this system, nutritious grasses or grass-legume mixtures are raised between tree rows. The author presents guidelines for afforestation in these arid zones.
ACACIA TORTILIS; ALBIZIA LEBBEK; FUELWOOD; ENERGY; PLANTATIONS; SILVOPASTORAL SYSTEMS; AFFORESTATION; ARID ZONES;

00338
B01921
NAS
FIREWOOD CROPS: SHRUB AND TREE SPECIES FOR ENERGY PRODUCTION
Vol: 2, (1983); EN
XZ; pg 1-92
This is the second volume in the series, the first one having been published in 1980. The purpose of this report is not to delineate strategies for growing and using firewood but rather to provide some general concepts and methods for planners and technicians to consider. The emphasis is on species suitable for firewood for individual families. Species suitable for plantations, for fueling small industries, electric generators and crop curing are also discussed. Particular attention is given to multipurpose trees and shrubs that have uses in addition to providing fuel; plants that can adapt well to different sites, establish easily and need little care; plants that thrive in problem environments; and plants that can fix nitrogen, growing fast and coppice.
SPECIES LIST; FUELWOOD; PLANTATIONS; FAST GROWING TREES; RURAL COMMUNITIES;

00339
03689
O'KEEFE, P.; SHAKOV, D.
FUELWOOD IN KENYA: THE POSSIBILITY FOR AGROFORESTRY CENTRES
(1981); EN
BEIJER INST; XA/KE; pg 1-53
The purpose of this paper is to describe the findings of a Kenya Ministry of Energy and Beijer project and in the light of these findings to suggest a suitable policy for the establishment of agroforestry centres. The paper has four parts: 1) the nature of the fuelwood crisis, 2) the organization of current forestry efforts, 3) structural impediments to afforestation efforts including a review of alternative nursery costs and seed availability, and 4) an outline of species to be utilized in a variety of demonstrations. In the appendix, consideration is given to stove design technology and its deployment, as this has implications for wood demand.
FUELWOOD; AGROFORESTRY; AFFORESTATION; SPECIES LIST; STOVES;

00340
06095
OHLER, F.M.J.
<THE> FUELWOOD PRODUCTION OF WOODED SAVANNA FALLOWS IN THE SUDAN ZONE OF MALI
AGROFOR SYST; Vol: 3, No: 1; (1985); EN
XA/ML; pg 15-23
The characteristics of a fallow farming system in the Sudan zone of Mali are outlined. Sorghum and bulrush millet are the staple

crops (70 per cent of the cultivated area); groundnuts are the cash-crop (25 per cent of the cultivated area). On average, seven trees are kept per ha (crown cover 7 per cent), of which 60 per cent are sheabutter trees. Various productive and environmental functions of fallow periods are pointed out. Factors influencing the fallow vegetation are summarized. A concise description of fallow vegetation succession is given. Data are presented on the shrub layer structure (mainly coppice) and wood production in relation to grazing intensity. It is calculated that 30-50 per cent of the fuelwood consumption of small-scale farmers can be supplied by their fallows.
FALLOW SYSTEMS; WOODY PLANTS; SAVANNAS; SMALL SCALE FARMING; SPECIES LIST; TROPICS;

00341
01995
OPENSHAW, K.
WOODFUEL AND THE ENERGY CRISIS: PROBLEMS AND POSSIBLE SOLUTIONS
(1981); EN
XZ; pg 1-12
The paper examines the demand and supply situation for wood fuel in developing countries. It is estimated that in many areas of the tropics more wood is being removed than is growing annually. Fuelwood is a low-cost product and it has to be grown near where it is required. This is one of the problems when planning for its renewal; other problems are population change and competition for land, working time and establishment techniques needed to meet such a demand. Possible solutions examined include a switch to commercial, non-renewable energy and the substitution of alternative renewable energy resources, e.g. biogas. Neither are appropriate to rural people. The only lasting solution is to increase tree planting and this has (to a large extent) to be done by the farmers themselves. It is concluded that governments should increase tree planting on hillsides as well as on farms and should invest in energy plantations for industry and urban areas.
FUELWOOD; ENERGY CRISIS; POPULATION CHANGE; TREES; PLANTING; ENERGY; PLANTATIONS; TROPICS;

00342
03680
OPENSHAW, K.
COSTS AND BENEFITS OF PROPOSED TREE PLANTING PROGRAMME FOR SATISFYING KENYA'S WOOD ENERGY REQUIREMENTS
(1982); EN
BEIJER INSTITUTE; NAIRE; pg 1-134
Fuelwood is compared to other sources of energy in Kenya. Fuelwood is much cheaper and requires no foreign exchange. Growing woodfuel by the Forestry Department in Kenya is said to be more expensive than in Tanzania because of low task rates. Detailed input-output models are presented for woodfuel plantations (government operated), a taungya system, agrisilviculture farm models with different rotation periods, and agrosilvopastoral systems. Proposed species for the latter are Prosopis spp. and Leucaena spp. Recommended short-rotation fuelwood species are Calliandra spp. and Sesbania spp.
WATERSHEDS; MANAGEMENT; FUELWOOD; FODDER CROPS; FOOD; FERTILIZERS;

ENERGY; CHARCOAL; AGROFORESTRY; DEVELOPMENT; AGRISILVICULTURE; AGROSILVOPASTORAL SYSTEMS; TREES; ECONOMIC ANALYSIS; TREES; PLANTING;

00343
04467
PRASAD, U.
EUCALYPTUS TRIALS FOR RURAL FIREWOOD PLANTATIONS IN BIHAR
INDIAN FOR; Vol: 110, No: 5; (1984); EN
XP/IN; pg 510-517
The paper describes the provenance trials of Eucalyptus species: Eucalyptus camaldulensis, E. hybrid and E. rostrata. These trials were conducted in order to prove the worthiness of these species for firewood plantations. After analyzing the data it was concluded that the raising of Eucalyptus plantations for fuelwood in Bihar was promising.
EUCALYPTUS CAMALDULENSIS; EUCALYPTUS ROSTRATA; EUCALYPTUS TERETICORNIS; FUELWOOD; RURAL AREAS; PROVENANCE TRIALS; FOREST PLANTATIONS;

00344
B02764
SPECIAL ENERGY PROGRAMME
WOODFUEL PLANTATIONS IN KENYA
(1984); EN
XA/KE; pg 1-68
This study presents the costs and benefits of woodfuel plantations in Kenya. It consists of four chapters: Ch. 1 deals with the concept of woodfuel plantations and its potential as an energy-policy strategy in Kenya; Ch. 2 discusses the economic principles of managing woodfuel plantations and outlines a practical approach for the economic assessment of fuelwood-charcoal production schemes; Ch. 3 is concerned with the feasibility of energy cropping under the specific conditions to be found at Muka Mukuu Estate in Machakos District; and Ch. 4 draws up the final conclusions.
FUELWOOD; ENERGY; PLANTATIONS; ECONOMICS; WOOD ;

00345
03583
SKAR, S.L.
FUEL AVAILABILITY, NUTRITION AND WOMAN'S WORK IN HIGHLAND PERU: THREE CASE STUDIES
ILO - WORLD EMPLOYMENT PROGRAMME RES WORK PAP NO 23; (1982); EN
XL/PE; pg 1-96
This study explores the relationship between changing fuel availability, rural women's work and family nutrition. It is based on field research work in three villages representing distinct ecologies, population, settlement patterns and land tenure systems in Peru's southern highlands. The study reveals the linkages between access to fuel, eating habits and welfare of villagers. The author found out that the poorest fuel area was forced by isolation and lack of market to depend on food that demands a lot of fuel to cook, and partly as a result only two meals are cooked per day as opposed to three or four in other areas. The study also

illustrates the inappropriateness of a simple distinction between commercial and non-commercial fuels in separating traditional renewable fuels (like wood) from modern fuels (like kerosene and oil). In the areas studied as in many other regions, fuelwood may be more or less commercial, depending on access rights to forage, the distance necessary for gathering and the availability of unpaid family labour. Trade in fuelwood can in fact be a source of income.
FUELWOOD; WOMEN; LABOUR; RURAL COMMUNITIES; VILLAGES; NUTRITION; FOOD PREPARATION;

00346
05155
BAUMER, M.C.
<THE> ROLE OF BOSCIA SENEGALENSIS (PERS) LAM. IN RURAL ECONOMY IN AFRICA: ITS CONSUMPTION BY CATTLE
(ROLE DE BOSCIA SENEGALENSIS (PERS) LAM. DANS L'ECONOMIE RURALE AFRICAINE: SA CONSOMMATION PAR LE BETAIL)
REV ELEV MED VET PAYS TROP; Vol: 34, No: 3; (1984); FR
IEMVT; XA/SN; pg 325-328
The classification of fodder plants according to their acceptability for cattle is unreliable and it depends a lot on what fodder resources are available to livestock. Boscia senegalensis has generally been considered as being little palatable for cattle in some regions of Senegal where the drought has killed many fodder plants. It is perhaps a palatable ecotype or a particular taste of local cattle.
BOSCIA SENEGALENSIS; FODDER CROPS; CATTLE; PALATABILITY; RURAL DEVELOPMENT; SEMI ARID ZONES;

00347
04551
BELIARD, C.A.
PRELIMINARY RESULTS OF A STUDY ON BIOMASS PRODUCTION FROM LIVING FENCE POSTS OF GLIRICIDIA SEPIUM ESTABLISHED ON CATTLE FARMING, PALMERA, SAN CARLOS, COSTA RICA
(1983); EN
XL/CR; pg 1-11
The paper presents preliminary results of a study on biomass production from living fence posts of Gliricidia sepium established on a cattle farm in Palmera, San Carlos, Costa Rica. The 5-year-old posts had an average height of 2-2.5 m at a spacing of 1.5 m. Pruning frequencies of 3 to 6 months were compared. It is indicated that one pruning after 6 months gave an overall higher forage production (dry weight) than two prunings at 3-month intervals. The amount of forage produced did not differ significantly at 1.6 and 1.4 ton per km of fence at 6 and 3 months respectively.
GLIRICIDIA SEPIUM; HEDGING PLANTS; BIOMASS; FODDER; CATTLE;

00348
02187
CISSE, M.I.
EFFECTS OF VARIOUS STRIPPING REGIMES ON FOLIAGE PRODUCTION OF SOME BROWSE BUSHES OF THE SUDANO-SAHELIAN ZONE

BROWSE IN AFRICA: THE CURRENT STATE OF KNOWLEDGE (LE HOUREOU, H.N. ED.); (1980); EN
XA; pg 211-214
This paper presents the results of a study carried out to determine the reaction of bushes to browsing. Three species (Combretum aculeatum, Cadaba farinosa and Feretia apodanthera) were experimented with to test the effects of stripping on annual production and the influence of stripping interval and method on total production. The results showed that the interval, method and date of first utilization have an influence on the foliage production of that year and may as well affect the subsequent year's production.
COMBRETUM ACULFATUM; CADABA FARINOSA; FERETIA APONDANTHERA; BROWSING; TREES; LIVESTOCK; ARID ZONES; SAHEL;

00349
04580
DEB ROY, R.; PATHAK, P.S.
SILVOPASTORAL RESEARCH AND DEVELOPMENT IN INDIA
INDIAN REV LIFE SCI; Vol: 3, (1983); EN
XP/IN; pg 247-264
The authors have highlighted the paucity of various animal products like milk, meat and wool in spite of the huge livestock population of India which is mainly due to malnutrition. Similarly the acute scarcity of fuelwood and the high cost, which leads to the prevalent wasteful burning of huge amounts of cow dung, are also emphasized. The need to follow the silvopastoral system of farming for utilizing large tracts of wasteland to solve these problems is stressed. The available literature on silvopastoral research and development, which is quite scanty, has been reviewed under various headings.
ACACIA TORTILIS; ALBIZIA; LEUCAENA LEUCOCEPHALA; SESBANIA SESBAN; CENCHRUS CILIARIS; SILVOPASTORAL SYSTEMS; RESEARCH; ANIMAL PRODUCTS; FODDER CROPS; PLANT PRODUCTION; ECONOMICS;

00350
B00139
HABIT, M.A.
PROSOPIS TAMARUGO: FODDER TREE FOR ARID ZONES
FAO PLANT PRODUCTION AND PROTECTION PAPER 25; (1981); EN
XL; pg 1-110
This report offers a critical review of background material available on Prosopis tamarugo, a native of northern Chile. The purpose of the analysis is to contribute further to what is already known about this interesting desert fodder tree, in the hope of stimulating more research, both in Chile and the world over. The report is divided into four parts: part 1 gives general data on the genus Prosopis, the habitat where P. tamarugo is found, and the launching of a combined grazing and forestry programme; part 2 deals with the basic subject of this report: P. tamarugo, a native of the Tamarugal pampa; part 3 covers the multiple and complex facets of animal production; part 4 looks at the geographical features of the Tamarugal pampa, analyzing such abiotic factors as climate, geomorphology, hydrology and soils.
PROSOPIS TAMARUGO; ARID ZONES; FODDER CROPS; PRODUCTIVITY; MANAGEMENT; PLANTATIONS; GRAZING; SOILS; ANIMAL PRODUCTION;

00351
01921
JAMESON, D.A.
<THE> RELATIONSHIP OF TREE OVERSTOREY AND HERBACEOUS UNDERSTOREY VEGETATION
J RANGE MANAGE; Vol: 20, (1976); EN
XN; pg 274-249
A mathematical model is applied to study the effect of the upperstorey tree canopy on the development of the understorey vegetation. The results are presented in a set of curvilinear regression models.
PINUS PONDEROSA; FESTUCA ARIZONICA; MUHLENBERGIA MONTANA; JUNIPERUS; BOUTELOUA GRACILIS; GUTIERREZIA SAROTHRAE; SHADING; VEGETATION; CANOPIES;

00352
02276
JOHNSEN, T.N.; GOMM, F.B.
FORAGE PLANTINGS ON SIX ARIZONA PINYON-JUNIPER SUBTYPES
J RANGE MANAGE; Vol: 34, No: 2; (1981); EN
XN/US; pg 131-136
Forty-four species and varieties of forage plants, including 3 shrubs, 6 forbs, and 35 grasses, were planted at each of six sites in four Arizona pinyon-juniper climatic subtypes. Represented were cold-moist and cold-dry climatic subtypes, each on medium and fine textured soils: a warm-moist climatic subtype on fine textured soil; and a warm-dry climatic subtype on medium textured soil. Sites are described and classified to help identify planting potential and facilitate wider application of results. Data are given on plant emergence, establishment, survival during 12 growing seasons, and forage production.
ELYMUS SMITHII; ELYMUS HISPIDUS; SITANION HYSTRIX; ATRIPLEX CANESCENS; BOUTELOUA; FODDER CROPS; SITES; CLIMATE; SOWING; ARID ZONES;

00353
00105
KADAMBI, K.
USEFUL FODDER TREES AND GRASSES FOR CULTIVATION IN GHANA
GHANA FARMER; Vol: 5, No: 2; (1963); EN
XA/GH; pg 75-80
A description is presented of a number of trees used throughout South-East Asia and Australia as fodder trees, which would be suitable for the climatic conditions of the various regions of Ghana. Each description includes the address where seeds may be purchased. A few of these trees are Ficus bengalensis, Acacia arabica, Albizia amara, Pithecellobium saman, Sesbania grandiflora, Prosopis juliflora, Eucalyptus cladocalyx and Hardwickia binata. A list of fodder trees and grasses indigenous to West Africa concludes the article.
FICUS BENGHALENSIS; ACACIA ARABICA; ALBIZIA AMARA; PITHECELLOBIUM SAMAN; SESBANIA GRANDIFLORA; MORINGA OLEIFERA; HARDWICKIA BINATA; PROSOPIS JULIFLORA; ZIZIPHUS JUJUBA; PANICUM MAXIMUM; PENNISETUM PURPUREUM; FODDER CROPS; ROTATIONAL GRAZING; GRASSES; SPECIES

LIST;

00354
02159
LAWTON, R.M.
BROWSE IN MIOMBO WOODLAND
BROWSE IN AFRICA: THE CURRENT STATE OF KNOWLEDGE (LE HOUEROU, H.N. ED.); (1980); EN
XA/TZ/ZM/ZW; pg 25-31
This review of the browse resource in miombo considers a number of ecological and sociological constraints, such as the widespread presence of the tsetse fly (Glossina morsitans), the long dry season, and the lack of traditional skills in animal husbandry. Introduced pasture legumes are not discussed. Experiments over a 4-year period on the utilization of 29 species by cattle in north-eastern Zambia showed that they were browsed. Observations are made on browsing preference. Miombo species, it is concluded, will not survive frequent browsing throughout the year. Comments are made on some common browse species, especially their protein content, the difference in browsing between cattle and wildlife, and suggestions for the utilization and management of browse. Most nutritious browse is obtained during the latter half of the dry season.
BRACHYSTEGIA; BAPHIA; JULBERNARDIA; MARKHAMIA; COLOPHOSPERMUM MOPANE; DALBERGIA NITIDULA; PARINARI CURATELLIFOLIA; DIPLOCHYNCUS CONDYLOCARPON; COMBRETUM FRAGRANS; CAPPARIS; MIOMBO; VEGETATION; FEED CROPS; NATURAL DISTRIBUTION; ENVIRONMENTAL CONDITIONS; TRYPANOSOMIASIS; FIRES; PHENOLOGY; COPPICING; WILDLIFE; LIVESTOCK; PALATABILITY; REVIEW; CRUDE PROTEIN;

00355
B00631
LE HOUEROU, H.N. (ED.)
BROWSE IN AFRICA: THE CURRENT STATE OF KNOWLEDGE
(1980); EN
XA; pg 1-491
This book is a synthesis of the scattered and sometimes difficult to find literature on browse species and their utilization by animals in Africa. It is based on the sharing of experience by 50 scientists who are authorities on the subject and come from different ecological areas and continents. A further 10 communicators have been added to those presented at the symposium to allow better coverage of certain subjects. The book is divided into several sections: regional studies preceded and review papers, multiple use of fodder trees and shrubs, biology and pruning production, secondary production, nutritive value and use by animals, establishment, utilization and management, intensive production, integration of browse in pastoral or agropastoral systems, socioeconomic constraints to the use of browse in development programmes, gaps in knowledge and research priorities, conclusion and recommendations.
FEED CROPS; ANIMAL PRODUCTION; LIVESTOCK; MULTIPURPOSE TREES; SHRUBS; AGROFORESTRY;

00356
04079
MALCOLM, C.V.; DONEY, T.J.
PLANTING SHRUBS FOR BIOMASS PRODUCTION FROM SALINE ENVIRONMENTS
FAO-UNEP MANUAL ON FORESTRY IN ARID AND SEMI ARID LANDS WITH SPECIFIC REFERENCE TO DESERT AND RURAL; (1983); EN
XP/AU; pg 1-23
The authors discuss the methods of making salt-affected wastelands productive by planting salt-tolerant shrubs. Under natural conditions many saline environments support salt-tolerant shrubs which are useful as forage and fuel. Revegetation of the bare saline soils using these shrubs may provide forage and fuel, reduce run-off, erosion and groundwater levels. Species for testing in saline environments are listed and methods of testing for their adaptability to specific sites are discussed.
SALINE SOILS; SALT TOLERANCE; PLANTS; FEED CROPS; GOATS; CAMELS; EROSION CONTROL; SPECIES SELECTION; FUELS;

00357
01552
MANANDHAR, P.K.
FARM FORESTRY IN MOUNTAIN ECOSYSTEM
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1979); EN
XP/IN; pg 69-75
The Nepalese depend almost wholly on forest products for their fuelwood and animal fodder requirements. The overdependence on forest resources has led to massive deforestation, soil erosion and other severe consequences. Past government effort to curb the practice has met little success. Hence, new forest rules had to be promulgated. This led to the creation of Panchayat forest, a system similar to community forestry. A list of forest tree species planted each year in Panchayat forests is provided. A separate list of fodder trees is also attached to the end of the article.
FARM FORESTRY; SOILS; EROSION; ECOSYSTEMS; AFFORESTATION; FORESTS; SPECIES LIST; POLICIES; FODDER CROPS; HIGHLAND;

00358
B00631
MCKELL, C.M.
MULTIPLE USE OF FODDER TREES AND SHRUBS, A WORLD WIDE PERSPECTIVE
BROWSE IN AFRICA: THE CURRENT STATE OF KNOWLEDGE (LE HOUEROU, H.N. ED.); (1980); EN
ILCA; XA; pg 141-150
Fodder trees and shrubs have been overlooked. This paper identifies areas where opportunities for development exist, highlights available knowledge, and points out deficiencies in knowledge. Shrubs are useful for grazing and in dry seasons, complement forage available during most seasons. Examples are given of use of shrubs for firewood, the job of shrubs in soil fertility maintenance, habitat maintenance, control of desert encroachment, construction, windbreaks and landscaping. Shrubs provide their greatest benefits to grazing animals during periods of nutritional stress when the nutritional value of dormant grasses and forbs is low or when there is little forage except

shrubs available because of drought. However, biological information on the various shrub genera and species is inadequate to serve as a basis for developing the full potential of browse. Management practices need to be improved to optimize the advantages shrubs offer for multiple rangeland uses.
RANGELANDS; ARID ZONES; SEMI ARID ZONES;

00359
04192
MILTON, S.J.
ACACIA TORTILIS SUBSP. HETERACANTHA PRODUCTIVITY IN THE TUGELA DRY VALLEY BUSHVELD: PRELIMINARY RESULTS
BOTHALIA; Vol: 14, No: 3-4; (1983); EN
XA/ZA; pg 767-772
Acacia tortilis dominates secondary succession in the Tugela dry valley bushveld of the Natal midlands. The parts of KwaZulu in this veld type are impoverished, overpopulated and overgrazed. Preliminary results indicate that at a density of 2700 plus or minus 600 trees per ha, there is a standing crop of C.2.87 ton per ha dry matter (DM) of Acacia twigs suitable for hand pruning and milling into fodder, but this is a costly process. Herbage biomass peaked at 0.73 t per ha (DM). Veld condition assessments suggested a stocking rate of 10.1 animals per ha (grazers), but actual grazer stocking may be many times this density. It is recommended that the grazer-browser ratio be altered to make use of the 1.05 tons per ha (DM) of shoot growth produced annually by A. tortilis subsp. heteracantha.
ACACIA TORTILIS; SEMI ARID ZONES; FODDER CROPS; ENVIRONMENTAL CONDITIONS; VELD; BIOMASS; PRUNING;

00360
03758
MUTHANA, K.D.; ARORA, G.D.
PERFORMANCE OF ACACIA TORTILIS (FORSK) UNDER DIFFERENT HABITATS OF THE INDIAN ARID ZONE
ANN ARID ZONE; Vol: 19, No: 1-2; (1980); EN
XP/IN; pg 110-118
Trials on Acacia tortilis have been carried out at various locations in W. Rajasthan since 1958. Germination and growth attributes of this species have been compared with a large number of other acacias at different habitats. The effects of weeding, fertilization, spacing and cropping have been recorded. Pre-germination seed treatment both with 50 per cent sulphuric acid for 30-40 min or with boiling water for 3 min increased the rate and extent of germination. A. tortilis was adjudged the best species in terms of growth at all habitats. The mean annual increment in height was 61 cm on deep sandy soils, 56.1 cm on shifting sand dunes, 44 cm on rocky sites, 57.5 cm on semi-rocky sites and 55.5 cm on shallow sandy loam soils. Weeding round the plants improved their growth whereas fertilizer applications had no significant effect. Spacing of 3 m x 3 m gave the highest fuel yield. Although the desirable spacing of this tree for silvopastoral management has been worked out as 5.6 m x 10 m, it has also demonstrated an excellent ability to coppice. This species should therefore find very wide application in increasing the productivity of arid tracts at a faster rate.

ACACIA TORTILIS; ARID ZONES; SILVOPASTORAL SYSTEMS; DROUGHT RESISTANCE; FODDER CROPS; GERMINATION; WEEDING; SPACING; YIELDS;

00361
04865
PAKHRIBAS AGRICULTURAL CENTRE
FODDER TREE PRODUCTION STUDY 1976-1977
(1983); EN
XP/NP; pg 1-5
This study measures the productivity of some commonly utilized fodder trees in Nepal. Eight fodder trees were examined and the following measurements were taken: diameter at breast height, height to base of crown, and crown diameter. The branches were also cut, the leaves and the twigs separated and weighed, and the moisture content determined. Presents results, which suggest that there are intrinsic features that make one tree more productive than another of the same species, and lists the best of the trees examined.
FODDER CROPS; PRODUCTIVITY; CHEMICAL ANALYSIS;

00362
B00620
PANDAY, K.K.
FODDER TREES AND TREE FODDER IN NEPAL
(1982); EN
XP/NP; pg 1-107
The author explains the livestock and fodder situation in Nepal and shows a way to improve the fodder base and the ecology. He describes the fodder trees of Nepal and their nutritive value, methods of propagation and utilization techniques. He also suggests ways of promoting them. A list of these trees and shrubs is given with names in Nepali, Latin and English. Included are a number of colour photos.
SOILS; EROSION; FODDER CROPS; SPECIES LIST; PLANT PROPAGATION; LIVESTOCK;

00363
06091
PANDAY, K.K.; NOSBERGER, J.
NUTRIENT CONTENTS OF THE LEAVES OF THE FODDER TREE ARTOCARPUS LAKOOCHA ROXB.
AGROFOR SYST; Vol: 3, No: 3; (1985); EN
XP/NP; pg 297-303
Artocarpus lakoocha Roxb. of the Moraceae family is cultivated in Nepal as a fodder tree. The crude protein, crude fibre and mineral contents of the fodder tree leaves were investigated during the lopping season from November 1980 to March 1982 at 800 m, 1200 m in eastern Nepal. The crude protein content varied from 122 to 131 g/kg dry matter (DM); the crude fibre content, which seemed to remain generally low during the lopping season, varied from 171 to 202 g/kg DM. P, K, Mg, S, Mn, Fe, Cu, Zn and B concentrations in the leaves were found at levels that would meet the dietary requirements of cattle performing better than those found in Nepal.
ARTOCARPUS LAKOOCHA; NUTRIENT CONTENTS; FODDER CROPS; CRUDE

PROTEIN; CRUDE FIBRE; MINERAL CONTENT;

00364
02433
PELLEW, R.
<THE> PRODUCTION AND CONSUMPTION OF ACACIA BROWSE FOR PROTEIN PRODUCTION
BROWSE IN AFRICA: THE CURRENT STATE OF KNOWLEDGE (LE HOUEROU, H.N. ED.); (1980); EN
XA; pg 223-231
The paper considers the potential of Acacia browse as a food resource for meat production, either by domestic livestock or by free-ranging ungulate population cropped to provide a sustained protein yield. The data presented were a part of a collection of a 4-year study in Serengeti National Park, Tanzania. The paper provides a superficial outline of the methods used to determine browse production and consumption in the arid and semi arid zones of Africa with special reference to eastern Africa. It is hoped that the results of this study will at least partly remedy the deficiency of published data of browse dynamics in eastern Africa.
ACACIA; BROWSING; FEEDS; PLANT PRODUCTION; MEAT PRODUCTION; ARID CLIMATE; SPECIES LIST;

00365
03847
POULSEN, G.
IMPORTANT FOREST PRODUCTS IN AFRICA OTHER THAN WOOD AND WOOD EXTRACTIVES: A PRELIMINARY STUDY
(1981); EN
FAO; XA; pg 1-37
This report describes non-wood forest products, which include feed for wildlife, fibrous materials for structural purposes, and a large number of useful chemical compounds. It emphasizes the importance of carrying out research covering important products and recommends investigation of their chemical contents and nutritional and physical characteristics. Another aspect given great importance is the promotion of activities that may serve to enhance production quantitatively: silvicultural measures, genetic improvement, integrated resource management, improved marketing, etc. Finally, it recommends a selection of developmental activities aiming at enhancing resource utilization within the framework of continental collaboration.
SPECIES LIST; MINOR FOREST PRODUCTS; FOOD; FODDER; RESEARCH; INFORMATION FLOW;

00366
04864
PRADHAN, P.R.
CHEMICAL ANALYSIS FOR FODDER TREES FROM DHANKUTA DISTRICT, KOSHI ZONE, NEPAL, 1980-1981
(1983); EN
XP/NP; pg 1-16
In areas with shortages of forages, tree fodders are utilized as feed for animals. It is thus essential to know the composition of foodstuffs and what the animals require for their maintenance and

production. This paper aims at obtaining an estimate of digestibility and nitrogen content of fodder tree species being used by Nepalese farmers. The author presents the results of the analysis and recommends those species that had higher values of crude protein, dry matter and dry matter digestibility.
FODDER CROPS; CHEMICAL ANALYSIS; SPECIES LIST; NUTRITIVE VALUE;

00367
04226
ROBINSON, P.J.
TREES AS FODDER CROPS
ATTRIBUTES OF TREES AS CROP PLANTS (CANNEL, M.G.R., ET AL. EDS.); (1984); EN
XZ; pg 1-29
The author looks at past reliance on fodder from woody perennials (in this paper referred to as fodder trees) and at their potential in farming systems. The current revival in interest in fodder trees is associated with the increasing emphasis placed by many individuals and institutions who are concerned with research and development in rural areas on the role of multipurpose trees and of agroforestry in sustaining rural development. The discussions in this paper include the historical perspective of fodder trees, their production and nutritive value, livestock performance and nutrition, and the potential and further role of fodder trees. It is concluded that agricultural development in developing countries points toward situations where fodder trees could play an important role, and this means a list of better fodder tree species for different environmental and management conditions is urgently required so that more detailed investigations can be initiated.
FEED CROPS; PHOTOSYNTHESIS; VEGETATION; SHADING; TOLERANCE; NUTRITIVE VALUE; RESEARCH; SAHEL; BIOLOGICAL PRODUCTION; LIVESTOCK:

00368
01109
SALINAS, H.E.; SANCHEZ, S.C.
STUDY OF PROSOPIS TAMARUGO AS A PRODUCER OF FORAGE FOR LIVESTOCK (ESTUDIO DEL TAMARUGO COMO PRODUCTOR DE ALIMENTO DEL GANADO LANAR EN LA PAMPA DEL TAMARUGAL)
INST FORESTAL ING TEC NO 38; (1971); ES
XL; pg 1-36
During the years 1976 to 1979 the Forestry Institute worked on a study of Prosopis tamarugo Phil. as a producer of forage for livestock. Thirty control plots were established within existing plantations of known age. Data dealing with growth and production of leaves and fruit related with age, initial spacing and ecological factors were analyzed. Salinity and groundwater table depth were the environmental conditions analyzed since these two variables have a great significance in vegetation growth. The results demonstrated that the growth of tamarugo was conditioned by age and initial spacing and its potential productivity varied greatly in relation to the age of the trees. Salinity and depth of the groundwater table did not show significant effects.
Considering the relation of growth and production of fruits as a function of age and initial spacing, an economic evaluation was

made by using the alternatives of 10 x 10 m, 13.5 x 13.5 m and 15 x 15 m in the initial spacing. The rate of productivity was 10.87 per cent, 12.12 per cent and 11.75 per cent respectively; therefore, the most profitable initial spacing was 13.5 x 13.5 m.
PROSOPIS TAMARUGO; PLANTATIONS; LEAVES; ECOLOGY; SALINITY; ECONOMIC ANALYSIS; CLIMATE; FODDER CROPS; LIVESTOCK; SPACING; YIELDS; TROPICS;

00369
03745
SHARMA, S.K.; GUPTA, R.K.
EFFECTS OF SEASONAL LOPPING ON THE TOP FEED (LOONG) PRODUCTION AND GROWTH OF PROSOPIS CINERARIA (LINN) DRUCE
INDIAN J FOR; Vol: 4, No: 4; (1981); EN
XP/IN; pg 253-255
Prosopis cineraria is frequently lopped by villagers in W. Rajasthan to feed their livestock. Investigations on lopping of this tree in different seasons of the year indicate detrimental effect on the growth and top feed production of the tree when lopped in spring and summer. Winter is the ideal season for lopping. Besides high quality top feed production, winter lopping boosts plant height and bole diameter of the tree. One year rest period is essential for sustained forage yield.
PROSOPIS CINERARIA; LOPPING; ARID ZONES; GROWTH; FODDER CROPS; YIELDS;

00370
04857
VON SZYSZA, M.; MEULEN, U. TER
<THE> ACCEPTABLE DAILY INTAKE FOR MIMOSINE IN PRODUCTIVE LIVESTOCK AND ITS IMPORTANCE FOR THE USE OF LEUCAENA LEUCOCEPHALA IN ANIMAL NUTRITION
(DER (ACCETABLE DAILY INTAKE) FUR MIMOSIN BEI LANDWIRTSCHAFLICHEN NUTZTIEREN UND SEINE BEDEUTUNG FUR DIE EINSETZBARKEIT VON LEUCAENA LEUCOCEPHALA IN DER TIEFERNAHRUNG)
DTSCH TIERAERZTL WOCHENSCHR; Vol: 91, (1984); DE
XZ; pg 260-262
By feeding Leucaena leaves and seeds respectively to broilers, laying hens, rabbits, cattle, goats and sheep, there were found acceptable intakes of mimosine of 0.16, 0,21; 0.23, 0.18, and 0.14 g mimosine intake per kg body weight respectively. The primary symptoms caused by mimosine were different with animal species, age and rate of synthesis. In calculating mimosine tolerance of productive livestock, the relation to absolute body weight seems more appropriate than metabolic body weight.
LEUCAENA LEUCOCEPHALA; MIMOSINE; TOXICITY; LIVESTOCK; BODY WEIGHT; ANIMAL NUTRITION;

00371
04099
ZUMER-LINDER, M.
IMPLEMENTATION OF WOOD AND FORAGE PRODUCTION IN ARID, PASTORAL PARTS OF AFRICA: A CASE OF TURKANA, KENYA
SEMINAR ON FORAGE AND FUEL PRODUCTION FROM SALT AFFECTED WASTELANDS, W AUST MAY 1984; (1984); EN

XA/KE; pg 1-21
The revegetation of arid salinity-affected pastoral lands has long been considered one of the most difficult issues in the management and reclamation of natural resources. The transformation of migrating pastoralists to semi-sedentary and sottled life has been almost everywhere in Africa characterized by indiscriminate destruction of indigenous vegetation in areas of population pressure and of innovative land use. Afforestation projects in pastoral lands are usually initiated only whenever the shortage of resources is becoming serious, with the well known consequence of advancing desertification. The paper describes in detail a tree planting and reclamation project in Turkana which was initiated to incorporate trees into many types of land use, produce fuelwood as well as fodder, and to reclaim areas where the population pressure was too high and the land badly degraded. Most of Turkana is arid with a closed drainage system and sparse vegetation. Soils are largely saline and alkaline.
ARID ZONES; SALINE SODIC SOILS; PASTORALISM; TREES; PLANTING; POPULATION CHANGE; MARGINAL LANDS; FUELWOOD; FODDER CROPS;

00372
05252
AHMED, S.; GRAINGE, M.
<THE> USE OF INDIGENOUS PLANT RESOURCES IN RURAL DEVELOPMENT: POTENTIAL OF THE NEEM TREE
INT J DEV TECH; Vol: 3, (1985); EN
XZ; pg 123-130
The potential of the hardy neem tree (Azadirachta indica), a native of the Indian subcontinent where it is revered for its many pharmacological and other beneficial properties, is assessed for agriculture and rural development in less developed countries (LDCs). It is considered that pest-control materials, which can be produced from the neem tree at the village level, can be used effectively to reduce dependence on imported synthetic pesticides and to generate income for the rural poor. Analysis shows that the transfer of neem pest control technology should not pose any serious problem, either in countries of which the neem is a native, or in those into which it has recently been introduced. The major problem to be solved, it would appear, is that of removing the stigma that is often attached to the use of traditional materials in LDCs agriculture.
AZADIRACHTA INDICA; INDIGENOUS PLANTS; RESOURCES; RURAL DEVELOPMENT; PEST CONTROL; DEVELOPING COUNTRIES; TROPICS;

00373
05022
CHAGAS, J.M.; FILHO, I.A.P.; VIEIRA, C.
EFFECTS OF LEUCAENA AS A GREEN MANURE AND CHEMICAL FERTILIZER NPK ON THE YIELD OF BEANS
(EFEITOS DA LEUCENA E DA ADUBACAO NPK SOBRE A CULTURE DO FEIJAO NO CERRADO)
REV CERES; Vol: 30, No: 172; (1983); PT
XL/BR; pg 481-485
An experiment was carried out in a poor "cerrado" soil at Patrocinio, state of Minas Gerais, to determine the effect of Leucaena leucocephala as a green manure and of chemical

fertilization on the yield of beans (Phaseolus vulgaris). Treatments included leucaena plus levels of 0 and 40 kg/ha of N (as ammonium sulphate), 0 and 70 kg/ha of P2O5 (as ordinary superphosphate), and 0 and 60 kg/ha of K2O (as Potassium chloride). Additional treatments were 0-0-0 and 40-70-60 kg/ha of N-P2O5-K2O, both without the green manure. The leucaena and the NPK fertilization had the same effect, increasing the bean yield from 83 to 350 kg/ha. With leucaena, the superphosphate had the greatest effect, followed by the nitrogenous fertilizer. The complete chemical fertilization associated with the green manuring resulted in the highest yield of 900 kg/ha.
LEUCAENA LEUCOCEPHALA; PHASEOLUS VULGARIS; GREEN MANURES; FERTILIZERS; YIELDS; CROP PRODUCTION;

00374
04993
FOUQUE, A.
MEDICINAL PLANTS OF THE GUYANESE FOREST
(LES PLANTES MEDECINALES PRESENTES EN FORET GUYANAISE)
FRUITS; Vol: 36, No: 10; (1981); FR
IRFA; XL/GF; pg 567-592
The ecology movement and the widespread tendency to return to nature have caused international laboratories to send phytologists to South America, Africa and Asia in search of medicinal plants. The paper presents different medicinal plants encountered by the author while prospecting the Guyana forests. The plants are classified by family, and the plant origin, description, multiplication and utilization are given.
DRUG PLANTS; BOTANY; PLANTS; SERVICES; TROPICAL RAIN FORESTS; SPECIES LIST; PLANT PROPAGATION; HUMID TROPICS;

00375
05269
NAMBIAR, V.P.K.
OUR VANISHING MEDICINAL TREES: 2. STERIOSPERMUM SPP.
(1985); EN
XP/IN; pg 5-6
Stereospermum species is fast disappearing in India, leading to an acute shortage of medicinal raw material. Various varieties and the medicinal value of the respective parts of the plant are given.
STEREOSPERMUM COLAIS; STEREOSPERMUM CHELONOIDES; DRUG PLANTS; FORESTS;

00376
04659
ADEM, H.H.; TISDALL, J.M.; WILLOUGHBY, P.
TILLAGE MANAGEMENT CHANGES, SIZE DISTRIBUTION OF AGGREGATES AND MACRO-STRUCTURE OF SOILS USED FOR IRRIGATED ROW CROPS
SOIL TILLAGE RES; Vol: 4, (1984); EN
XP/AU; pg 561-576
The Tatura system for the preparation of seedbeds for irrigated annual row crops is described, where the soil is tilled when wet and friable and so requires few passes with implements to become suitable for crops and where seeds are sown into wet soil. The

macrostructure of the surface layer of soil tilled at different water contents by the Tatura system is also quantified statistically by the method of wax impregnation.
TILLAGE; MANAGEMENT; SOIL STRUCTURE; WATER; IRRIGATION;

00377
04660
ADEM, H.H.; TISDALL, J.M.
MANAGEMENT OF TILLAGE AND CROP RESIDUES FOR DOUBLE CROPPING IN FRAGILE SOILS OF SOUTH EAST AUSTRALIA
SOIL TILLAGE RES; Vol: 4, (1984); EN
XP/AU; pg 577-589
Irrigated red-brown soils in northern Victoria were surveyed to relate water-stable aggregation and organic carbon in the surface horizon to cultural practices. In one experiment a cultivated red-brown soil was left untilled for 6 months over winter; the water-stable aggregation increased by 48 per cent. The growth of ryegrass for 6 months in the same soil increased the water-stable aggregation by a further 35 per cent when compared with the untilled bare control. In a second experiment, the effects over 4 years of two different systems of soil management for continued row cropping on the physical and biological properties of a red-brown soil are described.
ZERO TILLAGE; SOIL MANAGEMENT; SOIL TYPES; CROPS; MINERALS;

00378
00030
CHARREAU, C.; VIDAL, P.
INFLUENCE OF ACACIA ALBIDA ON THE SOIL MINERAL NUTRITION AND YIELDS OF PEARL MILLET IN SENEGAL
(INFLUENCE DE L'ACACIA ALBIDA SUR LE SOL, NUTRITION MINERALE ET RENDEMENTS DES MILS PENNISETUM AU SENEGAL)
AGRON TROP (PARIS); Vol: 20, No: 6-7; (1966); FR
XA/SN; pg 600-626
The paper discusses the importance of Acacia albida in the improvement of soil fertility as well as soil structure in Senegal. Experiments carried out with millet grown underneath the acacia trees indicated that nitrogen mineralization under the tree trunks was 60 kg N/ha whereas away from the trees was as low as 45 kg N/ha. Millet yields under the trees was much higher than way from the trees because of the nitrogen fixation by the acacia trees. The authors conclude that from the agricultural and methodological points of view Acacia albida will play a great role in the improvement of Senegalese soils.
ACACIA ALBIDA; PENNISETUM ; SOILS; NUTRIENT CONTENT; SOIL PHYSICOCHEMICAL PROPERTIES; SOIL FERTILITY; SEED COLLECTION; CROPS; YIELDS; SEMI ARID ZONES;

00379
00052
DANCETTE, D.; POULAIN, J.F.
INFLUENCE OF ACACIA ALBIDA ON PEDO-CLIMATIC FACTORS AND CROP YIELDS
Vol: 14, No: 2; (1969); EN
XA/SN; pg 143-184

The microclimate changes induced by the presence of Acacia albida and the effects of the physical and chemical properties of the sandy soils in Senegal are discussed. About 60 kg N/ha and 40 kg N/a may be mineralized in soils under and away from the acacia trees respectively. Therefore, without any fertilizer application groundnut and sorghum grown under the trees yielded more than the plants away from the trees. Furthermore, addition of fertilizers resulted in insignificant yield increases. The possibility of increasing and maintaining the level of organic matter in the soil is briefly discussed. It is concluded that the effects of Acacia albida are of great importance in traditional agriculture where fertilizers are not used.
ACACIA ALBIDA; SOIL FERTILITY; MICROCLIMATE; SOIL WATER CONTENT; SOIL PHYSICOCHEMICAL PROPERTIES; NITROGEN FIXATION; CONSERVATION; RESEARCH; CROPS; YIELDS; SEMI ARID ZONES;

00380
03184
FELKER, P.
DEVELOPMENT OF LOW WATER AND NITROGEN REQUIRING PLANT ECOSYSTEMS TO INCREASE AND STABILIZE AGRICULTURAL PRODUCTION OF ARID LAND DEVELOPING COUNTRIES
OTA PAP NO 3; (1981); EN
XA/XL/XP; pg 157-198
A low-industrial-input, commodity-oriented approach for stimulating economies of arid land developing countries is described using adapted plant species. Tree legume biomass farms of Acacia, Leucaena and Prosopis genera are suggested to provide increased fuelwood. Increased soil fertility and ensuing water-use efficiency could be achieved by the use of deep-rooted, drought-resistant, nitrogen fixers such as Acacia albida and Prosopis cineraria. Prosopis and Acacia pods, Atriplex forage, Leucaena and cactus could increase livestock feed supplies. Production of food crops such as millet, sorghum and groundnuts could be increased by intercropping them with arid-land-adapted legumes. The paper discusses the potential of some of these plants in the improvement of agricultural production and economies of the arid lands of the world.
PROSOPIS CINERARIA; ACACIA ALBIDA; SIMMONDSIA CHINENSIS; PARTHENIUM ARGENTATUM; ATRIPLEX; LEUCAENA; ARID ZONES; AGRICULTURAL PRODUCTION; NITROGEN FIXATION; RESEARCH; FARMERS;

00381
03235
GIBBON, D.; HARVEY, J.; HUBBARD, K.
<A> MINIMUM TILLAGE SYSTEM FOR BOTSWANA
WORLD CROPS; Vol: 26, No: 5; (1974); EN
XA/BW; pg 229-234
The authors outline the problems faced by small farmers in Botswana in trying to produce enough food to feed their families. The low soil fertility and low rainfall coupled with poor farming methods are major contributors to low crop production. New systems and techniques plus implements for minimum or zero tillage have been tried by the Farming Systems Research Project; their outcomes are discussed.
ZERO TILLAGE; FARMING SYSTEMS; DRY FARMING; DRAUGHT ANIMALS; FARM

IMPLEMENTS; FERTILIZERS;

00382
04553
GLOVER, N.L.; BEER, J.W.
SPATIAL AND TEMPORAL FLUCTUATIONS OF LITTERFALL IN THE AGROFORESTRY ASSOCIATIONS COFFEA ARABICA VAR. CATURA - ERYTHRINA POEPPIGIANA AND C. ARABICA VAR. CATURA - E. POEPPIGIANA - CORDIA ALLIODORA
(1984); EN
XL/CR; pg 1-43
This paper reports on the results of a case study on spatial and temporal fluctuations in litterfall (including artificial pruning) in two adjacent privately owned Erythrina poeppigiana - Coffea arabica plots, one of which includes Cordia alliodora as a third component. The study concentrated on the role of Erythrina poeppigiana with the objective of learning how to better manage this species with two different associations for the benefit of C. arabica. The site of study is described and the methodology discussed in detail.
COFFEA ARABICA; CORDIA ALLIODORA; ERYTHRINA POEPPIGIANA; AGROFORESTRY; ASSOCIATIONS; SHADE TREES; NITROGEN FIXATION; FOREST LITTER; NUTRIENTS; NATURAL DISTRIBUTION; HUMID TROPICS;

00383
B00757
GUPTA, R.K.
PLANTS FOR ENVIRONMENTAL CONSERVATION
(1980); EN
XP/IN; pg 1-247
Environmental degradation resulting from the twin effects of deforestation and soil erosion is threatening the ecological stability of the Himalayas. The book comprehensively discusses the nature and extent of the problem in view of recommending possible solutions. The author has specifically underlined the importance of tree-based structural components as a positive measure toward ameliorating the situation.
SPECIES LIST; SOIL CONSERVATION; EROSION; SOIL FERTILITY; VEGETATION; IRRIGATION; CARRYING CAPACITY; FLOODING; AGROFORESTRY; FOREST LITTER;

00384
03309
HARRISON, P.
FOOD, FUEL AND ZERO TILLAGE
DEV COOP; Vol: 6, (1981); EN
XA/XL/XP; pg 13-14
The author outlines the importance of organic farming in the tropics with reference to the use of minimum or zero tillage for better crop production.
ZERO TILLAGE; CROP PRODUCTION; ORGANIC FARMING; TROPICS;

00385
04903
IBARRA, R.B.
PROPOSALS FOR SOIL AND WATER CONSERVATION BASED ON PRELIMINARY ASSESSMENT OF LAND DEGRADATION: NAMIBIA
FAO - FIELD DOCUMENT DPNAM78004, ROME; (1981); EN
XA/NA; pg 1-38
This report evaluates land degradation in Namibia; it recommends feasible measures to prevent further destruction of land resources and a conservation farming system to increase production from agricultural, range and forestry land. Remedies to ameliorate land degradation are explained and recommended farming systems for cultivated lands in Etosha Basin are presented. For the protection of ridges of the tallest hills against wind erosion, shelterbelts of poplar or willow trees are recommended. Trees should however be re-established in overgrazed areas to achieve an effective forest cover for protecting the land from soil erosion. The method of surface runoff control includes the use of bench and absorption terraces on sloping lands and tied ridges on top of low hills.
LANDSCAPE; SOIL CONSERVATION; WATER SUPPLY; WATER CONSERVATION; LAND USE; SOIL FIXATION; DUNES; SALINE ALKALINE SOILS;

00386
B02938
KELLEY, H.W.
KEEPING THE LAND ALIVE: SOIL EROSION - ITS CAUSES AND CURES (INCLUDES WORLD SOIL CHARTER)
FAO SOILS BULL NO 50; (1983); EN
XZ; pg 1-79
Erosion is severe in many developing countries, and the aim of practically all conservation systems is to permit a satisfactory level of production while keeping erosion as low as possible. This soils bulletin describes how soil erosion is destroyed, and touches on food production versus land degradation, human barriers to conservation and aims and techniques of soil management. The author then points out government's responsibility for conservation, and stresses the need for obtaining more facts about resources.
SOILS; EROSION; FOOD PRODUCTION; SOIL MANAGEMENT; EROSION CONTROL; HUMAN ACTIVITIES; SOIL CONSERVATION; RESOURCES; PROJECT;

00387
02277
LE HOUEROU, H.N.
AGROFORESTRY TECHNIQUES FOR THE CONSERVATION AND IMPROVEMENT OF SOIL FERTILITY IN ARID AND SEMI ARID ZONES
BROWSE IN AFRICA: THE CURRENT STATE OF KNOWLEDGE (LE HOUEROU, H.N. ED.); (1980); EN
XZ; pg 433-435
This paper draws attention to a few successful examples of agroforestry in various countries with a variety of ecological and socioeconomic conditions. It outlines the scientific justifications for such systems and discusses the more familiar ones. These include 1) the Acacia albida agropastoral system in Africa, 2) fodder shrub plantations in the Mediterranean basin, 3) the Dehesa system, 4) trees and grass (grass production under a

tree canopy). It also discusses the role of trees and shrubs in improving soil fertility in arid and semi arid areas.
ACACIA ALBIDA; PROSOPIS CINERARIA; AGROPASTORAL SYSTEMS; SOIL FERTILITY; SEMI ARID ZONES; FODDER CROPS; FOOD CROPS; ARID ZONES;

00388
06070
LUNDGREN, B.O.; NAIR, P.K.R.
AGROFORESTRY FOR SOIL CONSERVATION
SOIL EROSION AND CONSERVATION (EL-SWAIFY, S.A. ET AL EDS.); (1985) ; EN
XZ; pg 703-717
In this review the potential of agroforestry (AF) in soil conservation, soil conservation is used in its widest sense, including all aspects of quality that contribute to sustained soil productivity, i.e. soil erosion control, maintenance and improvement of soil, and physical, chemical and biological properties. The paper touches on the conservation role of woody perennials, soil management for conservation, traditional soil conservation, and emerging principles. It gives research needs and recommendations and briefly describes the International Council for Research in Agroforestry.
AGROFORESTRY; SOIL CONSERVATION; SOIL MANAGEMENT; TROPICS;

00389
05220
MGENI, A.S.M.
SOIL CONSERVATION IN KONDOA DISTRICT, TANZANIA
LAND USE POLICY; Vol: 2, No: 3; (1985); EN
XA/TZ; pg 205-209
This paper describes how overpopulation and overgrazing have taken their toll on the sandy loam soils of the Irangi Highlands, Kondoa District, Tanzania. Deforestation, animal husbandry and bush fires have together exacerbated the problem of soil erosion. The paper describes how the HADO rehabilitation and reclamation programme (Hifadhi Ardhi Dodoma - Conserve Soil in Dodoma) has put into practice a series of soil conservation measures including ridge construction along contours reinforced by trees and grasses, construction of diversion banks, animal evacuation, and improved agricultural practices. The sometimes detrimental effects of these measures are outlined, and the author concludes with an analysis of lessons learnt from HADO.
SOIL CONSERVATION; RURAL DEVELOPMENT; EROSION CONTROL; SANDY SOILS; ZOOTECHNY; FIRES; TROPICS;

00390
B01262
MONGI, H.O. (ED.); HUXLEY, P.A. (ED.)
SOILS RESEARCH IN AGROFORESTRY: PROCEEDINGS OF AN EXPERT CONSULTATION, NAIROBI
(1979); EN
XA/XL/XP; pg 1-584
The proceedings are a collection of soils research review papers on methodologies and strategies that can be of value in the development and study of agroforestry systems. The papers indicate

the state of the art in soils research relative to the needs of agroforestry by examining research in agriculture and forestry under monoculture, mixed, and intercropping conditions, especially those incorporating trees. They describe research methods that require further development to meet agroforestry needs and presents indications for soils research in different agro-ecological conditions and for fragile ecosystems. They summarize the chemical, biological and physical methods proposed for use in monitoring soils under agroforestry and stress the need for standardization in methodology, reporting styles, and research strategy.
SOILS; RESEARCH; AGROFORESTRY; TROPICS;

00391
05004
NARAYANA, V.V.D.; SASTRY, G.; BABU, R.
SOIL CONSERVATION MEASURES IN THE CATCHMENT OF RESERVOIRS
INDIAN FARMING; Vol: 46, (1985)
XP/IN; pg 3-6
The Central Soil Conservation Research and Training Institute has evolved a soil conservation technology that will reduce soil erosion and flood hazards and increase the productivity of denuded lands. Techniques include measures for water harvesting and measures of agricultural lands, forests and grasslands in a watershed. The author presents a general list of these practices in a tabulated manner. The author also presents results of efficiency of each of these soil conservation practices.
SOIL CONSERVATION; EROSION; WATERSHEDS; TECHNOLOGY; CATCHMENT AREAS;

00392
03616
NEUMANN, I.F.
USE OF TREES IN SMALLHOLDER AGRICULTURE IN TROPICAL HIGHLANDS
ENVIRONMENTALLY SOUND AGRICULTURE (LOCKERETZ, W. ED.); (1983); EN
XA/RW; pg 351-374
The soils of Rwanda are poor, with severe soil acidity, low absorption capacity and low base saturation; hence even fertilizers are used with poor efficiency. The main problem of hill agriculture is soil erosion, and farm size is frequently well below one hectare. In view of this situation, the hypothesis regarding the function of trees in the agroecosystem is here tested.
GREVILLEA ROBUSTA; LEUCAENA LEUCOCEPHALA; TROPICS; HIGHLAND; SMALL SCALE FARMING; ORGANIC FARMING; TREES; SPECIES LIST; FOOD PRODUCTION; SOIL CONSERVATION; EROSION CONTROL;

00393
02783
RADWANSKI, S.A.; WICKENS, G.E.
VEGETATIVE FALLOWS AND POTENTIAL VALUE OF THE NEEM TREE (AZADIRACHTA INDICA) IN THE TROPICS
ECON BOT; Vol: 35, No: 4; (1981); EN
XA/XL/XP; pg 398-414
Research into the systems of agriculture based on vegetative

fallows should begin from inquiries into the shrubs and trees most efficient in restoring soil productivity and providing firewood, timber fodder and other products essential in meeting basic needs of rural households and communities. Local processing of such products can give rise to the establishment of thriving village industries and thus generate employment and additional income. The neem tree, Azadirachta indica, of the semi arid regions is one outstanding example of a species that is not only an efficient soil ameliorant but can also provide a series of products highly competitive in price and quality with petroleum-based synthetics. Enough scientific evidence has been gathered from several hundred references on the subject to warrant the launching of a well-coordinated multidisciplinary research and development programme leading to agricultural, industrial and commercial exploitation of this tree. Proposals for the implementation of several projects within the programme are briefly outlined in this paper.
AZADIRACHTA INDICA; FARMING SYSTEMS; FALLOW SYSTEMS; FODDER; FOOD; WOOD; FUELWOOD; RURAL COMMUNITIES; HOUSEHOLDS; SEMI ARID ZONES; SOIL AMENDMENTS; RESEARCH; PROJECTS;

00394
04465
SHARMA, B.M.
SCRUB FOREST STUDIES: FOLIAR AND SOIL NUTRIENT STATUS OF PROSOPIS JULIFLORA DC
INDIAN FOR; Vol: 110, No: 4; (1984); EN
XP/IN; pg 367-374
In recent years attention has been given to the effect of a concentration of cations in the soil and of those taken up by plants. Such information is not available for the phanerophytes of the arid lands. This paper aims at providing information about the nutrient content of the habitat in the scrub forest of a desert (Thar desert of India), the nutrient content of the leaves of one of the dominant trees, Prosopis juliflora, and the correlation, if any, between the foliar and the soil nutrients.
PROSOPIS JULIFLORA; NUTRIENT UPTAKE; ARID ZONES; SOIL; NUTRIENT CONTENT;

00395
02744
SINGH, K.S.; LAL, P.
EFFECTS OF KHEJRI (PROSOPIS SPICIGERA) AND BABOOL (ACACIA ARABICA) TREES ON SOIL FERTILITY AND PROFILE CHARACTERISTICS
ANN ARID ZONE; Vol: 8, (1969); EN
XP/IN; pg 33-36
A study was conducted to find out the soil profile characteristics under Prosopis spicigera and Acacia arabica. Levels of soil fertility under both trees were determined and comparisons were made with the open field conditions in the adjoining area to find out whether soil properties have any bearing on the observed growth characteristics of the understorey vegetation. The results were tabulated. Better crop growth under khejri could have been due to higher content of organic matter, total nitrogen, available P2O5 and soluble calcium and lower pH values. The author recommends khejri plantations for improving arid lands.

ACACIA ARABICA; PROSOPIS SPICIGERA; ARID ZONES; MANAGEMENT; SOIL STRUCTURE; SOIL FERTILITY; SHADING; ORGANIC MATTER;

00396
03092
VAN KESSEL, C.; ROSKOSKI, J.P.
NODULATION AND NITROGEN FIXATION BY INGA JUNICUIL, A WOODY LEGUME IN COFFEE PLANTATIONS: 2. EFFECT OF SOIL NUTRIENTS ON NODULATION AND N2 FIXATION
PLANT SOIL; Vol: 59, (1981); EN
XL/MX; pg 207-215
The effect of soil nutrients on nodulation by Inga jinicuil, a leguminous tree used for shade in Mexican coffee plantations, is discussed. Nodulation and acetylene reduction of I. jinicuil seedlings, grown in soil taken at different distances from coffee trunks, are described. Nodule biomass and activity are compared to the nutrient content of soils within various distances of coffee trunks. Seven coffee plantations that employ I. jinicuil for shade were examined with respect to nodule biomass, acetylene-reducing activity and soil characteristics. Highest nodule biomass was observed in soils with high levels of available phosphorus. High nitrogen content of the soil, on the other hand, appeared to be correlated with low nodule biomass. Potassium and magnesium, while apparently having little effect on nodule biomass, seem to be positively correlated with acetylene reduction.
INGA JINICUIL; COFFEA; NUTRIENT CONTENT; NITROGEN FIXATION; ROOT NODULATION; SHADE TREES; ACETYLENE REDUCTION; BIOMASS; WOODY PLANTS; LEGUMES;

00397
04924
VAN KRAAYENOORD, C.W.S.
POPLARS IN EROSION CONTROL
SOIL WATER; Vol: 2, No: 4; (1966); EN
XZ; pg 5-7
Trees are a major tool in combating soil erosion. In sites subject to continual soil movement, poplars and willows can be used to conserve the soil. Poplars are able to recover from mechanical damage, and when roots are broken, new shoots will be sent up. New roots will also develop when parts of the stem are buried. The author presents the planting patterns and species selection of the poplars. Further research areas are also identified.
EROSION CONTROL; TREES; PLANTING; SELECTION;

00398
04343
VERINUMBE, I.; KNIPSCHEER, H.C.; ENABOR, E.E.
<THE> ECONOMIC POTENTIAL OF LEGUMINOUS TREE CROPS IN ZERO-TILLAGE CROPPING IN NIGERIA: A LINEAR PROGRAMMING MODEL
AGROFOR SYST; Vol: 2, (1984); EN
XA/NG; pg 129-138
An economic evaluation of a zero tillage farming system against the background of small-scale farmers of south-western Nigeria was undertaken, using linear programming to maximize yearly net return on alfisols. Alternative crop rotation systems considered were

maize - maize, maize - stylo, maize - maize/stylo, maize - pigeon pea, maize - maize/pigeon pea, and maize/leucaena - maize/leucaena. The results suggested a promising future for the combined production of agricultural and forestry crops under an integrated land management system by small scale farmers in the humid tropics.
LEUCAENA LEUCOCEPHALA; CAJANUS CAJAN; ZEA MAYS; STYLOSANTHES; ROTATIONAL CROPPING; TREES; LEGUMES; ZERO TILLAGE; CROPPING SYSTEMS; ECONOMIC ANALYSIS; HUMID TROPICS;

00399
B02260
VERINUMBE, I.
ECONOMIC EVALUATION OF SOME ZERO-TILLAGE SYSTEMS OF LAND MANAGEMENT FOR SMALL SCALE FARMERS IN SOUTH-WESTERN NIGERIA
(1981); EN
XA/NG; pg 1-288
A study was conducted to determine the most economically promising zero-tillage land management system for the small farmers in south-western Nigeria. The method of evaluation was in five stages: 1) a literature survey was made and personal interviews were held with scientists involved in zero tillage; 2) a practical zero-tillage farm system was undertaken; 3) information collected was aggregated and integrated; 4) a small-scale survey was conducted among a group of small-scale farmers; 5) the technical input/output coefficients and the resource bases of the small-scale farmers were combined in a linear programming model. The crop production systems were maize - maize, maize - stylo, maize - maize/stylo, maize - pigeon pea, maize - maize/pigeon pea and maize - leucaena. Results of the analysis showed that a maximum yearly net profit of 978.58 naira/ha could be earned if the farmer produced 1.35 ha under maize/leucaena and 0.07 ha under maize/stylo. This shows that the two-crop production systems formed a substantially stable optimum zero tillage model under the given resources and information levels. The most profitable zero-tillage model guaranteed rapid establishment of trees while maintaining high yield of arable crops from improved soil fertility.
STYLOSANTHES; CAJANUS CAJAN; ZEA MAYS; LEUCAENA LEUCOCEPHALA; ZERO TILLAGE; ECONOMIC ANALYSIS; SMALL SCALE FARMING; CROP PRODUCTION; HUMID TROPICS;

00400
06121
YOUNG, A.
<THE> POTENTIAL OF AGROFORESTRY AS A PRACTICAL MEANS OF SUSTAINING SOIL FERTILITY
ICRAF WORK PAP NO 34; (1985); EN
XZ; pg 1-28
Agroforestry is a major practical management method that has the potential to maintain soil fertility through soil biological processes that control the quantity, quality and timing of decomposition of plant residues. Trees have the potential to increase the supply of organic materials and nutrients, to reduce losses, and to control the quality and timing of inputs. The paper presents an approximation of a plant/soil-organic-matter cycle

under agroforestry. It also discusses the significance of work on different fractions of organic matter and root residues and summarizes results of work on soil rest-period requirements. It emphasizes the need for research in the decomposition of woody and herbaceous residues, singly and in combination, and its effect on soil properties.
AGROFORESTRY; SOIL FERTILITY; CROP RESIDUE; DECOMPOSITION;

00401
06069
YOUNG, A.
EFFECTS OF TREES ON SOILS
AMELIORATION OF SOILS BY TREES - CSC TECH PUBL; No: 190; (1986);
EN
XZ; pg 28-41
Briefly discusses aspects of the ways in which trees affect soils, with special reference to soil improvement, beneficial effects of trees on soils and adverse effects. Mentions some practical systems of land use and management in which trees are planted and tended i.e. the protection of slopes, reclamation of eroded or degraded land, forestry for timber, fuelwood and soil amelioration, agroforestry and water-shed management. The possible adverse chemical and biological effects. The author also stresses the need for: 1) good land use planning and management, and 2) further research to prove some of the basic hypotheses in this area.
TREES; SOILS; SOIL MANAGEMENT; USES;

00402
03973
ZAFFARONI, E.; BURITY, H.A.; LOCATELLI, E.; SHENK, M.
<THR> INFLUENCE OF ZERO TILLAGE ON THE PRODUCTION OF MAIZE AND BEANS IN TURRIALBA, COSTA RICA
(INFLUENCIA DEL NO LABORED EN LA PRODUCCION DE MAIS Y FRIJOL EN TURRIALBA, COSTA RICA)
CATIE PROGRAMA DE CULTIVOS ANUALES; (1979); ES
XL/CR; pg 21
Different systems of vegetation management prior to planting were studied in monoculture maize and in a maize-bean polyculture. The systems included two ploughed treatments, one without any weed control and one with a sterile seedbed, plus three treatments without tillage, two of these based on herbicides and one on mulch. The two zero-tillage treatments with chemical control resulted in yields statistically higher than those with mulch and ploughed treatments. The yields of maize on monoculture were higher than in polyculture with beans. The economic analysis demonstrates a clear advantage for zero-tillage systems with chemical control when compared to mechanized and mulch treatments.
PHASEOLUS VULGARIS; ZEA MAYS; ZERO TILLAGE; MIXED CROPPING; YIELDS; ECONOMIC ANALYSIS; HERBICIDES; HUMID TROPICS;

00403
05327
ZAMBOANGA DEL SUR DEVELOPMENT PROJECT
<WHY IS> AGROFORESTRY/HILL FARMING NEEDED

(BULAWAN SA BAKILID)
(1985); . EN
XP/PH; pg 1-17
Most of the land available for farming in Zamboanga del Sur is steep and has been totally cleared of rain forests. The land is thus subject to severe erosion. The need is emphasized for hillside farming, using agroforestry practices to improve soil fertility, prevent soil erosion, and increase agricultural produce.
LEUCAENA LEUCOCEPHALA; AGROFORESTRY; HILL FARMING; HIGHLAND; SOIL FERTILITY; NUTRIENTS; CYCLING; CONTOUR CULTIVATION;

00404
06063
KOZLOWSKI, T.T.; HUXLEY, P.A.
<THE> ROLE OF CONTROLLED ENVIRONMENTS IN AGROFORESTRY RESEARCH
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1984); EN
XZ; pg 551-567
The paper describes types of elaborate to relatively simple controlled-environment facilities and discusses some general considerations in using controlled environments, including some special difficulties with woody perennial plants. It outlines specific areas of research on multipurpose tree species. Controlled environments can be used to good advantage to grow uniform plants and to explore genetic variation at the seedling stage; to investigate responses of seedlings and young plants to environmental stresses; to explore allelopathic relationships; to help optimize seed germination and plant propagation techniques; to study root growth; and provide a cost-effective way of obtaining needed information about multipurpose tree species, especially if used in conjunction with field experiments.
AGROFORESTRY; RESEARCH; ENVIRONMENT; MULTIPURPOSE TREES;

00405
00681
NAIR, P.K.R.; BALAKRISHNAN, T.K.
ECOCLIMATE OF COCONUT PLUS COCOA CROP COMBINATION ON THE WEST COAST OF INDIA
AGRIC METEOROL; (1977); EN
XP/IN; pg 455-462
Daily variations in temperature, vapour pressure, relative humidity and evaporation were measured at 0, 100 and 200 cm above ground level, inside plantations of unirrigated and irrigated monocrops of coconut, inside a combination crop of irrigated coconut plus cocoa, and in the open area during November-May in two consecutive seasons. The crop combination offered a buffering effect against drastic diurnal variation in the ecoclimate. Differences between the average daily values of maximum and minimum temperature and relative humidity were considerably less in the ecoclimate of the crop combination. Evaporation from the ecoclimate of the crop combination was only about 30 per cent of that from the open area.
COCOS NUCIFERA; THEOBROMA CACAO; CLIMATE; MANAGEMENT; IRRIGATION; INTERCROPPING; PLANT INTERACTION; TREE CROPS;

00406
05196
SAMRA, J.S.; DABRAL, B.G.; SINGH, K.
EDAPHIC AND MICROCLIMATOLOGICAL STUDIES WITH REFERENCE TO REGENERATION OF SAL (SHOREA ROBUSTA)
INDIAN FOR; Vol: 111, No: 6; (1985); EN
XP/IN; pg 390-408
Regeneration of sal (Shorea robusta) with reference to morphological, physico-chemical, topographical and root distribution characteristics of the lithosphere have been studied in West Dehra, Utter Pradesh. Soil temperature and moisture at two depths along with air temperature at two heights were also monitored throughout the year. Poor drainage, deficient aeration, dispersed conditions of soil during the monsoon season because of high Mg, soil moisture stress coupled with hardness during dry periods, and topographic location seem to be important edaphic factors limiting natural regeneration of sal. Comparatively low temperature and high amplitude in diurnal variation in air and soil temperature during the winter season, possibly because of scanty ground flora, absence of a shrub layer, and topographical location may be some of microclimatic factors affecting natural regeneration.
SHOREA ROBUSTA; MICROCLIMATE; REGENERATION; SPECIES LIST; SOLI PHYSICOCHEMICAL PROPERTIES; SOIL WATER CONTENT;

00407
04995
SIMON, J.C.
STUDY OF AGRONOMIC EFFECTS OF WINDBREAKS IN IRRIGATED AREAS OF THE MIDDLE-WEST OF ARGENTINA: 1. WINDBREAK EFFECTS ON GROWTH AND DEVELOPMENT OF VINES
(ETUDE DES INFLUENCES AGRONOMIQUES DES BRISE-VENT DANS LES PERIMETRES IRRIGUES DU CENTRE OUEST DE L'ARGENTINE: 1. EFFETS DES BRISE-VENT SUR LA CROISSANCE ET LE DEV. D'UNE CULTURE TYPE: LA VIGNE)
ANN AGRON PARIS; Vol: 28, No: 1; (1977); FR
XL/AR; pg 75-93
This study extends a general method for the study of windbreak biological effects to the particular case of vines used as natural windbreaks under the arid climatic conditions of the middle west of Argentina. These effects agree with those observed in temperate climates, particularly in Brittany. An advance in precocity (flowering time, fruit setting, turning and ripening stages) and an increase in production are the main effects appearing near the windbreaks. This result points out the double influence of windbreaks: permanent protection against common winds and occasional protection against high-speed winds.
VITIS VINIFERA; WINDBREAKS; IRRIGATION; FARMING SYSTEMS; MICROCLIMATE; CLIMATE; IRRIGATION;

00408
04871
STIGTER, C.J.
WIND PROTECTION IN TRADITIONAL MICROCLIMATE MANAGEMENT AND MANIPULATION: EXAMPLES FROM EAST AFRICA
EFFECTS OF SHELTER ON THE PHYSIOLOGY OF PLANTS AND ANIMALS (GRACE,

Z. ED.); (1985); EN
XA; pg 145-154
Traditional farmers have developed many skills in managing and manipulating soil and crop microclimate and in protecting crops from mechanical wind effects. Belts of trees or shrubs and windbreaks have been grown to provide shelter for crops all over East Africa. The windbreaks range from raising sides of rice beds to building walls of maize stalks around cereal fields to growing hedges and trees. Forests and forest strips are also used as shelterbelts by growing food crops at their edges.
WINDS; WINDBREAKS; WIND EROSION; TRADITIONAL FARMING; EAST AFRICA; MICROCLIMATE; CROPS;

00409
04876
STIGTER, C.J.
TRADITIONAL USE OF SHADE: A METHOD OF MICROCLIMATE MANIPULATION
ARCH METEOROL GEOPHYS BIOCLIMATOL; Vol: 34, (1984); EN
XA/TZ; pg 203-210
This paper reports on the methods smallholders employ to shade soil, seedlings, plants and crops to protect them from environmental stresses and to improve their yield capacity. Natural and artificial shading are discussed, both open shade and mulches, as well as other means of covering. Consequences of shading and shade reduction are reviewed from the point of view of modifying the energy balance of surfaces. Other consequences of shading techniques and other manipulations providing shade as a side effect are considered. Some specific examples collected from Tanzanian practice are described as evidence of today's use of shading methods in traditional farming. It is concluded that we can learn a lot from small farmers in this respect but that the science of micrometeorology could assist in improving efficiency and labour requirements of traditionally employed techniques, as well as in their wider dissemination in the farmer community.
SHADING; MICROCLIMATE; SMALL SCALE FARMING; CROPS;

00410
04877
STIGTER, C.J.
SHADING: A TRADITIONAL METHOD OF MICROCLIMATE MANIPULATION
NETH J AGRIC SCI; Vol: 32, (1984); EN
XA/TZ; pg 81-83
Microclimate management and manipulation are among the methods that have traditionally been employed on small plots in low-input agriculture. This paper deals with methods smallholders employ to shade soil, seedlings, plants and crops to protect them from environmental stresses and to improve their yield capacity. Specific examples collected from Tanzanian practice are described as evidence of today's use of shading methods in traditional farming.
SHADING; MICROCLIMATE; SMALL SCALE FARMING; TRADITIONAL FARMING;

00411
02717
TIEDEMANN, A.R.; KLEMEDSON, J.O.

EFFECTS OF MESQUITE TREES ON VEGETATION AND SOILS IN DESERT GRASSLAND
J RANGE MANAGE; Vol: 30, No: 5; (1977); EN
XN; pg 361-367
Effects of shade, roots and litter of mesquite trees on understorey vegetation and micro-environmental factors were assessed. Each of the components was observed separately and the results were statistically analyzed. It was shown that under mesquite canopies the moisture use by perennial grasses increased and approximately 7 per cent additional moisture was available for growth of understorey vegetation. Elimination of mesquite shade and root action increased foliar cover of understorey vegetation in the canopy zone from 19 to 24 per cent. Other effects were also reported. Thus it was shown the degree to which mesquite canopies moderate their environment.
PROSOPIS JULIFLORA; ACACIA GREGGII; OPUNTIA; SHADING; FOREST LITTER; VEGETATION; SOIL WATER CONTENT; SOILS; EROSION; CANOPIES; NUTRIENT CONTENT; ECOSYSTEMS; SOIL TEMPERATURE; RADIATION; COVER PLANTS; ORGANIC MATTER; PERENNIALS; GRASSES; BIOMASS; ARID ZONES;

00412
00372
MISRA, D.K.; PRASAD, R.; BHAN, S.
RECLAMATION OF THE RAJPUTANA DESERT
WORLD CROPS; Vol: 20, No: 3; (1968); EN
XP/IN; pg 18-24
Clearing the ground of vegetation cover and overgrazing are the principal causes of desertification. To reclaim these demarginalized lands the following activities are recommended in this paper: 1) control overgrazing and exploitation of trees and bushes; 2) afforest sand dunes and rocky refractory sites; 3) create windbreaks and shelterbelts to check the march of the desert; and 4) improve farming practices. Each activity is discussed at length.
ACACIA SENEGAL; ZIZIPHUS NUMMULARIA; GREWIA TENAX; COMMIPHORA MUKUL; ARISTIDA; PROSOPIS JULIFLORA; ACACIA TORTILIS; EUCALYPTUS CAMALDULENSIS; AILANTHUS EXCELSA; ALBIZIA LEBBEK; COLLIGONUM POLYGONOIDES; DESERTIFICATION; WIND EROSION; RESEARCH; ARID ZONES; CONSERVATION; AFFORESTATION; SOIL FIXATION; DUNES; WINDBREAKS; RECLAMATION; WOOD; GRASSES; SPECIES LIST; MULCHING;

00413
05390
ALLEN, J.C.; BARNES, D.F.
<THE> CAUSES OF DEFORESTATION IN DEVELOPING COUNTRIES
ANN ASSOC AM GEOGR; Vol: 75, No: 2; (1985); EN
XA/XL/XP; pg 163-184
Developing countries are faced with a two-edged sword in the field of energy: 1) the rising price of oil, and 2) increased prices or shortages of fuels such as fuelwood and charcoal. This paper reviews the most recent and sometimes controversial estimates of deforestation in developing countries and analyses the relationship between deforestation and its probable causes. Results indicate that in the short term, deforestation is due to population growth and agricultural expansion, aggravated over the long term by wood harvesting for fuel and export.

DEFORESTATION; DEVELOPING COUNTRIES; WOOD; ENERGY; FUELWOOD; CHARCOAL; POPULATION CHANGE; AGRICULTURE;

00414
06077
LUNDGREN, B.O.
GLOBAL DEFORESTATION, ITS CAUSES AND SUGGESTED REMEDIES
AGROFOR SYST; Vol: 3, No: 2; (1985); EN
XZ; pg 91-95
Man's use of land - forested land, land that borders forest, and land that long ago ceased to be forest - is the subject of this contribution. The point made is that in most developing countries, the economic potential of forestry and the ecological importance of forest ecosystems are very low priority issues. If we are concerned with the survival and perpetual utilization of tropical forests, we have to analyze the question: why do forests disappear in an alarming increasingly rate? Not because there is an evil conspiracy aiming at clearing the world of tropical forests. There are two main reasons: people and nations need new land for food production, and they need wood for a variety of different purposes. Forests, where they exist, can provide both; in many cases forests are the only reserves of land and wood.
DEFORESTATION; LAND USE; FORESTRY; TROPICS;

00415
06110
BEETS, W.C.
ASPECTS OF TRADITONAL FARMING SYSTEMS IN RELATION TO INTEGRATED PEST MANAGEMENT
ICRAF WORK PAP NO 21; (1984); EN
XA; pg 1-18
This paper gives examples of traditional systems that play an important role in pest control in modern agriculture. For each plant, there is a range of pest and disease susceptibility; therefore, selecting components of the cropping system should be carefully done. Advantages of traditional pest and disease control should be exploited before pesticides are recommended; but in view of the population pressures, land shortages and the ever-increasing quest for food, it is necessary to modernize traditional systems to some extent. Agroforestry therefore offers opportunities for sustained production of both food and wood and also integrated pest management. A few practical ways to manage pests include planting: 1) a trap or diversionary crop; 2) a crop that attracts or repulses insects through usual stimuli; 3) a physical barrier that reduces the mobility of harmful insects; 4) a pest-resistant camouflage crop to hide a susceptible second crop; 5) a genetically diverse crop that changes the microclimate of the second crop, so conditions become unfavourable for insects; 7) alternate host crops for predators; 8) crops with a repellent action; 9) pest- and disease- resistant crops or cultivars; and 10) crops in rotation with crops that host different pathogens.
FARMING SYSTEMS; TRADITIONAL FARMING; DISEASE CONTROL; PEST CONTROL; TROPICS;

00416
04952
PRASAD, S.N.
IMPACT OF AGROFORESTRY PRACTICES ON ENVIRONMENT
KARNATAKA STATE OF ENVIRONMENT REPORT 1983-1984 (SALDAHNA, C.J. ED.); (1984); EN
XP/IN; pg 36-51
This report discusses the deliberate introduction, cultivation and spreading of agroforestry tree crops and their effect on the environment. Crops like arecanut, coconut, cashew, mango, jack, cocoa and cardamom can be grown to mimic the natural forest ecosystems in their pattern of organization. They are organized in such a fashion that a unit of land supports 5-6 cultivated plant species. The tree crop or agroecosystem has a tree layer, a shrub layer, climbers and herbs. The report also discusses the possible environmental costs incurred in maintaining a cultured vegetation tailored to human needs and the sustainability of present-day agroforestry practices in the long run.
COCOS NUCIFERA; ARECA CATECHU; ANACARDIUM OCCIDENTALE; EUCALYPTUS; MICROCLIMATE; REGENERATION; SPECIES LIST; SOIL PHYSICOCHEMICAL PROPERTIES; SOIL WATER CONTENT;

00417
05026
TRIBE, D.E.
<THE> CONSERVATION AND IMPROVEMENT OF RESOURCES: THE GRAZING ANIMAL
PHILOS TRANS R. SOC LOND B BIOL SCI; Vol: 278, (1977); EN
XA/XP/AU; pg 565-582
A comparison of livestock productivity in the arid zones of Central Australia and sub-Saharan Africa is used to illustrate the ecological, social and economic factors that together determine the contrasting ways in which animal resources may be developed. Severe ecological restraints necessarily result in fluctuating animal populations and in the need for effective measures to control soil erosion, to prevent serious overgrazing, to vary stocking rates and to maintain the water supply. The aims, attitudes and needs of livestock owners also need to be recognized. Australian cattlemen primarily want to produce meat in order to make money; many African nomadic pastoralists primarily want to produce milk in order to feed their families. The need to coordinate livestock and rangeland research, planning and development on a multidisciplinary basis is emphasized and the difficulties of doing so are discussed.
GRAZING; RESOURCE CONSERVATION; LIVESTOCK; NOMADISM; ARID ZONES; PASTORALISM; ANIMAL DISTRIBUTION;

00418
04991
SIMON, J.C.; DELECOLLE, R.
STUDY OF AGRONOMIC EFFECTS OF WINDBREAKS IN IRRIGATED AREAS OF THE MIDDLE-WEST OF ARGENTINA: 2. EXPERIMENTAL STUDY OF DAMAGES INDUCED BY AN ACCIDENTAL WIND (THE ZODA) ON PLUM TREE ORCHARDS
(ETUDE DES INFLUENCES AGRONOMIQUES DES BRISE-VENT DANS LES PERIMETRES IRRIGUES DU CENTRE EST DE L'ARGENTINE DEUXIEME PARTIE ANALYSE EXPERIMENTALE DES DEGATS CAUSES PAR UN VENT ACCIDENTEL (LE

ZONDA) SUR)
ANN AGRON PARIS; Vol: 28, No: 2; (1977); FR
XL/AR; pg 215-226
The zonda, a local wind in Argentina, causes very serious damage to plum tree leaves. Exposed trees are injured particularly to the windward and to a lesser extent to the leeward. A mutual protection between trees is shown, which however seem insufficient for this sensitive species. These effects cannot be directly extended to other species. A comparative study of the sensitivity of various species to leaf injury would be necessary to define the most resistant. These might be used to protect sensitive ones.
PRUNUS; WINDBREAKS; MICROCLIMATE; FRUIT TREES; MEDITERRANEAN CLIMATE; IRRIGATION;

00419
03721
BENGE, M.D.
SOLAR CURING BARNS, FAST-GROWING TREES AND AGROFORESTRY OFFEF SOLUTION TO THE DEFORESTATION CAUSED BY TOBACCO PRODUCTION IN THAILAND, TANZANIA, SRILANKA, NEPAL, PHILIPPINES AND OTHER DEV. COUNTRIES
TECH SER NO 15 USAID WASHINGTON D.C.; (1983); EN
TH/TZ/LK/NP/PH; pg 133
In most tobacco-growing areas of the world energy requirements for tobacco curing are the main cause of deforestation. Fossil fuels are cost prohibitive and the proceeds from the enterprise do not justify their use. Wood is attractive to most farmers because it is cheap to obtain. The future of this source of energy is however becoming bleak, as extensive areas of former forest stands are cleared for tobacco plantations and as sources of wood energy. The articles contained in this publication discuss some practical solutions to the challenges posed by this high energy demand. Agroforestry systems and the utilization of solar energy are seen as two positive solutions with a long-term promise.
LEUCAENA LEUCOCEPHALA; ALBIZIA FALCATARIA; EUCALYPTUS DEGLUPTA; SHOREA NEGROSENSIS; FUELWOOD; DEFORESTATION; FUELS; AGROFORESTRY; SEEDLINGS; FARMING SYSTEMS; SHADING; NITROGEN FIXING TREES; SOIL FERTILITY; GERMINATION; POPULATION;

00420
05169
DARU, R.D.; TIPS, W.E.J.
FARMERS PARTICIPATION AND SOCIO-ECONOMIC EFFECTS OF A WATERSHE MANAGEMENT PROGRAMME IN CENTRAL JAVA (SOLO RIVER BASIN, WIROKC WATERSHED)
AGROFOR SYST; Vol: 3, (1985); EN
XP/ID; pg 159-180
A self-help watershed management project in the densely populated areas of central Java, Indonesia, is discussed in terms of its achievements to combine activities to improve the physical, the social and the economic environment. Without simultaneous, well-planned action on these three essential components the project's improvements cannot be sustained by the farmers. It was found that activities such as tree planting and maintenance, construction of soil-erosion control structures and training in agroforestry-type intensification techniques for land cultivation

serve as a focus to induce farmers to participate. Participation cannot be sustained in spite of initial decreasing net income unless increases in land productivity based on agroforestry practices together with appropriate training programmes organize and motivate the farmers. In future watershed management programmes more emphasis may be placed on the rural development planning aspects of agroforestry techniques and on rural community organization.
AGROFORESTRY; WATERSHEDS; MANAGEMENT; TREES; PLANTING; LAND USE; EROSION CONTROL; SOCIOECONOMIC ASPECTS; RURAL COMMUNITIES; HUMID TROPICS;

00421
06058
DOVE, M.R.
THEORIES OF SWIDDEN AGRICULTURE, AND THE POLITICAL ECONOMY OF IGNORANCE
AGROFOR SYST; Vol: 1, No: 2; (1983); EN
XZ; pg 85-99
Swidden agriculture is today the focus of a great deal of debate in the context of agroforestry development in humid, tropical countries. This paper argues that much of this debate deals not with the empirical facts of swidden agriculture, however, but rather with widely accepted myths and that this explains the widespread failures of developmental schemes involving swidden agriculturalists. The paper examines three of these myths in some detail.
SHIFTING CULTIVATION; CULTURAL HERITAGE; TENURE; HUMID TROPICS;

00422
04879
FORD FOUNDATION
PEOPLE AND FORESTS: A REPORT OF A FORD FOUNDATION MEETING ON SOCIAL FORESTRY AND AGROFORESTRY, NARO MORU, KENYA, 20-22 MARCH 1985
(1985); EN
XA/KE; pg 1-57
In this report of a Ford Foundation meeting on social forestry and agroforestry held at Naro Moru, Kenya, in 1985, social forestry is defined as farm- and village-level forestry by or for small farmers and the landless, whereas agroforestry is defined as a land use system in which trees, shrubs and other woody perennials are grown on land used for production of agricultural crops and animals. The main topics discussed in the meeting include 1) a review of Ford Foundation programmes, 2) target groups, 3) research and information, 4) performance criteria and evaluation, 5) experience with government programmes, 6) experience with non-government organizations, 7) other approaches, 8) common property resources management, and 9) international organizations (ICRAF and ODI programmes).
SOILS; FORESTRY; AGROFORESTRY; PROJECTS; DEVELOPMENT AID; RESOURCE MANAGEMENT;

00423
06092
FORTMAN, L.
<THE> TREE TENURE FACTOR IN AGROFORESTRY WITH PARTICULAR REFERENCE TO AFRICA
AGROFOR SYST; Vol: 2, No: 4; (1985); EN
XA; pg 229-251
Rights over trees are often distinct from rights over land. Tree tenure consists of a bundle of rights over trees and their produce which may be held by different people at different times. These rights include the right to own or inherit trees, the right to plant trees, the right to use trees and tree products, the right to dispose of trees, and the right to exclude others from the use of trees and tree products. Factors affecting who has what rights include the nature of the tree, the nature of the use, and the nature of the person or group. Landowners and tree planters tend to be relatively advantaged in terms of their rights to trees. Those with temporary claims to the land and in some cases women tend to be disadvantaged. The implications of tree tenure issues for the design of agroforestry projects are discussed.
AGROFORESTRY; TREES; TENURE; SOCIAL SCIENCES;

00424
01805
GRANDSTAFF, T.B.
<THE> DEVELOPMENT OF TRADITIONAL SWIDDEN (SHIFTING CULTIVATION) SYSTEMS IN THE MARGINAL AREAS OF NORTH THAILAND: A CASE STUDY
(1977); EN
XP/TH; pg 65
Much literature has been written on shifting cultivation in many parts of the tropics. It is often argued that these systems are ecologically undesirable and therefore should be replaced with a more sustainable land use system. This study has carried the discussion further. The study looks at the relationship between the particular agricultural adaptations and the socio-cultural characteristics of the groups involved. It does not recommend transformation of the systems, through improved technology, but encourages better understanding of the systems.
SOCIOECONOMIC ASPECTS; SHIFTING CULTIVATION; FALLOW SYSTEMS; TAUNGYA SYSTEMS; TRADITIONAL FARMING; MARGINAL LANDS; SEMI ARID ZONES;

00425
06072
LUNDGREN, B.O.; LUNDGREN, L.
SOCIOECONOMIC EFFECTS AND CONSTRAINTS IN FOREST MANAGEMENT: TANZANIA
SOCIOECONOMIC EFFECTS AND CONSTRAINTS IN TROPICAL FOREST MANAGEMENT (HALLSWORTH, E.G. ED.); (1983); EN
XA/TZ; pg 43-52
Because of the rapidly increasing population in Tanzania, there has been pressure on forest reserves both in the high-potential areas and the marginal areas. This has led to changes in forest land use practices. The paper aims at making new villages self-supplying in wood on a sustained yield basis by establishing village woodlots. Villagization programmes will prevent people

from reverting to traditional forms of living, therefore reducing shifting cultivation and cutting of trees. The taungya afforestation system has been used in establishing highland tree plantations, and emphasis is laid on protecting and managing reserved forests to achieve perpetual production of wood for the needs of the country and to secure ecological and hydrological stability of major watersheds.
SOCIOECONOMIC ASPECTS; FOREST MANAGEMENT; SMALL SCALE FARMING;

00426
B00442
OLOFSON, H.
ADAPTIVE STRATEGIES AND CHANGE IN PHILIPPINE SWIDDEN-BASED SOCIETIES
(1981); EN
XP/PH; pg 181
This volume of compiled papers discusses the various facets of shifting cultivation in the Philippines. A wide range of issues are covered in this respect. The swidden system has long been viewed as a destructive and undesirable system of land use. However, it has been shown throughout the discussions in this volume that the system, besides being complex, is built within the whole framework of social structure, and it is flexible and adaptive to changing environmental conditions and opportunities. The topics are discussed under two general headings: 1) traditional systems (4 papers), and 2) changing systems (5 papers), all preceded by an introduction which provides an in-depth analysis of the topics under discussion, compares the societies discussed, relates the papers to other works on shifting cultivation, and suggests directions for future research. Of particular agroforestry interest is the paper "From grain crops to tree crops in a Palawan swidden system".
ORGANIC MATTER; FARMING SYSTEMS; SHIFTING CULTIVATION; TECHNOLOGY; VEGETATION; REGENERATION; CONSERVATION; LOWLANDS; PLANTATIONS; EROSION; MICROCLIMATE; ROTATIONAL CROPPING; HORTICULTURE;

00427
04905
SINGH, A.K.; SINGH, M.K.; MASCARENHAS, O.A.J.
COMMUNITY FORESTRY FOR REVITALISING RURAL ECOSYSTEMS: A CASE STUDY
FOR ECOL MANAGE; Vol: 10, (1985); EN
XP/IN; pg 209-232
This paper presents a case study focusing on the socioeconomic and ecological aspects of a forest-based village, Debrasai, in the Sighbhum District of Bihar, India. This study was to evolve village-specific community forestry package programmes that could bring stability to the village, both economically as well as ecologically. The villagers have exploited the forests for fuelwood, timber and fodder. Three land-resource, skill-based package programmes, a tasar silk culture, an energy plantation, and dairying, have been suggested to generate employment opportunities and to cope with the other problems of deteriorating ecological and socioeconomic conditions.
COMMUNITY FORESTRY; SOCIOECONOMIC ASPECTS; RURAL AREAS; AGRICULTURE; FOREST PLANTATIONS; WOOD; FODDER; FUELWOOD;

00428
06088
AKACHUKU, A.F.
COST-BENEFIT ANALYSIS OF WOOD AND FOOD COMPONENTS OF AGRISILVICULTURE IN NIGERIAN FOREST ZONE
AGROFOR SYST; Vol: 3, No: 4; (1985); EN
XA/NG; pg 307-316
Costs and revenue of agrisilviculture in the Nigerian forest zone were estimated. Two crop combinations were considered: Gmelina arborea Roxb., a hardwood species, was interplanted with 1) yam (Dioscorea rotundata) and maize (Zea mays) and 2) cassava (Manihot utilissima) and maize. Agrisilviculture increases the farmer's income in this zone. The ratios of total cost to revenue are 1:2.3 for yam and maize and 1:2.4 for cassava and maize. The farmer's net income is US$4065.86 from yam and maize and US$2790.24 from cassava and maize. When the trees are clear cut after five years, the ratio of cost to revenue is 1:2.4. The farmer's net income from wood is US$2872.95. If 5 per cent of the farm families in the area practice agrisilviculture, each family cultivating one hectare, there will be enough fuelwood after five years of growth.
GMELINA ARBOREA; DIOSCOREA ROTUNDATA; ZEA MAYS; MANIHOT ESCULENTA; AGRISILVICULTURE; WOOD; FOOD; COST BENEFIT ANALYSIS; HUMID TROPICS;

00429
06060
ARNOLD, J.E.M.
ECONOMIC CONSIDERATIONS IN AGROFORESTRY PROJECTS
AGROFOR SYST; Vol: 1, No: 4; (1983); EN
XZ; pg 299-311
Economic benefits that can accrue to the small farmer from incorporating trees in his farm system, and the economic constraints and costs he may face in doing so, are reviewed. Various economic considerations other than cash outlay and income, such as impact of risk, need to be taken into account. Issues are discussed that can arise in identifying, designing and implementing projects intended to help farmers to capture the economic potentials of agroforestry and to avoid or remove related economic impediments. Correct understanding of the factors that will affect the success of project interventions, valuation of the costs and benefits of trees as perceived by the farmer rather than by outsiders, distributional and equity issues, and indentification of operational measures to ensure tangible short-term economic impacts of agroforestry practices on small-farmer situations is stressed.
AGROFORESTRY; PROJECTS; SMALL SCALE FARMING; ECONOMICS;

00430
01767
ARNOLD, J.E.M.
ECONOMIC CONSTRAINTS AND INCENTIVES IN AGROFORESTRY
(1982); EN
XP/PH; pg 11
A number of social, economic and institutional constraints, militate against farmers adopting agroforestry systems. These

constraints are discussed within the framework of cost-benefit analysis. The paper looks at the implications of encouraging farmers to adopt agroforestry systems without defining clearing the economic constraints. The paper underlines measures that can be taken to make agroforestry systems attractive by reducing these constraints.
ALBIZIA FALCATARIA; LEUCAENA LEUCOCEPHALA; EUCALYPTUS DEGLUPTA; TECTONA GRANDIS; CALLIANDRA CALOTHYRSUS; IMPERATA CYLINDRICA; PENNISETUM PURPUREUM; FARMING SYSTEMS; FALLOW SYSTEMS; AGROFORESTRY; ECONOMIC ANALYSIS; LAND USE; SHIFTING CULTIVATION; TAUNGYA SYSTEMS; ALLEY CROPPING; NUTRIENTS; FUELWOOD; FEED CROPS; LEGUMES; HOME GARDENS; CHARCOAL; FOOD;

00431
05016
BABU, R.; PURI, D.N.; SINGH, J.P.; SHARMA, S.K.
ECONOMICS OF MIXED PLANTATION OF PROSOPIS JULIFLORA AND ACACIA NILOTICA FOR FUEL IN AGRA RAVINES
ANN ARID ZONE; Vol: 23, No: 3; (1984); EN
XP/IN; pg 221-224
Economic analysis was carried out of the mixed plantation of Prosopis juliflora, Acacia nilotica, and miscellaneous species in lands with severe ravines along the bank of river Yamuna at Agra. The cost-benefit ratios of the first 15 years of rotation discount rates were worked out. Twenty per cent of the area covered with Prosopis juliflora in the first rotation coppiced profusely and was retained. The remaining area was resown. This paper reports the economic evaluation of Prosopis juliflora and Acacia nilotica plantations.
ACACIA NILOTICA; PROSOPIS JULIFLORA; ECONOMICS; FUELWOOD; MIXED FORESTS; SEMI ARID ZONES;

00432
03827
BROMLEY, D.W.
<THE> ECONOMICS OF SOCIAL FORESTRY: AN ANALYSIS OF A PROPOSED PROGRAMME IN MADHYA PRADESH, INDIA
(1981); EN
SCHOOL OF NAT RES, UNIV WISCONSIN; XP/IN; pg 53
It is emphasized that the feasibility of a programme for social forestry should be looked upon not only from the village point of view, but also from that of the forest department, the state, and the central government. Several multipurpose plantation models (grass, fodder, fuel, timber, fruit, pods, poles) are proposed for Madhya Pradesh, the mixture of trees depending on village preference. Detailed technical and economic data are provided with each model. The effect each model has upon each of the project participants is examined in detail, including a social cost-benefit analysis from the public sector point of view.
EUCALYPTUS; GMELINA ARBOREA; ACACIA; PROSOPIS; SILVICULTURE; SILVOPASTORAL SYSTEMS; WOODLOTS; ANIMALS; FUELWOOD; FRUIT TREES; FODDER CROPS;

00433
B00004
BURGESS, R.J.
<THE> INTERCROPPING OF SMALLHOLDERS COCONUTS IN WESTERN SAMOA: AN ANALYSIS USING MULTISTAGE LINEAR PROGRAMMING
(1981); EN
XP/WS; pg 1-270
Multistage linear programming has been used to model and optimize a coconut-based intercropping system for small farmers in western Samoa. It reviews some of the other methods used for optimizing multiperiod cropping systems. The model considers pineapple, cocoa, banana, and taro (a root crop) as understorey crops. Detailed input-output data are provided for the mixture as well as for the individual crops.
COCOS NUCIFERA; THEOBROMA CACAO; MUSA; COLOCASIA ESCULENTA; ANANAS COMOSUS; AGRISILVICULTURE; INTERCROPPING; ECONOMIC ANALYSIS; FARMING SYSTEMS; SMALL SCALE FARMING; YIELDS; PLANTATIONS; CROPS; FOOD CROPS; TROPICS;

00434
B02571
CHAMBERS, R.
RURAL DEVELOPMENT: PUTTING THE LAST FIRST
(1983); EN
XA/XP; pg 1-246
In this book the author challenges preconceptions dominating rural development. The central theme of the book is that rural poverty is often unseen or misperceived by outsiders, those who are not themselves poor. The focus is limited to rural poverty and to the developing countries. The author contends that researchers, scientists, administrators, and fieldworkers rarely appreciate the richness and validity of rural peoples' knowledge or the hidden nature of rural poverty. He urges a new professionalism that would fundamentally reverse the learning values and behaviour of outsiders and proposes more realistic action in tackling rural poverty.
RURAL POOR; RURAL DEVELOPMENT; SOCIOLOGY;

00435
03385
COLFER, C.J.P.
CHANGE AND INDIGENOUS AGROFORESTRY IN EAST KALIMANTAN
BORNEO RES BULL; Vol: 3, No: 21; (1983); EN
XP/ID; pg 3-21
The author reports on research motivated by an interest in documenting the interaction between the people and the forest of East Kalimantan, Borneo, in the light of the rapid changes taking place there with the extraction of the province's wealth in natural resources. A concern for the impact of these changes on women emerged as another important neglected consideration. Dayak agroforestry practices, referred to as shifting cultivation, forms the focus by which these changes can be analyzed. The author reviews some of the recent literature on shifting cultivation then analyses the agroforestry systems as practiced in this region, including the role played by women in the systems.
AGROFORESTRY; SHIFTING CULTIVATION; TRADITIONAL FARMING; HUMID

TROPICS;

00436
B01963
DYKSTRA, D.P.
FOOD AND FUELWOOD: A PRELIMINARY MATHEMATICAL PROGRAMMING ANALYSIS FOR UJAMAA VILLAGE IN TANZANIA
PROC KENYA NATIONAL SEMINAR ON AGROFORESTRY, ICRAF, NAIROBI, 12-22 NOVEMBER 1980 (BUCK, L. ED.); (1981); EN
XA/TZ; pg 123-136
This short paper deals with mathematical programming as a tool for analyzing alternative agroforestry schemes. An example is drawn from Musangano, an ujamaa village in Mbeya Region of southern Tanzania. Using a linear programming model, various food and fuelwood requirements are estimated. The statistical analysis employs secondary data from various sources. The method used is well illustrated. The paper closes with illustrative tables provided in the appendix.
AGROFORESTRY; TAUNGYA SYSTEMS; PROGRAMMING; FOOD; FODDER; FUELWOOD; LAND USE; RURAL DEVELOPMENT; ECONOMIC ANALYSIS;

00437
04003
ETHERINGTON, D.M.
MULTIPERIOD BUDGETING AND THE ECONOMIC ASSESSMENT OF PERENNIAL CROP INTERCROPPING SYSTEMS
(1981); EN
XZ
This paper describes the development and the use of an interactive computer-based multiperiod partial budgeting programme, the objective of which is to aid scientists in ranking alternative perennial crop intercropping systems by economic criteria.
AGROFORESTRY; EROSION; CROPPING PATTERNS; TECHNOLOGY; ECONOMIC ANALYSIS; INTERCROPPING;

00438
02894
ETHERINGTON, D.M.; KARUNANAYAKE, K.
AN ECONOMIC ANALYSIS OF SOME OPTIONS FOR INTERCROPPING UNDER COCONUTS IN SRI LANKA
J AGRAR STUD; Vol: 2, No: 1; (1981); EN
XP/LK; pg 1-25
This paper presents a discussion on economic and ecological beneficial effects of intercropping as opposed to monocropping systems. The advantages of intercropping are discussed with respect to the use of land and labour resources. To realize the beneficial effects accruing to such a system will depend on proper planning, based on a well-designed model. Current concerns are expressed that are involved in building perennial-crop intercropping models in general and for coconut in particular. The basic procedures for such modelling are outlined. For the purpose of the present analysis the authors have designed an interactive computer program called MULBUD. Application of the model has provided the results on which the authors proceed to analyze intercropping systems of a case study in Sri Lanka. The analysis

confirms the potential of intercropping under coconuts as a way of meeting the basic subsistence requirements of the farmers and the country.
ZEA MAYS; THEOBROMA CACAO; PASSIFLORA EDULIS; ANANAS COMOSUS; MANIHOT ESCULENTA; MANGIFERA INDICA; COFFEA; COCOS NUCIFERA; FARMING SYSTEMS; HUMID TROPICS; POPULATION; INTERCROPPING; BIOLOGICAL PRODUCTION; ECONOMIC ANALYSIS; ECOLOGY; EMPLOYMENT; ENERGY FLOW; MULTIPLE CROPPING;

00439
03844
FELKER, P.
ECONOMIC, ENVIRONMENTAL, AND SOCIAL ADVANTAGES OF INTENSIVELY MANAGED SHORT ROTATION MESQUITE (PROSOPIS SPP.) BIOMASS ENERGY FARMS
(1981); EN
XN/US; pg 1-20
The advantages of wood energy are illustrated in intensively managed short rotations (3-8 years) of woody biomass plantations with the presentation of data from mesquite biomass production trials in California and Texas. Results show that selected strains of arid-adapted nitrogen-fixing trees of the genus Prosopis have achieved yields of 14.5 t/ha per year, and natural Prosopis stands occur on 22 million ha in Texas. Managed biomass farms of Prosopis should therefore be capable of supporting large petrochemical- and electrical-generating facilities with fuel costs less than oil, gas, or coal in Texas. Prosopis also has significant economic, environmental, and industrial management advantages.
PROSOPIS; ENERGY; PLANTATIONS; ARID ZONES; NITROGEN FIXATION; ECONOMICS; ENVIRONMENTAL CONSERVATION; ROTATIONAL CROPPING; BIOMASS;

00440
B01363
FILIUS, A.M.
ECONOMIC ASPECTS OF AGROFORESTRY
VIEWPOINTS ON AGROFORESTRY (WIERSUM, K.F. ED); (1981); EN
XZ; pg 47-73
In this paper agroforestry is defined as the integration of forestry and agriculture, both vertically on a single plot and horizontally within a holding, and is analyzed in terms of relations between the components. A theoretical production possibility curve indicates the favourability of different combinations which are classified as complementary, supplementary, or competitive. The effect of various factors, including labour, land, capital, and local knowledge, on the potential economic and social success of agroforestry is discussed with particular reference to tropical systems on fragile land.
PINUS RADIATA; TECTONA GRANDIS; GMELINA ARBOREA; IMPERATA CYLINDRICA; AGROFORESTRY; BIOLOGICAL COMPETITION; ECOSYSTEMS; LAND USE; ECONOMIC ANALYSIS;

00441
04440
HAROU, P.A.

ECONOMIC PRINCIPLES TO APPRAISE AGROFORESTRY PROJECTS
PROC 17TH IUFRO WORLD CONGRESS, KYOTO, JAPAN; (1981); EN
XZ; pg 127-139
Current interest in agroforestry systems emerges from the expressed desire to preserve tropical and arid ecosystems and to ensure food self-sufficiency. The author has described various types of agroforestry projects, underlining the basic principles to take into consideration in project appraisal. A discussion of the method as applied to the evaluation of an agroforestry project in the Sahel is presented.
AGROFORESTRY; FRAGILE ECOSYSTEMS; TAUNGYA SYSTEMS; INTERCROPPING; CANOPIES; FARMLAND; SHIFTING CULTIVATION; FUELWOOD; ARID ZONES;

00442
06117
HOEKSTRA, D.A.
ECONOMIC CONCEPTS OF AGROFORESTRY
ICRAF WORK PAP NO 30; (1985); EN
XZ; pg 1-12
The paper briefly explains the economic methods for analyzing agroforestry systems. Mixing of perennials and annuals and animals may in time be profitable if the positive interactions are maximized and the negative ones are minimized. This will lead to income maximization and other economic benefits such as spreading of risk, diversity of income flow, and home consumption of tree products like firewood and poles and to "delayed" biologically and economically advantageous interactions such as "sustainability". Manipulation of biological and economical interactions between components can however only be achieved through proper choice of components and management practices. The paper also briefly touches on the tools and methods for analysis - linear programming, partial budgeting, and MULBUD, a computer program for multiperiod budgeting.
AGROFORESTRY; ECONOMIC ANALYSIS;

00443
06081
HOEKSTRA, D.A.
AN ECONOMIC ANALYSIS OF A SIMULATED ALLEY CROPPING SYSTEM FOR SEMI ARID CONDITIONS, USING MICROCOMPUTERS
AGROFOR SYST; Vol: 1, No: 4; (1984); EN
XA/KE; pg 335-345
Two models, 1) traditional maize and beans and 2) leucaena alley cropping with maize and beans were compared in Machakos. MULBUD, a microcomputer program for agroforestry systems, was used for simulations and analyses. Results indicated an increase in maize and beans in model 2. The maize benefited from the organic N from the leucaena mulch, and the beans benefited from the organic P obtained from leucaena. Land, labour, and drought appeared to be more beneficially handled in model 2 than in model 1. The paper presents graphical displays produced by MULBUD, illustrating the differences in labour use and flow of net revenue between models 1 and 2.
LEUCAENA LEUCOCEPHALA; ALLEY CROPPING; SEMI ARID CLIMATE; MICROCOMPUTERS; ECONOMIC ANALYSIS;

00444
01547
OPENSHAW, K.; MORIS, J.
<THE> SOCIOECONOMICS OF AGROFORESTRY
UNIV DAR ES SALAAM, MOROGORO, MISC PAP; (1979); EN
XP/ID/KR; pg 29
This paper examines the economic aspects of agroforestry, concentrating mainly on the forestry component. It addresses some social constraints that may prevent people from adopting such systems. Using a cost-benefit analysis model, the authors quantify the benefits and costs accruing to the farmer with and without tree components in the system under review. The authors have looked at the economics of energy use and the ecological consequences of deforestation. Sound farm management demands proper utilization of extension services; practical courses; and the provision of suitable tree species, equipment, credit facilities, and even cash. Land tenure is a major obstacle to tree growing in many countries, and this problem must be tackled before agroforestry techniques can be transferred from the drawing board to the field. The authors have drawn examples from different parts of the world to demonstrate the successful application of forest components into farm areas. The paper has been enriched by tables and bibliographic citations.
CALLIANDRA CALOTHYRSUS; ACACIA TORTILIS; GREWIA BICOLOR; EUCALYPTUS ; AGRISILVICULTURE; HUMID TROPICS; AGROFORESTRY; FUELWOOD; FODDER; SOIL FERTILITY; FOOD;

00445
B01680
RAINTREE, J.B.
BIOECONOMIC EVALUATION OF AGROFORESTRY: CROPPING SYSTEMS
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1983); EN
XZ; pg 271-289
This paper describes the potentiality of agroforestry systems under given circumstances. Particular emphasis is placed on the application of bioeconomic analysis as opposed to a pure economic analysis. Theoretical production possibility curves are provided to indicate the favourability of different combinations, which are classified as complementary, supplementary or competitive. The author adds that bioeconomic factors alone cannot indicate wholesome adoption of a technology. Equally important are socioeconomic features such as land use and tenure, community organizations, transport, and marketing systems. There is a great need to devise incentives for and encourage participation by local populations. Budgeting techniques are discussed and illustrative use of linear programming is given.
ACACIA ALBIDA; PARKIA CLAPPERTONIANA; LEUCAENA LEUCOCEPHALA; GLIRICIDIA SEPIUM; CAJANUS CAJAN; PROSOPIS CINERARIA; AGROFORESTRY; BIOECONOMICS; LAND USE; FARMING SYSTEMS; BIOLOGICAL COMPETITION; INTERCROPPING; MULTIPURPOSE TREES;

00446
04774
RHOADES, R.E.
USING ANTHROPOLOGY IN IMPROVING FOOD PRODUCTION: PROBLEMS AND

PROSPECTS
AGRIC ADM; (1984); EN
XA/XL/XP; pg 33
The paper explores the role of social anthropology in agricultural research and development. For the first time since the 1940s social anthropologists are showing an interest in applying their profession to problems related to basic food production and utilization. Similarly development agencies and agricultural research organizations are more receptive to anthropology than ever before. Potentials, limitations and misconceptions of using anthropology for improving basic food production are discussed. A case study of agricultural anthropology at an international crop improvement centre is discussed.
AGRICULTURAL DEVELOPMENT; ANTHROPOLOGY; RESEARCH; FOOD PRODUCTION; SOCIOLOGY;

00447
03355
ROKAYA, C.M.
IMPACT OF THE SMALL FARMERS CREDIT PROGRAM ON FARM OUTPUT, NET INCOME AND ADOPTION OF NEW METHODS: A NEPALESE CASE STUDY
ADC RES PAP SER NO 15; (1983); EN
XP/NP; pg 14
The author evaluates the impact of agricultural credit on farm output, net income and adoption of new agricultural methods by small farmers and examines the relationship of small farmers' personality attributes to the adoption of new methods and institutional borrowing. The analysis data were collected from 80 randomly selected farmers. The study shows that the provision of agricultural credit to small farmers increased farm output and net income through increased cropping intensity, but the credit was not related to the adoption of new agricultural methods. The small farmers' income levels, educational levels and attitudes toward risk and institutional credit were factors that influenced their adoption of new methods and their use of credit.
SMALL SCALE FARMING; INCOME; ECONOMIC ANALYSIS; CREDIT;

00448
03059
VERGARA, N.T.
ECONOMIC EVALUATION OF AGROFORESTRY PROJECTS
(1982); EN
EPI EAST-WEST CENTRE ; XA/XL/XP; pg 23
Some guidelines are provided on how to evaluate agroforestry land use systems in general terms as well as the techniques available for this purpose. It includes an example of an alley cropping system of Leucaena leucocephala and maize on a 2-hectare upland farm. The example gives physical as well as financial data and it concludes that alley cropping is more beneficial than the traditional cropping system of two maize crops per year.
LEUCAENA LEUCOCEPHALA; ZEA MAYS; AGRISILVICULTURE; ALLEY CROPPING; AGROFORESTRY; FAST GROWING NITROGEN FIXING TREES; FODDER; FUELWOOD; EROSION; ECONOMICS; TROPICS;

00449
02923
VERINUMBE, I.; KNIPSCHEER, H.C.; ENABOR, E.E.
<THE> POTENTIAL OF LEGUMINOUS TREE CROPS IN ZERO-TILLAGE CROPPING IN NIGERIA: A LINEAR PROGRAMMING MODEL
(1981); EN
XA/NG; pg 1-21
An economic evaluation of a zero-tillage farming system performed by smallholder farmers in south-west Nigeria. Applying a linear programming model, the authors were able to determine profit levels for zero-tillage systems. The various crop combinations considered were maize - maize, maize - stylo, maize - maize/stylo, maize - pigeon pea, maize - maize/pigeon pea, and maize/leucaena - maize/leucena. The maize/leucaena alley cropping system was seen to be the most promising.
LEUCAENA LEUCOCEPHALA; CAJANUS CAJAN; ZEA MAYS; FALLOW SYSTEMS; FARMING SYSTEMS; SOIL MANAGEMENT; ZERO TILLAGE; ALLEY CROPPING; GREEN MANURES; ECONOMIC ANALYSIS; WOODY PLANTS; RESEARCH; TROPICS; LEGUMES;

00450
04319
ADEYOJU, S.K.
SOME TENURAL AND LEGAL ASPECTS OF AGROFORESTRY
UNU WORKSHOP ON AGROFORESTRY, 31 MAY-5 JUNE, FREIBURG; (1982); EN
XA/NG; pg 1-16
This paper deals chiefly with the way in which land is held, inherited, acquired or disposed of, as well as the conditions enabling the farmer to transfer the use of land from agriculture to forestry or vice versa or a mixture of the two. It explains how the extent of agroforestry and the involvement of local farmers are directly related to the flexibility of the prevailing land tenure. It presents a table of 10 types of forest land tenure and highlights certain preconditions for meaningful agroforestry tenure.
AGROFORESTRY; RURAL POOR; TRADITIONAL FARMING; TENURE; FORESTS; LAND; RURAL DEVELOPMENT;

00451
01457
ADEYOJU, S.K.
LAND TENURE PROBLEMS AND TROPICAL FORESTRY DEVELOPMENT
FAO COMMITTEE ON FOREST DEVELOPMENT IN THE TROPICS, 4TH SESSION, ROME, 15-20 NOVEMBER 1976; (1976); EN
XA/NG; pg 1-36
This paper reviews traditional land use patterns, their tenurial implications, and circumstances in which modern forestry was introduced into tropical countries. It outlines the problems that have resulted from the superimposition of alien land tenures on customary land use practices and highlights alternative ways of reconciling forest management objectives with the increasingly diversified needs of developing societies. The discussion is largely restricted to West Africa.
LAND USE; TENURE; FORESTRY POLICIES; ECONOMICS; AGRICULTURE; FORESTRY DEVELOPMENT; TROPICS;

00452
02890
BAKER, D.C.
SMALL HOLDER FARMING IN SUB-SAHARAN AFRICA
RES ON RURAL ECONOMICS OF SUB-SAHARAN AFRICA: A CRITICAL APPRAISAL (EICHER, C.K. & BAKER, D. EDS.); (1982); EN
XA; pg 72-133
The paper presents an overview of progress in varietal and agronomic research in small-scale farms in sub-Saharan Africa. The first two sections critically review the research methods used by agricultural economists working at the farm level in Africa. They identify key methodological issues in conducting rural surveys and evaluate alternative techniques used for analyzing survey data. The paper also summarizes research findings on resource availability and use.
SMALL SCALE FARMING; METHODS; RESEARCH; TENURE; SOIL FERTILITY; TROPICS;

00453
B02201
BAY-PETERSEN, J. (ED.)
LAND TENURE AND SMALL FARMER IN ASIA
(1983); EN
FFTC; XP; pg 1-158
The papers in this book are concerned with land tenure and reform; emphasis is on economic development of small farms in Asia. The book is divided into three main sections: 1) problems of small farmers in Asia, 2) land tenure and agricultural development in developing countries and 3) land-tenure problems in the highly industrialized countries of Asia.
TENURE; SMALL SCALE FARMING;

00454
04852
BROKENSHA, D.; CASTRO, A.P.
FUELWOOD, AGROFORESTRY AND NATURAL RESOURCE MANAGEMENT: THE DEVELOPMENT SIGNIFICANCE OF LAND TENURE AND OTHER RESOURCE UTILIZATION SYSTEMS
AID CONTRACT NO OTR-000.0-00-3441-00; (1984); EN
XA/KE/TZ; pg 1-64
This report points out the ecological and economic context in which tree-management and wood-use problems are embedded. It draws attention to resources and ecological relationships that are integral parts of tree management and fuelwood use systems, within the context of the ecosystems they are part of. Land use is considered in relation to factors such as population growth, technology, and markets. The study concludes that 1) reforestation and tree management must be viewed within the context of competing uses of resources; therefore, resource use and resource competition must be looked at in a dynamic way; and 2) local action taken by farmers is the key factor if success in terms of increase in small farmers incomes, agricultural knowledge, self-help capabilities, etc., is to be realized.
FUELWOOD; AGROFORESTRY; NATURAL RESOURCES; RESOURCE MANAGEMENT; TENURE; SOCIAL FORESTRY; ECOLOGICAL ZONATION; TREES; PLANTING;

RURAL COMMUNITIES;

00455
03414
CAMPBELL, J.G.
OUTSTANDING SOCIAL ISSUES IN THE PROPOSED MADHYA PRADESH SOCIAL FORESTRY PROJECT
(1980); EN
USAID; XP/IN; pg 1-12
The report measures the success of the proposed Madhya Pradesh Social Forestry Project according to 1) the identified target of hectares planted, seedlings distributed, labour generated, etc.; and 2) the economic rate of return in environmental benefits, fuelwood, timber, fodder and forage, and other forest produce. It sees the project as meeting the basic criteria of economic, technical, organizational, and financial soundness. It highlights the fundamental problems underlying the trends of deforestation and increasing scarcity of forest products and focuses attention on treating the symptoms. The report also briefly identifies some of the important social issues associated with project treatment of the underlying problems in order to suggest ways in which the project could be refined to more successfully incorporate comprehensive solutions.
SOCIAL FORESTRY; FODDER; LAND USE; POPULATION CHANGE; TENURE; ECONOMIC ANALYSIS;

00456
03732
CERNEA, M.M.
LAND TENURE SYSTEMS AND SOCIAL IMPLICATIONS OF FORESTRY DEVELOPMENT PROGRAMS
WORLD BANK STAFF WORK PAP NO 452; (1981); EN
XP/PK; pg 1-35
The author briefly analyses the Hill Farming Technical Development Project, with emphasis on the role of land tenure systems and their sociological implications. The paper shows the relevancy of the findings of this project to other similar situations in developing countries. It examines cultural and behavioural variables in association with forest development and concludes that a clear understanding of rights and obligations of farmers is a precondition in designing and implementing forestry projects. It reviews and discusses the set of social and economic issues involved in the basic policy question of subsidizing or not subsidizing reforestation programmes and suggests alternative development strategies involving mobilization of farmers, with particular sociological consideration of their potential roles in self-help strategies, forestry cooperatives, and forestry plantations.
TENURE; SOCIAL BEHAVIOUR; DEVELOPING COUNTRIES; POPULATION CHANGE; FUELWOOD; DEFORESTATION; FOREST PLANTATIONS; FARMERS; SOCIAL STRUCTURE; AFFORESTATION; PROJECTS;

00457
05380
FOLEY, G.; BARNARD, G.

FARM AND COMMUNITY FORESTRY
ODI SOCIAL FORESTRY NETWORK PAP NO 1B; (1985); EN
XZ; pg 1-12
The article touches briefly on the main obstacles to tree growing and on ways of making community forestry work. It presents incentives to tree growing like 1) the commercial incentive where the farmers are encouraged to grow trees for wood or other tree products and the trees become a valuable cash crop (farm forestry), and 2) the non-commercial incentive where there is no commercial market for wood products but trees are grown to meet specific local requirements like firewood, poles, shade, and soil and water conservation.
FARM FORESTRY; COMMUNITY FORESTRY; TREES; PLANTING; TENURE; COMMERCIAL INCENTIVES; SOCIOLOGY; DEVELOPING COUNTRIES;

00458
B02485
FORTMAN, L.; RIDDELL, J.C.
TREES AND TENURE: AN ANNOTATED BIBLIOGRAPHY FOR AGROFORESTRY AND OTHERS
(1985); EN
XA/XL/XP; pg 153
This selected list of references on literature related to land- and tree-tenure systems covers areas in Africa, Asia, Latin America, and Oceania. Each reference has an abstract.
TREES; TENURE; SPECIES LIST; AGROFORESTRY; WOODLOTS; LAND USE; NITROGEN FIXATION; SOIL CONSERVATION;

00459
04791
GEPHART, M.
AFRICAN AGRICULTURE CRISIS AND TRANSFORMATION
ACLSSSRC WORKING PAP; (1985); EN
XA; pg 1-53
This working paper outlines the fundamental assumptions of project for ameliorating the agricultural crisis in Africa and describes the substantive issues around which it is organized. It examines the social embeddedness of agricultural production, especially the dynamics of the social and historical processes that affect agricultural performance. Emphasis in this project is laid on 1) African agricultural results from the interaction of social, political, and ecological processes; 2) understanding farming structures in relation to the overall patterns of research control; 3) changing political, economic, and cultural structures in Africa as they become more integrated into national and international systems; and 4) the functioning of households, original economies, and national and international systems.
AGRICULTURE; FARMING SYSTEMS; ECOLOGY; TRADITIONAL FARMING; TENURE; PEASANTRY; HOUSEHOLDS; SMALL SCALE FARMING;

00460
03399
GRASMICK, J.C.
LAND AND THE FOREST DWELLING SOUTH AMERICAN INDIAN: THE ROLE OF NATIONAL LAW

BUFFALO LAW REV; Vol: 27, No: 4; (1979); EN
XL; pg 759-800
The forest dwellers referred to here are the indigenous inhabitants of the more isolated areas of South American lowlands. The article focuses on the importance of outside contacts from dominant groups with these forest dwellers, which has resulted in the separation of these forest dwellers from the land they have used since time immemorial. The role of the national law in this dispossession process is discussed. The nomadic and semi-nomadic existence of these people, plus the fact that their relationship to land is especially vital for their welfare and survival, presents a special challenge to the national land-tenure system.
FORESTS; TENURE; LAND; LEGISLATION; RESOURCES; HUMID TROPICS;

00461
03401
LAWRY, S.W.
LAND TENURE POLICY, AND SMALLHOLDER LIVESTOCK DEVELOPMENT IN BOTSWANA
LAND TENURE CENTER, RES PAP NO 78; (1983); EN
XA/BW; pg 1-68
The paper presents an alternative approach to considering the tenure and resource-use problems of smallholders. While the preservation of communal tenure is essential to smallholder production, tenure rules must be better defined in terms of individual rights to common property. A distinction is drawn between common property and open access. Policy toward communal grazing-land management should be approached from a public lands management perspective. The paper is in two parts: part one describes the evolution of public policy toward livestock and grazing lands, and part two reviews some recent ideas for promoting the smallholder sector, mainly through improved communal grazing resources.
TENURE; SMALL SCALE FARMING; LIVESTOCK; ANIMAL PRODUCTION;

00462
05225
NEIL, P.E.; JACOVELLI, P.A.
AGROFORESTRY AS AN AID TO RATIONAL RURAL DEVELOPMENT IN VANUATU
COMMONW FOR REV; Vol: 64, No: 3; (1985); EN
XP/VU; pg 259-266
Eighty per cent of Vanuatu's population is rural and dependent on subsistence agriculture. Forestry development has led to difficulties over land acquisition, as all land is customarily owned, and lease agreements with the local land owners must be obtained. Subsistence crops have been grown between Cordia alliodora lines, and work has been initiated on growing cocoa and coffee within forestry plantations. The authors recognize and discuss the need for research in other potentially important forest tree species in agroforestry.
CORDIA ALLIODORA; COFFEA; THEOBROMA CACAO; AGROFORESTRY; TENURE; SUBSISTENCE FARMING; FOOD CROPS; RURAL AREAS; RURAL DEVELOPMENT; TROPICS;

00463
04185
NORONHA, R.; LETHEM, F.J.
TRADITIONAL LAND TENURES AND LAND USE SYSTEMS IN THE DESIGN OF AGRICULTURAL PROJECTS
WORLD BANK STAFF WORK PAP NO 561; (1983); EN
XA/XL/XP; pg 1-54
This paper provides agricultural project designers with an analytical basis and rationale for examining traditional land tenure and land use systems and suggests how to make operational use of such information for key project decisions. Understanding farmer behaviour helps project designers answer important questions like: 1) will land be available for the project? 2) how should inputs be introduced? 3) who is likely to adopt them and receive benefits? 4) will traditional forms of organization be viable for project organizations? With such knowledge the project designers will be able to suggest the project location, changes in traditional tenure, land use practices needed, and whether legislative amendments should be considered to resolve potential conflicts. The paper also stresses the need for cooperation between agriculturalist, lawyer, and anthropologist for proper design of the projects.
TENURE; LAND USE; DEVELOPING COUNTRIES; SOCIAL BEHAVIOUR; TRADITIONAL TENURE SYSTEMS; TECHNOLOGY; PROJECTS; DECISION MAKING; TROPICS;

00464
01406
PHORORO, D.R.
LAND TENURE IN LESOTHO
ANALYSIS AND SUGGESTED NATIONAL POLICY, SEC 1 CH 1 (MIN AGRIC, LESOTHO); (1979); EN
XA/LS; pg 1-17
The system of land tenure in Lesotho is an important factor in the life of the nation as it is designed to ensure equitable distribution of the limited land resources and the products derived from the land to the majority of the population. Any changes in the system must avoid disproportionate allocation of resources without making sure that alternative means exist. In this paper the future of land-tenure systems and land tenure in agricultural development issues are discussed. It is concluded that availability of the means of production and intensive, well-planned education of land users are considered as major policy issues, which must be attended to and must precede any substantial changes in existing land-tenure systems.
TENURE; AGRICULTURAL DEVELOPMENT; FARMERS; SUBSISTENCE FARMING; GRAZING; LAND;

00465
03733
PONGSAPICH, A.
<THE> DEVELOPMENT OF THE CONCEPT OF LAND OWNERSHIPS AND ITS CONSEQUENCES IN THUNG KULA RONGHAN AREA
(1983); EN
XP/TH; pg 1-56
This paper presents the development of the land ownership pattern

in Thailand. The author uses a case study to show that the concept of private land ownership is not only foreign to the villagers but also impractical, irrelevant, and meaningless.
TENURE; LANDLAWS; RURAL POPULATION; LAND TAX;

00466
03400
RIDDELL, J.C.
LAND TENURE ISSUES IN WEST AFRICAN LIVESTOCK AND RANGE DEVELOPMENT PROJECTS
LAND TENURE CENTER, RES PAP NO 77; (1982); EN
ML/MR/CM/SN/NE; pg 1-77
The paper addresses the problem of identifying the relevant issues associated with the kind of rights held in land resources in development projects dealing with livestock and range management in sub-Saharan Africa. There is an increasing pressure for the livestock sector to contribute more to national economies as the problem of food shortfalls increases. About 70 per cent of all Africans are to some degree engaged in agricultural production. Despite several decades of development initiatives by national and international agencies, current figures indicate decreasing per capita food production. The paper examines the area of land tenure in a variety of recent livestock projects in Mauritania, Senegal, Niger, Cameroon, and Mali. In conclusion it is indicated that since all these projects attempt to get herders to use existing (albeit decreasing) land resources in new ways, whether it be by restructuring range use, creating new water resources, or improving the quality of the herd for more intensive use of pastures, the question of who has how much right, and when, to these resources becomes an area of importance.
TENURE; WEST AFRICA; LIVESTOCK; RANGELANDS; ANIMAL PRODUCTION; ARID ZONES; SEMI ARID ZONES; TROPICS;

00467
03895
SELLERS, S.
<THE> RELATIONSHIP BETWEEN LAND TENURE AND AGRICULTURAL PRODUCTION IN TUCURRIQUE, COSTA RICA
(1977); EN
XL/RC; pg 1-10
The paper describes the different types of land-tenure systems known and used in Tucurrique, which is an agricultural community. The relationships of land tenure to agricultural cropping practices are analyzed.
TENURE; AGRICULTURAL PRODUCTION; CROPPING SYSTEMS;

00468
03954
TUAZON, R.
LAND TENURE, AGRARIAN REFORM AND UPLAND DEFORESTATION IN THE PHILIPPINES
(1984); EN
XP/PH; pg 1-29
Land reform measures and other agricultural policies that have been undertaken in the Philippines have increased upland

deforestation, which is linked to the migration of the landless to the uplands. Land tenure is the major factor influencing migration; it also defines access to the productivity of other land and other resources such as credit facilities. Land-reform measures altered tenure systems for the peasants by limiting the access to the productive potential of the land, thus decreasing their welfare. Modernization policies have resulted in decreased welfare for other peasants because their tenure status leaves them more vulnerable to exploitation. These policies make the peasants migrate to the uplands, increasing the potential for more serious deforestation.
TENURE; AGRICULTURAL DEVELOPMENT; HIGHLAND; DEFORESTATION; MIGRATION; PEASANTRY;

00469
04821
WILLIAMS, P.J.
WOMEN'S PARTICIPATION IN FORESTRY ACTIVITIES IN BURKINA FASO (FORMERLY UPPER VOLTA)
NINTH WORLD FORESTRY CONGRESS, MEXICO CITY, JULY 1985; (1985); EN
XA/HV; pg 1-16
How Burkina Faso women participate in forestry development activities is illustrated in this paper, which points out that women have been minimally involved in industrial plantations, forest management, and forestry education and research. Most have traditionally used and managed forest resources and a few have been involved in the improved cookstove programme. Some women's groups have, however, started mini-nurseries and planted trees, and there is potential for increased women's participation. Forestry in Burkina Faso must respond to women's needs and promote their participation, as they comprise 50 per cent of the population.
WOMEN; FOREST RESOURCES; FOREST MANAGEMENT; TENURE; LAND USE; RURAL AREAS; RESEARCH;

00470
06079
FORTMAN, L.; RICGEKEAY, D.
WOMEN AND AGROFORESTRY: FOUR MYTHS AND THREE CASE STUDIES
AGROFOR SYST; Vol: 2, No: 4; (1985); EN
DO/KE/IN; pg 253-272
Women are traditionally important participants in both the agricultural and the forestry components of agroforestry production. Women are frequently ignored in the design of agroforestry projects because of commonly held myths about their participation both in production activities and in public life. Their involvement is examined in case studies from the Dominican Republic, India, and Kenya. Considerations for including women in agroforestry projects are discussed.
AGROFORESTRY; WOMEN; CASE STUDIES;

00471
06074
RAINTREE, J.B.
STRATEGIES FOR ENHANCING THE ADOPTABILITY OF AGROFORESTRY

INNOVATIONS
AGROFOR SYST; Vol: 1, No: 3; (1984); EN
XZ; pg 173-187
Agroforestry has been given a broad and hopeful mandate to assist in devising productive and sustainable systems of land management to meet the demographic and ecological challenges of mankind's somewhat uncertain future. As a new and explicitly interdisciplinary field of applied scientific research and technological synthesis, agroforestry is in a unique position to benefit from recent advances in our understanding of the rural development process, which if properly integrated into the emerging paradigm for agroforestry research and development will greatly enhance its chances of fulfilling its potential as a source of solutions to many interrelated problems of tropical land use. Drawing on lessons from the literature on the adoption and diffusion of innovations, the author proposes a number of research strategies and design tactics by which agroforestry research and development generate relevant and adoptable technologies and thus stand a better chance to have the practical impact on land use systems that is expected of agroforestry.
AGROFORESTRY; RURAL DEVELOPMENT; INNOVATIONS; TECHNOLOGY; DESIGN; POPULATION DENSITY;

00472
01860
AHN, B.W.
VILLAGE FORESTRY IN KOREA
EIGHTH WORLD FORESTRY CONGRESS, JAKARTA, INDONESIA, 16-28 OCTOBER 1978; (1978); EN
XP/KR; pg 1-11
The paper provides a detailed analysis of the historical background and development of village forestry associations (VFAs) in Korea. Major organizational activities and institutional cooperation are highlighted. Prior to the founding of these associations, Korean forest environments were being threatened with extinction. Thus the success story accompanying the activities of these associations is rooted in people's real, felt needs. The objective of VFA's is to protect and reforest the deforested areas, and the community is fully involved in programme formulation and implementation. The main activities are an in-turn forest patrol system, forest-fire prevention and alarm, forest pest control, and improvement and protection of national forests. The village forestry associations are also involved in tree nurseries, reforestation, and silvicultural management for fuel.
PINUS DENSIFLORA, QUERCUS; TENURE; COMMUNITY FORESTRY; VILLAGES; AFFORESTATION; SILVICULTURE; LAND USE;

00473
01383
ATMOSOEDARYO, S.; BAYNARD, S.G.
<THE> PROSPERITY APPROACH TO FOREST COMMUNITY DEVELOPMENT IN JAVA
Vol: 57, No: 2; (1978); EN
XP/ID; pg 89-96
The rural people in Java depend upon forest products for most of their fuelwood, building materials, money, and food requirements. All efforts designed to curb the practice of deforestation have

only worked to the detriment of the people's welfare. A prosperity approach to community forest development has proved to be far more persuasive. This approach is an attempt to enhance the welfare of the community associated with the forest in such a way that the community is made aware that its development is very closely related to the welfare of the forest itself. The taungya system together with allied topics such as the base camp system, the planting of fuelwood species, the control of forest grazing, and the introduction of sericulture and apiculture are highlighted.
IMPERATA CYLINDRICA; PINUS MERKUSII; AGATHIS LORANTHIFOLIA; TECTONA GRANDIS; ACACIA VILLOSA; PENNISETUM PURPUREUM; LEUCAENA GLAUCA; CALLIANDRA CALOTHYRSUS; SESBANIA GRANDIFLORA; GLIRICIDIA MACULATA; FORESTS; FUELWOOD; FOREST GRAZING; MANAGEMENT; PROTECTION FOREST; WOOD; DEVELOPMENT; AGRISILVICULTURE; CULTIVATION; AFFORESTATION; LEGUMES; NITROGEN FIXATION; SYMBIOSIS; SOIL FERTILITY; SHADING;

00474
01844
FAO
IMPLEMENTING FORESTRY PROGRAMMES FOR LOCAL COMMUNITY DEVELOPMENT
(1978); EN
XZ; pg 1-20
This publication describes the essential role of forest resources in alleviating the existing rural problems of food, fuelwood, construction material, grazing land and fodder, and maintenance of the environmental stability necessary for continued crop and animal production. It stresses the need to design programmes with the community in mind. The contributors appreciate the difficulties associated with short-term versus long-term goals of the individual and the community, lack of a tradition for tree-growing, competing uses of land, and the apparent lack of immediate benefits to the community from forest resources. Policy, programme and project designs are highlighted. Recommendations are given for research on all aspects, physical, biological, and socioeconomic, and tabulated summaries are given. Although agroforestry and community forestry are not synonymous, the basic approach is similar in most aspects.
ACACIA SENEGAL; PROSOPIS; ALBIZIA; AGRISILVICULTURE; SILVOPASTORAL SYSTEMS; MULTIPLE USE; FORESTRY; COMMUNITY FORESTRY; RESEARCH; ECOLOGY; PHYSIOGRAPHY; SOCIOLOGY; CULTURES;

00475
B01034
FAO
FORESTRY FOR RURAL COMMUNITIES
(1978); EN
FAO; XZ; pg 1-56
This booklet discusses in general terms what community forestry involves. It describes the current overdependence on forests for fuelwood, building material, and so on. Succinctly, it looks at the ecological consequences of deforestation. Drawing examples from a number of countries in the tropics, the booklet highlights the major constraints to initiating forestry-oriented programmes. Suggestions are made as to possible solutions and specific forestry practices that can benefit the rural poor. Planning for

community forestry demands a clear understanding of the existing social systems and an intensive interdisciplinary survey.
AGRISILVICULTURE; TAUNGYA SYSTEMS; RURAL COMMUNITIES; TROPICS; TENURE; EXTENSION ACTIVITIES; RESEARCH; LAND USE; SOCIAL STRUCTURE;

00476
B01269
FAO; SIDA
FORESTRY FOR LOCAL COMMUNITY DEVELOPMENT
FAO FOREST PAP NO 7; (1978); EN
XZ; pg 1-114
The paper discusses the following topics: 1) the nature and extent of forestry at the community level, problems and possibilities; 2) policies, programmes and other requisites necessary for successfully developing forestry activities for the benefit of rural communities; 3) technical considerations to be taken into account in implementing community forestry activities. It also gives detailed information on project survey methodology, 16 case studies from countries in the tropics, a species list, and an annotated reference list for further reading.
ALNUS JORULLENSIS; ALBIZIA FALCATARIA; PENNISETUM PURPUREUM; PINUS RADIATA; CASSIA SIAMEA; EUCALYPTUS CAMALDULENSIS; ACACIA; TROPICS; FUELWOOD; FOOD; MANAGEMENT; FOREST PRODUCTS; POLICIES; SOCIOLOGY; FORESTRY; COMMUNITY DEVELOPMENT; ECOLOGY; AGRISILVICULTURE; FOOD PRODUCTION;

00477
06108
HOEKSTRA, D.A.; TORRES, F.; RAINTREE, J.B.; DARNHOFER, T.; KARIUKI, E.
AGROFORESTRY SYSTEMS FOR THE SEMI ARID AREAS OF MACHAKOS DISTRICT, KENYA
ICRAF WORK PAP NO 19; (1984); EN
XA/KE; pg 1-28
The paper presents a case study that is a result of collaborative activities between scientists from ICRAF, the National Dryland Farming Station - Katumani, and the Machakos Integrated Development Programme. The study aims at developing improved systems of agroforestry and land management appropriate to mixed farming systems in semi arid zones. The research plan discussed in this report proposes the refinement of results of on-station species and provenance studies carried out in the semi arid areas of Kenya. The identification of appropriate agroforestry systems and research needs for the target area, Machakos, was based on the application of ICRAF's diagnostic and design methodology, which diagnoses existing and future land management constraints and agroforestry potentials and formulates plans for research to develop the candidate agroforestry technologies through a combination of on-farm and on-station research. The report is laid out under four distinct headings: 1) biophysical and socioeconomic characteristics of the target area, 2) diagnosis of the farming systems, 3) appropriate technologies, and 4) research programme (on-farm/on-station).
AGROFORESTRY; SEMI ARID ZONES;

00478
06116
HOEKSTRA, D.A.
<THE> USE OF ECONOMICS IN DIAGNOSIS AND DESIGN OF AGROFORESTRY SYSTEMS
ICRAF WORK PAP NO 29; (1985); EN
XZ; pg 1-85
The paper highlights the economic aspects of the diagnostic and design (D&D) exercise of agroforestry systems and focuses attention on issues, methods and tools to be considered when finding solutions to existing land use problems or when exploiting existing potentials for agroforestry. Section one of the paper discusses the role of economics in D&D (macro and micro level), as well as socioeconomic information requirements and analysis of the information. It provides a general framework for the analysis of candidate technologies proposed during the design process. Section two discusses the cost-benefit analysis of agroforestry technologies from the private and the public economic viewpoint and illustrates the theoretical issues raised on the basis of two examples of cost-benefit analysis - one dealing with an alley cropping system and one with fuelwood tree planting on private farms. Section three deals with decision-making in the absence of numerical data and rationalizes the choice of technologies to be researched and disseminated for development.
AGROFORESTRY; DIAGNOSIS; DESIGN; ECONOMICS;

00479
01970
LAHIRI, A.K.
ROLE OF FORESTERS IN RURAL DEVELOPMENT
SILVAN; (1981); EN
XP/IN; pg 51-60
The current trend in population growth has increased pressure on the existing resources. The demand for food, fuelwood and building materials has led to massive deforestation. Traditional systems of shifting cultivation are no longer tenable on a sustainable basis. There is urgent need to evaluate the role of forests in rural development. Food, not wood, is the most imperative demand of the rural people. At least cow dung is a substitute for fuelwood. The author therefore urges foresters and relevant institutions to take a keen interest in developing social forestry - an exercise that invites an interdisciplinary teamwork. Examples of successful rural forestry programmes are given, plus work being done in research stations.
EUGENIA; TERMINALIA ARJUNA; CASUARINA; BAMBUSA NUTANS; EUCALYPTUS; SOCIAL FORESTRY; DEFORESTATION; MARGINAL LANDS; LAND USE; RESEARCH; RURAL DEVELOPMENT; FORESTERS;

00480
06068
RAINTREE, J.B.
BIOECONOMIC CONSIDERATIONS IN THE DESIGN OF AGROFORESTRY CROPPING SYSTEMS
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1984); EN
XZ; pg 271-289

The paper presents the main bioeconomic principles for a decision on the optimum number of trees in an agroforestry cropping system and discusses the bioeconomic considerations involved in deciding when it is advantageous to add trees to arable crop fields. It also discusses budgeting techniques and gives illustrations of the use of linear programming as a practical bioeconomic design tool in agroforestry.
PARKIA; ACACIA ALBIDA; AGROFORESTRY; CROPPING SYSTEMS; DESIGN; BIOECONOMICS; SPECIES LIST;

00481
01866
ROCHE, L.; COOPER, R.
FORESTRY FOR LOCAL COMMUNITY DEVELOPMENT: MANPOWER TRAINING AND EDUCATION REQUIREMENTS
COMMONW FOR REV; Vol: 59, No: 2; (1980); EN
XA; pg 163-179
In this discussion on the role of forest resources in rural development the existing forest development policy framework is described. An outline is provided indicating the present and the future manpower and training requirements for seven countries in Africa, extrapolating the estimates to the year 2000. Agroforestry and community forestry projects have an important role to play in rural and community development. However, these projects and programmes will have to be integrated into the main thrust of government forest policy and practice and of prevailing forestry training and educational institutions.
ACACIA SENEGAL; EUCALYPTUS GLOBULUS; AGROFORESTRY; COMMUNITY FORESTRY; EDUCATION; TRAINING; EXTENSION ACTIVITIES; RURAL DEVELOPMENT; POLICIES;

00482
06107
TORRES, F.; RAINTREE, J.B.; DALMACIO, M.V.; DARNHOFER, T.
AGROFORESTRY SYSTEMS FOR SMALLHOLDER UPLAND FARMERS IN A LAND REFORM AREA OF THE PHILIPPINES: THE TABANGO CASE STUDY
ICRAF WORK PAP NO 18; (1984); EN
XP/PH; pg 1-18
This paper reports a case study of agroforestry systems for smallholder upland farmers in the Tabango area of the Philippines. The study was carried out by a multidisciplinary team of scientists from ICRAF, the Forest Research Institute of the Philippines Council for Agricultural and Resources Research and Development, the University of Pertanian in Malaysia, and Kasetsart University in Thailand. The report diagnoses existing and future land management constraints and agroforestry potentials, designs appropriate agroforestry systems and formulates plans for research to develop the candidate agroforestry technologies through a combination of on-farm and field station research.
AGROFORESTRY; SMALL SCALE FARMING; HILL FARMING; LAND REFORM;

00483
06112
YOUNG, A.
LAND EVALUATION FOR AGROFORESTRY: THE TASKS AHEAD
ICRAF WORK PAP NO 24; (1984); EN
XZ; pg 1-54
The objectives and procedures of land evaluation and the nature of the results obtained are outlined. The present state of evaluation methodology is reviewed for kinds of land use related to agroforestry: crop production, forestry, and livestock production. The stages in the development of a methodology of land evaluation for agroforestry are described: an environmental data base, formulation of appropriate agroforestry land utilization types, determination of land use requirements, construction of biophysical models, assessment of environmental impact and sustainability, a method for comparing agroforestry and non-agroforestry land utilization types, and testing through case studies. Land evaluation draws up data from and interacts with many other ICRAF projects in agroforestry research. The principal outputs from a land evaluation research programme will be 1) a systematic assessment of the environmental suitabilities for specific agroforestry land utilization types and 2) a method for comparison of the suitability, including environmental, economic and social aspects, of land utilization types, both agroforestry and non-agroforestry, on different land units. The results will permit quantitative estimates of the potential contribution of agroforestry to sustainable production over specified areas of land.
LAND EVALUATION; AGROFORESTRY; LAND USE;

00484
01559
CONTANT, R.B.
TRAINING AND EDUCATION IN AGROFORESTRY
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1980); EN
XP; pg 191-218
This paper outlines some of the possible ways of introducing agroforestry training and education, the principal requirements and constraints. A strategy is outlined for the design and implementation of agroforestry courses and the preparation of lecture notes and other teaching aids. The author urges insertion of agroforestry and farming system courses into existing institutional curricula. In-service courses and seminars on agroforestry are urgently needed for teaching staff, policy-makers and planners. Combined faculties of agriculture and forestry are in the best position to offer these courses and programmes.
AGROFORESTRY; AGRICULTURE; FORESTRY; CURRICULUM; MULTIPURPOSE TREES; SHRUBS; SOCIOECONOMICS ASPECTS; ECOLOGY; PERENNIALS; CROPS;

00485
01560
HUXLEY, P.A.
AGROFORESTRY AT DEGREE LEVEL: NEW PROGRAMME STRUCTURE
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.) ; (1980); EN

XP; pg 219-227
This paper has raised a number of important issues related to teaching of agroforestry and other biological and earth science courses at university level. The teaching of these courses should be based on and start with a systems approach. At present, these disciplines have failed to equip students with ample, practical and integrative knowledge to cope with the complexities of the fields they are trained in. The author has forwarded a strong case for a need to change the current methods and curriculum design. A number of conceptual difficulties are likely to occur because of the conventional nature of present teaching methods. One feasible way to overcome the difficulties is to appoint highly experienced curriculum developers to work in conjunction with ICRAF and one or two selected faculties still flexible enough to try the scheme.
AGROFORESTRY; AGRICULTURE; FORESTRY; LAND USE; EDUCATION; CURRICULUM DESIGN; SYSTEMS ANALYSIS; ECOLOGY; HORTICULTURE; EARTH SCIENCE; BIOLOGY;

00486
B01422
MONGI, H.O.
AGROFORESTRY EXTENSION: NEEDS AND STRATEGY
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1980); EN
XP; pg 229-255
Success of agroforestry ventures in developing countries will depend largely on the effective utilization of accumulated knowledge from other disciplines. It will require a reorientation of thinking to an interdisciplinary approach. Agroforestry is a system of land use that invites liaison among departmental heads. The paper addresses a number of problems that exist in the tropical countries. Physical and climatic characteristics limit the choice of land use types that can be applied. Forestry remains the only viable option in marginal ecosystems. However, the long-term goal of conservation conflicts with the short-term demand for food. Agroforestry has great potential in mitigating these problems, if during its application bio-physical and socioeconomic backgrounds are well understood. The author has outlined agroforestry research methodology, which is well summarized in one diagram at the end of the discussion.
AGROFORESTRY; TROPICS; MARGINAL LANDS; EXTENSION ACTIVITIES; RESEARCH; FOOD PRODUCTION; TROPICS;

00487
04947
PEACE CORPS
PEACE CORPS FORESTRY INITIATIVE
(1979); EN
VITA; XZ; pg 1-46
This paper provides a possible framework for a global, community-based forestry programme. It represents an early step in developing a more focused Peace Corps programme for addressing the problems caused by deforestation. It illustrates a variety of activities that can be implemented by the volunteers, such as encouraging village woodlots, reforestation, agroforestry, and land rehabilitation, introducing wood-conserving technologies,

etc. The paper also evaluates past and present efforts of Peace Corps forestry programmes.
DEFORESTATION; SOIL FERTILITY; FUELWOOD; DESERTIFICATION; FORESTRY; INTERNATIONAL ORGANIZATIONS;

00488
0358
BERTRAND, R.; VALENZA, J.
A CARTOGRAPHIC METHOD OF NATURAL AREAS OF EASTERN SENEGAL: EVALUATION OF AGROSILVOPASTORAL POSSIBILITIES
(METHODE DE CARTOGRAPHIE DES MILLIEUX NATUREL DU SENEGAL ORIENTAL: EVALUATION DES POSSIBILITES AGROSYLVOPASTORAUX)
AGRON TROP (PARIS); Vol: 4, (1982); FR
XA/SN; pg 329-339
Les auteurs presentent leur carte d'evaluation des possibilites agro-sylvo-pastorales des milieux naturels du Senegal Oriental au 1500.000. Dans la premiere partie sont ecposees les bases de la methode suivie pour realiser la carte. L'utilisation de documents divers, tant dans leur precision que leur nature a conduit les auteures a se poser le probleme du niveau de perception du milieu naturel. Ils ont retenu 4 niveaux d'organisation: l'ecoregion, l'ecofacies, l'ecotope, l'ecovarient. Chaque niveau est caracterise par un groupe de facteurs homogenes (descriptifs ou dynamiques) et par un arrangement defini (aleatoire ou organise) La demanshe de perception utilisee pour cette carte est globale ou integree. Chaque type de milieu est considere immediatement comme un syteme identifie par un ensamble de caractereparticuliers lies par un ensemble d'interactions. Cette demarc prealable des elements du milieu. puis leur synthese par addition des divers themes, parfois nuancee par une certaine ponderation.
MAPPING; ECOSYSTEMS; ENVIRONMENTAL CONDITIONS; NATURAL RESOURCES; PROJECT EVALUATION; SPECIES LIST;

00489
B00178
CARPENTER, R.A. (ED.)
ASSESSING TROPICAL FOREST LANDS: THEIR SUITABILITY FOR SUSTAINABLE USES
NATURAL RESOURCES AND THE ENVIRONMENTAL SERIES NO 3; (1982); EN
XA/XP/XL; pg 1-337
This report has practical approaches to the classification of land capability and the assessment of the suitability of tropical forest lands for sustainable uses. It also contains some special considerations necessary for the proper management of tropical forest lands. Some recommendations for future multinational collaborative research are listed.
PINUS CARIBAEA; CRYPTOMERIA JAPONICA; CHAMAECYPARIS OBTUSA; LARIX LEPTOLEPIS; GREVILLEA ROBUSTA; AGROFORESTRY; WATERSHEDS; MANAGEMENT; TECHNOLOGY; PHYSIOGRAPHY; CLIMATE; LANDFORMS; VEGETATION; LAND USE; LAND CAPABILITY; LAND CLASSIFICATION;

00490
B01671
DENT, D.; YOUNG, A.

SOIL SURVEY AND LAND EVALUATION
(1981); EN
GEORGE ALLEN AND UNWIN (UK); XZ; pg 1-278
The textbook provides a concise and practical introduction to the techniques and procedures of soil survey and land evaluation. It emphasizes the wide range of surveys and the consequent need for survey methods directed toward the requirements of the users. Practical applications of the concepts are discussed within such areas as organizational labour, transport, and equipment and the consequences of adopting different scales and methods for accuracy, timing, and cost of the survey. The concepts of land evaluation are discussed in detail and a chapter is devoted to the economies of evaluation. Surveys for irrigation are treated as a case study of special-purpose surveys.
LAND USE; SOIL RESOURCES; LAND EVALUATION; MANAGEMENT; IRRIGATION; RECLAMATION; FORESTRY; CONSERVATION; RESEARCH; REMOTE SENSING; SOIL CLASSIFICATION; TAXONOMY; LANDFORMS; VEGETATION; CLIMATE; LAND CAPABILITY;

00491
B00219
GREGERSON, H.M.; CONTRERAS, A.H.
ECONOMIC ANALYSIS OF FORESTRY PROJECTS
FAO FORESTRY PAP NO 17; (1979); EN
; pg 1-193
This report provides guidelines for planning and appraising forestry projects. Chapter 1 examines the steps and techniques involved in an economic analysis. Chapter 2 contains a detailed discussion on financial and economic analysis. The two terms are differentiated with respect to social and private benefits and costs. Chapter 3 presents a discussion on how to define project context and the scope of the analysis. Input and output identification constitutes the body of chapter 4. Chapter 5 discusses the basic principles involved in valuing inputs and outputs. Chapter 6 provides a discussion on the use of market prices, whereas chapters 7 and 8 discuss the use of shadow prices in the absence of market prices. Chapter 9 defines project worthiness and chapter 10 examines practical guidelines for considering uncertainty in an economic analysis. Chapters 11 and 12 concentrate on the use of economic analysis in forestry project planning.
EUCALYPTUS; PINUS; ALBIZIA FALCATARIA; ECONOMIC ANALYSIS; FOREST PLANTATIONS; FUELWOOD; WOOD; HARVESTING; BIOLOGICAL PRODUCTION; WATERSHEDS; WOOD; LAND USE; MANAGEMENT; TECHNOLOGY; CONSERVATION; IRRIGATION; SOIL FERTILITY;

00492
02182
HOSKINS, M.W.
OBSERVATIONS OF INDIGENOUS AND MODERN AGROFORESTRY ACTIVITIES IN WEST AFRICA
UNU WORKSHOP ON AGROFORESTRY, 31 MAY-5 JUNE, FREIBURG; (1982); EN
XA
Traditional agroforestry systems in West Africa are described. The modern approach aimed at improving the situation of the farmer is castigated. Modern plans have tended to concentrate on farmers

with high access to resources at the expense of smallholders with low capital input. To a farmer, a project becomes technically feasible and economically viable when it takes into account the farmer's own resource base and when it offers special advantages over traditional practices. The new approach is more fragmented and sometimes irrelevant to the local rural family's needs. The author calls for more concerted efforts in project formulation to understand and respect indigenous knowledge.
ADANSONIA DIGITATA; BUTYROSPERMUM PARADOXUM; ACACIA ALBIDA; PARKIA; MORINGA OLEIFERA; AGROFORESTRY; PLANTATIONS; FUELWOOD; BROWSE; CONSERVATION; FRUIT TREES; FODDER CROPS; PASTURES; SHIFTING CULTIVATION; SHADE TREES; RESOURCE MANAGEMENT; AGRISILVICULTURE; VEGETATION; TENURE; LAND USE; LEGUMES;

00493
182
HUXLEY, P.A.
CONSIDERATION WHEN EXPERIMENTING WITH CHANGES IN PLANT SPACING
(1983); EN
GEORGE ALLEN &UNWIN; XZ; pg 1-31
The paper gives a comprehensive discussion on a set of decision alternatives for selecting and determining the spacing of plants. Choice of species and experimental approaches are among various aspects highlighted. Diagrams, graphs, and a decision flow chart are included. The appendix carries some practical examples of experimental designs for spacing experiments.
LEUCAENA LEUCOCEPHALA; CICER ARIETINUM; CARTHAMUS TINCTORIUS; AGROFORESTRY; THINNING; WOODY PLANTS; BIOMASS; FRUITS; MANAGEMENT; PHYSIOLOGY; ALLEY CROPPING; SEEDLINGS; CANOPIES; DRY MATTER CONTENT; SHADING; FUELWOOD; SOIL CONSERVATION; PHOTOSYNTHESIS;

00494
06114
HUXLEY, P.A.; WOOD, P.J.
TECHNOLOGY AND RESEARCH CONSIDERATIONS IN ICRAF'S "DIAGNOSIS AND DESIGN" PROCEDURES
ICRAF WORK PAP NO 26; (1985); EN
XZ; pg 1-74
ICRAF's diagnosis and design (D&D) methodology offers a logical step-by-step approach to the evaluation of land use systems through a pre-diagnostic analysis, rapid field appraisal, and additional surveys checking the effectiveness of the system. The pre-diagnostic and diagnostic stages also provide an analysis of constraints and an outline of the kinds of changes in the system that are seen to be needed. The design stage lists all possible kinds of technologies that can be considered to help overcome the identified constraints and arrives at precisely designated technical proposals, which state the species to be used and management practices to be tried. This is followed by the planning stage, which summarizes what can immediately be put into practice and gives the research needs and priorities. Then follows implementation of properly formulated detailed plans for individual investigations, with precise objectives, experimental designs, resource allocation, and methods of data evaluation. The paper also gives illustrative examples of the D&D procedure.
TECHNOLOGY; RESEARCH; DIAGNOSIS; DESIGN;

00495
01640
HUXLEY, P.A.
<THE> NEED FOR AGROFORESTRY AND SPECIAL CONSIDERATION REGARDING FIELD RESEARCH
NUCLEAR TECHNIQUES IN THE DEVELOPMENT OF MANAGEMENT PRACTICES FOR MULTIPLE CROPPING SYSTEMS; (1980); EN
XZ; pg 117-142
In response to the multiple problems of population growth, depletion of forest resources, degradation of the general environment and the multiplier effects thereby generated, agroforestry has become an area of concern to scientists in various disciplines. To stabilize apparently collapsing ecosystems, adoption of suitable land use systems is inevitable. This article proposes an integrative and interdisciplinary approach to land use problems. Academic specialization has in the past led to poor recommendations for suitable land use systems and could not avoid problems associated with ultra-specialization. The article details specific problems and research objectives. Six pages are devoted to outlining the reasons why agroforestry research is even more demanding than either agriculture or forestry taken independently. Little study has been done on the existing multiple-cropping systems; hence agroforestry research, design and implementation will have to draw from existing studies in other similarly related fields.
EUCALYPTUS DEGLUPTA; IMPERATA CYLINDRICA; ACACIA ALBIDA; ACID SOILS; AGROFORESTRY; CROPPING PATTERNS; MIXED CROPPING; MULTIPLE USE; RESEARCH; ECOSYSTEMS; LAND USE;

00497
B01344
HUXLEY, P.A.
EXPERIMENTAL WORK WITH TREES AND SHRUBS FOR USE IN AGROFORESTRY SYSTEMS
PROC KENYA NATIONAL SEMINAR ON AGROFORESTRY (BUCK, L. ED.) ; (19 81); EN
XZ; pg 75-79
Information on the interactive process between woody and annual components is a basic requirement for determining the potentiality of an agroforestry system. This paper addresses two principal aspects of initiating a successful agroforestry programme. First is outlined the way investigations can be "phased out". Phasing out a programme does not, however, preclude overlapping, since agroforestry investigations require a very flexible approach to experimentation and data collection. Part two looks specifically at the factors involved in removing (harvesting) the woody component when planning such experiments, and the main variables to be considered are outlined. The author concludes that simplifying experimental work by carrying it out in phases and extending trials over a range of ecological zones is a much better approach than conducting a few complex experiments in a limited number of sites.
AGROFORESTRY; WOODY PLANTS; EXPERIMENTS; MANAGEMENT; MULTIPURPOSE TREES; PHYSIOLOGY; LOPPING; PRUNING; IRRIGATION; PLANT POPULATION; LAND USE; MIXED CROPPING; ENVIRONMENTAL CONDITIONS; CANOPIES;

TROPICS;

00498
06073
HUXLEY, P.A.
SYSTEMATIC DESIGN FOR FIELD EXPERIMENTATION WITH MULTIPURPOSE TREES
AGROFOR SYST; Vol: 3, No: 2; (1985); EN
XZ; pg 197-207
Systematic field layouts are especially useful with multipurpose tree species for examining plant response, e.g. to density stress, where a wide range of treatment levels are needed because of lack of previous data. Examples of a "fan" and a "parallel-row" layout are given with suitable sets of dimensions, and the development of parallel-row designs for management trials and mixed cropping is illustrated.
MULTIPURPOSE TREES; EXPERIMENTAL DESIGN;

00499
06084
HUXLEY, P.A.
EXPERIMENTAL AGROFORESTRY: PROGRESS THROUGH PERCEPTION AND COLLABORATION
AGROFOR SYST; Vol: 3, No: 1; (1985); EN
XZ; pg 129-138
If agroforestry technologies are to be generated rapidly and effectively there has first to be established a sound basis for research methodology. This may entail no more than repackaging existing experimental agricultural or forestry techniques. In other cases new approaches will need to be investigated. Some of the special problems relevant to experimenting with multipurpose trees are noted. ICRAF has available a set of source materials and guidelines, "Research Methodology for the Exploration and Assessment of Multipurpose Trees"; the establishment of an informal experimental agroforestry network is mentioned.
AGROFORESTRY; EXPERIMENTS; RESEARCH; MULTIPURPOSE TREES;

00500
B01066
IRRI
SYMPOSIUM ON CROPPING SYSTEMS RESEARCH AND DEVELOPMENT FOR THE ASIAN RICE FARMER
(1977); EN
IRRI; XP
The document comprehensively combines papers from a variety of disciplines. The main subjects covered were the physical aspects of cropping patterns design, the economics of cropping systems, description and pattern design, testing cropping patterns, and component technology with special reference to weed science, insect pest management, and varietal requirements. A synthesis covers the cropping systems approach to adaptive research and the cropping systems approach to production programmes.
ORYZA SATIVA; CROPPING SYSTEMS; ENVIRONMENT; MANAGEMENT; IRRIGATION; TECHNOLOGY; PRECIPITATION; FLOODING; CANOPIES; MONOCULTURE; LEGUMES; RHIZOBIUM; SOIL WATER CONTENT;

DESERTIFICATION;

00501
B01016
LAURIE, N.V.
TREE PLANTING PRACTICES IN AFRICAN SAVANNAS
FAO FORESTRY DEV PAP NO 19; (1974); EN
XA; pg 1-185
Population growth rates in tropical Africa coupled with the need for economic development in the region are in part the causes of widespread deforestation. The publication outlines the basic methods by which the savanna could be made more productive under a sustainable land use system.
CATCHMENT AREAS; PLANTATIONS; WOODY PLANTS; CANOPIES; VEGETATION; ENVIRONMENTAL CONDITIONS; CLIMATE; SOIL FERTILITY; SOIL WATER CONTENT; PRECIPITATION; ORGANIC MATTER; SOIL SURVEY;

00502
03489
MICHON, G.; BOMPARD, J.; HECKETSWELER, P.; DUCATILLION, C.
TROPICAL FOREST ARCHITECTURAL ANALYSIS AS APPLIED TO AGROFORESTS IN THE HUMID TROPICS: THE EXAMPLE OF TRADITIONAL VILLAGE AGROFORESTS IN WEST JAVA
AGROFOR SYST; Vol: 1, No: 2; (1983); EN
XP/ID; pg 117-129
The features of the tropical forest are found in Sudanese village gardens. They are rich in plant species and have a layered structure of the vegetation, existing patch work, and a succession of sylvigenetic phases from pioneer to homeostatic. These traditional agroforests reflect the surrounding forest ecosystem, simplifying the features. The architectural method of tropical forest analysis is applied to Sudanese agroforests, but here each plant is a structural element of the agricultural landscape. Such structural analysis could represent one aspect of an integral analysis of complex agroforestry systems.
FORESTS; ARCHITECTURE; VILLAGES; AGROFORESTS; TRADITIONAL TECHNOLOGY; TROPICS; HUMID TROPICS;

00503
B01262
MONGI, H.O.; URIYO, A.P.; SUDI, Y.A.; SINGH, B.R.
STANDARDIZATION IN SOIL RESEARCH METHODOLOGIES AND STRATEGY IN AGROFORESTRY
SOILS RESEARCH IN AGROFORESTRY (MONGI, H.O. & HUXLEY, P.A. EDS.); (1979); EN
XZ; pg 539-568
This paper considers a number of aspects in soils research relevant to agroforestry in which standardization problems occur. It discusses the progress made in moving toward commonly accepted methods, and draws attention to problems still remaining owing to continued use of different methods and classification systems. Suggestions are given on ways in which research strategy in agroforestry might be coordinated.
AGROFORESTRY; FALLOW SYSTEMS; CROPPING SYSTEMS; BIOMASS; SOIL WATER; SOIL CHEMISTRY; ORGANIC MATTER; SOIL FERTILITY; RESEARCH;

NUTRIENTS; SOIL SURVEY; VEGETATION; TAXONOMY; SOIL CLASSIFICATION; LAND CAPABILITY;

00504
190
RAINTREE, J.B. (ED)
RESOURCES FOR AGROFORESTRY DIAGNOSIS AND DESIGN
ICRAF WORK PAP NO 7; (1983); EN
; pg 1-383
The document helps the user to avoid the common error of technology extension - that meant design. The medical saying that diagnosis should precede treatment has been used to emphasize the importance of inventory background information and knowledge about the existing system as an essential tool in the project design phase. The various aspects of physical and human geography that need be analyzed and incorporated in the project design, development and implementation have been underlined. The methodological approach adopted in the document is meant to be applied with minor modifications that will depend on specific conditions prevalent in the geographical region under examination. It is, however, a valuable tool for planners, research workers and extension agents in assessing the potentiality of an agroforestry system.
PROSOPIS PALLIDA; LEUCAENA LEUCOCEPHALA; ACACIA SALIGNA; STYLOSANTHES SCABRA; BRACHYLEANA HUTCHINSII; DALBERGIA MELANOXYLON; TERMINALIA BROWNII; CASUARINA EQUISETIFOLIA; PARKINSONIA ACULEATA; FARMING SYSTEMS; AGROFORESTRY; ECOSYSTEMS; TECHNOLOGY; LAND USE; TENURE; RESEARCH; DIVERSIFICATION; SILVICULTURE; LAND CAPABILITY; METEOROLOGY; SOIL SURVEY; SPECIES LIST; SOCIOLOGY; PHYSIOGRAPHY; POPULATION;

00505
189
RAINTREE, J.B.
PRELIMINARY DIAGNOSIS OF LAND USE PROBLEMS AND AGROFORESTRY POTENTIALS IN NORTHERN MBERE DIVISION, EMBU DISTRICT, KENYA
ICRAF WORK PAP NO 1; (1983); EN
XA/KE; pg 1-14
A preliminary diagnostic survey was made of a land use system at Mbere Division of Embu District, Kenya, and an agroforestry system was designed. Two nearby regional locations were studied and compared. The study examined environmental settings and socioeconomic aspects, which act singly and together to determine cropping patterns and other economic bases of the communities. Various agroforestry interventions were identified and potentials for alley cropping registered.
LEUCAENA LEUCOCEPHALA; MIMOSA SCABRELLA; SESBANIA BISPINOSA; ADHATODA VASICA; AZADIRACHTA INDICA; DERRIS INDICA; AGROFORESTRY; FARMLAND; PHYSIOGRAPHY; FUELWOOD; WOOD; EROSION; FARMING SYSTEMS; CULTIVATION; BUSH FALLOWING; SOIL FERTILITY; GRAZING; SOIL CONSERVATION; CHARCOAL; TECHNOLOGY; CROPPING PATTERNS; LEGUMES;

00506
06126
RAINTREE, J.B.; TORRES, F.

AGROFORESTRY RESEARCH IN FARMING SYSTEMS PERSPECTIVE: THE ICRAF APPROACH
ICRAF WORK PAP NO 39; (1986); EN
XZ; pg 1-30
ICRAF uses a systems approach to agroforestry, i.e. it defines the role of various agroforestry components in overcoming land use problems that have been diagnosed, specifies desirable component characteristics, indicates appropriate spatial arrangements and management practices, and designs and evaluates national technologies from which research needs can be derived. The paper covers various component and disciplinary research activities at ICRAF with emphasis on the multipurpose tree inventory and the methodology for experimental research on multipurpose trees. It outlines ICRAF's networking strategy, whose principal objective is to strengthen the capability of national institutions to evaluate land use systems and to identify their realistic agroforestry potentials. Also mentioned are larger networks like the Agroforestry Research Network for Africa (AFRENA).
AGROFORESTRY; FARMING SYSTEMS; RESEARCH;

00507
B02563
RUTHERNBURG, H.
FARMING SYSTEMS IN THE TROPICS
(1980); EN
XZ; pg 1-424
This book provides factual information on most tropical farming systems. It introduces a systems approach to farms, provides a methodology for ordering farm management data, discusses the expected development paths of various farming systems, and highlights management problems in relation to particular farming systems. The subject is examined from an agro-economic setting, which emphasizes the interactions between technical and economic aspects of farming. Most of the case studies are from Africa and Asia. Plates, graphs, tables, photographs, and a wide bibliography are included.
ACACIA ALBIDA; CENTROSEMA PUBESCENS; CROTALARIA STRIATA; ERAGROSTIS TEF; IMPERATA CYLINDRICA; PENNISETUM; PHYTOPHTHORA PALMIVORA; PUERARIA PHASEOLOIDES; SETARIA; FARMING SYSTEMS; SHIFTING CULTIVATION; RESOURCE MANAGEMENT; GRAZING; ROTATIONAL CROPPING; FALLOW SYSTEMS; CROPPING PATTERNS; NOMADISM; SOIL FERTILITY; VEGETATION; IRRIGATION; GREEN MANURES; MULTIPLE CROPPING;

00508
03325
SANVICTORES, J.G.
AFFORESTATION WORK OF THE INTERNATIONAL AGROFORESTRY DEVELOPMENT CORPORATION IN SURIGAO DEL SUR
(1980); EN
XP/PH; pg 1-5
The paper discusses the major activities involved in founding agroforestry programmes in the Philippines. Methods of tree species selection, establishment, thinning, weeding, pruning and plant disease control are highlighted.
ALBIZIA FALCATARIA; GMELINA ARBOREA; LEUCAENA LEUCOCEPHALA;

AGROFORESTRY; AFFORESTATION; WOOD; DEVELOPING COUNTRIES; PLANTATIONS; FEED CROPS; GRAZING; WINDBREAKS; SPACING; WEEDING; FUELWOOD; FOOD; ENERGY; CLIMATE; EROSION; SHIFTING CULTIVATION; FOOD CROPS;

00509
B00340
SHANER, W.W.; PHILLIP, P.F.; SCHMEHL, W.R.
FARMING SYSTEMS RESEARCH AND DEVELOPMENT: GUIDELINES FOR DEVELOPING COUNTRIES
(1982); EN
XZ; pg 1-405
This book synthesizes the farming systems research and development (FSR&D) procedures used by national governments and international research centres around the world, emphasizing methodologies that have proved successful in practice. The authors describe the characteristics and objectives of FSR&D, then present information on selecting target and research areas, problem identification and development of a research base, research design, on-farm research, extending research results, and implementation and training procedures. They emphasize that the FSR&D approach requires a clear understanding of farmers and their families, farmers' conditions, and governmental staffing and organizational capabilities. In one chapter they discuss how to determine whether the FSR&D approach is in a particular country's best interests. Appendixes present detailed examples of procedures described in the text, covering a variety of countries with different cropping and livestock systems, environmental conditions, and research and development capabilities.
FARMING SYSTEMS RESEARCH; CROPPING PATTERNS; MIXED FARMING; BIOLOGY; ECOLOGY; ECONOMICS; FUELS; POPULATION; MANAGEMENT; PHYSIOGRAPHY; CLIMATE; BIOLOGICAL PRODUCTION; ANIMALS; SOIL SURVEY; METEOROLOGY;

00510
04159
SIMON, A.
SOIL CONSERVATION TECHNIQUES IN THE HIGH PLATEAU OF WEST CAMEROON
(TECHNIQUES DE CONSERVATION DES SOLS DANS LES HAUTS PLATEAUX DE L'OUEST CAMEROUN)
(1983); FR
UNION CENT COOP AGRIC DE L'OUEST; XA/CM; pg 1-139
Ce manuel defense et restauration de Providence des Hauts Plateaux de l'Ouest, apres avec premiere partie une revue analytique des systemes cultures et de conservation des sols et pose des p de la lutte anti-erosive, propose une serie adaptables a cette region. Le choix de systeme fonction de leur possibilite de rentabilite a cou les paysans. Parmi les nombreux systemes propo culturesligneux etou betail, l'accent est mi bandes de stabilisation ou d'absorption....) leur plantation et l'entretien d'especes (semi)- ligne susceptibles d'etre installees dans des cultur restauration des sols, de nombrreux cas de jache (legumineuses, herbacees ou ligneuses), associant D'autres techniques classiques (fumure, paillage, egalement proposees. de pouren faciliter
SESBANIA; TEPHROSIA VOGELII; CAJANUS CAJAN; SOIL CONSERVATION;

EROSION; SLOPING LAND; EROSION CONTROL; METHODS; AGROFORESTRY; ALLEY CROPPING; MULCHING; PASTURES; EROSION CONTROL PLANTS; SPACING; WINDS; WATER; GREEN MANURES; HUMID TROPICS; SPECIES LIST;

00511
06067
STEPPLER, H.A.; RAINTREE, J.B.
<THE> ICRAF STRATEGY IN RELATION TO PLANT SCIENCE RESEARCH IN AGROFORESTRY
PLANT RESEARCH AND AGROFORESTRY (HUXLEY, P.A. ED.); (1984); EN
XA/KE; pg 297-305
ICRAF has developed an institutional strategy to fulfil its international coordinating role vis-a-vis agroforestry and is now evolving, through research in Kenya, a set of tactical principles and a methodology to implement that strategy. In order to guide agroforestry research and development along lines that are relevant to the needs of potential practitioners there is need for a diagnostic methodology to identify significant local problems and agroforestry potentials. While agroforestry systems are often location specific, the methodology for developing appropriate agroforestry systems is likely to be fairly general. This paper sets forth the main outlines of ICRAF's evolving multidisciplinary methodology and explores its relationship to international plant science research.
AGROFORESTRY; RESEARCH; PLANT SCIENCES; METHODS; TROPICS;

00513
01562
TORRES, F.
RESEARCH OBJECTIVES IN AGROFORESTRY: A CONCEPTUAL APPROACH
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1980); EN
XZ; pg 257-273
Agroforestry systems are more complex than most farming systems as they are composed of many interdependent components. Hence, research objectives should be clear and specific. The policy framework should be designed considering both the objectives and the components in the system. Improvement of the system should select that component that effects overall performance, whereas transformation of the system should gather knowledge to create new systems. Research in agroforestry systems should aim at obtaining knowledge necessary to develop adaptable technologies that will allow farmers to attain sustainable production. Consideration should be given to other interdependent systems, such as cultural practices, political factors and the productive component for a successful development of agroforestry systems. Diagrammatic tabulated information adds merit to this paper.
AGROFORESTRY; RESEARCH; SHIFTING CULTIVATION; POLITICAL FACTORS; TECHNOLOGY;

00514
06127
VON CARLOWITZ, P.G.
RECOMMENDATIONS FOR THE DESIGN AND ESTABLISHMENT OF DEMONSTRATION TRIALS AT THE ETHIOPIAN CENTRE FOR COMMUNITY FORESTRY AND SOIL

CONSERVATION: A MODEL FOR THE APPLICATION OF AF & SOIL CONSERVATION
ICRAF WORK PAP NO 41; (1986); EN
XA/ET; pg 1-89
This report is on the centre for community forestry in Ethiopia; it contains recommendations for the design and establishment of demonstration trials of agroforestry and soil conservation techniques. The recommended interventions and demontrations described are categorized by altitude, varying between 2000 m.a.s.l. and 3200 m.a.s.l. These relate to 1) pasture improvement - planting fodder trees along watersheds, sowing grasses, manually breaking and levelling heavily eroded slopes, planting trees and sowing fodder legumes, constructing crude contour ridges; 2) cropland improvement - conserving soil by constructing bench terraces "fanya juu" terraces; planting trees, grasses, and bushes;, ploughing along contours; and sowing trees, forages, and grasses on the bunds; 3) grassland improvement - planting borderline trees and sowing fodder legumes; 4) riverbank fixation by planting trees; 5) rehabilitation of water-logged depressions by planting trees; 6) fuelwood production by planting multipurpose trees; 7) live fences. A work plan including inputs in terms of labour and number of seedlings or weight of seeds is attached to each of the proposed interventions and demonstrations. Improvement of house compounds, bee-keeping, and guidelines for the establishment of community nurseries are also presented.
SOIL CONSERVATION; COMMUNITY FORESTRY; AGROFORESTRY; DEMONSTRATION; TRIALS; DESIGN; TROPICS;

00515
B00933
WEBER, F.; HOSKINS, M.W.
SOIL CONSERVATION TECHNICAL SHEETS
(1983); EN
UNIV IDAHO, MOSCOW ID; XA/GM/ML/MR; pg 1-94
The document contains a comprehensive discussion on the various techniques that can be applied in soil conservation in various local situations. The broad subjects of erosion control, surface water conservation, revegetation, and organic matter have been examined in detail. Under each subject the authors provide outlines on design guidelines, areas of applicability, and local participation.
ACACIA ALBIDA; PARKIA BIGLOBOSA; BUTYROSPERMUM PARKII; BORASSUS AETHIOPICUM; ACACIA SENEGAL; BALANITES AEGYPTIACA; ACACIA RADDIANA; EUPHORBIA; SALVADORA PERSICA; COMMIPHORA; TAMARIX; ACACIA SCORPIOIDES; SOIL FERTILITY; VEGETATION; EROSION CONTROL; SOIL CONSERVATION; TECHNOLOGY; AGROFORESTRY; BIOMASS; LEGUMES; GRAZING; ANIMALS; ORGANIC MATTER; WILDLIFE; MICROCLIMATE; SEEDLINGS; BROWSING; FODDER; WINDBREAKS;

00516
B00392
WMO
<THE> EFFECT OF METEOROLOGICAL FACTORS ON CROP YIELD AND METHODS OF FORECASTING THE YIELDS
WMO REP NO 566; (1982); EN
XZ; pg 1-54

This report reviews studies on seven commercial crops (potatoes, sugar beets, sunflowers, cotton, sugar cane, coffee, and cocoa) carried out in various countries. The results of investigations into effects of agrometeorological factors on crop yield and the methods used for forecasting yields have been summarized. Also it contains a chapter on mathematical modelling (crop-growth simulation) of plant growth and yield.
SOLANUM; HELIANTHUS; COFFEA; THEOBROMA CACAO; BETA VULGARIS; SACCHARUM; FEED CROPS; FOOD; TEMPERATURE; PRECIPITATION; SOIL WATER CONTENT; RADIATION; EXPERIMENTS; RESEARCH; METEOROLOGY; GERMINATION; DRY MATTER CONTENT; TECHNOLOGY; MANAGEMENT; MODELS; YIELDS; CASH CROPS;

00517
199
YOUNG, A.
AN ENVIRONMENTAL DATA BASE FOR AGROFORESTRY
ICRAF WORK PAP NO 5; (1983); EN
An environmental data base has the function of relating different kinds of information in agroforestry research to a common basis of environmental information. The paper outlines the principles and structure of the data base, the information contained within it, and its potential uses. Information is included on geology, land forms, climate, hydrology, soils, vegetation, fauna, diseases, and land use. There are two levels of detail: level 1 provides a broad environmental setting and level 2 contains more detailed information. Data are transferred from check lists to computerized storage, and the output on the line printer is by means of an interactive computer program, AFENU. Potential uses of the data base include, first, the collection, the storage and the selective retrieval of information on individual aspects of agroforestry systems and agroforestry experimental work; second, synthesis of these different kinds of information for such applications as land evaluation, diagnostic and design studies, and advisory work.
MICROCLIMATE; SOIL WATER CONTENT; ORGANIC MATTER; PASTURES; NITROGEN FIXING TREES; LAND EVALUATION; LAND USE; AGROFORESTRY; GEOLOGY; FARMLAND; CLIMATE; HYDROLOGY; VEGETATION; ANIMALS; CULTIVATION; WATERSHEDS;

00518
B02272
ZIMMERMANN, R.C.
ENVIRONMENTAL IMPACT ON FORESTRY: GUIDELINES FOR ITS ASSESSMENT IN DEVELOPING COUNTRIES
FAO CONSERVATION GUIDE NO 7, FAO, ROME; (1982); EN
XA/XP/XL; pg 1-85
Environmental impact assessment (EIA) is a systematic, explicit assessment of the actions of a developer and the environmental consequences. The publication provides the basic guidelines for project evaluation by applying EIA.
LEUCAENA LEUCOCEPHALA; IMPERATA CYLINDRICA; ANTHOCEPHALUS CHINENSIS; EUPATORIUM ODORATUM; ARAUCARIA CUNNINGHAMII; DESERTIFICATION; CONSERVATION; WASTE LAND; IRRIGATION; RENEWABLE RESOURCES; FLOODING; LAND USE; SOILS; EROSION; MEDICINAL PLANTS; REMOTE SENSING; ORGANIC MATTER; MICROCLIMATE; VEGETATION; DEVELOPING COUNTRIES;

00519
06122
FERNANDES, E.C.M.
CONSIDERATIONS FOR THE PLANNING, IMPLEMENTATION AND EVALUATION OF ON-FARM EXPERIMENTATION IN AGROFORESTRY FARMING SYSTEMS
ICRAF WORK PAP NO 35; (1984); EN
XZ; pg 1-18
Major criticism of over-reliance on on-station agricultural research is tnat in a good number of cases the conditions on these stations bear little resemblance to those under which the majority of farmers operate. Agroforestry (AF) researchers have learned from the experiences of agricultural researchers and have adopted a "bottom up" approach, hence use on-farm experimentation to gain a clear picture of the AF farming system and draw conclusions that are relevant to the farmers' circumstances. Agroforesters lack tried and tested technologies; therefore the role of the farmer must be active at all stages of on-farm experimentation in AF to supplement on-station AF research results, most of which have not yet become available because of the long-term nature of AF trials. The author gives the objectives and the role of on-farm experimentation, and its planning, implementation and evaluation in AF.
EXPERIMENTS; PLANNING; ON FARM TRIALS; AGROFORESTRY; FARMING SYSTEMS;

00520
06124
ROCHELEAU, D.E.
CRITERIA FOR REAPPRAISAL AND REDESIGN: INTRA-HOUSEHOLD AND BETWEEN-HOUSEHOLD ASPECTS OF FSRE IN THREE KENYAN AGROFORESTRY PROJECTS
ICRAF WORK PAP NO 37; (1985); EN
XA/KE; pg 1-24
The paper briefly describes three Kenyan agroforestry projects: the Kathama project, the Kakuyuni project (both in Machakos District), and the Siaya project. The project definitions, technology designs, and research designs were all based on the diagnosis and design approach. The study looked into the households and the "larger-than-farm" community of the project sites with the aim of refining the diagnosis and redesigning technology trials within the household and the community. The paper presents results of the case studies and the farm trials, stressing the important lessons learned from each project.
AGROFORESTRY; FARMING SYSTEMS; TROPICS;

00521
06123
ROCHELEAU, D.E.
LAND USE PLANNING WITH RURAL FARM HOUSEHOLDS AND COMMUNITIES: PARTICIPATORY AGROFORESTRY RESEARCH
ICRAF WORK PAP NO 36; (1985); EN
XA/KE; pg 1-43
The existing agroforestry systems in rural farm households and communities need to be improved and adopted to changing

conditions. There is also the need to develop new agroforestry practices and land use systems to stabilize or increase total food production. This paper looks at recent agroforestry research and states the need to identify and act upon farming system opportunities and limitations in subunits of the farm household. It gives the significance of the diagnosis and design methodology at farm and community levels and lists the lessons learnt from the Kathama project in Kenya.
LAND USE; PLANNING; RURAL COMMUNITIES; AGROFORESTRY; RESEARCH;

00522
06082
YOUNG, A.
LAND EVALUATION AND AGROFORESTRY DIAGNOSIS AND DESIGN: TOWARDS A RECONCILIATION OF PROCEDURES
SOIL SUR LAND EVAL; Vol: 5, No: 3; (1986); EN
XZ; pg 61-76
Land evaluation is a method for identifying the best system of improved land use, of any kind, for given sites. Diagnosis and design has essentially the same aim, but especially for land use systems that include agroforestry. The sets of procedures contain many activities in common. Land evaluation is stronger in treatment of environmental aspects; diagnosis and design stronger in treatment of social aspects. Land evaluation could benefit through inclusion of procedures from diagnosis and design: 1) the diagnosis of problems of existing land use systems; 2) in some circumstances, use of the central steps of diagnosis and design procedures as means for formulating improved land utilization types (not necessarily only for agroforestry); 3) a research loop for improving proposed land utilization types and testing their performance. Diagnosis and design could benefit from 1) a more specific differentiation into land units followed by an activity of site selection; 2) the inclusion of a stage of evaluation, leading to suitability classification. Diagrams are given showing how these changes fit into existing procedures.
AGROFORESTRY; LAND EVALUATION; DIAGNOSIS; DESIGN;

00523
06061
ETHERINGTON, D.M.; MATHEWS, P.J.
APPROACHES TO THE ECONOMIC EVALUATION OF AGROFORESTRY FARMING SYSTEMS
AGROFOR SYST; Vol: 1, No: 4; (1983); EN
XZ; pg 347-360
The economics of agroforestry systems can be approached in a purely analytical fashion with mathematical equations and diagrams explaining the principles of analysis. This paper argues that such an approach may be useful for teaching purposes but has little practical relevance. There is an urgent need for a practical tool with which multidisciplinary teams can assess agroforestry systems. The simplest and most common approaches to the economic analysis of farm management problems are various forms of budgeting. Recent advances in microcomputer technology provide the means by which the principles of partial budgeting can be adapted to the needs of agroforestry, taking account of its multiple component nature, seasonal variability, and long life span. The

paper sets out the specifications for such an approach and indicates how it might be used.
AGROFORESTRY; F RMING SYSTEMS; ECONOMIC ANALYSIS;

00524
06083
HOEKSTRA, D.A.
CHOOSING THE DISCOUNT RATE FOR ANALYZING AGROFORESTRY SYSTEMS TECHNOLOGIES FROM A PRIVATE ECONOMIC VIEWPOINT
FOR ECOL MANAGE; (1985); EN
XZ; pg 177-183
In this paper it is argued that the discount rate selected for the analysis of agroforestry systems needs careful consideration, especially when dealing with subsistence-oriented farmers. Adopting the borrowing or savings rate, or the investment rate, common in most analyses from the private economic viewpoint, will not do since there are reasons to believe that in many cases the consumption rate of interest will, in fact, be lower. Furthermore, it is argued that farmers who are relatively well fed but face sustainability problems on their farms will have a lower discount rate than farmers who are less well fed but expect an upward trend in their production with their present activities. Applying the same discount rate for all farmers should therefore be avoided if there are clear indications that there are differences in relative wealth and future prospects.
AGROFORESTRY; TECHNOLOGY; ECONOMICS; ECONOMIC ANALYSIS;

00525
01558
CHANDLER, T.
DOCUMENTATION OF AGROFORESTRY LITERATURE AND RESEARCH
INTERNATIONAL COOPERATION IN AGROFORESTRY (CHANDLER, T. & SPURGEON, D. EDS.); (1980); EN
XZ; pg 177-190
In this paper the need for adequate and easily accessible agroforestry information is discussed. Unlike other specialized sciences, information on agroforestry systems is scarce, hence unavailable to most planners and decision-makers in the less developed countries. The author has outlined a variety of information sources where information can be retrieved and sifted. Special mention is made of the following information centre:. AGRIS - an FAO specialized information system for the agricultural sciences and technology; CARIS for FAO - a cooperative information system within which developing countries exchange information on their research institutions, their research workers and their research programmes; INFOTERRA (UNEP) - a worldwide international referral service for environmental information. Other notable databases are AGRICOLA, CAB, Abstracts in Tropical Agriculture from the Royal Tropical Institute Netherlands, CSIRO, and AGRIPROP.
AGROFORESTRY; DOCUMENTATION; DATA COLLECTION; DEVELOPING COUNTRIES; LAND USE;

00526
B01627
COMBE, J.; SAA, H.J.; MONGE, C.
BIBLIOGRAPHY ON TROPICAL AGROFORESTRY
(1981); EN
CATIE; XP; pg 1-67
This bibliography includes 680 references on tropical agroforestry. Most of the documents deal with the American tropics, but there are also documents from Africa, Asia and Oceania. Two indexes are presented, one of authors and the other combining subjects, species and countries; included are 363 authors, 94 subject key words, 57 geographical terms, and 71 botanical genera. Instructions are given on the use of the bibliography, how to consult the documents and how to obtain (by mail) copies of these papers.
ERYTHRINA POEPPIGIANA; CORDIA ALLIODORA; ALNUS ACUMINATA; CASUARINA; LEUCAENA LEUCOCEPHALA; GMELINA ARBOREA; AGROFORESTRY; LAND USE; TENURE; SILVICULTURE; SHIFTING CULTIVATION; SOIL FERTILITY; BIBLIOGRAPHIES; TROPICS;

00527
06059
DI CASTRI, F.; CELECIA, J.; HADLEY, M.
FROM RESEARCH TO COMMUNICATION IN AGROFORESTRY: SOME INSIGHTS FROM THE MAB PROGRAMME
AGROFOR SYST; Vol: 1, No: 3; (1983); EN
KE/MX/PG; pg 189-203
Attempts within the Man and Biosphere (MAB) Programme of Unesco to produce research findings and information materials useful for education and training in agroforestry are outlined. Three different field projects - one in the humid tropics of Mexico, another in an urban situation in Papua New Guinea, the third in the arid zones of northern Kenya - provide examples of the types of educational materials and training activities that can be integrated within field research projects. Lessons learned in the preparation of a poster-exhibit, "Ecology in Action", and their possible relevance to the development of programmes in agroforestry education, are described.
AGROFORESTRY; COMMUNICATION; RESEARCH; HUMID TROPICS; ARID ZONES;

00528
05856
LABELLE, R.
<A> PRELIMINARY AGROFORESTRY WORLD LIST WITH DEFINITIONS
ICRAF WORK PAP NO 8; (1983); EN
XZ; pg 1-39
Descriptors are listed that are suggested as candidates for a controlled vocabulary of agroforestry. Some of the terms have definitions and explanatory notes.
AGROFORESTRY; DESCRIPTORS;

00529
06118
TORRES, F.
NETWORKING FOR THE GENERATION OF AGROFORESTRY TECHNOLOGIES

ICRAF WORK PAP NO 31; (1985); EN
XA; pg 1-24
In sub-Saharan Africa, there is little known about land use circumstances under which agroforestry can have maximum impact. Very few guidelines exist on management practices to be applied to optimize its multiple benefits. There is need therefore to use resources available in institutions from the agricultural and forestry sectors. The author stresses the need to develop institutions in order to achieve more effective use of existing research capacity at national, regional and international levels. The organizational structure to support networking is set up in four main ecozones - arid, semi arid, subhumid and humid; there is cooperation among countries in each ecozone with external organizations providing technical and financial assistance. Technology generation is based on an understanding of the agro-ecological and socioeconomic circumstances limiting production in existing systems. This technology will benefit smallholders in marginal areas and national institutions participating in land use research and training activities.
AGROFORESTRY; NETWORKS; TECHNOLOGY; SUBHUMID TROPICS; SEMI ARID ZONES; ARID ZONES; HUMID TROPICS;

00530
06085
VON CARLOWITZ, P.G.
SOME CONSIDERATIONS REGARDING PRINCIPLES AND PRACTICE OF INFORMATION COLLECTION ON MULTIPURPOSE TREES
AGROFOR SYST; Vol: 3, No: 2; (1985); EN
XZ; pg 181-195
Information on multipurpose trees (MPTs) is crucial to scientists and development workers for proper assessment, evaluation, and use both in agroforestry research and in development. The paper addresses and outlines one of the major problems peculiar to MPTs in the process of data collection and management: the large number of potential species combined with the complexity originating from multiple uses. It draws attention to the need to facilitate an objective short-listing of priority species. In view of the magnitude of the information requirements, the author describes the Hacketts (1983) modular system, its benefits and its problems. The paper also suggests a computerized approach for data collection, storage and management, including "specialized" and "support" data bases, and places emphasis on the need to set up data base networks to ensure maximum accessibility of accumulated data and to avoid unnecessary duplication. It describes ICRAF's MPT data base, its objectives, choice of descriptors, and its general approach to data collection and management.
MULTIPURPOSE TREES; INFORMATION FLOW; DATA BASES; DATA COLLECTION; DATA MANAGEMENT;

00531
06106
VON CARLOWITZ, P.G.
MULTIPURPOSE TREES AND SHRUBS, OPPORTUNITIES AND LIMITATIONS: THE ESTABLISHMENT OF A MULTIPURPOSE TREE DATA BASE
ICRAF WORK PAP NO 17; (1984); EN
XZ; pg 1 -16

The increasing awareness of ecological aspects of land use and the growing need to fully utilize natural resources on a sustained basis has led to the establishment of a multipurpose tree data base. A number of institutions and individuals have compiled knowledge and details on certain aspects of multipurpose trees and shrubs. This information is however only used in certain regions, hence lack a systematic overview and coordination. This calls for a worldwide compilation of data and information. This paper briefly outlines the importance of multipurpose trees and shrubs in agroforestry and mentions the limitations and problems that require due consideration in the use of multipurpose trees and shrubs. It outlines some of these considerations and shows the need to accumulate, interpret, evaluate and disseminate the acquired knowledge in a practical way for the benefit of researchers and field workers engaged in the development of agroforestry. It elaborates ways and means of seeking solutions to constraints and limitations in the use of multipurpose trees and shrubs; it discusses the means and methods of obtaining information, the computerization of data, and the opportunities and limitations of their evaluation.
MULTIPURPOSE TREES; SHRUBS; DATA BASES; LIMITING FACTORS;

AUTHOR INDEX

ABRAMIDES, P.L.G.

00293

ADEM, H.H.

00376, 00377

ADEYOJU, S.K.

00035, 00450, 00451

AGAMUTHU, P.

00266, 00299, 00300

AGBEDE, O.O.

00127, 00128, 00129

AHMED, S.

00372

AHN, B.W.

00472

AKACHUKU, A.F.

00428

AKKERMANS, A.D.L.

00269

ALCANTARA, P.B.

00293

ALCANTARA, V.B.G.

00293

ALIEU, E.K.

00085

ALLEN, B.J.

00086

ALLEN, J.C.

00413

ALTIERI, M.A.

00018

ALVIM, P. DE T.

00036, 00047

ALVIM, R.

00304

AMARE GETAHUN

00070, 00087, 00100, 00193

AMERICAN SOCIETY OF AGRONOMY

00019

AMPUERO, E.P.

00149

ANDERSON, A.B.

00215

ANDERSON, G.W.

00150, 00151, 00152, 00153

ANDRIESSE, J.P.

00037

ANON

00088, 00194, 00245

ANTHONY, K.J.

00306

ARANGUREN, J.

00310

ARELLANO, P.G.

00038

ARKCOLL, D.B.

00287

ARNOLD, J.E.M.

00312, 00429, 00430

ARNOLD, M.

00089

ARORA, G.D.

00360

ASABERE, P.K.

00095

ATMOSOEDARYO, S.

00090, 00473

AYLING, R.D. (ED.)

00246

BABU, R.

00391, 00431

BAGGIO, A.

00288

BAGLEY, W.T.

00195

BAKER, D.C.
00452
BALAKRISHNAN, T.K.
00405
BALL, J.
00091
BALLICK, M.J.
00215
BANDURSKI, R.S.
00257
BARNARD, G.
00318, 00457
BARNES, D.F.
00413
BATINI, F.E.
00151, 00152, 00153
BAUMER, M.C.
00346
BAVAPPA, K.V.A.
00123, 00247
BAY-PETERSEN, J. (ED.)
00453
BAYNARD, S.G.
00473
BAYOUMI, A.A.
00092
BAZILEVIC, N.I.
00020
BEALE, I.F.
00270
BEALL, H.W.
00039
BEER, J.W.
00093, 00271, 00382
BEETS, W.C.
00415
BELIARD, C.A.
00347
BELL, T.I.W.
00154
BENE, J.G.
00039
BENGE, M.D.
00196, 00197, 00248, 00419
BERGER, M.R.
00249
BERTRAND, R.
00488
BHAN, S.
00412
BILLINGS, D.
00263
BISHOP, J.P.
00155, 00156
BISWAS, A.
00315
BOGDAN, A.V.
00201
BOLAND, D.J.
00255
BOMPARD, J.
00502
BOND, D.J.
00165
BOONKIRD, S.A.
00185
BORNEMISZA, E.
00305, 00310
BOROUGH, C.J.
00157
BORTOLI, L.
00240
BOURKE, R.M.
00094
BOWEN, M.R.
00250
BRANSBY, D.I.
00290
BREWBAKER, J.L.
00198

BRISCOE, C.B.
00158
BROKENSHA, D.
00454
BROMLEY, D.W.
00432
BROUGHTON, W.J.
00266, 00299, 00300
BUCK, L.E.
00041, 00251
BUDOWSKI, G.
00001, 00003, 00042, 00052, 00199
BURGESS, R.J.
00433
BURGGRAFF, A.J.P.
00281
BURITY, H.A.
00402
BURLEY, J.
00200, 00313
BURTON, G.W.
00168
CABALA-ROSAD, P.
00311
CAIRO, M.
00230
CAMPBELL, J.G.
00455
CANNELL, G.H.
00202, 00274
CARE NIGER
00125
CARLSON, L.W. (COMP.)
00237
CARPENTER, R.A. (ED.)
00489
CASSADAY, K. (ED.)
00191
CASTRO, A.P.
00454
CATINOT, R.
00314
CELECIA, J.
00527
CERNEA, M.M.
00456
CHACHU, R.E.O.
00095
CHAGAS, J.M.
00373
CHAMBERS, R.
00434
CHAN KUO, P.
00002
CHAN, Y.K.
00299, 00300
CHANDLER, T.
00525
CHANDLER, T. (ED.)
00043
CHANDRA, V.
00252
CHAPMAN, E.C.
00044
CHARREAU, C.
00378
CHATTERJEE, S.
00315
CHAUDHRY, M.A.
00096
CHINGAIPE, T.M.
00116
CHOTA INUMA, J.
00132
CISSE, M.I.
00348
CLARK, P.R.
00202, 00274
CLARKE, W.C.
00140
CLARKIN, K.L.
00093

CLEMENT, J.
00335
COLE, D.E.
00253
COLFER, C.J.P.
00435
COMBE, J.
00003, 00045, 00526
CONLIN, S.
00111
CONTANT, R.B.
00484
CONTRERAS, A.H.
00491
COOPER, R.
00481
CORNET, F.
00272
COSSINS, N.J.
00046
COTE, A.
00039
CTFT
00098
DABRAL, B.G.
00406
DALMACIO, M.V.
00482
DANCETTE, D.
00079
DARNHOFER, T.
00477, 00482
DARU, R.D.
00420
DE GROOT, P.J.
00289
DE HAAN, C.
00171
DE JONG, W.
00132
DE LAS SALAS, G.
00093, 00097
DE LIYANGE, M.S.
00190
DEB ROY, R.
00349
DELECOLLE, R.
00418
DELWAULE, J.C.
00254
DENARIE, J.
00273
DENT, D.
00490
DENTON, F.H.
00316
DEPOMMIER, D.
00098
DI CASTRI, F.
00527
DIEM, H.G.
00272
DJIMDE, M.
00159, 00294
DOAT, J.
00317
DONEY, T.J.
00356
DORAN, J.C.
00255
DOUGALL, H.W.
00201
DOVE, M.R.
00421
DUCATILLION, C.
00502
DUFOUR, O.
00302
DULIEU, D.
00240
DUTT, G.S.
00324

DYKSTRA, D.P.

00436

ECKHOLM, E.P.

00050, 00318

EHLICH, M.

00066

EL-LAKANY, M.H.

00319

ELWIN, R.L.

00113

ENABOR, E.E.

00398, 00449

ESCALANTE, E.E.

00186

ESCALANTE, G.

00310

ESSIAMAH, S.K.

00303

ETHERINGTON, D.M.

00437, 00438, 00523

EVANS, P.T.

00187

FAGBENRO, J.A.

00129

FAO

00320, 00321, 00474, 00475, 00476

FARELL, J.

00018

FARNSWORTH, M.C.

00160

FAROOQI, M.I.H.

00252

FAULKNER, R. (ED.)

00256

FELKER, P.

00202, 00203, 00204, 00257, 00274, 00275, 00380, 00439

FERNANDES, E.C.M.

00021, 00068, 00185, 00213, 00217, 00223, 00519

FILHO, I.A.P.

00373

FILIUS, A.M.

00440

FLAG

00258

FLOOR, W.M.

00322

FOLEY, G.

00318, 00457

FONZEN, P.F.

00188

FORD FOUNDATION

00422

FORGIARINI, G.

00240

FORTMAN, L.

00423, 00458, 00470

FOUQUE, A.

00374

FRAZAO, J.M.

00215

FREEMAN, P.H.

00099

FRENCH, D.

00323

GALVAO, A.P.M.

00051

GELLER, H.S.

00324

GEPHART, M.

00459

GIBBON, D.

00381

GIBSON, A.H.

00276

GIBSON, I.A.S.

00259

GIFFARD, P.L.
00101, 00205
GILL, T.
00022
GILLET, J.B.
00260
GISZ, P.L.
00161, 00162
GLOVER, N.L.
00093, 00382
GOLD, M.A.
00261
GOLDSON, J.R.
00163
GOMM, F.B.
00352
GORDON, W.A.
00004
GRAINGE, M.
00372
GRANDSTAFF, T.B.
00424
GRASMICK, J.C.
00460
GRAY, S.G.
00206
GREENLAND, D.J.
00027, 00053, 00054
GREGERSON, H.M.
00491
GRIMME, H.
00108
GRINNELL, H.R.
00102
GUNN, B.V.
00255
GUNN, C.R.
00262
GUPTA, A.K.
00267
GUPTA, M.K.
00267
GUPTA, R.K.
00369, 00383
GUPTA, T.
00164
HABIT, M.A.
00350
HABS, M.
00249
HADLEY, M.
00527
HALL, D.O.
00289, 00325, 00326
HALLIDAY, J.
00263
HAN SHUFENG
00286
HANS, A.S.
00207
HAROU, P.A.
00441
HARRISON, P.
00384
HARVEY, J.
00381
HAWKE, M.F.
00165, 00169
HECKETSWELER, P.
00502
HENZELL, E.F.
00277
HERVE, M.
00170
HESMER, H.
00005, 00055
HEUVELDOP, J.
00110, 00288
HITCHCOCK, D.K.
00166
HOEKSTRA, D.A.
00442, 00443, 00477, 00478, 00524

HOEKSTRA, D.A. (ED.)

00103

HOFSTAD, O.

00104

HOSIER, R.

00327

HOSKINS, M.W.

00146, 00328, 00492, 00515

HUBBARD, K.

00381

HUGUET, L.

00105

HUMPHREYS, L.R.

00174

HUXLEY, P.A.

00006, 00056, 00209, 00210, 00211, 00291, 00404, 00485, 00493, 00494, 00495, 00497, 00498, 00499

HUXLEY, P.A. (ED.)

00057, 00390

IBARRA, R.B.

00385

INDIRA, P.

00135

INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE (IITA)

00106

IRRI

00500

IVES, J.D.

00058

IYAMABO, D.E.

00059

JACOVELLI, P.A.

00122, 00462

JAHN, S.A.A.

00249

JAMBULINGAM, R.

00213

JAMESON, D.A.

00351

JESINGER, R.

00299, 00300

JOHNSEN, T.N.

00352

JOHNSON, D.V.

00189

JONES, J.R.

00329

JUO, A.S.R.

00023

KADAMBI, K.

00353

KALLA, J.C.

00330

KANG, B.T.

00100, 00107, 00108

KARIUKI, E.

00477

KARTASUBRATA, Y.

00109

KARUNANAYAKE, K.

00438

KASS, D.C.L.

00199

KELLEY, H.W.

00386

KELLMAN, M.

00024

KELLOG, C.E.

00060

KEYA, S.O. (ED.)

00284

KHADER, K.B.A.

00306

KHANNA, P.K.

00307

KHOO, K.M.

00299, 00300

KHURANA, D.K.

00076

KING, K.F.S.

00007, 00008, 00009, 00010, 00011, 00061, 00062, 00063

KLEMEDSON, J.O.

00411

KNIPSCHEER, H.C.

00398, 00449

KNOWLES, R.L.

00071, 00169, 00181

KORSMO, H.

00331

KOZLOWSKI, T.T.

00404

KRUEGER, W.C.

00175

KUGURU, F.M. (ED.)

00103

KUMAR, V.

00207

LABELLE, R.

00528

LAGEMAN, J.

00110

LAHIRI, A.K.

00479

LAL, P.

00395

LAL, R.

00023, 00054

LALONDE, M.

00280

LAURIE, N.V.

00501

LAWRY, S.W.

00461

LAWSON, T.L.

00108

LAWTON, R.M.

00354

LE HOUEROU, H.N.

00387

LE HOUEROU, H.N. (ED.)

00355

LEDIG, F.T.

00332

LESLIE, A.

00111

LETHEM, F.J.

00463

LEWIS, C.E.

00167, 00168, 00333

LIE, T.A.

00278

LITTLE, E.L.

00334

LOCATELLI, E.

00402

LULANDALA, L.L.L.

00116

LUNDGREN, B.O.

00025, 00064, 00112, 00388, 00414, 00425

LUNDGREN, L.

00425

LYNCH, J.J.

00113

MACDONALD, L.H. (ED.)

00114

MACKLIN, B.

00070

MACLAURIN, A.R.

00290

MAGHEMBE, J.A.

00115, 00116, 00136, 00223

MALAJCZUK, N.

00296

MALCOLM, C.V.

00356

MALE, A.J.R.

00160

MANANDHAR, P.K.

00357

MANN, H.S. (ED.)

00214

MANNIKAR, N.D.

00176

MARKS, P.J.

00117

MASCARENHAS, O.A.J.

00427

MASSON, J.L.

00118

MATHEWS, P.J.

00523

MATHUR, H.N.

00267

MAY, P.H.

00215

MCCORMICK, W.C.

00168

MCKELL, C.M.

00358

MCQUEEN, I.P.M.

00169

MENAUT, J.

00240

MEULEN, U. TER

00370

MGENI, A.S.M.

00389

MICHON, G.

00502

MIEHE, S.

00216

MILLER, R.P.

00066

MILTON, S.J.

00359

MINCHIN, F.R.

00279

MISRA, D.K.

00412

MODGAL, S.C.

00026

MONGE, C.

00526

MONGI, H.O.

00486, 00503

MONGI, H.O. (ED.)

00390

MONSON, W.G.

00168

MONTALEMBERT, M.R.

00335

MORGAN, W.B.

00336

MORIS, J.

00444

MOSS, R.P.

00336

MOTTERSHEAD, B.E.

00113

MUTHANA, K.D.

00337, 00360

NAIR, G.M.

00135

NAIR, P.K.R.

00013, 00014, 00015, 00021, 00026, 00067, 00068, 00069, 00120, 00121, 00123, 00143, 00185, 00189, 00190, 00217, 00218, 00304, 00307, 00308, 00309, 00388, 00405

NAITHANI, K.C.

00264

NAMBIAR, V.P.K.

00375

NAMKOONG, G.

00200

NARAYANA, V.V.D.

00391

NAS

00338

NASH, P.

00202

NATIONAL ACADEMY OF SCIENCES

00219, 00220

NEIL, P.E.

00122, 00462

NELLIAT, E.V.

00123

NESME, X.

00280

NEUMANN, I.F.

00392

NEWLAND, K.

00050

NEWTON, W.E.

00276

NGEH, C.P.

00124

NITIS, I.M.

00174

NORMAND, P.

00280

NORONHA, R.

00463

NOSBERGER, J.

00227, 00363

NWOBOSHI, L.C.

00126

O'KEEFE, P.

00339

OAKES, A.J.

00221

OBEL, E.

00070

OBERHOLZER, E.

00188

OHLER, F.M.J.

00340

OJENIYI, S.O.

00127, 00128, 00129

OKAFOR, J.C.

00222

OKIGBO, B.N.

00027

OKTINGATI, A.

00223

OLAWOYE, O.O.

00130, 00131

OLIVIN, J.

00302

OLOFSON, H.

00028, 00426

OPENSHAW, K.

00224, 00341, 00342, 00444

OSARA, N.A.

00016

OSBORN, J.F.

00202, 00274

PADOCH, C.

00132

PAKHRIBAS AGRICULTURAL CENTRE

00361

PALMBERG, C.

00225

PANDAY, K.K.

00226, 00227, 00362, 00363

PAREEK, O.P.

00292

PARKER, E.J.

00207

PATHAK, P.S.

00349

PEACE CORPS

00487

PELLEW, R.

00364

PENALOZA, R.

00170

PERCIVAL, N.S.

00071, 00165, 00178

PERSLEY, G.J. (ED.)

00301

PHILLIP, P.F.

00509

PHORORO, D.R.

00464

PIOT, J.

00240

POLLISCO, F.S.

00133

PONGSAPICH, A.

00465

POSCHEN, P.

00228

POSEY, D.A.

00295

POULAIN, J.F.

00379

POULSEN, G.

00229, 00365

POUND, B.

00230

PRADHAN, P.R.

00231, 00366

PRASAD, R.

00412

PRASAD, S.N.

00416

PRASAD, U.

00343

PRATT, D.J.

00171

PURI, D.N.

00431

QUISPEL, A.

00281

RADWANSKI, S.A.

00134, 00232, 00393

RAINTREE, J.B.

00029, 00064, 00233, 00445, 00471, 00477, 00480, 00482, 00505, 00506, 00511

RAINTREE, J.B. (ED)

00504

RAMANUJAM, T.

00135

RAMCHANDER, P.R.

00247

REDDELL, P.

00296

REDHEAD, J.F.

00115, 00136

REILLY, J.J.

00157

REYNOLDS, S.G.

00172, 00173

RHOADES, R.E.

00446

RICA, I.K.

00174

RICGEKEAY, D.

00470

RIDDELL, J.C.

00137, 00458, 00466

RITCHIE, G.A. (ED.)

00234

ROATH, L.R.

00175

ROBINSON, P.J.

00367

ROCHE, L.

00138, 00481

ROCHELEAU, D.E.

00520, 00521

RODIN, L.E.

00020

ROKAYA, C.M.

00447

ROMBOLD, J.S.

00187

ROSKOSKI, J.P.

00282, 00283, 00310, 00396

RUSSELL SMITH, J. (ED.)

00235

RUSSELL, I.

00160

RUSSO, R.O.

00199

RUTHERNBURG, H.

00507

SAA, H.J.

00526

SABHASRI, S.

00058

SAGWAL, S.S.

00236

SAJISE, P.E.

00072

SALINAS, H.E.

00368

SAMRA, J.S.

00406

SANCHEZ, P.A.

00030, 00032, 00073

SANCHEZ, S.C.

00368

SANGAL, P.M.

00264

SANKARAN, K.V.

00298

SANTANA, M.B.M.

00311

SANVICTORES, J.G.

00508

SAR, N.L.

00162

SASTRY, G.

00391

SAXENA, S.K. (ED.)

00214

SCHMAHL, D.

00249

SCHMEHL, W.R.

00509

SEIF EL DIN, A.G.

00139

SELLERS, S.

00467

SHAKOV, D.

00339

SHANER, W.W.

00509

SHARMA, B.M.

00394

SHARMA, J.K.

00298

SHARMA, K.C.

00267

SHARMA, K.K.

00264

SHARMA, S.K.

00369, 00431

SHEA, K.R. (COMP.)

00237

SHENK, M.

00402

SIDA

00476

SILIM, S.

00096

SIMON, A.

00510

SIMON, J.C.

00407, 00418

SINGH, A.
00026
SINGH, A.K.
00427
SINGH, B.R.
00503
SINGH, D.
00176
SINGH, J.P.
00431
SINGH, K.
00406
SINGH, K.S.
00395
SINGH, M.K.
00427
SINGH, R.P.
00267
SIPKENS, L.
00107
SKAR, S.L.
00345
SOBARZO, L.
00170
SPECIAL ENERGY PROGRAMME
00344
SPURGEON, D. (ED.)
00043
SRIVAS, N.C.
00176
SRIVASTAVA, B.P.
00177
SRIVASTAVA, L.J.
00076
SSALI, H. (ED.)
00284
STEELE, K.W.
00178
STEINLIN, H.
00031
STEPPLER, H.A.
00511
STIGTER, C.J.
00408, 00409, 00410
SUDI, Y.A.
00503
SUMBERG, J.E. (ED.)
00191
TAITON, N.M.
00290
TAJJUDIN, I.
00179
TANNER, G.W.
00333
TEJWANI, K.G.
00190
TERRY, W.S.
00333
THEMAN, R.R.
00140
TIEDEMANN, A.R.
00411
TIMBERLAKE, L.
00318
TIPS, W.E.J.
00420
TISDALL, J.M.
00376, 00377
TOKY, O.P.
00076
TORRES, F.
00180, 00238, 00477, 00482, 00506, 00513, 00529
TOUTAIN, B.
00239, 00240
TREMBLAY, F.M.
00280
TRIBE, D.E.
00417

TRUCHET, G.

00273

TUAZON, R.

00468

TURNBULL, J.W.

00255

TUSTIN, J.R.

00181

UNRUH, J.

00132

URIYO, A.P.

00503

USAID

00192

VALENZA, J.

00488

VAN BAREN, F.A.

00077

VAN DIJK, C.

00269

VAN KESSEL, C.

00283, 00396

VAN KRAAYENOORD, C.W.S.

00397

VAN NAO, T.

00141

VASHISHTHA, B.B.

00292

VERACION, A.G.

00142

VERGARA, N.T.

00143, 00448

VERINUMBE, I.

00398, 00399, 00449

VIDAL, P.

00378

VIEIRA, C.

00373

VOGTMANN, H.

00078

VON CARLOWITZ, P.G.

00514, 00530, 00531

VON MAYDELL, H.J.

00012, 00017, 00065, 00079, 00080, 00182, 00241

VON SZYSZA, M.

00370

VORAURAI, P.

00058

WADE, M.K.

00032

WAMBUGU, P.N.

00217

WAN MOHAMED BIN WANG EMBONG

00183

WARNER, K.

00029

WASSINK, J.T.

00081

WASTON, G.A.

00144

WEAVER, G.H.

00223

WEAVER, P.

00145

WEBER, F.

00146, 00515

WEINSTOCK, J.A.

00033

WICKENS, G.E.

00134, 00393

WIERSUM, K.F.

00082, 00147, 00184

WIERSUM, K.F. (ED.)

00148

WIJAYAKUSUMAH, K.

00090

WILLIAMS, P.J.

00469

ZHOU XIANGQUAN

00285, 00286

ZIMMERMANN, R.C.

00518

ZOHAR, Y.

00297

ZUMER-LINDER, M.

00371

SPECIES INDEX

ACACIA

00020, 00061, 00090, 00101, 00134, 00159, 00248, 00254, 00255, 00277, 00364, 00432, 00476

ACACIA ALBIDA

00013, 00017, 00087, 00101, 00115, 00116, 00121, 00134, 00136, 00139, 00141, 00146, 00182, 00203, 00204, 00205, 00206, 00216, 00224, 00228, 00229, 00233, 00239, 00241, 00251, 00313, 00378, 00379, 00380, 00387, 00445, 00480, 00492, 00495, 00507, 00515

ACACIA ANEURA

00203, 00206, 00270

ACACIA ARABICA

00005, 00009, 00232, 00353, 00395

ACACIA ATAXANCANTHA

00125

ACACIA AURICULIFORMIS

00233, 00250

ACACIA GREGGII

00203, 00411

ACACIA HOLOSERICEA

00251, 00272

ACACIA LAETA

00125, 00240

ACACIA LEUCOPHLOEA

00213

ACACIA MANGIUM

00095, 00250, 00259, 00265

ACACIA MEARNSII

00148, 00274

ACACIA MELANOXYLON

00251

ACACIA NILOTICA

00213, 00214, 00241, 00251, 00330, 00431

ACACIA PULCHELLA

00296

ACACIA RADDIANA

00205, 00240, 00272, 00515

ACACIA SALIGNA

00504

ACACIA SCORPIOIDES

00125, 00515

ACACIA SENEGAL

00101, 00114, 00125, 00136, 00139, 00141, 00146, 00203, 00214, 00224, 00241, 00242, 00254, 00412, 00474, 00481, 00515

ACACIA SEYAL

00240, 00241, 00242

ACACIA TORTILIS

00114, 00139, 00164, 00214, 00224, 00330, 00337, 00349, 00359, 00360, 00412, 00444

ACACIA VILLOSA

00473

ACIOA BARTERII

00030, 00053, 00100, 00193

ACROCARPUS INDICA

00251

ADANSONIA DIGITATA

00114, 00139, 00205, 00207, 00239, 00492

ADHATODA VASICA

00505

AFZELIA

00059

AGATHIS LORANTHIFOLIA

00473

AGROSTIS

00149

AILANTHUS EXCELSA

00061, 00412

ALBIZIA

00025, 00098, 00116, 00226, 00254, 00349, 00474

ALBIZIA AMARA

00353

ALBIZIA CHINENSIS

00090

ALBIZIA FALCATARIA

00087, 00089, 00133, 00142, 00147, 00148, 00197, 00233, 00259, 00265, 00298, 00419, 00430, 00476, 00491, 00508

ALBIZIA GUMMIFERA

00100

ALBIZIA LEBBEK

00005, 00020, 00061, 00095, 00112, 00164, 00203, 00239, 00330, 00337, 00412

ALBIZIA PROCERA

00072

ALCHORNEA CORDIFOLIA

00193

ALISO ALNUS FORULLENCIS

00149

ALNUS

00013, 00269

ALNUS ACUMINATA

00097, 00229, 00526

ALNUS CRISPA

00280

ALNUS GLUTINOSA

00278, 00280, 00281

ALNUS JORULLENSIS

00039, 00042, 00476

ALNUS NEPALENSIS

00226

ALNUS RUBRA

00281

AMARANTHUS

00234

AMORPHOPHALLUS CAMPANULATUS

00120, 00123, 00306

ANACARDIUM

00039, 00101, 00120, 00163, 00185, 00189, 00254, 00268, 00416

ANANAS COMOSUS

00081, 00120, 00306, 00433, 00438

ANDROPOGON GAYANUS

00073

ANISOPHYLLEA BOEHMII

00207

ANTHOCEPHALUS CHINENSIS

00158, 00518

ANTHOCLEISTA VOGELLI

00100

ANTIARIS AFRICANA

00112

ARACHIS HYPOGAEA

00032, 00054, 00278

ARAUCARIA CUNNINGHAMII

00518

ARECA CATECHU

00120, 00247, 00306, 00416

ARISTIDA

00242, 00412

ARTOCARPUS ALTILIS

00086, 00227, 00363

ARUNDINARIA

00077

ASPIDOSPERMA

00077

ATRIPLEX

00234, 00380

ATRIPLEX CANESCENS

00352

ATRIPLEX NUMMULARIA

00224

AUCOUMEA KLAINEANA

00025, 00149

AZADIRACHTA INDICA

00009, 00061, 00101, 00103, 00134, 00214, 00224, 00229, 00232, 00254, 00268, 00313, 00330, 00372, 00393, 00505

BACTRIS GASSIPAES

00144

BALANITES AEGYPTIACA

00125, 00240, 00242, 00254, 00515

BAMBUSA NUTANS

00479

BAMBUSA VULGARIS

00112, 00229

BAPHIA

00354

BAUHINIA

00254

BAUHINIA MACROTACHIA

00073

BAUHINIA PURPUREA

00226

BAUHINIA RUFESCENS

00125

BERTHOLLETIA EXCELSA

00047, 00144

BETA VULGARIS

00516

BLEPHARIS

00114

BLIGHIA SAPIDA

00222

BORASSUS AETHIOPICUM

00101, 00146, 00243, 00254, 00515

BORASSUS FLABELLIFER

00213

BOSCIA SENEGALENSIS

00242, 00346

BOUTELOUA GRACILIS

00351, 00352

BRACHIARIA HUMIDICOLA

00073, 00158, 00172, 00174, 00183

BRACHYCHITON POPULNEUM

00206

BRACHYLEANA HUTCHINSII

00504

BRACHYSTEGIA SPICIFORMIS

00103, 00131, 00159, 00354

BRASSICA

00120

BRASSICA CAMPESTRIS

00026

BREWIA OPPOSITFOLIA

00177

BROMUS

00149

BROSIMUM ALICASTRUM

00224

BUTYROSPERMUM PARADOXUM

00131, 00146, 00254, 00492, 00515

BYRSONIMA CRASSIFOLIA

00024, 00329

CADABA FARINOSA

00348

CAJANUS CAJAN

00023, 00047, 00087, 00398, 00399, 00445, 00449, 00510

CALLIANDRA CALOTHYRSUS

00089, 00095, 00148, 00199, 00233, 00288, 00327, 00430, 00444, 00473

CALLISTEMON

00248

CALOPOGONIUM MUCUNOIDES

00054

CALOTROPIS PROCERA

00020, 00214

CAMELLIA

00307

CAMELLIA SINENSIS

00120

CANNA EDULIS

00155

CAPPARIS

00354

CAPPARIS DECIDUA

00214

CARTHAMUS TINCTORIUS

00493

CARYA PECAN

00195

CASSIA

00233, 00234, 00254

CASSIA AURICULATA

00214

CASSIA SIAMEA

00009, 00061, 00101, 00112, 00147, 00193, 00224, 00229, 00251, 00313, 00476

CASSIA STURTII

00224

CASUARINA EQUISETIFOLIA

00005, 00009, 00013, 00030, 00044, 00061, 00094, 00101, 00141, 00143, 00196, 00248, 00251, 00269, 00278, 00313, 00479, 00504, 00526

CATHA EDULIS

00228

CEANOTHUS

00269

CEDRELA ODORATA

00093, 00097, 00110, 00136, 00149

CEDRELINGA CATENAEFORMIS

00287

CEDRUS DEODARA

00267

CEIBA PENTANDRA

00059, 00112, 00213

CELTIS

00077, 00177

CELTIS OCCIDENTALIS

00020

CENCHRUS CILIARIS

00349

CENTROSEMA PUBESCENS

00054, 00073, 00172, 00174, 00299, 00300, 00507

CEONOTHUS AMERICANA

00281

CERATONIA SILIQUA

00039, 00195, 00203, 00204, 00206, 00241, 00313

CERCIDIUM FLORIDIUM

00202, 00203

CHAMAECYPARIS OBTUSA

00489

CHLOROPHORA EXCELSA

00059

CHRYSOPHYLLUM ALBIDUM

00059, 00144

CICER ARIETINUM

00493

CITRUS

00110, 00282

CITRUS SINENSIS

00093

CLETHRA HONDURENSIS

00024

CLITORIA CAJANIFOLIA

00054

COCOS NUCIFERA

00081, 00123, 00135, 00172, 00173, 00189, 00190, 00304, 00307, 00309, 00405, 00416, 00433, 00438

COFFEA

00122, 00186, 00199, 00271, 00282, 00283, 00305, 00310, 00396, 00438, 00462, 00516

COFFEA ARABICA

00094, 00382

COFFEA ROBUSTA

00086, 00128

COLLIGONUM POLYGONOIDES

00412

COLOCASIA ESCULENTA

00086, 00120, 00433

COLOPHOSPERMUM MOPANE

00354

COMBRETUM

00159, 00205, 00348, 00354

COMMIPHORA AFRICANA

00125, 00159, 00242, 00412, 00515

COMPTONIA PEREGRINA

00281

CONOCARPUS LANCIFOLIUS

00241

COPERNICIA PRUNIFERA

00189

CORDIA ABYSSINICA

00115, 00116, 00216

CORDIA ALLIODORA

00009, 00031, 00042, 00061, 00085, 00093, 00097, 00110, 00122, 00136, 00182, 00271, 00382, 00462, 00526

CORDIA GOELDIANA

00051

CORDIA TRICHOTOMA

00187

CRESTIS FERRUGINEA

00100

CROTALARIA

00120, 00206, 00233, 00507

CROTON

00077, 00098

CRYPTOMERIA JAPONICA

00005, 00489

CUCURBITA FOETIDISSIMA

00234

CUPRESSUS LUSITANICA

00025, 00093, 00111

CURATELLA AMERICANA

00038

CURCUMA LONGA

00123

CYNODON DACTYLON

00060, 00066, 00168

CYNODON PLECTOSTACHYUS

00134

CYTOSPERMA EDULIS

00097

DACRYDIUM ELATAN

00077

DALBERGIA LATIFOLIA

00090, 00254, 00354, 00504

DATISCA

00269

DERRIS INDICA

00103, 00505

DESMODIUM

00072, 00155, 00156, 00206, 00277

DHAINCHA

00120

DIALIUM GUIANENSE

00100

DIOSCOREA

00086, 00102,
00120, 00127,
00129, 00428

DIPLOCHYNCUS
CONDYLOCARPON

00354

DIPTEROCARPUS
TUBERCULATUS

00020, 00200

DOLICHOS HOSEI

00054

ELAEAGNUS UMBELLATA

00281

ELAEIS GUINEENSIS

00047, 00059,
00100, 00102,
00131, 00189,
00266, 00299,
00300, 00302,
00303, 00326

ELYMUS HISPIDUS

00352

ELYMUS SMITHII

00352

ENTANDROPHRAGMA

00138

ENTEROLOBIUM
CONTORTISILIQUA

00187

ERAGROSTIS TEF

00507

ERYTHRINA

00031, 00042,
00044, 00093,
00110, 00186,
00199, 00206,
00226, 00271,
00311, 00382,
00526

EUCALYPTUS GRANDIS

00005, 00009,
00025, 00038,
00039, 00042,
00061, 00089,
00090, 00095,
00098, 00114,
00115, 00116,
00127, 00129,
00136, 00148,
00149, 00158,
00162, 00185,
00196, 00200,
00229, 00241,
00248, 00253,
00254, 00259,
00265, 00287,
00296, 00313,
00327, 00343,
00412, 00416,
00419, 00430,
00432, 00444,
00476, 00479,
00481, 00491,
00495

EUGENIA

00479

EUGENIA CARYOPHYLLUS

00123

EUPATORIUM ODORATUM

00518

EUPHORBIA BALSAMIFERA

00139, 00214,
00326, 00515

FERETIA APONDANTHERA

00348

FESTUCA

00149

FESTUCA ARIZONICA

00351

FICUS

00098, 00100,
00226

FICUS BENGHALENSIS

00353

FICUS GNAPHALOCARPA

00239

FICUS LACOR

00231

FLEMINGIA CONGESTA

00193

FRANKIA

00280, 00281

GLEDITSIA TRIACANTHOS

00103, 00195,
00206, 00235,
00261, 00313

GLIRICIDIA SEPIUM

00072, 00087,
00090, 00093,
00100, 00110,

00148, 00193,
00199, 00233,
00347, 00445,
00473

GLYCINE MAX

00023, 00026,
00032, 00072

GLYCINE WIGHTII

00030, 00277

GMELINA

00059

GMELINA ARBOREA

00005, 00009,
00025, 00030,
00036, 00047,
00085, 00095,
00097, 00101,
00102, 00112,
00127, 00128,
00129, 00158,
00193, 00196,
00200, 00229,
00259, 00265,
00268, 00313,
00428, 00432,
00440, 00508,
00526

GREVILLEA ROBUSTA

00115, 00116,
00136, 00236,
00251, 00392,
00489

GREWIA BICOLOR

00242, 00444

GREWIA OPPOSITIFOLIA

C0226

GREWIA TENAX

00412

GUILIELMA GASIPAES

00097, 00155

GUTIERREZIA SAROTHRAE

00351

HALOXYLON

00241

HARDWICKIA BINATA

00353

HELIANTHUS

00072, 00516

HELICONIA

00030

HEVEA BRASILIENSIS

00005, 00044,
00047, 00179,
00183, 00185,
00304, 00326

HIPPOPHAE

00269, 00278

HYPARRHENIA RUFA

00073

IMPERATA

00233

IMPERATA CYLINDRICA

00039, 00044,
00054, 00058,
00060, 00096,
00141, 00147,
00174, 00219,
00430, 00440,
00473, 00495,
00507, 00518

INDIGOFERA

00206, 00277

INGA EDULIS

00155, 00156,
00287

INGA JINICUIL

00271, 00282,
00283, 00305,
00396

INGA VERA

00282

INOCARPUS EDULIS

00097

IPOMOEA AQUATICA

00097

IPOMOEA BATATAS

00094, 00123

IRVINGIA GABONENSIS

00112, 00144,
00222

JACARANDA COPAIA

00158, 00287

JUGLANS NIGRA

00195

JULBERNARDIA GLOBIFLORA

00103, 00159,
00354

JUNIPERUS PROCERA

00009, 00351

KHAYA

00098

KHAYA IVORENSIS

00138

LARIX LEPTOLEPIS

00489

LENEYA TESOTA

00202

LEUCAENA

00039, 00086, 00087, 00090, 00100, 00133, 00199, 00279, 00380

LEUCAENA DIVERSIFOILA

00198

LEUCAENA ESCULENTA

00198

LEUCAENA GLAUCA

00005, 00044, 00473

LEUCAENA LEUCOCEPHALA

00013, 00023, 00030, 00031, 00061, 00068, 00072, 00089, 00095, 00107, 00108, 00112, 00115, 00116, 00121, 00134, 00136, 00141, 00147, 00148, 00154, 00187, 00192, 00193, 00196, 00197, 00198, 00202, 00203, 00204, 00206, 00219, 00221, 00229, 00230, 00233, 00234, 00238, 00239, 00245, 00251, 00263, 00264, 00274, 00275, 00290, 00293, 00313, 00349, 00370, 00373, 00392, 00398, 00399, 00403, 00419, 00430, 00443, 00445, 00448, 00449, 00493, 00504, 00505, 00508, 00518, 00526

LEUCAENA PULVERULENTA

00197, 00198, 00219

LIPPIA TORRESSII

00093

LIVISTONA

00141

LOLIUM MULTIFLORUM

00160

LOLIUM PERENNE

00160

LOTONONIS BAINESII

00174

LOVOA TRICHILIOIDES

00138

LUPINUS ALBUS

00149

MAESOPSIS EMINII

00096, 00265

MANGIFERA INDICA

00020, 00093, 00110, 00226, 00239, 00438

MANIHOT

00102, 00127

MANIHOT ESCULENTA

00032, 00123, 00128, 00135, 00428, 00438

MARKHAMIA LUTEA

00098, 00354

MAURITIA FLEXUOSA

00097

MEDICAGO SATIVA

00030, 00277

MELIA AZADIRACHTA

00134

MELIA AZEDARACH

00185, 00187

MELIA INDICA

00134, 00232

MICONIA ALBICANS

00024

MIMOSA

00279

MIMOSA INVISA

00147

MIMOSA PUDICA

00172

MIMOSA SCABRELLA

00505

MORINGA OLEIFERA

00146, 00249, 00353, 00492

MORINGA STENOPETALA

00249

MORUS

00177

MUHLENBERGIA MONTANA

00351

MUSA

00282, 00306, 00433

MUSA ACUMINATA

00155

MYRICA GALE

00280

MYRISTICA FRAGRANS

00123

NAPOLEANA IMPERIALIS

00222

NAUCLEA DIDERRICHII

00138

NEPHROLEPSIS BISERRATA

00300

NICOTIANA TABACUM

00147

NIPER NIGRUM

00044

OPUNTIA

00294, 00411

ORBIGNYA

00215

ORBIGNYA MARTIANA

00189

ORYZA SATIVA

00026, 00032, 00158, 00500

PANICUM BREVIFOLIUM

00302

PANICUM MAXIMUM

00023, 00030, 00060, 00073, 00158, 00163, 00172, 00174, 00183, 00277, 00306, 00353

PANICUM MILIACEUM

00026

PARASPONIA

00013

PARINARI CURATELLIFOLIA

00207, 00354

PARINARI MACROPHYLLA

00139

PARKIA

00039, 00131, 00480, 00492

PARKIA BICOLOR

00204

PARKIA BIGLOBOSA

00139, 00146, 00205, 00515

PARKIA CLAPPERTONIANA

00136, 00193, 00203, 00445

PARKIA FILICOIDEA

00207

PARKIA JAVANICA

00185

PARKIA SPECIOSA

00090, 00185

PARKINSONIA ACULEATA

00202, 00275, 00504

PARTHENIUM ARGENTATUM

00380

PASPALUM CONJUGATUM

00300

PASPALUM NOTATUM

00066, 00167, 00168

PASPALUM PLICATULUM

00174

PASSIFLORA EDULIS

00438

PAULLINIA CUPANA

00051, 00097, 00144

PELTOPHORUM DUBIUM

00187

PENNISETUM PURPUREUM

00023, 00030, 00060, 00089, 00141, 00148, 00149, 00154, 00183, 00229, 00242, 00353, 00378, 00430, 00473, 00476, 00507

PENTACLETHRA MACROPHYLLA

00144, 00222

PERSEA AMERICANA

00110

PHALARIS AQUATICA

00113

PHASEOLUS LUNATUS

00053, 00115, 00155, 00373, 00402

PHYTOPHTHORA PALMIVORA

00507

PINUS

00025, 00095, 00253, 00269, 00491

PINUS CARIBAEA

00024, 00036, 00038, 00047, 00062, 00093, 00096, 00154, 00158, 00200, 00265, 00489

PINUS DENSIFLORA

00472

PINUS ELDARICA

00241

PINUS ELLIOTTII

00066, 00167, 00168, 00333

PINUS JORULLENSIS

00097

PINUS KESIYA

00133

PINUS MASSONIANA

00020

PINUS MERKUSII

00058, 00148, 00473

PINUS PALUSTRIS

00141

PINUS PATULA

00104, 00229

PINUS PINASTER

00152

PINUS PONDEROSA

00351

PINUS RADIATA

00009, 00062, 00149, 00151, 00152, 00153, 00157, 00160, 00161, 00162, 00165, 00169, 00170, 00178, 00181, 00440, 00476

PINUS RESINOSA

00200

PINUS ROXBURGHII

00188

PIPER NIGRUM

00036, 00123, 00141

PITHECELLOBIUM SAMAN

00353

PODOCARPUS

00025, 00077, 00098

POMETIA PINNATA

00086

POPULUS

00200

PROSOPIS

00087, 00134, 00146, 00202, 00203, 00204, 00205, 00233, 00234, 00432, 00439, 00474

PROSOPIS ALBA

00274, 00275

PROSOPIS CINERARIA

00013, 00039, 00101, 00103, 00114, 00121, 00125, 00164, 00204, 00214, 00239, 00251, 00274, 00275, 00369, 00380, 00387, 00445

PROSOPIS GLANDULOSA

00235, 00269

PROSOPIS JULIFLORA

00125, 00164, 00195, 00198, 00214, 00235, 00241, 00330, 00353, 00394, 00411, 00412, 00431

PROSOPIS NIGRA

00275

PROSOPIS PALMERI

00235, 00504

PROSOPIS SPICIGERA

00020, 00313, 00395

PROSOPIS TAMARUGO

00039, 00103, 00274, 00350, 00368

PROSOPIS VELUTINA

00235, 00274, 00275

PRUNUS

00418

PSIDIUM GUAJAVA

00093, 00110, 00154

PSOPHOCARPUS TETRAGONOLOBUS

00053, 00234

PTERIDIUM

00072, 00154

PTEROCARPUS

00059, 00240, 00242

PTEROGYNE NITENS

00187

PUERARIA

00302

PUERARIA PHASEOLOIDES

00023, 00054, 00073, 00299, 00300, 00507

PURSHIA

00269

QUERCUS

00472

QUERCUS LAMELLOSA

00226

QUERCUS OLEOIDES

00024

QUERCUS SCHIPPII

00024

RAPHIA

00059, 00222

RHIZOBIUM

00106, 00273

RICINODENDRON RAUTANENII

00207

SACCHARUM

00516

SALIX

00177, 00200

SALVADORA PERSICA

00515

SAMANEA SAMAN

00087, 00147

SESBANIA

00072, 00260, 00279, 00510

SESBANIA BISPINOSA

00252, 00505

SESBANIA CANNABINA

00120

SESBANIA GRANDIFLORA

00087, 00090, 00193, 00233, 00353, 00473

SESBANIA ROSTRATA

00106

SESBANIA SESBAN

00349

SETARIA

00507

SETARIA SPHACELATA

00060, 00229

SHEPHERDIA ARGENTEA

00281

SHOREA NEGROSENSIS

00419

SHOREA ROBUSTA

00025, 00188, 00406

SIMMONDSIA CHINENSIS

00203, 00234, 00380

SITANION HYSTRIX

00352

SOLANUM

00516

SOLANUM TUBEROSUM

00026

SORGHUM BICOLOR

00111, 00228

SPONDIAS MOMBIN

00059

SPONDIAS PURPUREA

00110

STERCULIA

00112, 00205

STEREOSPERMUM CHELONOIDES

00375

STYLOSANTHES GUIANENSIS

00023, 00072, 00073, 00154, 00174, 00277, 00398, 00399, 00504

SYZYGIUM AROMATICUM

00304

TAMARINDUS INDICA

00059, 00146, 00205, 00207, 00213

TAMARIX

00515

TAMARIX APHYLLA

00114

TECTONA GRANDIS

00005, 00009, 00020, 00030, 00044, 00089, 00090, 00095, 00109, 00138, 00147, 00148, 00185, 00200, 00265, 00430, 00440, 00473

TEPHROSIA CANDIDA

00087, 00510

TERMINALIA SUPERBA

00025, 00085, 00127, 00129, 00149, 00226, 00479, 00504

THEOBROMA CACAO

00047, 00081, 00085, 00122, 00123, 00189, 00199, 00271, 00304, 00307, 00310, 00311, 00405, 00433, 00438, 00462, 00516

TOONA CILIATA

00229

TRACHYPOGON

00038

TRECULIA AFRICANA

00059, 00144, 00193, 00222

TRIFOLIUM

00030, 00113, 00151, 00160, 00178, 00277

TRIPLOCHITON

00077

TRITICUM EASTIVUM

00026

UAPACA KIRKIANA

00207

VERNONIA AMYGDALINA

00098

VICIA FABA

00149, 00278

VICIA HIRSUTA

00277

VIGNA

00047, 00279

VIGNA UNGUICULATA

00032, 00053, 00108

VITIS VINIFERA

00407

XANTHOSOMA

00086

ZEA MAYS

00023, 00032, 00102, 00104, 00107, 00108, 00111, 00115, 00128, 00228, 00238, 00398, 00399, 00402, 00428, 00438, 00448, 00449

ZIZIPHUS

00114, 00164, 00313

ZIZIPHUS JUJUBA

00103, 00205, 00226, 00251, 00353

ZIZIPHUS MAURITIANA

00125, 00242, 00292

ZIZIPHUS NUMMULARIA

00214, 00412

ZIZIPHUS SPINA-CHRISTI

00216

WILLOUGHBY, P.

00376

WILSON, G.F.

00100, 00107

WILSON, R.T.

00242

WMO

00516

WOLFGANG GSCHLADT

00243

WONG, S.M.

00265

WOOD, P.J.

00034, 00083, 00494

YAP, S.K.

00265

YOUNG, A.

00084, 00244, 00400, 00401, 00483, 00490, 00517, 00522

ZAFFARONI, E.

00402

ZAMBOANGA DEL SUR DEVELOPMENT PROJECT

00403

ZECH, W.

00268

SUBJECT INDEX

ABSTRACTS

00076

ACETYLENE REDUCTION

00283, 00396

ACID SOILS

00495

AFFORESTATION

00038, 00062, 00070, 00082, 00115, 00117, 00142, 00185, 00197, 00198, 00204, 00205, 00214, 00219, 00248, 00251, 00322, 00330, 00337, 00339, 00357, 00412, 00456, 00472, 00473, 00508

AGRICULTURAL PRODUCTS

00047, 00078, 00080, 00081, 00092, 00111, 00137, 00145, 00147, 00289, 00332, 00380, 00413, 00427, 00446, 00451, 00459, 00464, 00467, 00468, 00484, 00485

AGRISILVICULTURE

00005, 00008, 00009, 00010, 00013, 00015, 00016, 00018, 00052, 00053, 00055, 00058, 00059, 00061, 00062, 00091, 00094, 00095, 00096, 00097, 00100, 00102, 00105, 00109, 00117, 00118, 00121, 00124, 00126, 00127, 00128, 00129, 00130, 00131, 00133, 00136, 00137, 00138, 00140, 00141, 00144, 00145, 00149, 00186, 00213, 00222, 00342, 00428, 00433, 00444, 00448, 00473, 00474, 00475, 00476, 00492

AGROFORESTRY

00001, 00002, 00003, 00006, 00007, 00008, 00010, 00012, 00013, 00014, 00015, 00017, 00018, 00028, 00029, 00031, 00033, 00035, 00037, 00038, 00039, 00041, 00042, 00043, 00045, 00051, 00052, 00056, 00057, 00058, 00059, 00061, 00063, 00064, 00065, 00066, 00067, 00068, 00069, 00070, 00071, 00072, 00073, 00079, 00080, 00081, 00082, 00083, 00084, 00085, 00086, 00088, 00090, 00093, 00094, 00097, 00098, 00100, 00101, 00103, 00110, 00112, 00114, 00115, 00116, 00121, 00122, 00124, 00132, 00136, 00139, 00142, 00143, 00144, 00146, 00148, 00149, 00150, 00151, 00152, 00153, 00158, 00161, 00162, 00167, 00168, 00177, 00178, 00179, 00180, 00182, 00184, 00185, 00186, 00187, 00188, 00189, 00190, 00192, 00193, 00199, 00209, 00211, 00213, 00214, 00216, 00217, 00218, 00222, 00223, 00228, 00229, 00233, 00236, 00241, 00261, 00271, 00289, 00291, 00304, 00308, 00309, 00326, 00327, 00339, 00342, 00355, 00382, 00383, 00388, 00390, 00400, 00403, 00404, 00419, 00420, 00422, 00423, 00429, 00430, 00435, 00436, 00437, 00440, 00441, 00442, 00444, 00445, 00448, 00450, 00454, 00458, 00462, 00470, 00471, 00477, 00478, 00480, 00481, 00482, 00483, 00484, 00485, 00486, 00489, 00492, 00493, 00495, 00497, 00499, 00502, 00503, 00504, 00505, 00506, 00508, 00510, 00511, 00513, 00514, 00515, 00517, 00519, 00520,

00521, 00522, 00523, 00524, 00525, 00526, 00527, 00528, 00529

AGRONOMY

00123, 00204, 00230

AGROPASTORAL SYSTEMS

00163, 00239, 00387

AGROSILVOPASTORAL SYSTEMS

00010, 00015, 00038, 00102, 00121, 00132, 00149, 00158, 00183, 00185, 00187, 00188, 00189, 00190, 00213, 00215, 00216, 00241, 00295, 00342

ALFISOLS

00023

ALLEY CROPPING

00013, 00087, 00088, 00100, 00106, 00107, 00108, 00193, 00233, 00238, 00430, 00443, 00448, 00449, 00493, 00510

ALTITUDE

00227

AMAZONAS

00047, 00132, 00253

AMINO ACIDS

00257

ANDEAN MOUNTAIN SYSTEM

00149

ANIMAL BEHAVIOUR

00175

ANIMAL DISEASES

00166, 00417

ANIMAL HOUSING

00166

ANIMAL HUSBANDRY

00047

ANIMAL INTEGRATION

00179

ANIMAL NUTRITION

00370

ANIMAL PRODUCTION

00152, 00166, 00168, 00169, 00191, 00349, 00350, 00355, 00461, 00466

ANIMALS

00083, 00092, 00174, 00183, 00242, 00270, 00432, 00509, 00515, 00517

ANTHROPOLOGY

00446

APICULTURE

00232

APPLIED RESEARCH

00170

ARCHITECTURE

00502

ARID CLIMATE

00364

ARID ZONES

00017, 00079, 00092, 00097, 00114, 00139, 00146, 00164, 00195, 00201, 00214, 00220, 00225, 00232, 00234, 00235, 00237, 00239, 00240, 00241, 00254, 00274, 00292, 00330, 00337, 00348, 00350, 00352, 00358, 00360, 00369, 00371, 00380, 00387, 00394, 00395, 00411, 00412, 00417, 00439, 00441, 00466, 00527, 00529

ASSOCIATIONS

00382

BACTERIA

00298

BEE KEEPING

00179

BEES

00089

BIBLIOGRAPHIES

00173, 00526

BIOECONOMICS

00445, 00480

BIOGAS

00326

BIOGEOGRAPHY

00072

BIOLOGICAL FACTORS

00007, 00059, 00092, 00179, 00197, 00204, 00209, 00229, 00273, 00275, 00284, 00326, 00367, 00438, 00440, 00445, 00491, 00509

BIOLOGY

00001, 00020, 00052, 00110, 00325, 00485, 00509

BIOMASS

00020, 00024, 00030, 00031, 00073, 00112, 00174, 00202, 00203, 00239, 00270, 00288, 00289, 00317, 00325, 00326, 00332, 00347, 00359, 00396, 00411, 00439, 00493, 00503, 00515

BODY WEIGHT

00370

BOTANICAL DESCRIPTION

00243, 00334

BOTANY

00174, 00214, 00374

BREEDING

00225, 00230, 00245, 00253, 00256, 00261, 00301, 00332

BREEDS

00207

BROWSE

00201, 00492

BROWSE PLANTS

00197, 00198

BROWSING

00134, 00157, 00159, 00186, 00196, 00206, 00214, 00219, 00224, 00226, 00239, 00242, 00348, 00364, 00515

BUSH FALLOWING

00027, 00087, 00100, 00107, 00112, 00134, 00505

CAMELS

00356

CANOPIES

00024, 00072, 00144, 00153, 00154, 00163, 00173, 00198, 00267, 00270, 00307, 00351, 00411, 00441, 00493, 00497, 00500, 00501

CARBON

00128

CARRYING CAPACITY

00054, 00080, 00173, 00197, 00224, 00242, 00383

CASE STUDIES

00470

CASH CROPS

00094, 00143, 00516

CATCHMENT AREAS

00391, 00501

CATTLE

00163, 00168, 00175, 00333, 00346, 00347

CEREALS

00228

CHARCOAL

00079, 00116, 00192, 00196, 00197, 00235, 00320, 00326, 00342, 00413, 00430, 00505

CHARCOAL PRODUCTION

00321

CHEMICAL ANALYSIS

00257, 00361, 00366

CHEMICALS

00325

CLASSIFICATION

00006, 00015, 00230

CLEARING

00067

CLIMATE

00023, 00054, 00058, 00073, 00102, 00120, 00124, 00172, 00204, 00226, 00235, 00251, 00326, 00352, 00368, 00405, 00407, 00489, 00490, 00501, 00508, 00509, 00517

COAGULANTS

00249

COCONUTS

00190

COMMERCIAL INCENTIVES

00457

COMMUNICATION

00527

COMMUNITY FORESTRY

00095, 00328, 00427, 00457, 00472, 00474, 00476, 00481, 00514

COMPETITIVE EFFECTS

00061

COMPOSITION

00020, 00201, 00207, 00252, 00257, 00294

COMPOUND FARMS

00027, 00100, 00222

CONSERVATION

00008, 00022, 00036, 00054, 00062, 00073, 00099, 00103, 00113, 00181, 00194, 00195, 00200, 00207, 00214, 00251, 00379, 00412, 00426, 00490, 00491, 00492, 00518

CONTOUR CULTIVATION

00403

CONTROLLED BURNING

00296

COOKING

00336

COOKING STOVES

00318

COPPICING

00354

COST BENEFIT ANALYSIS

00323, 00428

COVER PLANTS

00266, 00299, 00300, 00302, 00411

CREDIT

00447

CROP IMPROVEMENT

00301

CROP PRODUCTION

00099, 00171, 00373, 00384, 00399

CROP PROTECTION

00301

CROP RESIDUES

00053, 00116, 00174, 00315, 00400

CROP ROTATION

00142, 00252

CROPPING PATTERNS

00002, 00026, 00032, 00058, 00063, 00120, 00279, 00437, 00495, 00505, 00507, 00509

CROPPING SYSTEMS

00027, 00037, 00072, 00139, 00234, 00304, 00307, 00398, 00467, 00480, 00500, 00503

CROPS

00003, 00082, 00033, 00089, 00106, 00123, 00126, 00127, 00129, 00144, 00164, 00189, 00218, 00242, 00282, 00289, 00291, 00297,

00304, 00305, 00306, 00307, 00309, 00310, 00311, 00313, 00330, 00332, 00334, 00377, 00378, 00379, 00408, 00409, 00433, 00484

CRUDE FIBRE

00363

CRUDE PROTEIN

00354, 00363

CULTIVARS

00031

CULTIVATION

00103, 00114, 00232, 00235, 00281, 00473, 00505, 00517

CULTURAL HERITAGE

00421

CULTURES

00061, 00281, 00284, 00306, 00474

CURRICULUM

00484, 00485

CUTTINGS

00293

CYCLING

00072, 00089, 00145, 00266, 00271, 00282, 00299, 00305, 00311, 00331, 00403

CYTOLOGY

00202, 00234

DATA BASES

00530, 00531

DATA COLLECTION

00525, 00530

DATA MANAGEMENT

00530

DECISION MAKING

00083, 00463

DECOMPOSITION

00400

DEFOLIATION

00092

DEFORESTATION

00059, 00093, 00097, 00103, 00105, 00137, 00140, 00329, 00413, 00414, 00419, 00456, 00468, 00479, 00487

DEMONSTRATION

00514

DESCRIPTIONS

00194, 00230, 00236

DESCRIPTORS

00528

DESERTIFICATION

00004, 00011, 00079, 00192, 00204, 00224, 00241, 00313, 00412, 00487, 00500, 00518

DESIGN

00064, 00328, 00471, 00478, 00480, 00494, 00514, 00522

DEVELOPING COUNTRIES

00010, 00012, 00025, 00043, 00078, 00218, 00263, 00309, 00312, 00313, 00322, 00324, 00335, 00372, 00413, 00456, 00457, 00463, 00508, 00518, 00525

DEVELOPMENT STRATEGIES

00336, 00342, 00422, 00473

DIAGNOSIS

00064, 00083, 00478, 00494, 00522

DIETS

00101

DISEASE CONTROL

00415

DISEASES

00252, 00259, 00301

DIVERSIFICATION

00504

DOCUMENTATION

00525

DONORS

00328

DRAUGHT ANIMALS

00381

DROUGHT RESISTANCE

00294, 00370

DRUG PLANTS

00101, 00224, 00374, 00375

DRY FARMING

00005, 00079, 00241, 00381

DRY MATTER CONTENT

00026, 00197, 00202, 00226, 00242, 00493, 00516

DUNES

00196, 00202, 00214, 00385, 00412

EARTH SCIENCE

00485

EAST AFRICA

00408

ECOLOGICAL ASPECTS

00043, 00139, 00454

ECOLOGY

00036, 00037, 00038, 00051, 00061, 00072, 00080, 00082, 00091, 00112, 00130, 00140, 00177, 00203, 00206, 00207, 00229, 00230, 00255, 00277, 00368, 00438, 00459, 00474, 00476, 00484, 00485, 00509

ECONOMIC ANALYSIS

00083, 00084, 00091, 00104, 00110, 00157, 00161, 00162, 00327, 00342, 00368, 00398, 00399, 00402, 00430, 00433, 00436, 00437, 00438, 00440, 00442, 00443, 00447, 00449, 00455, 00491, 00523, 00524

ECONOMICS

00002, 00047, 00061, 00063, 00071, 00102, 00112, 00123, 00164, 00177, 00191, 00200, 00202, 00204, 00213, 00260, 00344, 00349, 00429, 00431, 00439, 00448, 00451, 00478, 00509, 00524

ECOSYSTEMS

00008, 00024, 00035, 00036, 00116, 00138, 00192, 00200, 00203, 00206, 00222, 00229, 00232, 00269, 00270, 00307, 00331, 00357, 00411, 00440, 00488, 00495, 00504

ECOZONES

00127, 00209

EDUCATION

00042, 00059, 00079, 00200, 00229, 00481, 00485

EMPLOYMENT

00080, 00438

ENERGY

00026, 00113, 00195, 00214, 00220, 00221, 00312, 00314, 00316, 00317, 00319, 00321, 00322, 00326, 00330, 00331, 00337, 00341, 00342, 00344, 00413, 00439, 00508

ENERGY CRISIS

00318, 00341

ENERGY FLOW

00438

ENERGY FORESTRY

00320

ENERGY SOURCES

00079, 00312, 00315, 00317, 00320, 00323, 00332, 00336

ENVIRONMENTAL CONDITIONS

00017, 00082, 00098, 00116, 00134, 00163, 00240, 00241, 00251, 00312,

00314, 00316,
00354, 00359,
00404, 00439,
00488, 00497,
00500, 00501

EROSION

00036, 00039,
00053, 00054,
00072, 00082,
00089, 00097,
00116, 00134,
00154, 00197,
00198, 00203,
00224, 00289,
00318, 00357,
00362, 00383,
00386, 00391,
00411, 00426,
00437, 00448,
00505, 00508,
00510, 00518

EROSION CONTROL

00032, 00054,
00103, 00188,
00196, 00251,
00356, 00386,
00389, 00392,
00397, 00420,
00510, 00515

EVALUATIONS

00066

EVAPOTRANSPIRATION

00073, 00113,
00163

EVOLUTION

00027, 00112,
00206

EXOTIC PLANTS

00022, 00025,
00157, 00241

EXPERIMENTS

00113, 00120,
00174, 00183,
00202, 00203,
00232, 00280,
00330, 00497,
00498, 00499,
00516, 00519

EXTENSION ACTIVITIES

00043, 00070,
00229, 00475,
00481, 00486

EXTRACTION

00243

FALLOW SYSTEMS

00023, 00029,
00053, 00086,
00105, 00118,
00126, 00147,
00156, 00213,
00233, 00239,
00340, 00393,
00424, 00430,
00449, 00503,
00507

FARM FORESTRY

00022, 00059,
00157, 00160,
00162, 00165,
00169, 00181,
00318, 00357,
00457

FARM IMPLEMENTS

00381

FARM MANAGEMENT

00028

FARM WOODLANDS

00187

FARMERS

00380, 00456,
00464

FARMING SYSTEMS

00002, 00010,
00011, 00013,
00014, 00018,
00027, 00030,
00034, 00037,
00044, 00052,
00053, 00054,
00058, 00059,
00078, 00082,
00094, 00097,
00102, 00105,
00106, 00114,
00116, 00118,
00120, 00124,
00131, 00133,
00134, 00136,
00144, 00145,
00146, 00148,
00183, 00184,
00191, 00192,
00200, 00222,
00229, 00381,
00393, 00407,
00415, 00419,
00426, 00430,
00433, 00438,
00445, 00449,
00459, 00504,
00505, 00506,
00507, 00509,
00519, 00520,
00523

FARMLAND

00071, 00131,
00146, 00216,
00224, 00226,
00441, 00505,
00517

FARMYARD MANURE

00231

FAST GROWING TREES

00095, 00268,
00287, 00316,
00317, 00331,
00332, 00338,
00448

FEED CROPS

00016, 00172, 00173, 00201, 00219, 00235, 00354, 00355, 00356, 00367, 00430, 00508, 00516

FEED LEGUMES

00156

FEED RESOURCES

00240

FEEDS

00099, 00191, 00289, 00364

FENCES

00098, 00125

FERTILIZERS

00047, 00107, 00152, 00153, 00221, 00230, 00231, 00271, 00290, 00302, 00342, 00373, 00381

FIBRE

00325

FIBRE CROPS

00303

FIELD CROPS

00047

FIRES

00354, 00389

FLOODING

00054, 00072, 00073, 00158, 00279, 00383, 00500, 00518

FLOWERING

00250, 00256, 00292

FODDER

00002, 00063, 00115, 00134, 00154, 00180, 00192, 00198, 00206, 00228, 00234, 00241, 00242, 00251, 00277, 00347, 00365, 00393, 00427, 00436, 00444, 00448, 00455, 00515

FODDER CROPS

00046, 00101, 00103, 00186, 00188, 00197, 00205, 00224, 00226, 00227, 00231, 00232, 00239, 00252, 00258, 00290, 00294, 00342, 00346, 00349, 00350, 00352, 00353, 00357, 00359, 00360, 00361, 00362, 00363, 00366, 00368, 00369, 00371, 00387, 00432, 00492

FODDER PRODUCTION

00240

FOOD

00002, 00035, 00063, 00080, 00103, 00115, 00116, 00130, 00131, 00138, 00180, 00195, 00203, 00204, 00215, 00221, 00234, 00251, 00275, 00325, 00335, 00342, 00365, 00393, 00428, 00430, 00436, 00444, 00476, 00508, 00516

FOOD CROPS

00046, 00094, 00096, 00118, 00122, 00123, 00127, 00128, 00228, 00387, 00433, 00462, 00508

FOOD PREPARATION

00345

FOOD PRODUCTION

00012, 00014, 00047, 00050, 00085, 00091, 00095, 00096, 00099, 00104, 00109, 00111, 00117, 00121, 00141, 00289, 00386, 00392, 00446, 00476, 00486

FOREST

00237

FOREST GRAZING

00150, 00151, 00161, 00162, 00168, 00178, 00226, 00333, 00473

FOREST LITTER

00020, 00024, 00030, 00054, 00192, 00270, 00271, 00296, 00382, 00383, 00411

FOREST MANAGEMENT

00001, 00016, 00425, 00469

FOREST PLANTATIONS

00025, 00254, 00259, 00265, 00267, 00268, 00333, 00343, 00427, 00456, 00491

FOREST PRODUCTS

00011, 00063, 00138, 00476

FOREST RESOURCES

00076, 00200, 00469

FOREST SOILS

00296

FOREST TREES

00131, 00246

FORESTERS

00479

FORESTRY

00076, 00080, 00081, 00101, 00111, 00133, 00145, 00155, 00313, 00414, 00422, 00474, 00476, 00484, 00485, 00487, 00490

FORESTRY DEVELOPMENT

00065, 00451

FORESTRY POLICIES

00016, 00451

FORESTS

00002, 00003, 00031, 00044, 00127, 00129, 00156, 00185, 00224, 00241, 00331, 00357, 00375, 00450, 00460, 00473, 00502

FRAGILE ECOSYSTEMS

00007, 00025, 00051, 00195, 00441

FREE RANGE GRAZING

00004

FRUIT TREES

00207, 00308, 00418, 00432, 00492

FRUITING

00292

FRUITS

00092, 00132, 00222, 00235, 00262, 00493

FUEL ECONOMY

00324

FUELS

00215, 00221, 00242, 00289, 00325, 00330, 00332, 00356, 00419, 00509

FUELWOOD

00002, 00013, 00025, 00070, 00079, 00089, 00094, 00098, 00099, 00101, 00102, 00103, 00115, 00116, 00121, 00147, 00156, 00188, 00192, 00196, 00197, 00198, 00203, 00204, 00214, 00219, 00220, 00224, 00226, 00228, 00232, 00234, 00235, 00238, 00242, 00251, 00275, 00289, 00312, 00313, 00314, 00315, 00318, 00319, 00320, 00321, 00322, 00323, 00324, 00326, 00327, 00328, 00329, 00334, 00335, 00336, 00337, 00338, 00339, 00341, 00342, 00343, 00344, 00345, 00371, 00393, 00413, 00419, 00427, 00430, 00431, 00432, 00436, 00441, 00444, 00448, 00454, 00456, 00473, 00476, 00487, 00491, 00492, 00493, 00505, 00508

FUNCTIONS

00021

GENETICS

00025, 00200, 00202, 00203, 00204, 00207, 00260, 00261

GENOTYPES

00195

GEOLOGY

00517

GERMINATION

00103, 00146, 00248, 00250, 00260, 00264, 00265, 00360, 00419, 00516

GERMPLASM

00036, 00200, 00202, 00204, 00209, 00234, 00258, 00275

GOATS

00166, 00191, 00356

GRAIN LEGUMES

00284, 00301

GRASSES

00163, 00173, 00201, 00239, 00240, 00242, 00277, 00353, 00411, 00412

GRASSLAND MANAGEMENT

00146, 00239

GRAZING

00071, 00096, 00157, 00164, 00174, 00175, 00206, 00224, 00277, 00350, 00417, 00464, 00505, 00507, 00508, 00515

GRAZING LANDS

00079, 00154, 00159, 00206

GRAZING SYSTEMS

00180

GREEN MANURES

00106, 00107, 00197, 00213, 00219, 00252, 00373, 00449, 00507, 00510

GROWTH

00227, 00231, 00369

GROWTH REGULATORS

00293

GUM ARABIC

00254

GUMS

00252

HABITATS

00255

HARVESTING

00142, 00234, 00250, 00263, 00270, 00307, 00326, 00491

HAY

00168

HEDGEROW PLANTING

00108, 00290

HEDGING PLANTS

00125, 00199, 00298, 00347

HERBICIDES

00299, 00300, 00402

HIGHLAND

00216, 00220, 00228, 00237, 00305, 00357, 00392, 00403, 00468

HILL FARMING

00028, 00188, 00403, 00482

HIMALAYAS

00177

HOME GARDENS

00021, 00081, 00082, 00090, 00098, 00144, 00185, 00223, 00430

HORTICULTURE

00027, 00426, 00485

HOSTS

00280

HOUSEHOLDS

00393, 00459

HUMAN ACTIVITIES

00386

HUMID CLIMATE

00032, 00107, 00109, 00191, 00237, 00258

HUMID SUBTROPICS

00187

HUMID TROPICS

00001, 00009, 00020, 00021, 00032, 00038, 00042, 00043, 00051, 00052, 00053, 00054, 00055, 00058, 00059, 00061, 00073, 00086, 00087, 00089, 00090, 00091, 00094, 00095, 00100, 00109, 00110, 00112, 00114, 00132, 00134, 00144, 00147, 00148, 00155, 00179, 00191, 00220, 00233, 00259, 00266, 00282, 00283, 00287, 00295, 00299, 00300, 00303, 00304, 00310, 00311, 00329, 00336, 00374, 00382, 00398, 00399, 00402, 00420, 00421, 00428, 00435, 00438, 00444, 00460, 00502, 00510, 00527, 00529

HYBRIDIZATION

00062, 00245

HYDROLOGY

00517

INCOME

00447

INDIGENOUS PLANTS

00090, 00295, 00372

INFORMATION FLOW

00365, 00530

INNOVATIONS

00471

INOCULATION

00263, 00272, 00284, 00286, 00290

INTEGRATION

00019, 00080, 00171

INTERCROPPING

00005, 00019, 00027, 00032, 00052, 00063, 00087, 00097, 00115, 00123, 00127, 00129, 00142, 00144, 00173, 00183, 00190, 00233, 00306, 00326, 00405, 00433, 00437, 00438, 00441, 00445

INTERNATIONAL ORGANIZATIONS

00487

IRRIGATION

00005, 00031, 00082, 00092, 00131, 00192, 00202, 00203, 00219, 00230, 00232, 00235, 00275, 00277, 00278, 00279, 00307, 00376, 00383, 00405, 00407, 00418, 00490, 00491, 00497, 00500, 00507, 00518

LABOUR

00345

LAND

00067, 00099, 00130, 00158, 00160, 00450, 00460, 00464

LAND CAPABILITY

00062, 00063, 00093, 00102, 00489, 00490, 00503, 00504

LAND CLASSIFICATION

00022, 00037, 00063, 00244, 00489

LAND EVALUATION

00084, 00244, 00483, 00490, 00517, 00522

LAND REFORM

00482

LAND TAX

00465

LAND USE

00002, 00006, 00009, 00010, 00012, 00017, 00022, 00030, 00031, 00035, 00036, 00037, 00038, 00039, 00041, 00044, 00051, 00052, 00054, 00056, 00057, 00058, 00062, 00063, 00065, 00068,

00069, 00079, 00080, 00082, 00083, 00084, 00087, 00093, 00097, 00100, 00103, 00110, 00112, 00114, 00120, 00121, 00123, 00124, 00139, 00141, 00148, 00151, 00154, 00158, 00170, 00181, 00182, 00192, 00209, 00218, 00222, 00224, 00228, 00229, 00241, 00306, 00385, 00414, 00420, 00430, 00436, 00440, 00445, 00451, 00455, 00458, 00463, 00469, 00472, 00475, 00479, 00483, 00485, 00489, 00490, 00491, 00492, 00495, 00497, 00504, 00517, 00518, 00521, 00525, 00526

LANDFORMS

00489, 00490

LANDLAWS

00465

LANDSCAPE

00385

LEACHING

00020, 00025, 00030, 00077, 00112, 00116, 00192, 00305, 00307, 00311

LEAVES

00163, 00192, 00196, 00197, 00227, 00232, 00270, 00368

LEGISLATION

00004, 00130, 00141, 00181, 00460

LEGUMES

00030, 00036, 00046, 00073, 00089, 00100, 00103, 00107, 00139, 00142, 00144, 00146, 00173, 00174, 00196, 00197, 00198, 00199, 00202, 00203, 00204, 00214, 00217, 00219, 00226, 00233, 00234, 00235, 00248, 00257, 00262, 00266, 00269, 00272, 00273, 00277, 00278, 00281, 00283, 00285, 00286, 00287, 00290, 00299, 00300, 00310, 00396, 00398, 00430, 00449, 00473, 00492, 00500, 00505, 00515

LIMITING FACTORS

00045, 00531

LIVESTOCK

00071, 00165, 00171, 00178, 00179, 00184, 00189, 00239, 00348, 00354, 00355, 00362, 00367, 00368, 00370, 00417, 00461, 00466

LOCAL COMMUNITIES

00328

LOPPING

00226, 00369, 00497

LOWLANDS

00051, 00219, 00235, 00426

MANAGEMENT

00008, 00019, 00025, 00027, 00036, 00039, 00063, 00071, 00073, 00079, 00082, 00114, 00120, 00125, 00154, 00157, 00158, 00163, 00172, 00173, 00181, 00183, 00192, 00195, 00197, 00203, 00206, 00209, 00210, 00214, 00226, 00234, 00236, 00243, 00251, 00274, 00277, 00291, 00295, 00307, 00330, 00342, 00350, 00376, 00395, 00405, 00420, 00473, 00476, 00489, 00490, 00491, 00493, 00497, 00500, 00509, 00516

MANGROVES

00020, 00039

MANURES

00099, 00116, 00226

MAPPING

00488

MARGINAL LANDS

00007, 00014
00033, 00117,
00121, 00164,
00176, 00371,
00424, 00479,
00486

MARKETING

00132, 00191,
00243

MEAT PRODUCTION

00364

MEDICINAL PLANTS

00188, 00232,
00234, 00518

MEDITERRANEAN CLIMATE

00018, 00170,
00418

METEOROLOGY

00504, 00509,
00516

METHODOS

00064

METHODS

00045, 00057,
00101, 00124,
00282, 00311,
00328, 00452,
00510, 00511

MICROCLIMATE

00001, 00019,
00072, 00082,
00092, 00163,
00181, 00224,
00239, 00248,
00379, 00406,
00407, 00408,
00409, 00410,
00416, 00418,
00426, 00515,
00517, 00518

MICROCOMPUTERS

00443

MIGRATION

00468

MIMOSINE

00370

MINERAL CONTENT

00363

MINERALIZATION

00305, 00311

MINERALS

00377

MINOR FOREST PRODUCTS

00365

MIOMBO

00159, 00354

MIXED CROPPING

00019, 00053,
00060, 00061,
00100, 00123,
00130, 00135,
00402, 00495,
00497

MIXED FARMING

00027, 00034,
00087, 00509

MIXED FORESTS

00431

MODELS

00516

MONOCULTURE

00052, 00277,
00500

MORPHOLOGY

00262, 00294

MULCHES

00031, 00106,
00163, 00231,
00302

MULCHING

00192, 00412,
00510

MULTIPLE CROPPING

00008, 00014,
00019, 00031,
00032, 00042,
00087, 00100,
00120, 00127,
00129, 00223,
00438, 00507

MULTIPLE USE

00009, 00039,
00069, 00130,
00141, 00160,
00209, 00222,
00474, 00495

MULTIPURPOSE TREES

00010, 00014,
00017, 00031,
00057, 00093,
00098, 00101,
00139, 00148,
00184, 00188,
00193, 00196,
00205, 00210,
00213, 00216,
00217, 00221,
00223, 00225,
00226, 00236,
00237, 00243,

00244, 00250,
00252, 00254,
00261, 00275,
00305, 00355,
00404, 00445,
00484, 00497,
00498, 00499,
00530, 00531

MULTISTOREYED CROPPING

00087

MYCORRHIZAE

00259, 00296

NATURAL DISTRIBUTION

00003, 00159,
00260, 00354,
00382

NATURAL RESOURCES

00336, 00454,
00488

NETWORKS

00529

NITRIFICATION

00311

NITROGEN

00020, 00024,
00107, 00128,
00192, 00198,
00238, 00310,
00311

NITROGEN FIXING TREES

00001, 00030,
00036, 00095,
00106, 00108,
00112, 00143,
00178, 00198,
00199, 00202,
00203, 00204,
00205, 00219,
00229, 00266,
00269, 00271,
00274, 00276,
00277, 00279,
00281, 00282,
00283, 00284,
00285, 00287,
00305, 00379,
00380, 00382,
00396, 00419,
00439, 00458,
00473, 00517

NODULATION

00196

NOMADISM

00017, 00027,
00116, 00239,
00417, 00507

NOMENCLATURE

00260

NURSERY MANAGEMENT

00125, 00250

NUTRIENT CONTENT

00055, 00107,
00113, 00134,
00153, 00269,
00363, 00378,
00394, 00396,
00411

NUTRIENT DEFICIENCIES

00268, 00301

NUTRIENT UPTAKE

00331, 00394

NUTRIENTS

00020, 00024,
00053, 00059,
00077, 00108,
00116, 00152,
00163, 00173,
00232, 00271,
00296, 00299,
00302, 00307,
00382, 00403,
00430, 00503

NUTRITION

00345

NUTRITIVE VALUE

00159, 00192,
00203, 00206,
00214, 00219,
00226, 00234,
00235, 00239,
00242, 00294,
00366, 00367

OIL CROPS

00266, 00302,
00303

OIL MEALS

00252

ON FARM TRIALS

00519

ORCHARDS

00256

ORGANIC FARMING

00384, 00392

ORGANIC MATTER

00020, 00023,
00024, 00030,
00054, 00077,
00128, 00152,
00195, 00307,
00395, 00411,
00426, 00501,
00503, 00515,
00517, 00518

OVERGRAZING

00138, 00240,
00270

PALATABILITY

00346, 00354

PALMAE

00215, 00243, 00247, 00303

PASTORALISM

00046, 00182, 00240, 00371, 00417

PASTURES

00002, 00030, 00036, 00047, 00073, 00083, 00097, 00113, 00114, 00152, 00153, 00154, 00157, 00163, 00166, 00167, 00168, 00172, 00174, 00181, 00195, 00197, 00206, 00235, 00277, 00284, 00492, 00510, 00517

PEASANTRY

00459, 00468

PERENNIALS

00163, 00180, 00189, 00201, 00239, 00306, 00307, 00411, 00484

PEST CONTROL

00372, 00415

PESTS

00197, 00207, 00236, 00252

PHENOLOGY

00209, 00269, 00282, 00291, 00354

PHOSPHORUS

00282

PHOTOSYNTHESIS

00026, 00030, 00092, 00135, 00274, 00278, 00279, 00326, 00367, 00493

PHYSIOGRAPHY

00038, 00110, 00474, 00489, 00504, 00505, 00509

PHYSIOLOGY

00163, 00196, 00207, 00214, 00281, 00326, 00493, 00497

PIGS

00155

PLANNING

00316, 00519, 00521

PLANT ANATOMY

00120

PLANT COMMUNITIES

00270

PLANT DISEASES

00147, 00298

PLANT INTERACTION

00405

PLANT MORPHOLOGY

00292

PLANT PHYSIOLOGY

00202, 00276, 00278, 00279, 00292

PLANT POPULATION

00240, 00497

PLANT PRODUCTION

00034, 00227, 00349, 00364

PLANT PROPAGATION

00247, 00256, 00362, 00374

PLANT PROTECTION

00240, 00256

PLANT SCIENCES

00511

PLANTATIONS

00027, 00097, 00102, 00120, 00123, 00125, 00144, 00157, 00158, 00195, 00282, 00304, 00305, 00307, 00309, 00310, 00311, 00319, 00330, 00331, 00337, 00338, 00341, 00344, 00350, 00368, 00426, 00433, 00439, 00492, 00501, 00508

PLANTING

00098, 00263, 00289, 00318, 00341, 00342, 00371, 00397, 00454, 00457

PLANTS

00006, 00047, 00057, 00059, 00356, 00374

POLICIES

00041, 00357, 00476, 00481

POLITICAL SYSTEMS

00035, 00130, 00513

POPULATION

00005, 00025, 00027, 00072, 00085, 00105, 00111, 00112, 00138, 00155, 00324, 00341, 00371, 00413, 00419, 00438, 00455, 00456, 00471, 00504, 00509

POTASSIUM

00268

POULTRY

00179

POVERTY

00289

PRECIPITATION

00058, 00500, 00501, 00516

PRODUCTION

00172, 00173

PRODUCTIVITY

00350, 00361

PROGRAMMING

00436

PROJECT

00386

PROJECT EVALUATION

00021, 00488

PROJECTS

00043, 00066, 00393, 00422, 00429, 00456, 00463

PROTECTION FOREST

00473

PROTEINS

00257

PROVENANCE

00253, 00254, 00259, 00343

PRUNING

00072, 00108, 00271, 00359, 00497

PULPWOOD

00168

RADIATION

00073, 00120, 00411, 00516

RAIN

00024, 00267, 00307

RANGELANDS

00046, 00175, 00242, 00358, 00466

RECLAMATION

00038, 00412, 00490

REGENERATION

00025, 00142, 00299, 00406, 00416, 00426

REGIONAL COOPERATION

00321

REMOTE SENSING

00039, 00240, 00490, 00518

RENEWABLE RESOURCES

00138, 00195, 00200, 00221, 00232, 00323, 00326, 00518

RESEARCH

00011, 00019, 00022, 00036, 00037, 00042, 00043, 00052, 00053, 00054, 00057, 00059, 00060, 00061, 00072, 00073, 00077, 00079, 00080, 00091, 00097, 00102, 00103, 00106, 00114, 00120, 00126, 00131, 00133, 00134, 00136, 00138, 00144, 00148, 00158, 00160, 00169, 00173, 00181, 00183, 00193, 00195, 00197, 00207, 00221, 00229, 00234, 00235, 00237, 00270, 00276, 00281, 00289, 00307, 00321, 00326,

00336, 00349,
00365, 00367,
00379, 00380,
00390, 00393,
00404, 00412,
00446, 00449,
00452, 00469,
00474, 00475,
00479, 00486,
00490, 00494,
00495, 00499,
00503, 00504,
00506, 00511,
00513, 00516,
00521, 00527

RESOURCE CONSERVATION

00076, 00417

RESOURCE MANAGEMENT

00138, 00333,
00422, 00454,
00492, 00507

RESOURCES

00253, 00372,
00386, 00460

REVIEW

00305, 00354

RHIZOBIUM

00219, 00230,
00259, 00272,
00277, 00278,
00279, 00284,
00285, 00286,
00290, 00301,
00500

RHIZOSPHERE

00279

ROOT CROPS

00135

ROOT NODULATION

00106, 00202,
00203, 00219,
00234, 00259,
00263, 00269,
00273, 00277,
00278, 00279,
00280, 00281,
00282, 00286,
00396

ROOT SYSTEM

00297

ROOTING

00293

ROTATIONAL CROPPING

00031, 00103,
00134, 00154,
00157, 00158,
00181, 00195,
00232, 00353,
00398, 00426,
00439, 00507

RUBBER

00179

RUMINANTS

00191

RUNOFF

00106

RURAL AREAS

00101, 00122,
00315, 00322,
00336, 00343,
00427, 00462,
00469

RURAL COMMUNITIES

00312, 00338,
00345, 00393,
00420, 00454,
00475, 00521

RURAL DEVELOPMENT

00035, 00041,
00052, 00088,
00097, 00122,
00141, 00207,
00316, 00328,
00346, 00372,
00389, 00434,
00436, 00450,
00462, 00471,
00479, 00481

RURAL POOR

00434, 00450

RURAL POPULATION

00465

SAHEL

00079, 00348,
00367

SALINE ALKALINE SOILS

00385

SALINE SODIC SOILS

00252, 00371

SALINE SOILS

00356

SALINITY

00202, 00203,
00319, 00368

SALT TOLERANCE

00356

SANDY SOILS

00108, 00389

SAP

00303

SAVANNAS

00024, 00222,
00239, 00340

SEED COLLECTION

00245, 00246, 00248, 00250, 00255, 00256, 00265, 00378

SEED LONGEVITY

00265

SEED PRODUCTION

00246, 00263

SEED STORAGE

00250, 00255, 00265

SEED TREATMENT

00230, 00250, 00255, 00264, 00265

SEED TREES

00263

SEEDLINGS

00024, 00070, 00103, 00196, 00198, 00202, 00232, 00235, 00278, 00298, 00330, 00419, 00493, 00515

SEEDS

00070, 00204, 00248, 00249, 00251, 00256, 00262

SELECTION

00210, 00225, 00244, 00245, 00247, 00397

SEMI ARID ZONES

00017, 00033, 00171, 00201, 00204, 00216, 00225, 00237, 00258, 00268, 00272, 00274, 00275, 00282, 00294, 00305, 00346, 00358, 00359, 00378, 00379, 00387, 00393, 00424, 00431, 00443, 00466, 00477, 00529

SEMINARS

00070

SERVICES

00052, 00374

SHADE PLANTS

00085, 00135, 00283

SHADE TREES

00092, 00094, 00144, 00198, 00199, 00271, 00282, 00304, 00305, 00310, 00311, 00382, 00396, 00492

SHADING

00102, 00120, 00135, 00181, 00196, 00219, 00224, 00235, 00251, 00351, 00367, 00395, 00409, 00410, 00411, 00419, 00473, 00493

SHEEP

00151, 00152, 00156, 00161, 00162, 00170, 00179, 00191

SHIFTING CULTIVATION

00005, 00007, 00013, 00014, 00020, 00023, 00027, 00029, 00033, 00036, 00037, 00039, 00044, 00047, 00050, 00053, 00055, 00058, 00060, 00061, 00068, 00077, 00081, 00082, 00086, 00089, 00100, 00102, 00105, 00111, 00112, 00116, 00118, 00126, 00131, 00134, 00138, 00142, 00143, 00144, 00147, 00155, 00185, 00193, 00215, 00241, 00287, 00421, 00424, 00426, 00430, 00435, 00441, 00492, 00507, 00508, 00513, 00526

SHRUBS

00010, 00012, 00139, 00198, 00217, 00223, 00225, 00229, 00240, 00269, 00275, 00355, 00484, 00531

SILVICULTURE

00017, 00025, 00036, 00039, 00150, 00181, 00182, 00195, 00214, 00241, 00314, 00327,

00332, 00432,
00472, 00504,
00526

SILVOPASTORAL SYSTEMS

00004, 00010,
00015, 00017,
00061, 00089,
00101, 00121,
00148, 00156,
00164, 00170,
00172, 00176,
00178, 00179,
00180, 00186,
00189, 00214,
00337, 00349,
00360, 00432,
00474

SITE PREPARATION

00167

SITES

00244, 00352

SLOPING LAND

00084, 00510

SMALL SCALE FARMING

00018, 00028,
00083, 00171,
00179, 00185,
00187, 00188,
00329, 00340,
00392, 00399,
00409, 00410,
00425, 00429,
00433, 00447,
00452, 00453,
00459, 00461,
00482

SOCIAL BEHAVIOUR

00456, 00463

SOCIAL FORESTRY

00028, 00098,
00236, 00454,
00455, 00479

SOCIAL SCIENCES

00423

SOCIAL STRUCTURE

00456, 00475

SOCIAL UNREST

00130, 00177

SOCIAL WELFARE

00303

SOCIOECONOMIC ASPECTS

00001, 00007,
00008, 00035,
00043, 00051,
00079, 00080,
00082, 00091,
00110, 00115,
00130, 00133,
00209, 00327,
00329, 00420,
00424, 00425,
00427, 00484

SOCIOLOGY

00002, 00009,
00063, 00111,
00138, 00434,
00446, 00457,
00474, 00476,
00504

SOFTWOOD

00104

SOIL

00394

SOIL AMENDMENTS

00393

SOIL CHEMISTRY

00030, 00503

SOIL CLASSIFICATION

00490, 00503

SOIL CONSERVATION

00012, 00058,
00101, 00114,
00121, 00184,
00209, 00383,
00385, 00386,
00388, 00389,
00391, 00392,
00458, 00493,
00505, 00510,
00514, 00515

SOIL DETERIORATION

00011, 00063

SOIL FERTILITY

00013, 00019,
00024, 00073,
00077, 00112,
00114, 00120,
00126, 00176,
00180, 00184,
00203, 00205,
00222, 00224,
00331, 00378,
00379, 00383,
00387, 00395,
00400, 00403,
00419, 00444,
00452, 00473,
00487, 00491,
00501, 00503,
00505, 00507,
00515, 00526

SOIL FIXATION

00196, 00214,
00385, 00412

SOIL MANAGEMENT

00026, 00030,
00054, 00377,
00386, 00388,
00401, 00449

SOIL PHYSICOCHEMICAL PROPERTIES

00023, 00073, 00107, 00112, 00127, 00129, 00172, 00230, 00378, 00379, 00416

SOIL RESOURCES

00490

SOIL STRUCTURE

00376, 00395

SOIL SURVEY

00501, 00503, 00504, 00509

SOIL TEMPERATURE

00031, 00053, 00411

SOIL TYPES

00023, 00053, 00126, 00377

SOIL WATER CONTENT

00023, 00024, 00073, 00092, 00108, 00113, 00173, 00219, 00278, 00307, 00379, 00406, 00411, 00416, 00500, 00501, 00503, 00516, 00517

SOILS

00030, 00059, 00082, 00089, 00106, 00124, 00128, 00153, 00289, 00302, 00319, 00350, 00357, 00362, 00378, 00386, 00390, 00401, 00411, 00422, 00518

SOLAR ACTIVITY

00163

SOLAR ENERGY

00325

SOLI PHYSICOCHEMICAL PROPERTIES

00406

SOUTH EAST ASIA

00005, 00090

SOUTHERN AFRICA

00294

SOWING

00151, 00352

SPACING

00106, 00142, 00154, 00158, 00165, 00181, 00232, 00235, 00290, 00333, 00360, 00368, 00508, 00510

SPECIES

00039

SPECIES LIST

00001, 00003, 00005, 00009, 00012, 00019, 00020, 00033, 00034, 00041, 00059, 00061, 00068, 00086, 00087, 00090, 00091, 00097, 00100, 00110, 00131, 00143, 00155, 00172, 00174, 00177, 00180, 00185, 00186, 00188, 00194, 00198, 00201, 00204, 00207, 00218, 00220, 00222, 00223, 00224, 00226, 00229, 00234, 00235, 00237, 00239, 00242, 00248, 00251, 00254, 00256, 00257, 00258, 00269, 00270, 00275, 00286, 00303, 00313, 00314, 00329, 00330, 00334, 00338, 00339, 00340, 00353, 00357, 00362, 00364, 00365, 00366, 00374, 00383, 00392, 00406, 00412, 00416, 00458, 00480, 00488, 00504, 00510

SPECIES SELECTION

00095, 00140, 00254, 00313, 00356

STATISTICS

00106

STIMULANT CROPS

00147

STOVES

00324, 00339

SUBHUMID TROPICS

00087, 00529

SUBSISTENCE FARMING

00122, 00462, 00464

SUPPLY

00335

SYMBIOSIS

00030, 00192, 00196, 00204, 00206, 00229, 00259, 00273, 00276, 00277, 00278, 00279, 00281, 00285, 00473

SYSTEMS ANALYSIS

00485

TAUNGYA SYSTEMS

00004, 00007, 00011, 00029, 00042, 00044, 00055, 00059, 00085, 00088, 00089, 00090, 00091, 00096, 00101, 00104, 00111, 00124, 00133, 00144, 00148, 00177, 00193, 00424, 00430, 00436, 00441, 00475

TAXONOMY

00198, 00202, 00203, 00234, 00255, 00490, 00503

TECHNOLOGY

00009, 00030, 00044, 00101, 00103, 00138, 00192, 00207, 00237, 00251, 00316, 00325, 00326, 00391, 00426, 00437, 00463, 00471, 00489, 00491, 00494, 00500, 00504, 00505, 00513, 00515, 00516, 00524, 00529

TEMPERATE ZONES

00331

TEMPERATURE

00264, 00516

TENURE

00089, 00102, 00111, 00122, 00131, 00137, 00143, 00146, 00158, 00181, 00215, 00421, 00423, 00450, 00451, 00452, 00453, 00454, 00455, 00456, 00457, 00458, 00459, 00460, 00461, 00462, 00463, 00464, 00465, 00466, 00467, 00468, 00469, 00472, 00475, 00492, 00504, 00526

THINNING

00060, 00103, 00153, 00157, 00270, 00493

TILLAGE

00106, 00376

TOLERANCE

00120, 00135, 00367

TOXICITY

00249, 00370

TRADITIONAL FARMING

00027, 00060, 00085, 00137, 00148, 00184, 00408, 00410, 00415, 00424, 00435, 00450, 00459, 00463, 00502

TRADITIONS

00243

TRAINING

00117, 00481

TREE CROPS

00117, 00128, 00164, 00199, 00271, 00302, 00405

TREES

00012, 00020, 00038, 00039, 00056, 00070, 00071, 00083, 00089, 00098, 00125, 00127, 00129, 00206, 00211, 00214, 00217, 00220, 00223, 00224, 00234, 00240, 00253, 00257, 00269, 00272, 00283, 00284, 00285, 00286, 00287, 00289, 00290, 00308, 00318, 00326, 00341, 00342, 00348, 00371, 00392, 00397, 00398, 00401, 00420, 00423, 00454, 00457, 00458

TRIALS

00514

TROPICAL FORESTS

00059

TROPICAL RAIN FORESTS

00005, 00020, 00025, 00036, 00039, 00050, 00055, 00062, 00089, 00095, 00126, 00131, 00134, 00287, 00295, 00303, 00374

TROPICAL SOILS

00031, 00121

TROPICS

00008, 00009, 00010, 00011, 00012, 00013, 00014, 00019, 00026, 00028, 00030, 00031, 00035, 00037, 00041, 00043, 00044, 00045, 00050, 00060, 00063, 00067, 00068, 00069, 00070, 00077, 00078, 00081, 00085, 00093, 00105, 00108, 00116, 00118, 00122, 00124, 00126, 00131, 00135, 00136, 00137, 00138, 00145, 00156, 00159, 00171, 00186, 00189, 00198, 00199, 00204, 00206, 00213, 00216, 00217, 00218, 00223, 00228, 00235, 00238, 00270, 00272, 00283, 00288, 00291, 00307, 00308, 00309, 00314, 00318, 00340, 00341, 00368, 00372, 00384, 00388, 00389, 00390, 00392, 00414, 00415, 00433, 00448, 00449, 00451, 00452, 00462, 00463, 00466, 00475, 00476, 00486, 00497, 00502, 00511, 00514, 00520, 00526

TRYPANOSOMIASIS

00354

TSETSE FLIES

00159

ULTISOLS

00287

UNDER EXPLOITED PLANTS

00218

UPLAND CROPPING

00051

USES

00056, 00223, 00236, 00303, 00401

VEGETATION

00024, 00030, 00054, 00077, 00092, 00102, 00124, 00142, 00154, 00206, 00224, 00235, 00241, 00351, 00354, 00367, 00383, 00411, 00426, 00489, 00490, 00492, 00501, 00503, 00507, 00515, 00517, 00518

VEGETATIVE PROPAGATION

00293

VELD

00359

VILLAGES

00133, 00185, 00323, 00345, 00472, 00502

WASTE LAND

00008, 00039, 00518

WATER

00249, 00376, 00510

WATER CONSERVATION

00209, 00385

WATER REQUIREMENTS

00274

WATER RESOURCES

00072

WATER SUPPLY

00092, 00249, 00302, 00385

WATERSHEDS

00342, 00391, 00420, 00489, 00491, 00517

WEATHERING

00024, 00025, 00054

WEED CONTROL

00071, 00179, 00202, 00234, 00299, 00300

WEEDING

00103, 00360, 00508

WEEDS

00142, 00154, 00172, 00173, 00197, 00219, 00232, 00277

WEST AFRICA

00191, 00268, 00303, 00466

WILDLIFE

00114, 00138, 00333, 00354, 00515

WIND EROSION

00092, 00408, 00412

WINDBREAKS

00022, 00039, 00092, 00101, 00113, 00169, 00195, 00196, 00219, 00251, 00297, 00407, 00408, 00412, 00418, 00508, 00515

WINDS

00092, 00408, 00510

WOMEN

00345, 00469, 00470

WOOD

00025, 00035, 00089, 00094, 00098, 00101, 00109, 00138, 00142, 00150, 00151, 00157, 00162, 00165, 00194, 00195, 00207, 00219, 00232, 00235, 00291, 00312, 00314, 00316, 00317, 00321, 00333, 00344, 00393, 00412, 00413, 00427, 00428, 00473, 00491, 00505, 00508

WOOD PRODUCTS

00098

WOODLANDS

00039, 00159, 00164, 00203, 00206, 00224, 00270

WOODLOTS

00137, 00142, 00169, 00287, 00323, 00327, 00329, 00432, 00458

WOODY PLANTS

00013, 00020, 00134, 00180, 00193, 00206, 00209, 00277, 00340, 00396, 00449, 00493, 00497, 00501

YIELDS

00032, 00106, 00108, 00109, 00127, 00128, 00129, 00150, 00151, 00230, 00274, 00289, 00360, 00368, 00369, 00373, 00378, 00379, 00402, 00433, 00516

ZERO TILLAGE

00023, 00053, 00095, 00377, 00381, 00384, 00398, 00399, 00402, 00449

ZINC

00268

ZOOTECHNY

00166, 00389

]PLANTING

00420

COUNTRY/GEOGRAPHIC INDEX

AR

00407, 00418

AU

00113, 00150, 00151, 00152, 00153, 00157, 00161, 00162, 00206, 00270, 00296, 00356, 00376, 00377, 00417

BR

00036, 00047, 00051, 00158, 00189, 00215, 00253, 00287, 00293, 00295, 00304, 00373

BW

00246, 00381, 00461

CA

00280

CL

00018, 00170

CM

00098, 00124, 00466, 00510

CN

00286

CR

00001, 00042, 00052, 00093, 00097, 00110, 00271, 00288, 00347, 00382, 00402

DO

00470

EC

00156

EG

00319

ET

00046, 00228, 00258, 00514

FJ

00154

GF

00374

GH

00095, 00102, 00112, 00353

GM

00515

HT

00066

HV

00240, 00469

ID

00082, 00090, 00109, 00147, 00148, 00174, 00233, 00420, 00435, 00444, 00473, 00502

IL

00297

IN

00076, 00120, 00123, 00135, 00164, 00176, 00177, 00213, 00214, 00236, 00247, 00252, 00264, 00267, 00292, 00298, 00306, 00315, 00330, 00337, 00343, 00349, 00357, 00360, 00369, 00375, 00383, 00391, 00394, 00395, 00405, 00406, 00412, 00416, 00427, 00431, 00432, 00455, 00470, 00479

JM

00088

KE

00041, 00070, 00163, 00201, 00217, 00251, 00327, 00339, 00342, 00344, 00371, 00422, 00443, 00454, 00470, 00477, 00505, 00511, 00520, 00521, 00527

KR

00444, 00472

LK

00190, 00419, 00438

LS

00464

ML

00242, 00340, 00466, 00515

MR

00466, 00515

MW

00159, 00229, 00246

MX

00282, 00283, 00396, 00527

MY

00179, 00183, 00250, 00259, 00265, 00266, 00299, 00300

MZ

00159

NA

00385

NE

00125, 00243, 00466

NG

00023, 00087, 00091, 00102, 00106, 00107, 00108, 00112, 00124, 00126, 00127, 00128, 00129, 00130, 00131, 00138, 00193, 00222, 00287, 00398, 00399, 00428, 00449, 00450, 00451

NL

00248

NP

00188, 00226, 00227, 00231, 00361, 00362, 00363, 00366, 00419, 00447

NZ

00071, 00160, 00165, 00169, 00178, 00181

PA

00329

PC

00140

PE

00032, 00118, 00132, 00345

PG

00086, 00094, 00527

PH

00002, 00028, 00072, 00133, 00142, 00166, 00197, 00316, 00403, 00419, 00426, 00430, 00468, 00482, 00508

PK

00456

PY

00187

RC

00467

RW

00392

SD

00092, 00111, 00139, 00216

SL

00085

SN

00099, 00101, 00205, 00272, 00346, 00378, 00379, 00466, 00488

TH

00058, 00089, 00185, 00301, 00419, 00424, 00465

TZ

00025, 00104, 00115, 00116, 00136, 00159, 00223, 00224, 00246, 00354, 00389, 00409, 00410, 00419, 00425, 00436, 00454

UG

00096

US

00167, 00168, 00175, 00195, 00202, 00248, 00261, 00274, 00333, 00352, 00439

VE

00186

VU

00122, 00462

WS

00172, 00173,
00433

XA

00009, 00010,
00012, 00013,
00014, 00017,
00023, 00025,
00026, 00027,
00030, 00034,
00041, 00043,
00046, 00055,
00059, 00070,
00079, 00085,
00087, 00091,
00092, 00095,
00096, 00098,
00099, 00101,
00102, 00103,
00104, 00106,
00107, 00108,
00111, 00112,
00114, 00115,
00116, 00121,
00124, 00125,
00126, 00127,
00128, 00129,
00130, 00131,
00136, 00137,
00138, 00146,
00163, 00171,
00191, 00193,
00194, 00201,
00205, 00207,
00216, 00217,
00222, 00223,
00224, 00228,
00229, 00239,
00240, 00241,
00242, 00243,
00246, 00251,
00254, 00258,
00260, 00268,
00272, 00275,
00284, 00287,
00290, 00294,
00302, 00303,
00319, 00322,
00323, 00327,
00335, 00336,
00339, 00340,
00342, 00344,
00346, 00348,
00353, 00354,
00355, 00358,
00359, 00364,
00365, 00371,
00378, 00379,
00380, 00381,
00384, 00385,
00389, 00390,
00392, 00393,
00398, 00399,
00408, 00409,
00410, 00413,
00415, 00417,
00422, 00423,
00425, 00428,
00434, 00436,
00443, 00446,
00448, 00449,
00450, 00451,
00452, 00454,
00458, 00459,
00461, 00463,
00464, 00469,
00477, 00481,
00488, 00489,
00492, 00501,
00505, 00510,
00511, 00514,
00515, 00518,
00520, 00521,
00529

XE

00248

XG

00317

XL

00001, 00003,
00009, 00010,
00012, 00013,
00014, 00018,
00032, 00036,
00038, 00042,
00043, 00047,
00051, 00052,
00066, 00073,
00088, 00093,
00097, 00110,
00118, 00121,
00132, 00145,
00149, 00155,
00156, 00158,
00170, 00171,
00186, 00187,
00189, 00200,
00209, 00215,
00235, 00253,
00271, 00275,
00282, 00283,
00287, 00288,
00293, 00295,
00304, 00305,
00310, 00311,
00322, 00323,
00329, 00335,
00336, 00345,
00347, 00350,
00368, 00373,
00374, 00380,
00382, 00384,
00390, 00393,
00396, 00402,
00407, 00413,
00418, 00446,
00448, 00458,
00460, 00463,
00467, 00489,
00518

XN

00167, 00168,
00175, 00195,
00202, 00203,
00248, 00261,
00274, 00275,
00280, 00333,
00351, 00352,
00411, 00439

XP

00002, 00005,
00009, 00010,
00012, 00013,
00014, 00028,
00043, 00044,
00058, 00071,
00072, 00076,
00077, 00082,
00086, 00089,
00090, 00094,
00109, 00120,
00121, 00122,

00123, 00133,
00135, 00140,
00142, 00143,
00147, 00148,
00150, 00151,
00152, 00153,
00154, 00157,
00160, 00161,
00162, 00164,
00165, 00166,
00169, 00171,
00172, 00173,
00174, 00176,
00177, 00178,
00179, 00181,
00183, 00185,
00188, 00190,
00197, 00206,
00213, 00214,
00226, 00227,
00231, 00233,
00236, 00237,
00247, 00248,
00250, 00252,
00259, 00264,
00265, 00266,
00267, 00270,
00286, 00292,
00296, 00298,
00299, 00300,
00301, 00306,
00310, 00315,
00316, 00322,
00323, 00330,
00335, 00336,
00337, 00343,
00349, 00356,
00357, 00360,
00361, 00362,
00363, 00366,
00369, 00375,
00376, 00377,
00380, 00383,
00384, 00390,
00391, 00393,
00394, 00395,
00403, 00405,
00406, 00412,
00413, 00416,
00417, 00420,
00424, 00426,
00427, 00430,
00431, 00432,
00433, 00434,
00435, 00438,
00444, 00446,
00447, 00448,
00453, 00455,
00456, 00458,
00462, 00463,
00465, 00468,
00472, 00473,
00479, 00482,
00484, 00485,
00486, 00489,
00500, 00502,
00508, 00518,
00526

XW

00297

XZ

00004, 00006,
00007, 00008,
00011, 00015,
00016, 00019,
00020, 00021,
00022, 00024,
00029, 00031,
00033, 00035,
00037, 00039,
00045, 00050,
00053, 00054,
00056, 00057,
00060, 00061,
00062, 00063,
00064, 00065,
00067, 00068,
00069, 00078,
00080, 00081,
00083, 00084,
00100, 00105,
00117, 00134,
00141, 00144,
00180, 00182,
00184, 00192,
00198, 00199,
00204, 00210,
00211, 00218,
00219, 00220,
00221, 00225,
00230, 00232,
00234, 00238,
00244, 00245,
00249, 00255,
00256, 00257,
00262, 00263,
00269, 00273,
00276, 00277,
00278, 00279,
00281, 00285,
00289, 00291,
00307, 00308,
00309, 00312,
00313, 00314,
00318, 00320,
00321, 00325,
00326, 00328,
00331, 00332,
00334, 00338,
00341, 00367,
00370, 00372,
00386, 00387,
00388, 00397,
00400, 00401,
00404, 00414,
00421, 00429,
00437, 00440,
00441, 00442,
00445, 00457,
00471, 00474,
00475, 00476,
00478, 00480,
00483, 00[illegible]7,
00490, 00[illegible]3,
00494, 00495,
00497, 00498
00499, 00503,
00506, 00507,
00509, 00513,
00516, 00519,
00522, 00523,
00524, 00525,
00528, 00530,
00531

ZA

00290, 00359

ZM

00159, 00207,
00246, 00354

ZW

00159, 00354