

- PN - ABE - 049

# *Agroforestry Development in Kenya*



The International Council for Research in Agroforestry (ICRAF) was established in 1978 with headquarters in Nairobi, Kenya. ICRAF is an autonomous, nonprofit 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 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 1989

P. O. Box 30677, Nairobi, Kenya

Kilewe, A.M. and Kealey, K.M.

ICRAF, Nairobi CA

Agroforestry Development in Kenya: An Executive Summary of the Second Kenya National Seminar on Agroforestry, Held in Nairobi, Kenya, 7-16 November 1988. Nairobi, Kenya, ICRAF, 1989. 36p.

Agroforestry systems; diagnosis and design; land use systems; social forestry; fuelwood; soil conservation; water conservation; rural development; research planning; collaborative programmes; training; NGOs; list of participants

UDC:634.0.26

ISBN:92 9059 054 8

Cover drawing by T. Hirst

Printed by Man Graphics Ltd, Nairobi, Kenya

M/ARE-049

64246

# ***Agroforestry Development in Kenya***

***An Executive Summary of the  
Second Kenya National Seminar on Agroforestry  
Held in Nairobi, Kenya***

***7-16 November 1988***

***Editors: A. M. Kilewe and K. M. Kealey***

***Cosponsored by the  
National Council for Science and Technology  
and the  
International Council for Research in Agroforestry***

***The views expressed in this publication are those of the participants and do not necessarily represent those of their institutions or the cosponsors of this seminar.***

## *Abstract*

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

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

The information generated at the Seminar has been provided in two publications: an Executive Summary and a complete Seminar Proceedings. The Executive Summary publication contains an introduction, a list of the most important recommendations, summaries of 15 invited papers, and a list of participants. The complete Seminar Proceedings, on the other hand, contains the summary as well as all technical papers presented in the plenary sessions.

## *Résumé*

Cette publication contient un résumé des recommandations issues du Second Kenya National Seminar on Agroforestry tenu du 7 au 16 novembre 1988 au siège de l'ICRAF, à Nairobi, au Kenya. Organisé conjointement par le National Council for Science and Technology (NCST) et le Conseil international pour la recherche en agroforesterie (ICRAF), ce séminaire faisait suite au premier colloque national sur l'agroforesterie qui a eu lieu en 1980. L'objectif visé était de réunir des experts d'horizons divers pour traiter des tendances de la science et des pratiques agroforestières, promouvoir les échanges par le biais de séances plénières, de groupes de travail et de visites de terrain, et formuler des recommandations pour l'élaboration d'une stratégie nationale de recherche et de développement en agroforesterie.

Le programme du séminaire comprenait des séances plénières avec présentation d'exposés, des sessions consacrées à des présentations visuelles, trois visites de terrain, et cinq réunions de groupes de travail. Ces réunions ont permis aux participants d'exploiter leurs connaissances et les informations acquises lors des séances plénières pour formuler des recommandations sur les axes et priorités de la recherche, les stratégies de vulgarisation, les facteurs socio-économiques, l'éducation et la formation, ainsi que les aspects institutionnels de la recherche et du développement en agroforesterie.

Deux publications officielles ont été consacrées à ce séminaire: le présent résumé qui contient une introduction, la liste des plus importantes recommandations, les résumés de 15 exposés et la liste des participants; et les actes du séminaire, qui contiennent le texte intégral des exposés présentés à l'occasion des séances plénières.

## Contents

---

*Foreword* 5

*Summary/Recommendations* 7

    Research Strategies and Priorities 9

    Extension Packages and Strategies 11

    Socioeconomic Factors 13

    Education and Training 17

    Institutional Issues 20

    Selected Abstracts 23

*Participants* 31

## *Foreword*

---

This report presents an Executive Summary of the proceedings of the Second Kenya National Seminar on Agroforestry, held from 7 to 16 November 1988 at the International Council for Research in Agroforestry (ICRAF) headquarters in Nairobi as a joint venture between the National Council for Science and Technology (NCST) and ICRAF. The Seminar was the second major meeting of its kind in Kenya, the first one was held in 1980, to bring together a wide variety of professionals to share practical experiences and disciplinary refinements and to set future national agroforestry development priorities and strategies. Ninety-six participants from government, nongovernment, and donor organizations, including nine participants from Ethiopia, Tanzania, and Zambia, attended.

The Seminar consisted of plenary sessions in which technical papers were presented. Poster sessions were included, as well as three field tours and five working-group meetings. The main themes of the plenary sessions included general approaches to agroforestry development, reviews of agroforestry research and development (R&D) in Kenya, extension activities, institutional issues, socio-economic aspects, education and training, integrated research, agroforestry component R&D, and databases and seed supply.

Along with the plenary sessions, field tours aimed at providing the participants with an opportunity to appreciate agricultural, forestry, and agroforestry developments as well as the scenic beauty of the countryside. A half-day tour of the ICRAF Field Station at Machakos and a 2-day tour to the Coast and Western Kenya were included. At the ICRAF Field Station, the participants observed agroforestry demonstrations and trials including the use of multipurpose trees and shrubs for agroforestry, soil conservation technologies, tree-establishment trails, alley cropping, and tree/crop interface studies and systematic tree-arrangement designs.

Those who participated in the Western Kenya tour saw industrial tree plantations on both escarpments of the Great Rift Valley; large-scale wheat and sheep farming around Molo; tea plantations in Kericho District, sugarcane growing in the Muhoroni area, and rice growing in Ahero; women's group agroforestry projects at Got Abayo and Nyamninia in Siaya District; collaborative agroforestry research with ICRAF, the Kenya Agricultural Research Institute (KARI), and the Kenya Forestry Research Institute (KEFRI) at Maseno; and the agroforestry demonstration centre at Bukura.

Those participants who took part in the Kenya Coast tour saw wildlife and range management, dryland agriculture, Kenya's dry-zone vegetation, coastal vegetation including mangrove forests, the agroforestry demonstration centre at Mtwapa, and the rehabilitation of land disturbed by mining for cement production at Baobab farm.

The main objective of the five working groups was to provide an opportunity to all participants, based on their experience and on what they were able to gather from the plenary sessions and field tours, to make specific contributions on agroforestry R&D issues. The agenda for the working groups included research strategies and priorities, extension strategies and packages, socioeconomic factors, education and training, and insitutional issues.

To facilitate dissemination to specialized audiences, the information generated at the Seminar is being provided in two publications: an Executive Summary and a complete Seminar Proceedings. The Executive Summary contains an introduction, a list of the most important recommendations, and summaries of the 15 invited papers, which formed the basis for the selection of the plenary session themes. The complete Seminar Proceedings contains the summary and all technical papers presented in plenary sessions, representing some 50 presentations. A few papers not presented during the plenary sessions but circulated at the Seminar have been included in the full proceedings with the permission of the Editorial Advisory Committee because of their potential contribution to the overall objectives of the Seminar. We are confident that the wealth of information generated from this important meeting will encourage and increase the efforts of those concerned with agroforestry development in Kenya.

Finally, and most important, we would like to express our appreciation to the Seminar Organizing Committee and the National Steering Committee on Agroforestry for guiding the planning of the Seminar, the authors of the technical papers, and the plenary-session and working-group chairpersons and rapporteurs. Appreciation is also extended to the participants for setting the high standards that ensured the success of the Seminar and the many individuals and organizations who made valuable contributions in one way or another. Special thanks is given to the Editorial Advisory Committee for prompt and efficient publication of this Summary.

Bjom Lundgren  
Director-General  
ICRAF

F.J. Wang'ati  
Secretary  
NCST

Fred Owino  
Chairman  
Seminar Organizing Committee

## *Summary/Recommendations*

---

### *Introduction*

The current national strategy for land use in Kenya is sectoral where agriculture, livestock, and forestry are developed separately. This structural division is provided for by separate legal acts, and the policies are implemented by three government ministries: the Ministry of Agriculture, the Ministry of Livestock Development, and the Ministry of Environment and Natural Resources. High-potential land is limited and, therefore, if Kenya is to produce sufficient agricultural, livestock, and forest products, competition for land is to be expected given the very high population growth rate. There is already a trend toward forested areas being converted into crop and grazing lands. In view of the scarcity of suitable land for arable farming and livestock rearing, this trend is likely to continue. There is an urgent need, therefore, to develop land-use systems that promote conservation of the natural resources for sustainable development.

Agroforestry, a new name for old practices, holds substantial promise for ameliorating critical development and environmental problems in Kenya. As a land-use system that combines the production of food, livestock, and forest products, preferably on the same unit of land on a sustained yield basis, agroforestry offers potential for reducing the increasing conflicts between arable farming, livestock keeping, and forestry interests, especially in the high-potential areas that are facing intense population growth.

Agroforestry offers the possibility of household access to a range of forest products including food, fuelwood, building materials, medicine, and animal fodder, in addition to agricultural produce. Furthermore, it offers the capacity for sustained yield production of these commodities because agroforestry systems, properly conceived and practiced, may enhance organic-matter production, maintain soil fertility, reduce erosion, and create a balanced microclimate. In selecting a management system, however, it is necessary to appreciate that in agroforestry we are dealing with a multidisciplinary field of activity involving foresters, agriculturalists, animal specialists, social economists, etc. Failure to facilitate this understanding could result in conflicts in agroforestry management and a hybrid of contradictory compromises.

The First Kenya National Seminar on Agroforestry was held in November 1980 as a joint venture between ICRAF and the University of Nairobi. For the first time, a wide variety of professionals was brought together to discuss their views and experiences on agroforestry in Kenya. A number of measures and options were recommended for future guidance in agroforestry technology development including the early establishment of a Kenya Agroforestry Coordinating Committee to help

promote and sustain agroforestry activities among all government and non-governmental organizations (NGOs). At the Seminar, it was recognized that there was already a wide interest in agroforestry in Kenya, and much useful data and discussion were contributed during the 10-day meeting.

The location of ICRAF headquarters in Kenya has no doubt served as an effective catalyst. In particular, the establishment of the Field Station at Machakos in 1981 and its agroforestry demonstrations and trials have enabled ICRAF to participate directly in Kenya's agroforestry development efforts.

As a result of these efforts, Kenya has experienced a significant growth in agroforestry R&D during the last decade. Such accelerated development is also largely a result of the concerted efforts between and among the government ministries, research organizations, development agencies, and a large number of national and international NGOs. These collaborative efforts have, fortunately, been matched by Kenya's strong tradition and infrastructure developed around tree planting and the personal commitment of His Excellency, Daniel T. Arap Moi, The President of the Republic of Kenya, in leading the nation in an active tree-planting tradition.

During this significant growth in agroforestry R&D, many valuable experiences and lessons have been learned. This, therefore, creates an urgent need to take stock of the efforts, experiences, and lessons learned to establish the relationships and responsibilities among the government, NGOs, donor agencies, and the farmers to facilitate the establishment of the development paths of agroforestry and its wide use for sustainable development in Kenya.

It is against this background that the Second Kenya National Seminar on Agroforestry was organized by NCST and ICRAF to highlight trends in agroforestry science and practice; facilitate the exchange of ideas and experiences through plenary sessions, working-group discussions, and field tours; and set general guidelines and make specific recommendations for a national agroforestry R&D strategy for the next decade.

The following is a synthesis of the main recommendations on research strategies and priorities, extension strategies and packages, socioeconomic factors, education and training, and institutional issues in agroforestry R&D that were presented and approved at the final plenary session. The institutional issues were seen as the main constraint limiting the full realization of the potential of agroforestry to increase the productivity, sustainability, and economic diversity of rural lands in Kenya. Recommendations on institutional issues were, therefore, accorded the highest priority requiring immediate action to harmonize and strengthen research and extension programmes through a multidisciplinary and interinstitutional approach rather than the current fragmented monodisciplinary approach characterized by competitive, overlapping, and uncoordinated efforts.

## *Research Strategies and Priorities*

---

The participants noted that Kenya has a good information base on physical features including topography, soils, climate, vegetation, and land-use systems; agroforestry has captured the attention and interest of the leaders and planners; and many developments in agroforestry research have occurred following the First Kenya National Seminar on Agroforestry held in 1980. In particular, the participants observed that the National Agroforestry Steering Committee established under the aegis of NCST is already providing an effective contact point for R&D, and the NCST information centre now has the capacity for acquiring, storing, and disseminating agroforestry data.

Also, many agroforestry R&D and quasiresearch projects have proliferated in different parts of the country and are now generating very useful working information. Commendable progress has been made on land-use surveys and in the development of prototype agroforestry technologies for given land-use systems. Comparatively little research has been accorded to the identification of the role of agroforestry practices and systems in soil and water conservation, but some progress has been made in the documentation of descriptive information on agroforestry systems in Kenya; however, this area still lacks sufficient data on production outputs and socioeconomic parameters. Candidate multipurpose tree (MPT) species have been established by different governmental and nongovernmental organizations, and the results of field testing of a number of the promising species for different agroecological zones are becoming available. Finally, some progress has been realized in germplasm acquisition, methods of seed treatment, and vegetative propagation, but this effort requires a more concerted approach.

Noting the growing need for information on different aspects of agroforestry practices and systems, the participants recognized the need to define research in agroforestry to embrace (a) classical, empirical, basic, and applied research efforts based on scientifically acceptable experimental designs; (b) prototype trials embracing evaluation of best-bets, not necessarily meeting statistical obligations; and (c) accumulation of observational data, including information drawn from field situations and experiences. Research on MPT species should include: (a) assessment of productivity, nutrient accumulation and turnover, management and design protocols to enhance sustainable production, and optimization of plant residue; and (b) documentation of germplasm evaluation efforts by all agencies.

The initiative on provenance selection should be followed with an improvement programme of superior genotypes of both indigenous and exotic germplasm. Ethnobotanical surveys should be promoted to support the breeding of indigenous species. This programme should be supported by developments in biotechnologies through basic and adaptive research. Research on designs and management of

agroforestry systems should be conducted to generate hard data. This work could be greatly facilitated by involving extension workers and farmers as research collaborators.

### *Recommendations*

- The growing threats from pests and diseases call for careful monitoring and identification of potential pernicious organisms under agroforestry systems and the development of effective avenues for their control.
- Soil erosion has been identified as a pressing agricultural problem presenting a major threat to all facets of land productivity in Kenya. Concerted research effort should, therefore, be given to the identification of the role of agroforestry practices and systems in erosion control and maintenance of soil fertility in different agroecological zones of Kenya.
- In recognition of the potential of agroforestry technologies in supporting the production of small ruminants, including beekeeping and aquaculture, researchers should provide available information and guidelines to managers of these resources.
- Experience from the field has shown that management of resources in arid and semi-arid regions of Kenya presents a separate set of complicated problems different from those found in the high- and medium-potential regions and should be approached cautiously. Some of these problems could be attributed to the high population changes, which are at a rate of 3.8% per year, and an even higher actual growth rate because of immigration from high- and medium-potential regions. Agroforestry R&D in these regions should, therefore, focus on areas of high population concentration.
- Investigations on lesser known products of plants including plant-based chemicals and oils, particularly those with potential for import substitution, should be promoted with full farmer and government participation.
- In addition to documentation of biophysical data on different agroforestry systems in various agroecological zones, parallel economic and sociological implications should be studied to enable the evaluation of the practical application of agroforestry interventions. Projects that do not have the capability for data documentation, storage, analysis, and interpretation should be supported through the establishment of training to permit improved data management.

## *Extension Packages and Strategies*

---

### *Agroforestry Extension Packages*

The participants noted that much information on agroforestry technologies and components is already available in Kenya. The Rural Afforestation Extension Service (RAES) has documented a number of useful agroforestry species. The Kenya Energy Non-Governmental Organization (KENGO) has done work on indigenous species through the Juja Project. KEFRI is screening agroforestry species in a number of agroclimatic zones, including on-farm trials. The Ministry of Energy has generated much information through its six Agroforestry Energy Centres. The Ministry of Agriculture has collected useful information on the use of trees in soil and water conservation. KARI has carried out research on the establishment of fodder banks and silvopastoral systems. MPT species information is available from the Museums of Kenya. Many other small research and extension projects have generated applicable information in field, although frequently without documentation. The Swedish International Development Authority (SIDA)/ICRAF Project is developing a bibliography on agroforestry in Kenya; a source book on agroforestry practices in Kenya emphasizing basic configurations, species, identification, and placement by provenance, without management information; and selected extension materials. Based on this, the participants agreed that there is no need for extension to wait until sophisticated technology packages are developed. With minor modifications and adjustments, existing practices would keep the farmers going while the scientists conduct detailed studies to develop improved technologies.

#### *Recommendations*

- Information on agroforestry technologies should be systematically collected from the farmers' knowledge base, government extension institutions, NGOs, research institutions, and other institutions.
- Available information on agroforestry technologies should be evaluated and tested with selected farmers before dissemination on a wider scale.
- Specific agroforestry practices and components should be identified for the different agroecological zones and should be focused on meeting farmers' needs and conditions.
- The Farmers' Training Centres of the Ministry of Agriculture and secondary schools should be used not only for training in agroforestry but also as sites for technology demonstrations and evaluation.

## *Extension Strategies*

The participants noted that agroforestry development in Kenya has suffered because of a lack of institutional coordination in field extension. There has also been concern about an institutional base for agroforestry extension. However, efforts have been made by a few projects to improve local coordination. In addition, the District Focus for Rural Development Strategy, as promoted by the Government of Kenya, offers a potential framework for coordinated extension planning.

The participants identified in-service training as critical for agroforestry extension staff. However, it was noted that the existing training information and material on agroforestry in Kenya are poorly documented and unconsolidated. The participants further noted that much of agroforestry extension in Kenya in the past has been directed at "tree-planting" efforts generally and agreed that this approach should now be modified to emphasize agroforestry for a purpose with full participation of the farmers.

### *Recommendations*

- The agencies concerned should have a coordinated approach in agroforestry field-extension activities with planning at the district level.
- At this time, there is no need for specific institutionalization of agroforestry extension. However, the existing extension personnel in their respective ministries and projects could be trained in agroforestry through a joint in-service scheme for a more consolidated extension approach. Such training needs to be developed and implemented in collaboration with the various ministries and projects.
- Development of audiovisual aids as tools for agroforestry extension work with farmers is needed.
- Training tours for farmers should be organized on a national basis through agency collaboration.
- As an incentive, a reward system for the best agroforestry farmers should be created with careful consideration of the criteria for selection.
- Extension methods and materials should be developed that focus on agroforestry for a purpose.
- Agroforestry extension should emphasize farmer participation in technology adaptation and two-way communication between farmers and extensionists. This will require retraining of extensionists in communication skills and knowledge-transfer systems.

## *Socioeconomic Factors*

---

The participants identified five major problem areas related to the socioeconomic determinants of agroforestry technology development, transfer, and evaluation. These include farmer/household/community, analysis of existing land-use systems, assessment of agroforestry technologies, infrastructure and support services for agroforestry, and economic and agricultural development policies.

### *Farmer/Household/Community*

Considering that the main beneficiary and decision-maker in agroforestry technologies is the farmer/household/community, the participants observed that (a) agroforestry technology development and transfer programmes are not adequately incorporating farmer-relevant criteria to evaluate the impact and implications of their work; (b) farmer-participatory approaches are not being exploited in the various phases of development, i.e., problem identification, programme design, technology transfer, etc.

### *Recommendations*

- The human system should be analyzed to define real felt needs, decision-making, knowledge base, opportunities, perspectives, and meaningful criteria that define their immediate and future objectives.
- Current agroforestry programmes that are making substantial progress in this type of analysis should be evaluated objectively to identify and extract practical experiences on farmer/household analysis, farmer participatory methods, classification of farmers/households/communities for effective targeting, and programme impact on human standards and welfare. This analysis should be integrated with the analysis of the socioeconomic aspects of land-use systems, technology, infrastructure and support services, and policy.

### *Analysis of Existing Land-Use Systems*

The participants noted that (a) resource allocation at the community and household levels with respect to land, labour, and cash inputs in alternative on-farm and off-farm activities, and resource rights with respect to land, trees, animals, and water, are not well understood; (b) management levels associated with the various production systems of crop, livestock, or trees, are not well understood; and (c) per-

formance (yields) in terms of meeting socioeconomic priorities and criteria of the household are not usually measured.

#### *Recommendation*

- Governmental and nongovernmental projects should be analyzed to identify the extent to which they are addressing these socioeconomic factors in the analysis of the land-use systems.

### *Assessment of Agroforestry Technologies*

Considering that technology is defined as the process where inputs (materials, labour, information, etc.) are managed to produce outputs (food, fodder, fuelwood, soil conservation, etc.), the participants observed that the planning of agroforestry projects is not appropriately addressing the socioeconomic potentials, impacts, and implications of improving or integrating new agroforestry technologies into existing land-use systems. Ongoing agroforestry projects are not adequately and systematically assessing the economic viability and social acceptability of on-farm (or on-range) research or extension work.

At present, there are no training programmes that explicitly focus on the socioeconomic concepts and methodologies to evaluate agroforestry technologies and that could be used to upgrade the analytical skills of current project staff in this area. Also, without undermining the value of farmer-participatory approaches in technology development, agroforestry technologies are being recommended and promoted with farmers without proper specification and validation in the farmers' environment.

#### *Recommendations*

- The following socioeconomic criteria should be addressed in technology assessment:
  - (a) Net returns to labour and cash resources;
  - (b) Compatibility with other on-farm and off-farm activities of the household;
  - (c) Technology effects on the reduction/increase of risk and uncertainty normally faced by farmers;
  - (d) Technology effects on the responsibilities of household members with respect to resource allocation, implementing changes, and receiving the benefits; and
  - (e) Technology effects on the goals/objectives of the household and their relationships in the community.
- Educational and training institutions with socioeconomic programmes should be reviewed to assess the appropriateness of their curricula for agroforestry technology evaluation.

## *Infrastructure and Support for Agroforestry*

The participants recognized that infrastructure and support services for agroforestry are inadequate because agroforestry is new. Most of the current support is on an ad hoc project basis. It is not clear how and by whom such infrastructure and support services for widescale and permanent programmes should be provided. Extension staff are specialists often not willing or able to address themselves to technical issues outside their areas of competence, usually commodity based. Information support (technical communication, farmer training, on-farm demonstration, research support, etc.) is nonexistent in most areas of the country. Credit availability is restricted by conventional policies and methods of lending, markets for agroforestry products are not well developed and promoted, and multipurpose tree seeds, seedlings, and access to nurseries and other sources of inputs may not be adequately developed.

### Recommendations

- Government policy on rural service centres should take into account the needs for agroforestry.
- Training of extension workers should aim at an all-round extension worker who can handle the multidisciplinary and multicommodity issues of agroforestry and land-use systems.
- Problem-identification surveys, interventions based on the D&D approach, participatory on-farm trials and demonstrations, and self-reliant strategies should be adopted, i.e., with the farmers being the main driving force and "actors" in these projects.
- Credit for inputs should go along with the development of markets for products and the management of agroforestry according to the felt need of the farmers.
- Project design should be such that adequate technical and managerial skills are passed on so that by the end of the project local households or farmers themselves can take over the project effectively.
- Agroforestry development should be supported with appropriate technology services at rural markets and growth centres taking advantage of economies of scale to motivate farmers.
- There is an urgent need to analyze alternative options for organizing, managing, and financing infrastructure and support services in ways that are sustainable and complementary with respect to the contribution of public, private, and other organizations.

## *Economic and Agricultural Development Policies*

The participants recognized that the operationalization and implementation of policies related to agroforestry development present an extremely difficult task of coordination across government ministries and departments and other relevant NGOs.

### *Recommendations*

- An integrated approach to development must be reviewed with regard to agroforestry, especially at the level of translating policy into implementation.
- Project design, evaluation, and monitoring should be related to government policies. These reviews should supply feedback information from the farmers so that government policies, regulations, and directives are consistent and supportive of agroforestry development.

## *Education and Training*

---

The participants noted that the National Agroforestry Technical Coordinating Committee (NATCC) has not yet addressed education and training issues; however, various institutions have introduced some form of agroforestry training. In some cases, such training is structured, whereas in others the term "agroforestry" does not even appear.

The participants recognized five different levels of education and training: basic education (primary and secondary education), professional-level education and training (undergraduate and postgraduate), technical assistant-level training, diploma-level training, and continuing education in agroforestry. The participants also recognized the urgent need to develop an agroforestry curriculum, training materials, and agroforestry trainers.

### *Basic Education*

The participants noted that under the 8-4-4 curriculum, agroforestry could be catered for under agriculture and environment. It was further noted that teachers tend to teach those subjects where source materials are available and that there are currently no agroforestry textbooks.

#### *Recommendations*

- The Kenya Institute of Education should be involved in the development of agroforestry curriculum through the persons in charge of agriculture and environment panels and by sending a summary of the recommendations of this seminar to the chief executive of that institution.
- Publication of textbooks and other materials on agroforestry should be promoted.

### *Professional-Level Education and Training*

The participants took note of the recommendations of the Professional Education in Agroforestry Workshop, held from 5 to 10 December 1982, in Nairobi, Kenya, which laid emphasis on postgraduate training. It was further noted that physical and human resources in the institutes of higher learning are not adequate for postgraduate training. The participants, therefore, recognized the contribution that ICRAF can make at this level in terms of training and research facilities. The tentative curriculum submitted by Moi University was also noted.

### *Recommendations*

- Postgraduate training should be accorded the highest priority and collaborative arrangements should be made with Kenyan universities, ICRAF, and other external institutions to facilitate training at this level.
- All undergraduate training curricula in forestry, agriculture, and environmentally based disciplines should have strong components of agroforestry.
- There should be more comprehensive consultations with other training institutions on the curriculum proposed by Moi University.

### *Technical Assistant-Level Training*

The participants recognized that technical assistants are the staff closest to the farmers. It was further recognized that agroforestry training covered under extension at Londiani Training College was not satisfactory.

#### *Recommendation*

- The existing training curricula at the respective institutions should be reviewed to incorporate agroforestry.

### *Diploma-Level Training*

The participants agreed that the diploma programmes at various Kenyan institutions have identified inadequacies in the existing curricula for effective agroforestry implementation.

#### *Recommendation*

- Arrangements should be made for retraining of such personnel in agroforestry at one institution that has sufficient disciplinary spread. Such training should lead to the award of a certificate that is recognized by government ministries.

### *Continuing Education in Agroforestry*

Because agroforestry is a new discipline, the participants agreed that there is an urgent need for practicing foresters, agriculturalists, and environmentally based professionals to be offered training in agroforestry through short-term courses.

#### *Recommendation*

- A Kenyan university should prepare and implement short-term courses in agroforestry in collaboration with ICRAF.

## *Curriculum Development and Training Materials*

The participants noted that because agroforestry is a new discipline it does not have well-developed curricula at all levels and that development of a curriculum requires experience and source materials that are not readily available in the existing institutions.

### *Recommendation*

- Opportunities should be made available for Kenyan trainers to undertake short-term internships at ICRAF to develop training materials and curricula at various levels.

## *Agroforestry Trainers*

In view of the recommended agroforestry training at various levels, the participants identified the need for the training of teachers in agroforestry.

### *Recommendation*

- Training courses of about 1-month duration should be developed for agroforestry teachers at all levels.

## *Institutional Issues*

---

The participants agreed that agroforestry has a considerable potential to increase the productivity, sustainability, and economic diversity of rural lands in Kenya. The full realization of this potential can only be achieved through a systematic optimization and integration of the tree/shrub component with the crop and livestock components. It was further agreed that a multidisciplinary and interinstitutional approach to agroforestry development stands a significantly higher chance of achieving rapid results than does a fragmented, monodisciplinary approach characterized by competitive, overlapping, and uncoordinated efforts by various disciplinary institutions.

The participants recognized that the interest in and support for agroforestry are greater in Kenya than in most other countries. Several government ministries, departments, and institutions, as well as nongovernmental and international organizations, are either directly engaged in some aspect of agroforestry R&D work or in work that is indirectly or potentially important for such efforts. This considerable institutional effort is, however, basically monodisciplinary, fragmented, and inadequately coordinated, except for the growing informal contacts between professionals interested in agroforestry. Some recent encouraging efforts to formalize institutional cooperation on various aspects of agroforestry have, however, been identified:

(a) A National Steering Committee on Agroforestry Research has been set up under NCST with all main governmental and NGO "actors" being members.

(b) A Memorandum of Understanding for ministerial cooperation and coordination of agroforestry efforts in Kenya has been drafted but is still under discussion.

(c) The six agroforestry centres developed by the now completed Kenya Renewable Energy Development Project under the Ministry of Energy have proved to be valuable extension tools for both the Ministry of Agriculture and the Ministry of Environment and Natural Resources (RAES) as well as being main suppliers of multipurpose tree seeds for a variety of government and NGO projects in the country.

(d) A National Tree Seed Committee has been set up to coordinate questions related to quality control and dissemination of tree seeds throughout Kenya. The committee is operating under the Permanent Presidential Commission on Soil Conservation and Afforestation.

(e) The planning and implementation of the Kenya component of the Agroforestry Research Networks for Africa (AFRENA) for the Eastern African highlands is a truly interinstitutional effort involving NCST, KARI, KEFRI, Ministry of Agriculture, Ministry of Environment and Natural Resources, and ICRAF.

(f) The National Seminars on Agroforestry (of which this meeting is the second) have brought together virtually all actors on the agroforestry scene in Kenya to exchange views and information on the present experience in agroforestry identifying gaps in technological know-how and formulating recommendations on how to proceed in developing the potential of agroforestry for national economic benefit.

These institutional efforts to increase collaboration are commendable but far from sufficient to develop the agroforestry potential. Determined efforts must be made to harmonize and strengthen research and extension programmes in agroforestry. Only by doing this can we bring out the considerable strength that lies in the complementary institutional and disciplinary knowledge and experience that exist in Kenya.

#### *Recommendations*

- A National Agroforestry Coordination Committee should be created at the central government policymaking level. The Committee should preferably be made up of permanent secretary/director-level persons from the relevant ministries and should deal with issues related to:
  - (a) Priorities for agroforestry development in the country,
  - (b) Sharing of resources and responsibilities between ministries,
  - (c) Analyzing the legal framework for adoption by farmers practicing agroforestry, and
  - (d) Coordination of external funding of agroforestry efforts and long-term institutional reforms needed to achieve permanent benefits from agroforestry.

The Office of the President should be requested to facilitate the establishment of this committee, which would be advised on technical matters by the two bodies recommended in the following:

- The Technical Coordinating Committee on agroforestry established last year and hosted by the NCST, apart from being responsible for coordinating research efforts, should also advise on coordination of university education in agroforestry. The representation of the four national universities at the Committee should, therefore, be strengthened.

The Technical Coordinating Committee should try to initiate well-conceived inter-institutional research programmes and, where necessary, assist in identifying internal and external funding resources for such programmes.

- The most urgent need today is to harmonize extension efforts in agroforestry, therefore, an Agroforestry Extension Task Force (or committee) should be set up by the National Agroforestry Coordination Committee with representatives from all government extension services involved in agroforestry today as well as one or two of the key NGOs. This task force would initially have four main areas to address:

(a) Collate present technological knowledge on agroforestry and identify what technologies are ready for major extension efforts,

- (b) Develop extension packages on these technologies,
  - (c) Harmonize extension efforts at local (district, division, location, etc.) levels and initiate a short-term training programme for extension personnel, and
  - (d) Coordinate and improve the use of various extension facilities (such as the Farmers' Training Centres, the Agroforestry Centres, etc.) for agroforestry purposes.
- The District Focus for Rural Development, mentioned earlier, provides a potentially strong opportunity for adapting and disseminating agroforestry extension messages to local needs as well as an efficient mechanism for identifying local agroforestry potential and problems. The relevant officers on the District Development Committees should, therefore, be given short, joint training in agroforestry to enable them to operate as multidisciplinary teams in this respect.

## *Selected Abstracts*

---

The following selected abstracts are of the 15 invited papers presented at the Seminar. The plenary sessions were developed around the themes of these specific papers. The full proceedings contains all the technical papers that were presented, which amounts to roughly 50 contributions. The full Seminar Proceedings is available on request from ICRAF headquarters in Nairobi.

### *Agroforestry: A Tool for Socioeconomic Advancement of the Rural People*

*Stephen G. Mbogoh, Department of Agricultural Economics, University of Nairobi,  
P.O. Box 29053, Nairobi, Kenya*

---

Agroforestry can contribute significantly to rural development. The practice of agroforestry makes trees part and parcel of the total farming system. Traditionally, agriculture has been associated with the following role in the process of economic development: provision of food for both rural and urban people, release of labour for the growing industrial sector, provision of capital and raw materials for industrial development, creation of markets for off-farm inputs and consumer goods, and provision of export earnings.

Of course, the process of agricultural production itself absorbs rural labour, and any improvements in agricultural productivity will directly contribute to rural development, i.e., the advancement of the welfare of the rural people. Agroforestry will enhance soil productivity and sustainability of land-use systems and generally contribute to environmental protection. Hence, agroforestry will enhance agricultural productivity and enable the agriculture sector to play a greater role in the process of rural development.

The trees and shrubs produced under agroforestry systems are multipurpose, and they may provide or be an important source of (a) food for human beings, (b) fodder for livestock production, (c) building material for human and other shelters, (d) fibres, (e) fuelwood, and (f) chemical extractives with medicinal and industrial value. Furthermore, trees and shrubs may play a service function, e.g., in soil conservation and microclimate amelioration, soil-nitrogen fixation, and provision of shade. All these functions and attributes of agroforestry have socioeconomic benefits and, thus, directly or indirectly contribute to rural development. In any case, the practice of agroforestry has employment-creation effects because agroforestry is labour intensive.

*Agroforestry Diagnosis and Design:  
Methods Used in Kenya*

*John B. Raintree, International Council for Research in Agroforestry (ICRAF), P.O.  
Box 30677, Nairobi, Kenya*

---

The International Council for Research in Agroforestry (ICRAF's) design and diagnosis (D&D) methodology is a family of procedures for the diagnosis of land-management problems and potentials and the design of appropriate agroforestry interventions. Agroforestry D&D is also concerned with the growing body of substantive knowledge and practice on which the sequence of decisions in a D&D application is based.

This paper concentrates on the procedural side of D&D and presents an overview of the methods applied and, in some cases, developed in Kenya by agroforestry researchers and extensionists at three different scales of analysis: micro (household), meso (local community/ecosystem), and macro (ecozone, country, region). Emphasis is placed on how the methods stemming from the basic D&D logic can be adapted to meet the needs of different users.

*Agroforestry for Development in Kenya*

*Amre Getahun, International Council for Research in Agroforestry (ICRAF), P.O.  
Box 30677, Nairobi, Kenya*

---

This paper covers agroforestry development in Kenya, which is relatively new but its growth and development during the last decade have been unprecedented. Such accelerated development is largely attributed to the concerted efforts between and among the Government of Kenya and the donor and nongovernmental communities.

Fifteen major Government of Kenya policy interventions that have had a positive effect on agroforestry development in Kenya have been enacted between 1971 and 1987. Although the necessary government policy instruments are in place and efforts to date are commendable, government-based agroforestry programmes and activities are, nonetheless, weak and require donor support and the active participation of nongovernmental organizations (NGOs). Fortunately, both donors and NGOs have positively responded and are complementing and supporting government efforts.

Agroforestry developments in Kenya, especially during the last 10 years, are impressive and the future is bright. The need to consolidate efforts and institutionalize agroforestry is great. What is urgently needed now is to take stock of these efforts and the lessons learned and clearly establish relationships and responsibilities among and between the government, the NGO community, the donors, and the farmers. By so doing, the development paths of agroforestry and its wide use for sustained development will be charted and made solid.

## *Agroforestry in Arid and Semi-Arid Areas*

*P. I. D. Kinyua, Department of Range Management, University of Nairobi, P.O. Box 29053, Nairobi, Kenya*

---

The vegetation of arid and semi-arid areas of Kenya is varied, ranging from barren lands to woodlands. It also displays diverse grass, shrub, and tree species. Although grass forms the main forage source, shrubs and trees provide valuable browse that supplements grass, especially during dry seasons or drought periods.

Overexploitation of these lands by poor management practices and widespread destruction of natural plant cover have resulted in ecological degradation leading in turn to the deterioration of the quality of life of the people and creating a threat to their survival. Agroforestry offers an effective response to the challenge of maintaining and improving productivity and sustainability of these lands. A silvopastoral approach would be the most convenient through integration of indigenous browse shrub and tree species with livestock.

### *Agroforestry: Institutional Arrangements*

*F. J. Wang'ati and B.F. Makau, National Council for Science and Technology (NCST), P.O. Box 30623, Nairobi, Kenya, and Ministry of Planning and National Development, P.O. Box 30005, Nairobi, Kenya, respectively*

---

In view of the large number of scientific disciplines involved in agroforestry, successful research and extension programmes will depend very much on cooperation and collaboration among the scientists, government institutions, and other organizations involved in this activity. The establishment of a National Steering Committee and Technical Coordinating Committee for agroforestry in Kenya is considered a useful starting point, and the National Council for Science and Technology (NCST) could help to ensure continuity and effectiveness of these committees. Attention is drawn to the potential conflicts in agroforestry research activities under the Kenya Agricultural Research Institute (KARI), the newly created Forestry Research Institute (FRI), and projects with research components under other ministries. It is suggested that institutional mechanisms be sought to overcome this problem and that an agroforestry research fund located and operated centrally under the NCST could help to foster collaboration between scientists. Agroforestry extension activities will definitely need strong financial support from government ministries and nongovernmental organizations and should also be built into donor-funded development projects.

### *Animal Husbandry in Agroforestry Production Systems*

*Albert E.O. Chabeda, Ministry of Livestock Development, P.O. Box 34188, Nairobi, Kenya*

---

Agriculture plays a very important role in the economy of Kenya contributing between 35 and 40% of the gross domestic products (GDP). In 1984, its share of the total GDP was about 30%. The livestock subsector is estimated to contribute 30% of the total gross marketed value of agricultural production and is, therefore, an important sector in the national economy. Of the 8.6 million ha available for arable agriculture in the high-potential areas, 5.2 million is under crop and milk production, with 47% of this land estimated to be directly under dairy production.

Although there are no estimates given for land under meat production, it is estimated that about 33 million ha are under some form of extensive grazing forming the basis for the red meat production for the country. In addition, the agriculture and livestock sector accounts for more than 70% of the total foreign exchange earnings, financing about 55% of the total import bill.

### *Appropriate Incentives for Agroforestry Production Systems*

*W. Oluoch-Kosura, Department of Agricultural Economics, University of Nairobi, P.O. Box 29053, Nairobi, Kenya*

---

An agroforestry production system is basically a land-use strategy that integrates agricultural and forest production under a common management. In a situation where population pressure is high and arable land is diminishing, agroforestry should, if properly conceived and applied, offer opportunity for a sustainable production system. This is because of its ability to minimize the conflict between agriculture and forestry by providing food, fuelwood, timber, fodder, and other basic needs as well as facilitating the conservation of the environment.

In an effort to achieve a desirable level of development in a country, our aim should be to improve the quality of life of people, especially the poor and those living on the margin of subsistence. These people are often forced by economic need to damage the natural resource base on which they and others depend for survival. Technology generated by agroforestry research can arrest the potential damage. This paper aims at highlighting the incentives that should be in place to enhance the adoption of appropriate agroforestry production systems. The incentives include improved technologies capable of increasing the system's output and, therefore, farm incomes, improved infrastructure, appropriate land-tenure arrangements, reduction of drudgery, and increased awareness.

## *Curriculum Development for Undergraduate and Postgraduate Training in Agroforestry*

*F. Owino and F. K. Sang, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya, and Department of Forestry, Moi University, Eldoret, Kenya, respectively*

---

Although the practice of agroforestry dates back perhaps to the origins of agriculture, the development of the discipline of agroforestry has only been realized in the last 20 years. It is not surprising, therefore, that very few training institutions (including universities) have started training programmes around this discipline. In its present stage of development, the discipline of agroforestry is far broader than a simple combination of agriculture and forestry disciplines. It should, therefore, not be assumed that the existing curricula for agriculture and forestry training at universities provide sufficient bases for effective training.

Only a few institutions across the globe have developed specific agroforestry training programmes at the undergraduate and postgraduate levels to date. Notable among these are the University of the Philippines at Los Baños for undergraduate training and the Centro Agronomico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica, for postgraduate training. Besides these full degree programmes, many universities are already offering agroforestry courses as components of other degree programmes or as short courses at both the undergraduate and the postgraduate levels.

Focusing on the Kenyan scene, several papers presented at this seminar have underscored the great potential role agroforestry will play in the country's development. Arrangements for appropriate manpower training at professional and technical levels are a prerequisite for effective implementation of agroforestry activities in the country. This paper discusses arrangements for agroforestry training at the professional level.

### *Education and Training for Agroforestry Developments: A Case Study of Kenya*

*Ester Zulberti, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya*

---

Research results in agroforestry are scarce if compared to those available for cash and food crops. Land-use circumstances under which existing agroforestry technologies are applied and the interactions between system components are not, in most cases, properly understood. The research constraint is further aggravated by a shortage of trained and experienced professionals with the knowledge and skills to integrate several disciplines that together must be combined in researching, planning, and managing agroforestry.

Agroforestry education and training have been constrained by the lack of validated scientific information and methods, rigid institutional structures, lack of appropriate training materials, inadequately prepared lecturers and trainers, and a lack of awareness about the potentials of agroforestry in policymakers and planners.

A brief review of the present state of agroforestry education and training programmes, in general, is presented in the first part of this paper. Information is mainly presented from English-speaking countries. This is followed by a section on agroforestry education and training in Kenya and the present and future possible directions.

### *Gender Division of Work, Resources, and Rewards in Agroforestry Systems*

*Dianne E. Rocheleau, Ford Foundation, P.O. Box 41081, Nairobi, Kenya*

---

This paper presents a case for reorienting the focus on "women's roles" in agroforestry to allow for a broader treatment of the gender division of resources, knowledge, rights, and responsibilities in agroforestry systems. The field of agroforestry research and extension in Kenya has advanced considerably over the last decade in terms of the incorporation of women as participants. However, much of the work on women and agroforestry in Kenya has emphasized women's labour contributions with less attention to women's interests and a neglect by both agroforestry and women's projects of the relationships of complementarity and conflict between men's and women's roles and priorities in agroforestry land-use systems. A selected review of experience in Kenya is complemented by a summary of the specific case of Kathama in Machakos District, Kenya. The experience in this rural community demonstrates the importance of recognizing and incorporating gender divisions in the process of agroforestry innovation in both traditional and experimental systems.

The interests of both women and men in agroforestry projects and practices can best be served by the adoption of a user-focused approach to technology design and land-use planning, with special attention to the gender division of resources, knowledge, work, and benefits. Once the existing gender division of land use is understood then fieldworkers and policymakers alike may build upon this to reinforce complementarity, resolve conflicts, and restore the balance between the rights and responsibilities shared between men and women in traditional, evolving, or experimental agroforestry systems. Such an explicit and creative treatment of the gender division of land use in agroforestry systems would serve the objectives of environmental sustainability, social equity, and economic productivity from the individual to national level.

### *Land-Tenure and Land-Use Legislation Issues in Agroforestry Development*

*Arthur Okoth-Owiro, Faculty of Law, University of Nairobi, P.O. Box 30197,  
Nairobi, Kenya*

---

In this paper, land-tenure and land-use legislation are defined. Their place in a system of laws is also considered. They are then discussed as issues in agroforestry. The discussion identifies the problem areas posed by each and suggests the appropriate responses within a context of legislative arrange-

ments. The major conclusion reached is that there are more problems posed by enforcement issues than by either tenure or land use in agroforestry development in Kenya.

Specifically, the purpose of this presentation is to discuss the role of land-tenure and land-use legislation in agroforestry development in Kenya by (a) conceptualizing land tenure and land use in the context of Kenya's legal system, and (b) raising and discussing issues of land tenure and land use that are relevant for agroforestry development in Kenya.

### *Land-Use Systems in Kenya and their Agroforestry Potential*

*S. Minae, I. N. Kamau, and B. Jama, International Council for Research in  
Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya*

---

The role that Kenya accords agroforestry is best illustrated by the 15 government policy interventions that have direct and positive effects on agroforestry development. All these were published between 1971 and 1987 and have been interpreted into various agroforestry activities by government executive agencies, nongovernmental organizations, donors, and individual farmers.

This development, however, has not been matched by answers to basic questions relating to agroforestry; for example, trees for what purpose, which trees, where should they be planted, and how should they be managed? To answer these questions, it is important to identify the existing land-use systems and their production constraints and then to derive from them the agroforestry potential. This is the approach taken in this paper. It is based on two land-use studies that the International Council for Research in Agroforestry (ICRAF) has participated in between 1987 and 1988. The first was under a regional agroforestry programme covering the bimodal highlands of eastern and central Africa. The second covered the rest of Kenya, particularly the coastal region and the arid and semi-arid areas.

### *The Potential of Agroforestry*

*B. Lundgren, International Council for Research in Agroforestry (ICRAF), P.O.  
Box 30677, Nairobi, Kenya*

---

This paper offers an assessment of the potential of agroforestry to improve the use of agricultural and other lands thereby contributing to economic growth through increased and more sustainable food and wood production. The questions addressed in the paper include current status, in the world in general, and in Kenya in particular; what are the present technological and institutional constraints; and what lies ahead?

It is stressed that institutional functions are needed for problem identification, priority setting, and resource allocation. Such new functions can initially be created without fundamental structural changes. It is suggested that we begin by creating interinstitutional planning committees on land-use improvement, committees that will become more and more executive in setting priorities and allocating resources and can create appropriate task forces from existing disciplinary institutions and resources.

## *Research Issues in Agroforestry*

*J. A. Odera, Kenya Forestry Research Institute (KEFRI), P.O. Box 20412, Nairobi, Kenya*

---

The existing tree-planting effort and the state-of-the-art of agroforestry are discussed. Key priority areas in the agroforestry research agenda, embracing technical and socioeconomic issues, are also presented including:

- (a) Documentation of indigenous agroforestry technologies by different ecozones and land-use systems.
- (b) Recruitment and evaluation of species of multipurpose trees and shrubs (MPTs) for different sites, agroforestry systems, prototype agroforestry technologies, and the development of appropriate management protocols, covering: crop designs including alley cropping in croplands and pastures; farm boundaries and home gardens, shelterbelts, riverbanks, and canals; roadside plots and plantations; intensive woodlots and fodder banks; and rehabilitation of degraded sites and environments.
- (c) Socioeconomic issues to address economic efficiencies of given agroforestry technologies and systems, constraints to popular adoption of agroforestry technologies by farmers, market outlets, and opportunities for prompt sale of wood products from the farmers to ensure a positive injection of gainful economic activities in the rural sector.
- (d) Development of proven agroforestry technology packages that are technically feasible and economically viable, with a clear eye for both subsistence and commercial farming.

## *Soil Erosion and the Role of Agroforestry Practices in Soil Conservation*

*A. M. Kilewe, Kenya Agricultural Research Institute (KARI), P.O. Box 30148, Nairobi, Kenya*

---

Soil erosion has been identified as a pressing agricultural problem presenting a major threat to all facets of land productivity in Kenya. Quantitative documentation of the extent, causes, and impact of soil erosion, however, is almost nonexistent. This paper, therefore, discusses the major processes and causes of soil erosion with special emphasis on the role of agroforestry practices in soil conservation. In doing so, a broader interpretation of soil conservation, implying not only soil erosion control but also maintenance and improvement of soil fertility, was used. The need for special research efforts to determine (a) how loss of soil productivity changes as erosion progresses, (b) how soil productivity varies over time under a given land use, (c) the process whereby soil productivity declines, (d) the rehabilitation requirements of eroded lands, and (e) the role of agroforestry practices and systems in erosion control and maintenance of soil fertility is emphasized.

## *Participants*

---

*Kifle Abegaze*, Regional Soil Conservation, Ministry of Agriculture, P.O. Box 33394, Addis Ababa, Ethiopia

*Jaspat L. Agatsiva*, Remote Sensing Section, Department of Resource Surveys and Remote Sensing (KREMU), P.O. Box 47146, Nairobi, Kenya

*Imataa M. Akayombokwa*, Department of Agriculture, P.O. Box 50291, Lusaka, Zambia

*Kassaw Aragaw*, Soil Conservation, Ministry of Agriculture, Wollo, Ethiopia

*Marcelino Avila*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*Achoka Awori*, Kenya Energy Non-Governmental Organization (KENGO), P.O. Box 84197, Nairobi, Kenya

*Edmund G. C. Barrow*, Turkana Rural Development Programme, P.O. Box 175, Lodwar, Kenya

*Jean A. Bassett*, Project Développement Agroforestier, TCP/PRC/8861, c/o FAO, B.P. 972, Brazzaville, Congo

*Azene Bekele*, Community Forests and Soil Conservation and Development Department (CFSCDD), Ministry of Agriculture, P.O. Box 2597, Addis Ababa, Ethiopia

*Peter von Carlowitz*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*Albert E.O. Chabeda*, Ministry of Livestock Development, P.O. Box 34188, Nairobi, Kenya

*Reuben Chirchir*, Kenya Forestry Research Institute (KEFRI), P.O. Box 2, Embu, Kenya

*Bernard M. Chomba*, Silviculture Tending, Division of Forest Research, Forest Department, P.O. Box 22099, Kitwe, Zambia

*Peter A. Dewees*, Department of Forestry, Moi University, P.O. Box 3900, Eldoret, Kenya

*J. H. van Doorne*, Kerio Valley Development Authority, P.O. Box 2660, Eldoret, Kenya

*James F. Dunn*, United States Agency for International Development (USAID/Kenya), Union Towers Building, P.O. Box 30261, Nairobi, Kenya

*Trygve O. Foss*, Special Energy Programme - German Agency for Technical Cooperation (GTZ), P.O. Box 41607, Nairobi, Kenya

*Charles W. Gaiho*, BAT Kenya Ltd, P.O. Box 30000, Nairobi, Kenya  
*Gideon Gathaara*, Ministry of Energy, P.O. Box 30582, Nairobi, Kenya  
*Amare Getahun*, International Council for Research in Agroforestry (ICRAF),  
P.O. Box 30677, Nairobi, Kenya

*James J. Gichuki*, Permanent Presidential Commission on Soil Conservation and  
Afforestation, P.O. Box 30510, Nairobi, Kenya

*James Gitonga*, Forest Department, Bura Irrigation Scheme, P.O. Box 51,  
Bura/Tana, Kenya

*Haruyuki Hatori*, Kenya/Japan Social Forestry, Training Project, c/o Kenya  
Forestry Research Institute (KEFRI), P.O. Box 20412, Nairobi, Kenya

*Douglas R. Henderson*, Winrock International, Petit Jean Mountain, Morrilton  
AR 72110, USA

*R. Huggan*, International Council for Research in Agroforestry (ICRAF), P.O.  
Box 30677, Nairobi, Kenya

*Peter Huxley*, International Council for Research in Agroforestry (ICRAF),  
P.O. Box 30677, Nairobi, Kenya

*Abraham Igobwa*, Ministry of Environment and Natural Resources, P.O. Box  
30126, Nairobi, Kenya

*Paul Ilg*, Soil and Water Conservation Branch, Ministry of Agriculture, P.O. Box  
30028, Nairobi, Kenya

*Dominic E. Iyambo*, IUFRO Special Programme for Africa, ICRAF House,  
P.O. Box 30677, Nairobi, Kenya

*Christine H.S. Kabuye*, E.A. Herbarium, National Museums of Kenya, P.O. Box  
45166, Nairobi, Kenya

*Andrew Kahenya*, Ministry of Research, Science and Technology, P.O. Box  
25033, Nairobi, Kenya

*Irene N. Kamau*, International Council for Research in Agroforestry (ICRAF),  
P.O. Box 30677, Nairobi, Kenya

*P. M. Kariuki*, ACF Fuelwood Afforestation/Extension - Baringo, MENR/FAO,  
P.O. Marigat, Via Nakuru, Kenya

*David Kasuya*, Department of Resource Surveys and Remote Sensing,  
KREMU, P.O. Box 47146, Nairobi, Kenya

*Alice Kaudia*, Kenya Forestry Research Institute (KEFRI), P.O. Box 20412,  
Nairobi, Kenya

*Katherine M. Kealey*, International Council for Research in Agroforestry  
(ICRAF), P.O. Box 30677, Nairobi, Kenya

*Chris E.M. Keil*, World Bank, P.O. Box 30577, Nairobi, Kenya,

*Beatrice N. Khayota*, E.A. Herbarium, National Museums of Kenya, P.O. Box  
45166, Nairobi, Kenya

*Paul Kiepe*, International Council for Research in Agroforestry (ICRAF), P.O.  
Box 30677, Nairobi, Kenya

*Felician B. Kilahama*, Forestry and Beekeeping Division, P.O. Box 426, Dar-es-  
Salaam, Tanzania

*A. M. Kilewe*, Kenya Agricultural Research Institute (KARI), P.O. Box 30148, Nairobi, Kenya

*Norman N. Kimanzu*, VI Tree Planting Project, P.O. Box 2006, Kitale, Kenya

*P. I. D. Kinyua*, Department of Range Management, University of Nairobi, P.O. Box 29053, Nairobi, Kenya

*A. K. Kiroro*, National Environment Secretariat, P.O. Box 67839, Nairobi, Kenya

*J. O. Kokwaro*, Botany Department, University of Nairobi, P.O. Box 30197, Nairobi, Kenya

*Thomas Litscher*, Swiss Development Cooperation (SDC), Embassy of Switzerland, P.O. Box 30752, Nairobi, Kenya

*J. K. Lugadiru*, EMI Project, P.O. Box 110, Meru, Kenya

*B. Lundgren*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*Lill Lundgren*, Swedish International Development Authority (SIDA), Swedish Embassy, P.O. Box 30600, Nairobi, Kenya

*Robert MacDonald*, Kenya/Canada Energy Advisory Project, Ministry of Energy, P.O. Box 41122, Nairobi, Kenya

*John K. Maina*, Projects Office, Catholic Relief Services (CRS), P.O. Box 49675, Nairobi, Kenya

*John K. Maingi*, Forestry Research/Kenya Forestry Research Institute (KEFRI), Bura Fuelwood Plantation Project, P.O. Box 51, Bura/Tana, Kenya

*B. F. Makau*, Ministry of Planning and National Development, P.O. Box 30005, Nairobi, Kenya

*P. M. Makenzi*, Egerton University, P.O. Box 536, Njoro, Kenya

*Jane M. Mbaratha*, National Environment Secretariat, Ministry of Environment and Natural Resources, KENGO, P.O. Box 12159, Nairobi, Kenya

*Daniel K. Mbengei*, Forest Department, Ministry of Environment and Natural Resources, P.O. Box 2, Embu, Kenya

*Stephen G. Mbogoh*, Department of Agricultural Economics, University of Nairobi, P.O. Box 29053, Nairobi, Kenya

*S. Minae*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*C. D. K. Muchia*, Kenya Energy Non-Governmental Organization (KENGO), P.O. Box 48197, Nairobi, Kenya

*E. M. Muchiri*, Kenya Forestry College, P.O. Box 8, Londiani, Kenya

*John G. Mukinya*, Fisheries Department, Ministry of Regional Development, P.O. Box 58187, Nairobi, Kenya

*Pius W. Mumiukha*, Egerton University, P.O. Box 536, Njoro, Kenya

*Mathenge J. Munene*, Kenya Energy Non-Governmental Organization (KENGO), P.O. Box 48197, Nairobi, Kenya

*Robert C. Munro*, National Museums of Kenya, P.O. Box 45166, Nairobi, Kenya

*Anthony W. Muriithi*, Beekeeping Branch, Ministry of Livestock Development, P.O. Box 34188, Nairobi, Kenya

*Cyrus Mutahi Ndegwa*, Baringo Fuelwood Afforestation Extension, P.O. Box 30470, Nairobi, Kenya

*Stachys N. Muturi*, Ministry of Research, Science and Technology, P.O. Box 25033, Nairobi, Kenya

*Ndegwa Ndiang'ui*, E.A. Herbarium, National Museums of Kenya, P.O. Box 45166, Nairobi, Kenya

*Francis Ng'ang'a*, Forest Department, Ministry of Environment and Natural Resources, P.O. Box 30513, Nairobi, Kenya

*Annalee Ng'eny-Mengech*, Chemistry Department, University of Nairobi, P.O. Box 30197, Nairobi, Kenya

*Bernard J.M. Ngoda*, Egerton University, Natural Resources Department, P.O. Box 536, Njoro, Kenya

*Eliud K. Ngunjiri*, OXFAM, P.O. Box 40680, Nairobi, Kenya

*Roger S. Nield*, Biomass Advisor, Kenya/Canada Energy Advisory Project, Ministry of Energy, P.O. Box 41122, Nairobi, Kenya

*Titus Njagi*, Permanent Presidential Commission on Soil Conservation and Afforestation, P.O. Box 30510, Nairobi, Kenya

*Daniel M. Njiru*, Dryland Agroforestry Research Project/Kenya Forestry Research Institute (KEFRI), P.O. Box 340, Machakos, Kenya

*Jesse T. Njoka*, Department of Range Management, University of Nairobi, P.O. Box 29053, Nairobi, Kenya

*Crispus R.J. Nyaga*, Ministry of Environment and Natural Resources, P.O. Box 30513, Nairobi, Kenya

*Daniel Nyamai*, Kenya Forestry Research Institute (KEFRI), P.O. Box 20412, Nairobi, Kenya

*Nelson N. Nyandat*, National Council for Science and Technology (NCST), P.O. Box 30623, Nairobi, Kenya

*Jeff A. Odera*, Kenya Forestry Research Institute (KEFRI), P.O. Box 20412, Nairobi, Kenya

*Norbert Odero*, Fisheries Department, Ministry of Regional Development, P.O. Box 58187, Nairobi, Kenya

*Fredrick M. Odok*, Ministry of Agriculture, P.O. Box 30028, Nairobi, Kenya

*Arthur Okoth-Owiro*, Faculty of Law, University of Nairobi, P.O. Box 30197, Nairobi, Kenya

*Aku O'Ktingati*, Faculty of Forestry, Sokoine University of Agriculture, P.O. Box 3009, Morogoro, Tanzania

*W. Oluoch-Kosuni*, Department of Agricultural Economics, University of Nairobi, P.O. Box 29053, Nairobi, Kenya

*Eliud O. Omolo*, International Centre of Insect Physiology and Ecology (ICIPE), Mbita Point Field Station, P.O. Box 30, Mbita, Kenya

*Loice A. Omoro*, Soil and Water Conservation Branch, Ministry of Agriculture, P.O. Box 30028, Nairobi, Kenya

*Obiero Ong'any'a*, Wildlife Clubs of Kenya, P.O. Box 4201, Kisumu, Kenya

*P.T. Otieno*, Cooperative for American Relief for Everywhere (CARE Kenya), P.O. Box 526, Homa Bay, Kenya

*F. Owino*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*J. B. Raintree*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*M. R. Rao*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*Dianne E. Rocheleau*, Ford Foundation, P.O. Box 41081, Nairobi, Kenya

*J. H. Roger*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*Christian Schaefer*, Kenya Forestry Research Institute (KEFRI), c/o GTZ, P.O. Box 41607, Nairobi, Kenya

*Sara J. Scherr*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*Salim B. Shaaban*, Ministry of Livestock Development, P.O. Box 34188, Nairobi, Kenya

*Martin Shimba*, Department of Resource Surveys and Remote Sensing, KREMU, P.O. Box 47146, Nairobi, Kenya

*Samuel Simute*, Forest Department, P.O. Box 510095, Chipata, Zambia

*G. B. Singh*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*Geoffrey M. Swara*, Ministry of Planning and National Development, P.O. Box 30007, Nairobi, Kenya

*Bo Tengnas*, RSCU, Swedish International Development Authority (SIDA), P.O. Box 30600, Nairobi, Kenya

*Rolf Tjernstrom*, Soil and Water Conservation Branch, Ministry of Agriculture, P.O. Box 30028, Nairobi, Kenya

*James N. Waiyaki*, Ministry of Research, Science and Technology, P.O. Box 30568, Nairobi, Kenya

*Kirsten N. Walter*, Royal Danish Veterinary Agricultural University, Department of Plant Pathology, Thomsdalsensvej 40, Copenhagen, Denmark

*Dierk Walther*, German Agricultural Team, Range Management Handbook, P.O. Box 47051, Nairobi, Kenya

*B. G. Wamugunda*, Forestry/RAES, Ministry of Environment and Natural Resources, P.O. Box 30515, Nairobi, Kenya

*Fredrick J. Wang'ati*, National Council for Science and Technology (NCST), P.O. Box 30623, Nairobi, Kenya

*William W. Wapakala*, Kenya Agricultural Research Institute (KARI), P.O. Box 57811, Nairobi, Kenya

*Richard K. Wataaru*, Genebank of Kenya, Muguga, P.O. Box 781, Kikuyu, Kenya

*Katsura Watanabe*, Social Forestry Training Project, c/o JICA Office, P.O. Box 50572, Nairobi, Kenya

*J. Y. Wawiye*, Forest Department, Ministry of Environment and Natural Resources, P.O. Box 30513, Nairobi, Kenya

*Y. Yanagihara*, Social Forestry Training Project, c/o JICA Office, P.O. Box 50572, Nairobi, Kenya

*Anthony Young*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya

*Robert Zimmermann*, Swiss Development Cooperation (SDC), East Africa Section, 3003 Bern, Switzerland

*Ester Zulberti*, International Council for Research in Agroforestry (ICRAF), P.O. Box 30677, Nairobi, Kenya