

JAPAN INTERNATIONAL COOPERATION AGENCY
THE REPUBLIC OF KENYA
MINISTRY OF RESEARCH, TECHNICAL TRAINING
AND TECHNOLOGY

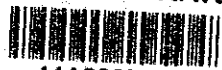
BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR EXPANSION
OF
NURSERY TRAINING CENTRE FOR SOCIAL FORESTRY
IN
THE REPUBLIC OF KENYA

OCTOBER, 1993

YAMASHITA SEKKEI INC.

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YAMASHITA SEKKEI INC.

PREFACE

In response to a request of the Government of the Republic of Kenya, the Government of Japan decided to conduct a Basic Design Study on the Project for Expansion of Nursery Training Centre for Social Forestry and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Kenya a study team headed by Mr. Yutaka Sasaki, Director, Planning Division, Forestry and Fisheries Development Cooperation Department, JICA and constituted by members of Yamashita Sekkei Inc. from May 31 to June 29, 1993.

The team held discussions with the officials concerned of the Government of Kenya, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Kenya in order to discuss a draft report, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Kenya for their close cooperation extended to the team.

October, 1993



Kensuke Yanagiya

President

Japan International Cooperation Agency

October, 1993

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

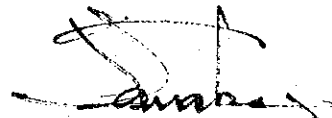
We are pleased to submit to you the basic design study report on the Project of Expansion of Nursery Training Centre for Social Forestry in the Republic of Kenya.

This study was conducted by Yamashita Sekkei Inc., under a contract to JICA, during the period May 25 to October 8, 1993. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Kenya and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

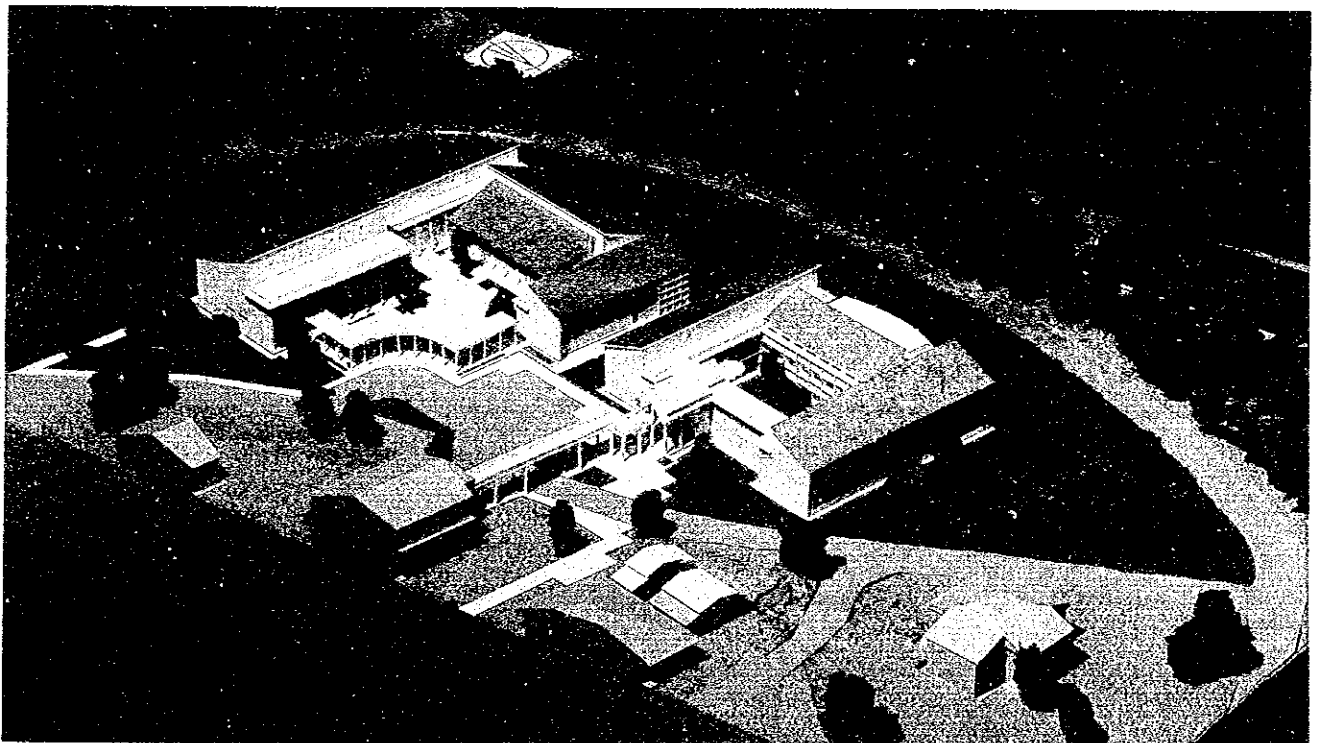
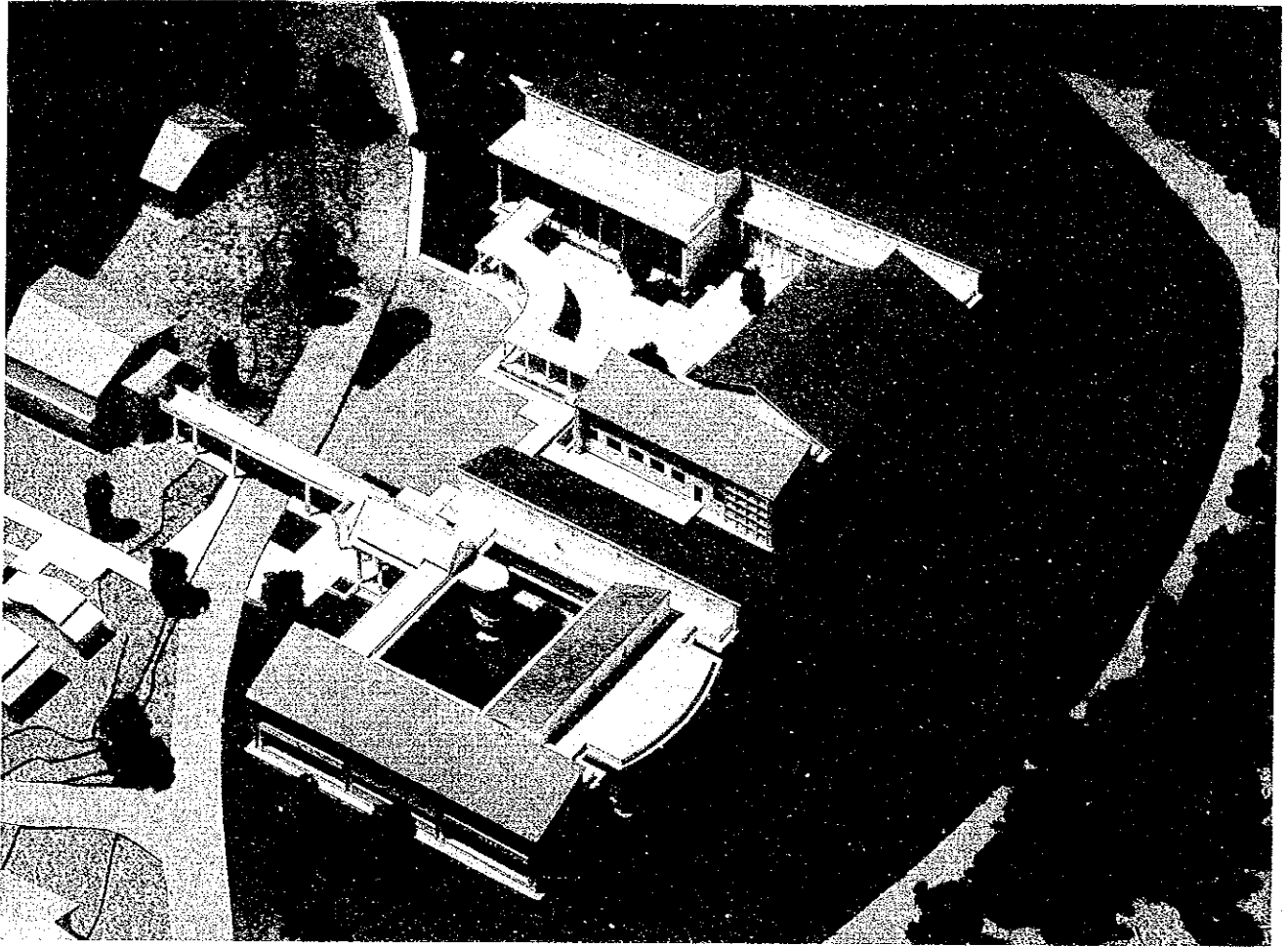
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, and the Ministry of Agriculture, Forestry and Fisheries. We would also like to express our gratitude to the officials concerned of Kenya Forestry Research Institute, Ministry of Research, Technical Training and Technology, the JICA Kenya office, the Embassy of Japan in Kenya for their cooperation and assistance throughout our field survey.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

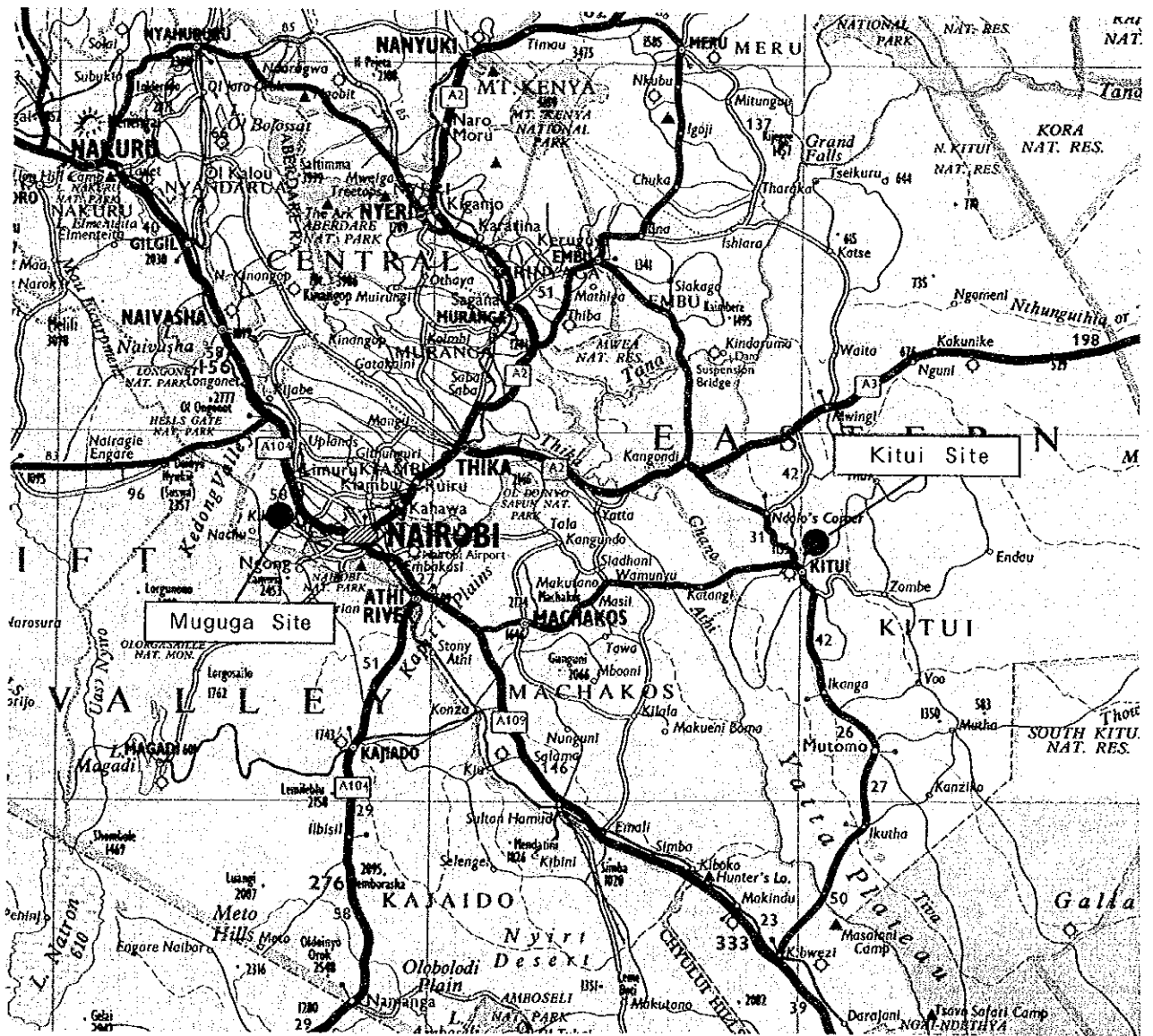
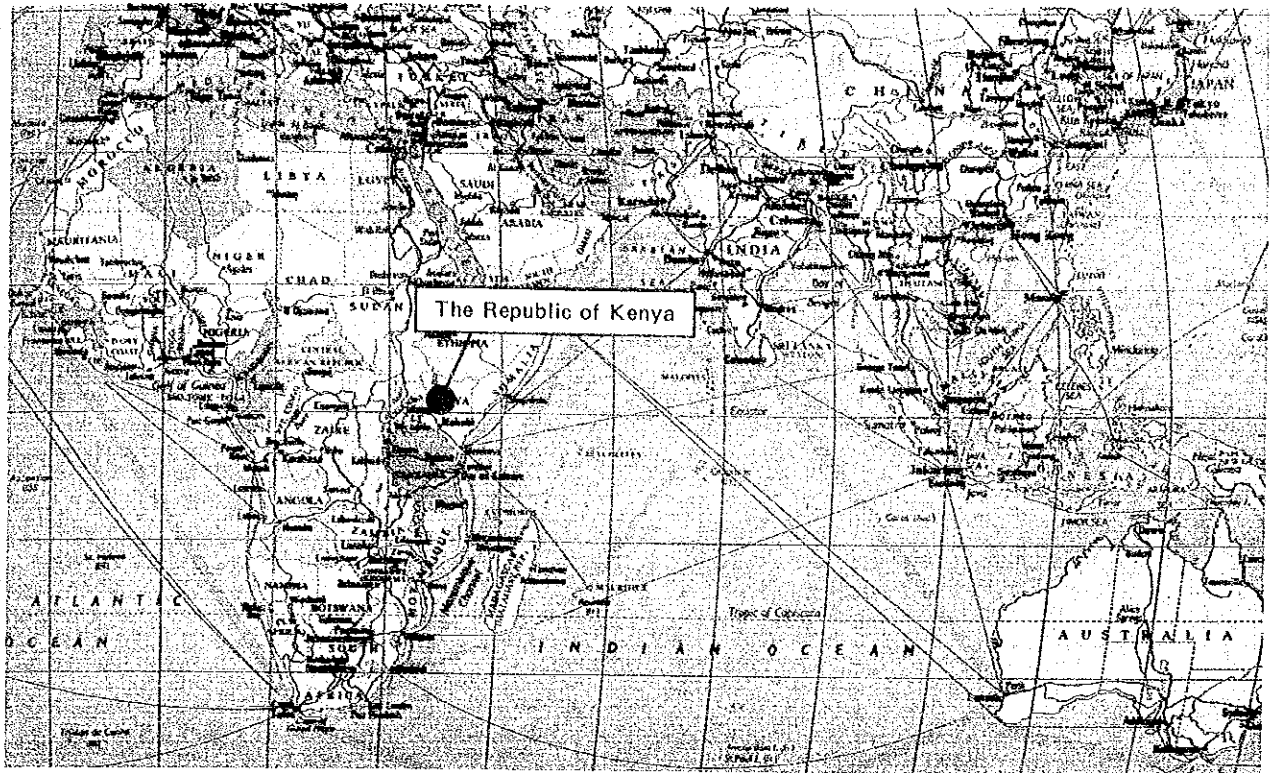


Takanori Tanaka
Project Manager,
Basic design study team on
the Project for Expansion of
Nursery Training Centre for
Social Forestry
Yamashita Sekkei Inc.

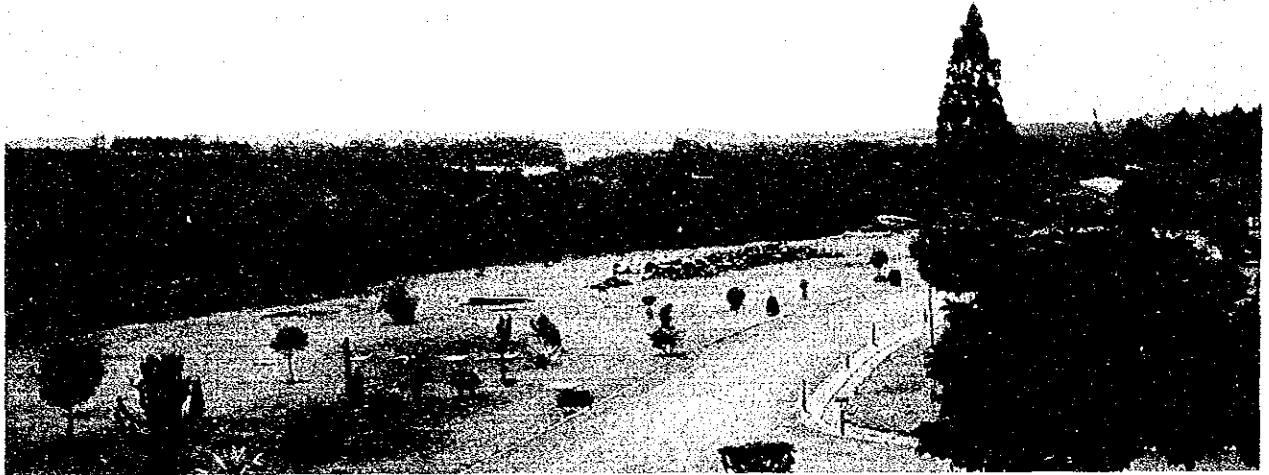


The Project for Expansion of Nursery Training Centre
for Social Forestry

Muguga Centre Perspective



SITE LOCATION MAP



Proposed construction site at Muguga



Proposed construction site at Kitui

SUMMARY

SUMMARY

The Republic of Kenya used to have ample forest resources. At present, however, the total area of closed forest land accounts for only 3 percent of the country's total land area as a result of the reclamation, slash-and-burn farming and excessive pasture. In the case of shrub land which represents about 65 percent of the country's total land area, the sharp increase in demand for woodfuel, which has resulted from the growth in the country's population, is threatening to drain shrubs which are the main source of fuelwood and charcoal. The decrease in closed forest and shrub resources is serious particularly in the arid and semi-arid areas, which accelerate the destruction of nature and desertification.

Under such circumstances, the methodology of "social forestry" was introduced as an effective means of promoting the production of fuelwood and charcoal while retaining forest resources. Conceptual definition of social forestry envelops all those forestry activities conducted outside the closed forest land areas by rural communities for their own direct and indirect benefits and experimental projects to promote the extension of social forestry are being implemented in various parts of the country. However, promotion of social forestry requires comprehensive research on the technical, personnel, economic and social aspects of the methodology. It is particularly important to expand the scope of basic forestry research and to nurture experts in forestry.

Kenya Forestry Research Institute (KEFRI) is Kenya's public research organization specializing in forestry research. KEFRI has its headquarters in Muguga, a suburb of Nairobi city. Its headquarters and 20 national and regional centres are jointly carrying out training and information collecting and managing operations. However, the research

facilities of Muguga Centre, which is playing a pivotal role in the research work, are dispersed in four different places out of its premises, borrowing laboratories and equipment from other organizations. Furthermore, its national centres and regional centres are not provided with sufficient research facilities. As a result, it is difficult for KEFRI to carry out research work it ought to do. It is also suffering from a shortage of training/extension facilities, which makes it difficult to organize seminars and conferences or to prepare training materials.

With above background, the Government of Kenya requested the Government of Japan to provide a grant aid for the improvement of the facilities and equipment of Muguga Centre, Kitui Centre, Maseno Centre and Marigat Centre of KEFRI to strengthen the country's forest research system with utmost emphasis on the extension of social forestry.

In response to the request, the Government of Japan decided to conduct a basic design study, and the Japan International Cooperation Agency (JICA) dispatched a basic design study team to Kenya from May 31 to June 29, 1993 to confirm the contents of the request and examine the basic design of facilities and equipment as well as the necessity and propriety of Japan's grant aid for the project. After returning to Japan, the basic design study team analyzed the collected data and prepared a draft final report outlining the basic design of necessary facilities and equipment. This final report was prepared after the draft final report was explained to the Government of Kenya from September 7 to 18, 1993.

Kenya Forestry Research Institute (KEFRI) is the executing agency of the project. KEFRI plays a central role in the forestry research of the country and its headquarters and 20 national and regional centres are jointly carrying out operations in the four main areas of research, training/extension, experimental plantation and publication.

This project is to expand the existing facilities of Muguga Centre and Kitui Centre of KEFRI, which were founded by a Japan's grant aid cooperation in 1985, aiming at improving the basis for the extension of social forestry by means of promotion of positive forestry research as well as diffusion of forestry technologies. More specifically, this project includes integration of Muguga Centre's research facilities for ten (10) fields of forestry research, which are dispersed around the centre's premises and construction of conference facilities and publication facilities necessary for the training/extension. And the project also includes construction of research facilities for Kitui Centre required to start research on three fields of forestry in semi-arid area. It is expected that this project will contribute to the comprehensive forestry research including semi-arid forestry and to enhancement of the training/extension of social forestry technologies effectively. Since the facilities expanded under this project are to be operated and managed by the existing personnel of KEFRI, there will be no need to increase the number of researchers and engineers in implementing this project.

The additional operational costs which KEFRI needs to appropriate after completion of the project is only the cost of maintenance and operation of the additional facilities and equipment, which is estimated at 1,880,000 Kshs (about ¥3,140,000). There is no need to increase the amount of personnel expenses. The amount of the additional operational cost is equivalent to 0.4 percent of the total budget of the Ministry of Research, Technical Training and Technology for fiscal 1992-93 and 2.5 percent of that of KEFRI. For these reasons, budgetary appropriations for the operation of the additional facilities to be procured under this project is judged feasible.

Shown below is the outline of the facilities and equipment required to realize the above-mentioned functions.

- Project sites : 1. The premises of the existing Muguga Centre
Muguga, Kiambu District, Central Province
- 2. The premises of the existing Kitui Centre
Kitui City, Kitui District,
Eastern Province

- Size of the facilities

Muguga Centre total floor space	:	4,855 m ²
Kitui Centre total floor space	:	864 m ²
Outdoor facilities	:	788 m ²
Total		6,507 m ²
(Repair of existing facilities	:	890 m ²)

- Structure and No. of stories:

: 2-story reinforced concrete buildings

- Outline of the facilities and equipment space:

Centre	Building	Facility	Equipment
Muguga	Research Bldg.	Tree Breeding	Clean bench, Gel electrophoresis apparatus, Autoclave
		Soil Science	Clean bench, N/C analyzer, Rotary evaporator
		Physiology	Clean bench, Drying oven, Colony counter
		Forest Ecology	Leaf area meter, Pressure bomb, Tree measuring equipment
		Agroforestry	Atomic absorption spectrophotometer, Growth cabinet, Shaker, pH meter
		Biotechnology	Fourier transform infrared spectrophotometer, Gas chromatograph, Growth cabinet
		Entomology	Clean bench, Centrifuge, Rotary evaporator, Colony counter
		Forest Pathology	Centrifuge, Gel electrophoresis apparatus, Blender/homogenizer
		Common Lab.	Grinding mill, Microtome unit, Soil humidity tester, Electronic precision balance
		Researcher's office/ Analysis Room	Personal computer, Cabinet for instruments
	Information Centre		Multipurpose Hall
Data Room			
Office, Clinic, Library, etc.			Personal computer, Consultation bed, Bed, Chemical/instrument cabinet, Bus

Centre	Building	Facility	Equipment
	Others Facilities	Greenhouse	Mist propagation unit, Soil heater, Shading net
		Nursery House	Water still, Balance
	Remodeling	Existing Research Bldg.	Water still, Soil moisture meter, pH meter, Planimeter
		Dining Hall, Library, Bore Hole	Water tank truck, Pump
Kitui	Research Bldg.	Soil Science	Clean bench, Centrifuge, Growth cabinet, Autoclave
		Semi-dryland Silviculture	Leaf area meter, Pressure bomb, Tree measuring equipment
		Soil Forestry	Deep freezer, Refrigerator
		Culture Room, Library, Conference	Growth cabinet, Rack
	Seed Storage	Seed Storage at Tiva	Rack
	Remodeling	Library, Office, Bore Hole	Pump

In case this project is to be implemented under Japan's grant aid cooperation, it will be reasonable that the construction work should be executed in a single phase (12 months) judging from the size of the facilities and the condition of the local construction industry.

In case this project is implemented and the research facilities and equipment as well as necessary facilities for training/extension activities of KEFRI for social forestry are expanded and improved, the environment for forestry research and training activities will be improved. This will contribute to the extension of social forestry and the preservation of forest resources. In view of the fact that KEFRI is playing a key role in forestry research in East African countries, it is expected that the advancement of social forestry in Kenya will have great ripple effects in the entire East African region.

As is clear from the above descriptions, it is expected that many positive effects are expected from this project and that this project will greatly contribute to the preservation of forests in Kenya. For this reason, it is significant to implement this project under the grant aid cooperation of the Government of Japan.

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LETTER OF TRANSMITTAL

PERSPECTIVE

SITE LOCATION MAP

PROPOSED CONSTRUCTION SITE

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1. Members of the Basic Design Study Team
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CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

The Government of Kenya has been promoting the social forestry programme in order for preservation of forest resources and formulated a project to expand facilities of Muguga National Centre and Kitui Regional Centre of Kenya Forestry Research Institute (KEFRI) as well as to construct facilities and to procure equipment for KEFRI's two other centres, Maseno National Centre and Marigat Regional Centre. Muguga Centre and Kitui Centre were founded in 1985 by Japan's grant aid as the Establishment Project of Nursery Training Centre for Social Forestry. With above background, the Government of Kenya requested the Government of Japan to provide a grant aid for the project as the second phase of the Japan's grant aid project.

In response to the request, the Government of Japan decided to conduct a basic design study, and the Japan International Cooperation Agency (JICA) dispatched a basic design study team headed by Mr. Yutaka Sasaki, Director, Planning Division, Forestry & Fisheries Development Cooperation Department, Japan International Cooperation Agency, to Kenya from May 31 through June 29, 1993. Through the field survey, the basic design study team confirmed the contents of the request and discussed the background of the project with the Government of Kenya, and made the following investigations to examine the possibility of the Japan's grant aid cooperation in implementation of this project.

1. Analysis of the background and appropriateness of the project
2. Investigation of the present state of the four centres of KEFRI
3. Discussion on the scope of activities and future plans of KEFRI

4. Examination of the necessity and details of the requested facilities and equipment
5. Confirmation of the implementation system of the project and budgetary appropriations for the work which shall be borne by the Kenyan side
6. Survey of the project sites
7. Investigation of the present situation of the local construction industry

After returning to Japan, the basic design study team analyzed the results of the field survey and prepared a draft final report of the basic design of the facilities as well as necessary items of equipment. The contents of the draft final report was explained to the Kenyan side by the explanation team headed by Mr. Yutaka Sasaki, Director, Planning Division, Forestry & Fisheries Development Cooperation Department, JICA which was dispatched to Kenya from September 7 through September 18, 1993.

This report presents the results of the above-mentioned surveys.

Member lists of the basic design study team, the survey schedules, a member list of concerning parties of the Government of Kenya and the minutes of the discussions are attached at the end of this report.

CHAPTER 2 BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 Present State of Forestry in Kenya

2-1-1 Forestry Resources

(1) Natural Environment

The Republic of Kenya is situated on the eastern coast of the African continent, from lat. 4°S to lat. 4°N and from long. 34°E to long. 42°E. The country has an area of about 569,000km², of which 528,600km² consists of the total land area.

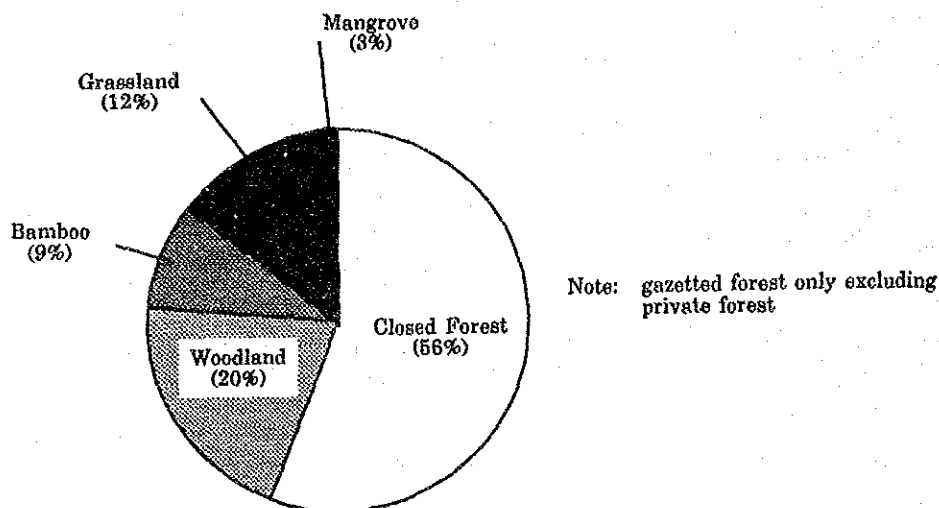
The country is divided into 6 ecological zones reflected by a wide range of difference in the rainfall, temperatures, altitude and soil.

Table 2-1 Ecological Zones

Zone	Covered Area km ² (%)	Rainfall (mm)	Note
Zone I	800 (1)	2000 more	High altitude of more than 3,000 m above sea level. Barren afroalpine moorland areas, such as the peaks of Mt. Kenya and Mt. Elgon.
Zone II	53,000 (9)	1000~2000	Kenya's high potential land area which includes forests and agricultural areas between altitudinal range of 1,000 ~3,000m. Nairobi-city is in this zone.
Zone III	53,000 (9)	750~1,250	Dry sub-humid to semi-arid area which carries a variable vegetation cover of woodland, bushland or savanna. It covers the mixed farming region for wheat, barley, maize and livestock production.
Zone IV	53,000 (9)	500~750	Semi-arid area which vegetation is dry from of woodland, savanna or bushland. Important for livestock production.
Zone V	279,000 (49)	250~500	Arid area which vegetation is woody often of shrubby habit. Development of this zone is important for Kenya's economy.
Zone VI	131,000 (23)	250 less	Very arid. Vegetation is dwarf shrub grassland or a very dry form of bushed grassland.

(Source: KEFRI)

show that the total area of closed forest land is 1,700,000 ha, which accounts for only about 3 percent of the total land area of the country.



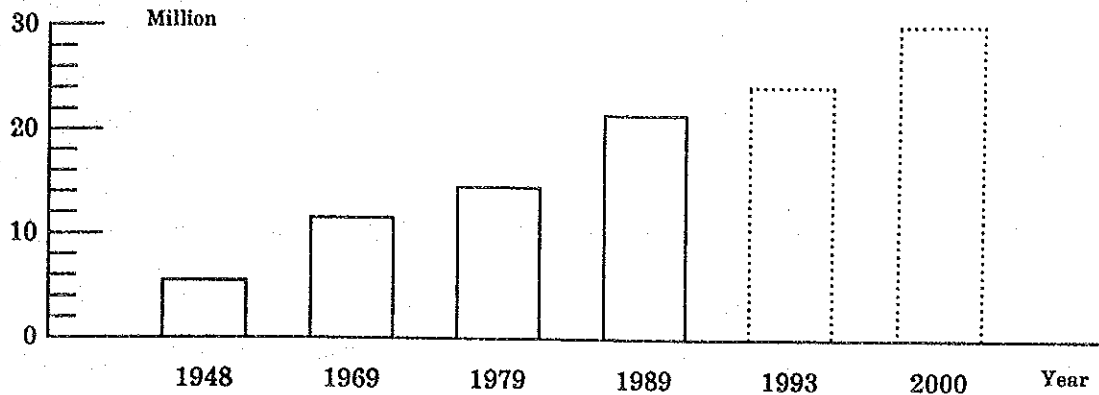
(Source: Central Bureau of Statistics)

Fig. 2-1 Classification of Forests

(2) Population

In 1989, Kenya had a population of about 21,000,000. As indicated in figure 2-2, the country's population is on the increase as a result of the decrease in the death rate and the infant mortality, which was attributable to the recent improvement in the quality of the country's health care. At present, the growth rate of the country's population is a high 3.3 percent. It is expected that the country's population will reach the 30,000,000 mark in the year 2000 when it continues to increase at the present rate. The national average population density is 20 persons/km², that for the semi-arid areas being 5 persons/km² and that for the arable land areas being 700 persons/km². Particularly noteworthy is the population concentration in the urban areas. It is projected that the annual rate of growth of the population in Nairobi, the capital of the country, will reach 7.9 percent. According to a survey conducted in 1989, it is estimated that 15 percent of the country's total population is

concentrated in the arable land areas, including urban areas, which make up only 15 percent of the total area of the country.



(Source: Ministry of Planning)

Fig. 2-2 Population Growth

The rapid growth of the country's population has led to an increase in domestic demand for fuelwood and charcoal wood, which in turn has resulted in a decrease in the country's forest resources.

(3) Demand for Wood

In Kenya, forests have long been utilized as important resources for the social development of the country. Forests have been a direct source of supply of timber, fuelwood and charcoal wood, pulp, food and feed. They have also been an indirect source of supply of manure, which has been instrumental in preventing the outflow of topsoil. As such, forests have been playing a vital role in the country's agricultural production.

1) Timber

Kenya is currently self sufficient in timber. No timber is imported at the moment except for small amount of hard wood timber. In the case of softwood, plantation projects have been implemented and as a result it is possible to produce 430,000 tons of softwood a year. It is predicted that over the next decade the supply will exceed the

demand. While the country has the ability to export softwood, its export is banned from the standpoint of preservation of forest resources.

2) Pulp

In Kenya, paper consumption has increased sharply reflecting the rapid growth of the country's economy in recent years. As a result, demand for pulp and timber as the raw material of paper is on the rise. In 1990, annual pulp production stood at 350,000 m³. Although, pulp is in short supply at present, it is predicted that pulpwood production will become large enough to meet domestic demand in 10 years as shown in figure 2-3.

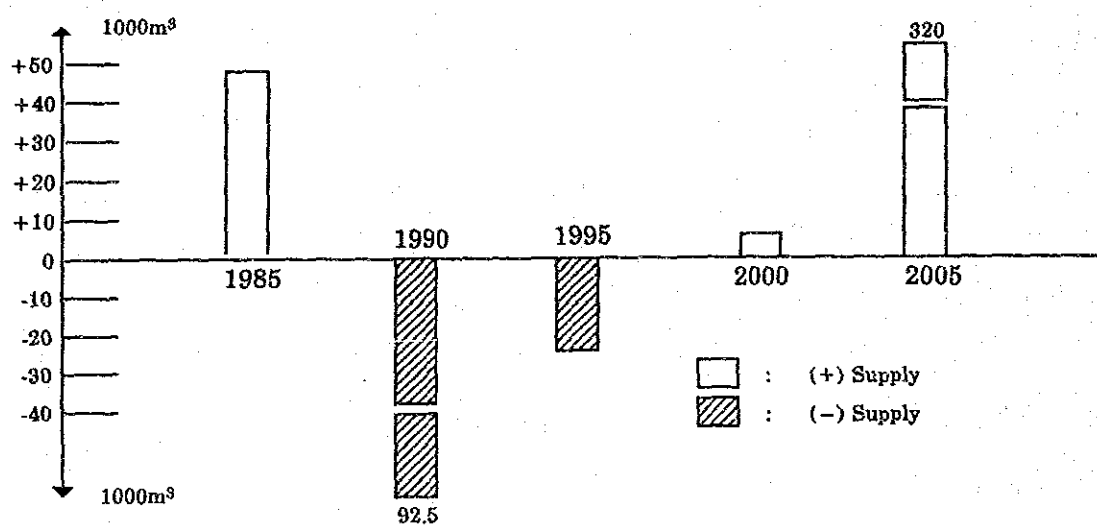


Fig. 2-3 Demand-Supply of Pulp

3) Fuelwood and Charcoal Wood

According to tentative calculations by KEFRI, fuelwood and charcoal wood meet more than 90 percent of demand for energy for home use and 77 percent of the country's total demand for energy. Of the country's total production of forest products for 1990, 33,820,000m³ or 95 percent was fuelwood and charcoal wood production, of which 62 percent

was fuelwood production and 33 percent charcoal wood production. Most of the fuelwood and charcoal wood are supplied from those pruned or felled in shrub forests. The closed forests, on the other hand, forests account for less than 5 percent of the total supplies of fuelwood and charcoal wood.

Demand for fuelwood and charcoal wood has been continuing to increase in keeping with the rise in the country's population. According to the Ministry of Energy, it is expected that by the year 2000 the supply of fuelwood and charcoal wood will be short of the demand by about 45,000,000m³, which is 1.6 times as large as the current annual supply, as shown in figure 2-4.

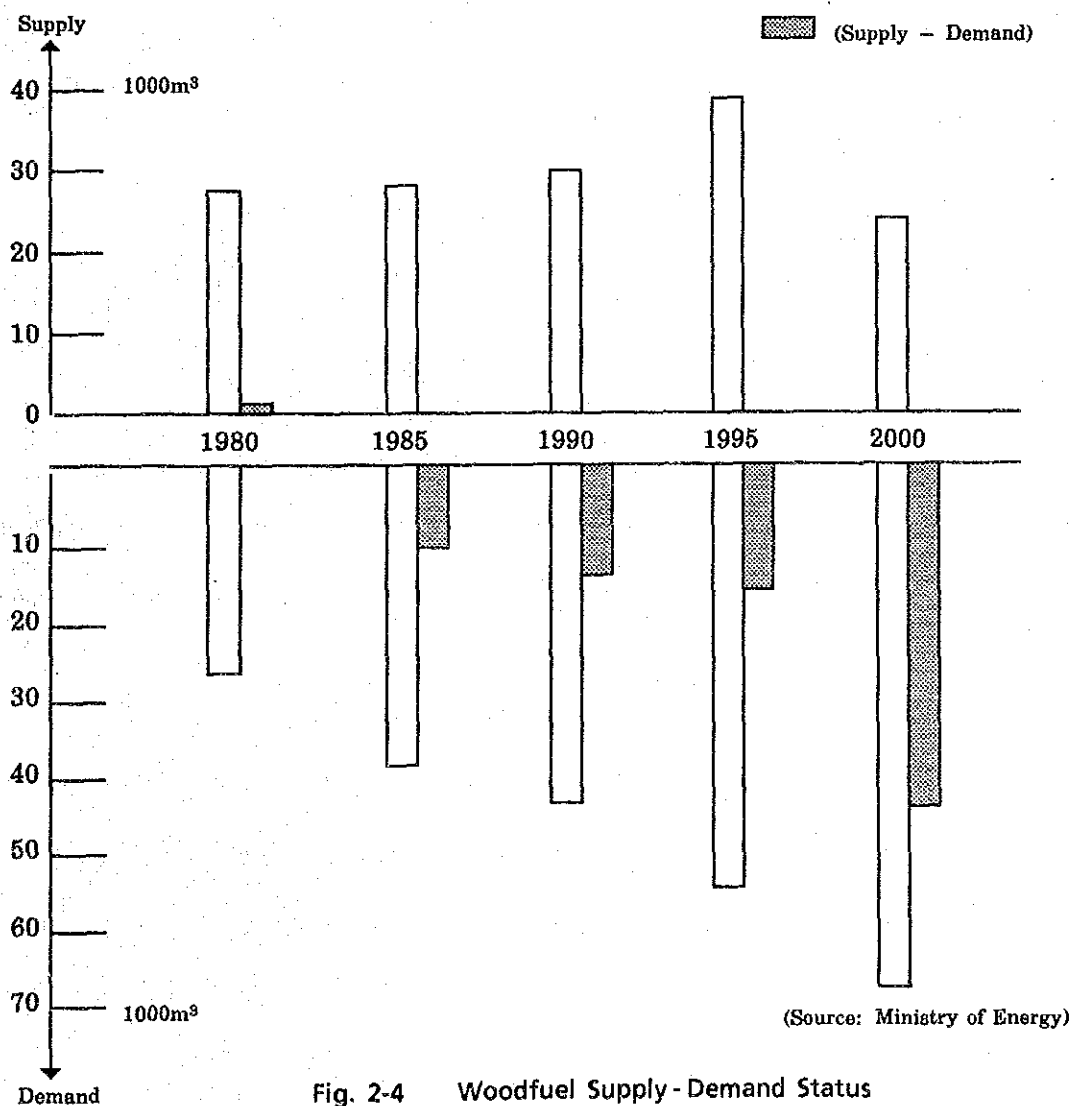


Fig. 2-4 Woodfuel Supply-Demand Status

In Kenya, demand for wood is increasing in keeping with the growth of the country's population. According to the World Bank Report of 1986, the country's total area of closed forest land is decreasing by 19,000 ha a year. In addition, since most of the supplies of fuelwood and charcoal wood come from shrubs, the felling of wood is detrimental to the growth of shrubs. The serious decrease in shrubs in the semi-arid areas is considered a factor aggravating the destruction of nature and desertification. At the same time, the increase in the country's population has brought about a strong need to increase food production, which in turn has prompted efforts to clear forest land for cultivation and livestock feed. All this has accelerated the decrease in forests.

2-1-2 Necessity of Forestry Research

The felling of fuelwood and charcoal wood has been the main factor to cause the decrease in forest resources. In the non-urban areas, in particular, fuelwood and charcoal are the main fuels for home use. In the country, fuelwood and charcoal meet more than 70 percent of total demand for energy. While it is very likely that demand for wooden fuels will continue to increase in keeping with the growth of the country's population, it is estimated that their supply will begin to decrease in 1995. If the supply-demand situation remains unchanged, it will be impossible to arrest the continuing decrease in forests. In addition to the felling of fuelwood and charcoal wood, cultivation to forests and grazing of livestock in forests which relates to the matters of farm life are also eroding forest resources.

Under such circumstances, research in various fields of forestry, which is aimed at securing more supply of fuelwood and preserving forests, is being conducted in Kenya.

(1) Extension of Social Forestry

The most direct means of preserving forests is plantation. It is judged to be difficult to maintain or recover forest resources through plantation projects only in light of the following factors.

1. Since tracts of land which are suited for growing trees are also suited for farming, increasing numbers of such tracts of land are used for the production of food to cope with the increase in the country's population. Forests in such tracts of land are decreasing, and it is difficult to plant such tracts of land.
2. When a semi-arid area is planted for the wood supply, it takes a long time -- from plantation to wood production -- to recover the investment money. In view of the small accumulation of capital in the economy of the country, it is very unlikely that investment will be made in plantation in the semi-arid areas.
3. Many farmers in Kenya own small farmland, most of which is used mainly for the production of food. This means that few farmers have additional tracts of land for use in plantation.

In Kenya, "social forestry" is used as an effective means of evading such difficulties and promoting the production of fuelwood and charcoal wood. This is a system in which community residents produce fuelwood, charcoal wood and trees to be used as feed for their own consumption. It is aimed at preventing the further decrease in forests. Although the importance of social forestry is well understood, a standard method of

actually implementing the system is not yet established. The method varies from one area to another depending on the ecological conditions and socio-economics conditions. For example, in highlands and arable land districts in the high-rain areas, where fast-growing trees and fruit trees are planted, it will be easier to introduce agroforestry. In the semi-arid areas, on the other hand, it is necessary to select and plant trees which are highly resistant to dryness in arable land and grazing land districts.

(2) Present State of Forestry Research

The Government of Kenya has worked out the following guidelines, which are centered on the extension of "social forestry", with the aim of preventing the further decrease in forests and promoting the production of fuelwood, charcoal wood and other wood resources.

- ① scientific development of social forestry and agroforestry systems
- ② expanding forest management into the arid and semi-arid areas
- ③ increasing per unit land and labour wood productivity through tree improvement and the development and use of high biotechnology packages
- ④ energy conservation and improvement efficiency in utilization of wood

In Kenya, forestry research is being conducted in accordance with these guidelines, and satisfactory results are being attained in the research on trees suited for planting in the country, the development of plantation technologies, and the establishment of a system for production, sales and use of wooden products. Given below is the outline of the contents of forestry research conducted mainly by KEFRI.

Table 2-2 Achievement Forestry Research

Category	Field	Activities
1. Silviculture	(1) Tree Improvement	This is the oldest field of forestry research, in which studies on types of trees suited for the local natural conditions and forest development technologies are conducted.
	(2) Raising of Tree Seedling	Research on the size of nursery trees, the timing of nursery tree growing and the selection of suitable nursery trees, all of which are necessary for the production of strong trees. At present, more emphasis is placed on research on the production of nursery trees for use in social forestry.
	(3) Forest Plantation Practice	In the past, research in this field was conducted mainly on tree planting technologies for use with imported trees. At present, however, more emphasis is placed on research on tree planting technologies related to the existing types of trees and social forestry.
	(4) Tree Seed Technology	Thus far, this field of forestry research has covered the selection, preservation and distribution of seeds, in addition to research on seed. From now on, however, the practical aspects of research in this field will be transferred to local organizations.
	(5) Arid and Semi-Arid Lands	Extensive research has been continued on afforestation in the arid and semi-arid lands. The main subjects include preparation of afforested tracts of land, selection of types of trees, investigation of water sources, irrigation management, and introduction of new species.
	(6) Natural Forest Ecology and Management Research	The ecological study of natural forest is the main research activity in this field. In recent years, however, the scope of research in this field has been expanded to include research on bamboo and rattan. Most research themes concern the production of a wide variety of natural forests.
	(7) Growth and Yield Research	Until most recently no significant progress has been made in this field. Research aimed at the preservation of natural forests has just been started. The Forest Department is responsible for research on natural forests.
2. Forest Protection	(1) Forest Pathology	Research in this field, which was started in the 1960s, is conducted on diseases that trees contract in all stages of tree raising. Various types of tree diseases have been discovered through research in this field.
	(2) Forest Entomology	Significant progress has been made in research on insects causing damage to forests. In recent years, greater emphasis is placed on research on damage caused by termites in arid areas.
	(3) Forest Fires	Forest fires are on the increase. At present, 5.9 percent of forest land is lost due to forest fires. Research on prevention of forest fires is still in its rudimentary stages.
3. Forest Products Research and Wood Science		Research on the chemical properties of useful trees and tree processing technologies necessary for effective use of trees.

However, the following problems have been pointed out concerning the extension of social forestry, which is one of the main themes of these research activities.

1. Development of technologies necessary for social forestry is going slower than expected.

2. Training of the extension officers/staff is insufficient.
3. Means of extending the social forestry (equipment and facilities) is in short supply.
4. Sufficient information is not provided to community residents.

In order to extend social forestry, which is considered very effective in preserving the country's forest resources, it is necessary to promote forestry research, which forms the basis of social forestry. At the same time, it is important to train forestry researchers.

2-1-3 Forestry Policies and Research Organizations

The Government of Kenya has taken various forestry policy measures and established a number of forestry research organizations with the aim of making effective use of, and preserving, forest resources. Given below is the outline of the Government of Kenya's forestry policies and the country's main forestry research organizations.

(1) Forestry Policies

The Government of Kenya's forestry policies were initially aimed at promoting the production of forest products for industrial use. As the problem of decrease in forest resources surfaced as a result of the rapid increase in the country's population, it has become more centered around social forestry. Given below is the outline of the Government of Kenya's major forestry policies implemented thus far.

1) Forestry White Paper No. 84 1957

Detailed in this white paper was a policy to introduce foreign trees to enhance productivity in forestry. The policy included the methods of selecting exotic species and growing trees and the planned number of each type of exotic tree to be introduced. This policy was the Government of Kenya's first forestry policy measure.

2) Sessional Paper No.1, 1968

This was the Government of Kenya's full-fledged forestry policy measure aimed at giving concrete guidelines for promoting the growth of forestry while preserving forest resources. The policy measure formed the basis for the government's subsequent forestry policy measures. The sessional paper contained the following 10 concrete guidelines as shown in table 2-3.

Table 2-3 Forestry Policy in Sessional Paper No.1

Item	Policy
1. preservation	to preserve the existing forest resources
2. protection	to protect forests against fires and livestock
3. management	to increase profitability through forest management
4. industry	to promote the growth of forest products processing industry
5. finance	to take sufficient financial measures
6. employment	to promote employment related to plantation
7. state forest	to improve forest management
8. private forest	to protect and develop private forests
9. harmonisation	to achieve harmony between forestry and nature
10. research/training	to conduct forestry research and train human resources

3) Forest Department Technical Order No.52, 1979

This technical order banned the clear felling of indigenous forest to provide land for establishing fast growing exotic species. At the same time the technical order provided cutting methods for the management of natural forests to achieve sustainable production of forest products from the residual forest.

4) Development Plan 1983-93

This development plan is aimed at promoting industrial development by positioning "comprehensive development" and "residents participation for progress" as the main methodology of development. In the fields of forestry and agriculture, special emphasis is placed on agricultural development in the arid and semi-arid areas, and comprehensive agricultural development projects are being implemented in top priority areas. An equally great emphasis is put on the preservation and expansion of forest resources in these areas, which is considered as an important condition for the agricultural development in these areas, as well as on the development of agroforestry and methods of social forestry and the promotion of forestry research required to realize such development.

5) Tree-Planting Policy Measures

The Government of Kenya is implementing the following tree-planting policy measures to cope with the decrease in forest resources.

① The Chief's Tree Nursery Scheme (1980)

This scheme is aimed at promoting community residents' establishing and operating of tree nurseries. Thus far as many as 850 tree nurseries have been established.

② Forest Plantation Development

Under this plan, trees are to be planted in forests within the jurisdiction of the Forest Department at a rate of 8,500 ha per annum.

③ Forestry Development in Agricultural Villages (1982)

Under this plan, 200 million nursery trees are to be planted a year.

The country's plantation projects are being successfully implemented under the above-mentioned policy measures. For example, the number of tree nurseries increased from 362 in 1982 to 1,000 in 1987. Annual nursery tree production has already exceeded the 100 million mark. As stated in a 1986 World Bank Report, however, the total area of closed forest land decreased by 19,000 ha a year between 1980 and 1985.

(2) Forestry Research Organizations

As a result of the implementation of the government's forestry policy measures, a number of national and international forestry research organizations have been established and their operation and management systems have been improved. Shown below are the major ones.

1) East African Agricultural and Forestry Research Organization (1948-1987)

This is an international research organization based in Meguga, which East African countries jointly established based on the results of forestry research that had been conducted in Kenya since 1934.

2) Conservancy of Forestry Research Services (1973-77)

This East African forestry research committee conducted research on silviculture, tree improvement, tree physiology, entomology and utilization of forest resources.

3) Forest Research Department of Kenya Agricultural Research Institute (1981-1986)

The Forestry Department of the East African Agricultural and Forestry Research Organization and the Forestry Research Committee of the Forest Department of Kenya were merged into the Forestry Research Department, one of the four departments of the Kenya Agricultural Research Institute. When it was established in 1981, it had a staff of 12 researchers and conducted research on silviculture, tree improvement, tree physiology and entomology.

4) Kenya Forestry Research Institute (1986-present)

The Forestry Research Department of the Kenya Agricultural Research Institute was reorganized and became an independent public research organization in accordance with the provisions of Cap 250 of the Science and Technology Act of 1986. This new research institute is responsible for conducting extensive research on forestry. The results of its research are presented to the Forest Department and other forestry-related organizations for practical applications.

As described in this section, the history of the research organizations and government's policies to implement activities concerning social forestry is relatively new and sufficient effects by the policies and organizations' activities have not been attained. Further improvements, therefore, in research organizations and policies are being awaited.

2-2 Present State of the Kenya Forestry Research Institute

2-2-1 Organization

(1) Board of Management

The Kenya Forestry Research Institute (KEFRI) was established in July 1986 as statutory scientific research institute under the Cap 250 of the Science and Technology Act to promote basic and applied forestry research and development. The supreme decision-making organ of KEFRI is its Board of Management, which consists of 12 members. Seven of the members are persons of experience or academic standing and the remaining five members serving in their exofficio status from the following public bodies:

- The Permanent Secretary, the Ministry of Research, Technical Training and Technology, or his representative
- Director of Forestry or his representative
- Director of Agriculture, or his representative
- The Secretary of the National Council for Science and Technology
- The Permanent Secretaries of the participating Ministries or their representative

The Board of Management carries out most of its work through its two committees; the Finance and Administration Committee and the Scientific and Technical Committee. Main tasks of both of which are as shown in the following table 2-4.

Table 2-4 Responsibility for Board of Management

Committees	Responsibility
Finance and Administration Committees	<ol style="list-style-type: none"> 1. periodical review of the financial management of KEFRI and identification of measures to improve its fiscal performance; 2. review of proposed budgets and priorities and to make recommendations on desirable changes and adjustments; 3. identification and conducting of negotiations with donor organizations on procurement of possible support to KEFRI's programmes; 4. development of financial policies and procedures for performance evaluation and staff development, and fiscal operations of KEFRI; 5. staff appointments, staff performance reviews, evaluation, and advancement, and staff discipline.
Scientific and Technical Committee	<ol style="list-style-type: none"> 1. assistance, through review and comment in the formation of the research and technical programmes of KEFRI; 2. periodical review of the on-going work programme of KEFRI 3. ensuring the KEFRI operates at the highest possible level of scientific excellence.

(2) Operating Organization

KEFRI consists of its headquarters in Muguga, 7 national centres, 5 regional centres and 4 sub-centres as shown in figure 2-5 and 2-6.

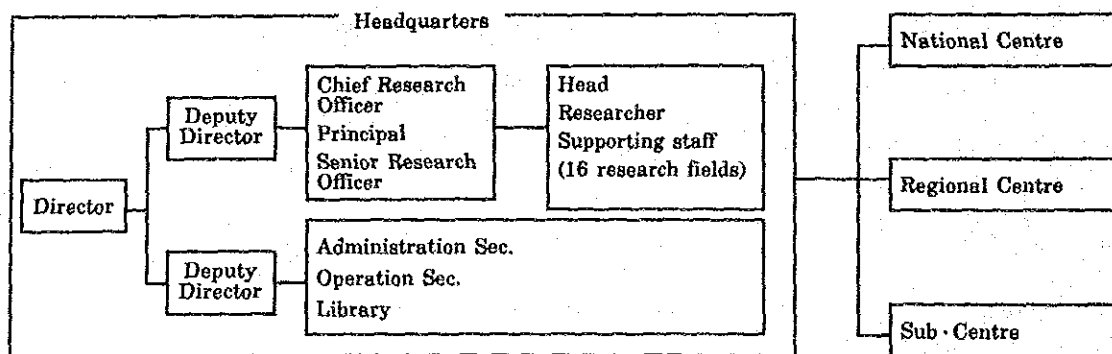


Fig 2-5 KEFRI's Organization

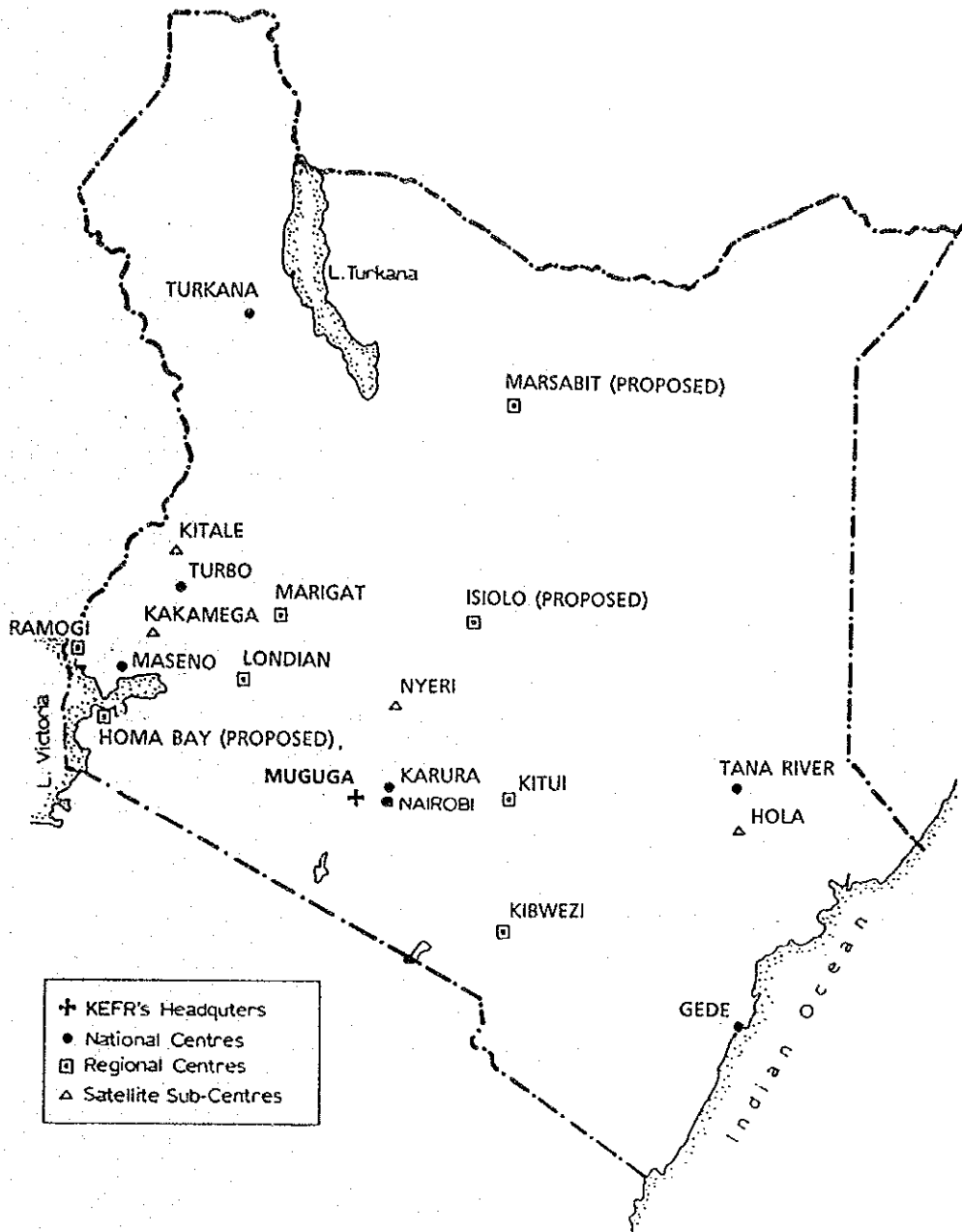


Fig. 2-6 Distribution of KEFRI's Centres

Each centre is located in a place which has unique climatic and pedological characteristics, and is carrying out activities as described in the following table for the purpose of promoting social forestry.

Table 2-5 Activities of Centres

Class	Centre	Ecological zone	Research Programmes/Activities
HQ	KEFRI Headquarter	Countrywide	<ul style="list-style-type: none"> Leadership, planning and coordination of all research programmes.
NC	Muguga National Research Centre	High potential areas east of the rift valley	<ul style="list-style-type: none"> Planning of all research programmes in silviculture, tree improvement, forest ecology, agroforestry, forest pathology, entomology, economics and other support programmes. Tree seed technology implementation of programmes on highlands east of the rift valley.
NC	Karura National Research Centre	Countrywide	<ul style="list-style-type: none"> Planning, implementation and ordination of research programmes in forest products.
RC	Londiani	High potential areas on highlands west of the rift valley	<ul style="list-style-type: none"> Silvicultural and tree improvement research for highlands species. Tree seed production. Research activities in pathology, entomology.
NC	Turbo	High potential areas	<ul style="list-style-type: none"> Silviculture and tree improvement of pulpwood species. Pathology and entomology research.
NC	Gede	Medium potential coastal lowlands.	<ul style="list-style-type: none"> Silviculture and tree improvement for coastal lowlands Seed production centre Ecological research on lowland forests. Pathology and entomology research activities.
RC	Kibwezi	Semi-arid areas	<ul style="list-style-type: none"> Silviculture and tree improvement research. Seed production and agroforestry research.
RC	Ramogi	Semi-arid to medium potential	<ul style="list-style-type: none"> Silviculture and tree improvement for difficult hilly sites, particularly for farm forestry systems. Agro-social forestry research for lake region.
NC	Tana river	Semi-arid	<ul style="list-style-type: none"> Silviculture and tree improvement for drylands. Irrigated forestry research. Research on management of riverine forests along rivor tana.
SC	Hola	Semi-arid	<ul style="list-style-type: none"> Ecological studies of woody vegetation in semi-arid areas.
NC	Turkana	Arid	<ul style="list-style-type: none"> Silviculture and tree improvement for arid zones. Ecological studies of arid land woody vegetation. Research on fodder trees/shrubs.
NC	Maseno	Highland bimodal rainfall, maize-bean system	<ul style="list-style-type: none"> Agroforestry research.
RC	Marigat	Arid	<ul style="list-style-type: none"> Silviculture and tree improvement Social forestry training
RC	Kitui	Semi-arid	<ul style="list-style-type: none"> Social forestry training Pilot forest

(Note) NC: National Centre RC: Regional Centre SC: Sub-Centre

2-2-2 Activities

KEFRI is engaged in forestry research and development and application of the results of such research and development. More specifically, the main tasks of KEFRI the development of procedures for multipurpose management of forest resources, development and application of forestry cultures and silvicultural choices essential for establishment of the forests, development and preservation of reliable germplasm, and training of forestry officers. KEFRI has also built a nationwide forestry network designed to strengthen its relations with other institutions and co-operative initiatives for the purpose of extension the results of its research and development efforts as much as possible. It is acting as the nucleus of the network. An outline of its main activities is given below.

(1) Activities

KEFRI is carrying out the following activities jointly with its centres located across the country.

1) Research and development

① Silviculture and tree improvement

KEFRI is engaged in research and development on silviculture and tree improvement and application of the results of such research and development. The main research subjects include proper species of trees, trees' adaptability to soil, tree nursery/forest land management, and higher productivity per unit land/labour. In the case of introduction of genetic material, for example, 107 seedlots of selected "plus" trees had been introduced from Zimbabwe, 216 seedlots of "plus" trees from Australia, and *Liquidambar styraciflua* a timber species from Mexico by 1989.

② Agroforestry

KEFRI is carrying out a variety of programmes aimed at developing and promoting agroforestry technologies. In the field of yield management, in particular, it has repeatedly conducted research on model farms, and as a result has developed technologies related to maintenance of soil productivity and high yield. Thus KEFRI has already established basic guidelines for the development and spread of agroforestry technologies. Pilot on-station and on-farm trials have also established at Embu, Baringo, Muguga, Machakos, Maseno, and Siaya.

③ Tree seed technology

This programme has been greatly strengthened and basic studies on seed for agroforestry have been initiated. In the case of seed production of agroforestry species, for example, nine seed orchards and many seed centres have been established. Research is also under way on the improvement of seed germination for many utility species of trees and shrubs.

④ Afforestation in arid and semi-arid areas

KEFRI is carrying out programmes for expanding green tracts of land through the introduction of multipurpose trees/shrubs and promoting appropriate techniques in order to prevent the further decrease in forest resources in the country's arid and semi-arid areas. KEFRI's centres located in various areas of the country are playing an important role in carrying out these programmes, as well as collecting data and extension of techniques.

⑥ Forest products

KEFRI is conducting research on forest products made of Kenya's native species of trees. Research on timber, wooden boards and pulp is conducted under the KEFRI's "forest products research programme".

⑥ Forest pathology and mycology

Basic research in the fields of pathology and mycology is conducted to prevent rhizomes and seeds from suffering from diseases. For example, control of *Fusarium* spp., a common tree disease, is conducted by spraying with 1% benlate solution on three applications at intervals of 14 days.

⑦ Forest entomology and zoology

Basic research on insects and other animals injurious to trees is conducted. Particular emphasis is placed on control of termites and Millipedes.

⑧ Other basic research

The research institute is conducting basic scientific research on forestry. The main research subjects include forest climate, soil science, biotechnology, and socio-economics

KEFRI is positioned as a representative forestry research organization of Kenya, and is therefore required to expand its main programmes for research and development to meet public demand for the preservation of wood lands.

2) Training and Extension

① Extension of social forestry

Aware that it is effective to extend social forestry in order to make effective use of forest resources and to preserve forests, KEFRI is actively carrying out promotional activities for the extension of social forestry. At Muguga Centre and Kitui Centre, in particular, a technical cooperation by the Government of Japan has been implemented, which has greatly contributed to the improvement in the forestry officers' capabilities and community residents' participation in social forestry. The training programme under Phase 1 of the technical cooperation included 30 training courses and 5 "social forestry prize day" participated in by a cumulative total of 732 trainees at Muguga Centre, and 35 training courses participated in by a cumulative total of 875 trainees at Kitui Centre. These training courses included those for farmers and those for women, all of which were aimed at promoting the direct extension of social forestry.

② Pilot forest

Pilot forest schemes are carried out at each regional centre for the purpose of developing plantation technologies to be used in training in social forestry and methods of promoting these technologies. Special emphasis is placed on the selection of trees suited for the semi-arid areas and the development of plantation and nursery tree raising, and as a result technologies necessary for recovery of the forest environment are being developed. For example, a pilot forest scheme under the Government of Japan's technical cooperation is being implemented at Kitui Centre, which is located in a semi-arid area. Thus far lots with a total area of 372 ha have been planted and at

nursery 850,000 nursery trees of more than 70 species have been produced. On the other hand, at Marigat Centre, which is located in a arid area, about 100 lots (each with an area of 2h on average) have been tentatively planted, all of which have been utilized in promoting the extension of social forestry.

③ Information system

KEFRI's information system is aimed at straightening and managing information on the results of all of its operations and preparing training materials for use in its training programmes and those for extending social forestry. In this area of KEFRI's activities, a computerized information management system is being built, and as a result the work to computerize a wide variety of data on forestry has been added. KEFRI's information system also includes the preparation of audio-visual information, illustrations, presentation panels, and exhibits.

The Government of Kenya considers the recovery and preservation of forest resources as one of the greatest challenges facing it. It is expected, therefore, that the training and extension activities by KEFRI, which are aimed at promoting the extension of social forestry, will be expanded further in the future.

(2) Institutional Linkages and Cooperation

KEFRI is trying hard to deepen its formal and informal linkages between other forestry-related organizations through the exchange of information and interchanges of personnel. The following table 2-6 shows the major collaborating forestry-related organizations.

Table 2-6 KEFRI' Collaborating Organization

	Organization	Collaborating Fields
Government Department	Ministry of Agriculture	tree planting as a component of soil and water conservation
	Ministry of Livestock Development	food for livestock
	Ministry of Energy	woodfuel crops through agroforestry programme
	Ministry of Water Development	river flows in forest catchment area
	Ministry of Environment and Natural Resources	social forestry and agroforestry
	Department of Resources Survey and Remote Sensing	survey on forest area
	National Environment Secretariat	preservation of forest preservation of national environment
	Permanent Presidential Commission on Soil Conservation and Afforestation	sound environmental management and conservation
Parastatal	National Scientific Documentation and Communication Centre	compilation of statistic data
	National Museum	preservation of animal habitats
University	Moi University	research on silviculture in arid area
	Egerton University	investigation of grazing land
	University of Nairobi	research on plants species
Kenya's Research Organization	Kenya Agricultural Research Institute	agroforestry research is jointly conducted with KEFRI in Maseno and Embu
	Kenya Marine and Fisheries Research Institute	research on mangrove area
	Kenya Medical Research Institute	research on medical trees
	Tea Research Foundation	research on tea plant
International Research Organization	International Council for Research in Agroforestry	joint research for the development of agroforestry technologies is being conducted with other research organizations.
	International Union of Forestry Research Organization	an organization responsible for international exchange of data and information on forestry research
	United Nations Environmental Programme	preservation of genes and development of biotechnologies

KEFRI is also providing information on forestry to local tea companies and agricultural organizations, in addition to the organizations listed in the above table.

(3) Strategic Plan

KEFRI has drawn up new strategic plan for 1990-99 with the aim of developing appropriate technologies necessary for the wise management of forest resources. These new strategic plan are to be implemented in order of research priorities. Detailed descriptions of the necessary number of staff members, facilities and budget for each new project have already been prepared.

1. Research in silviculture, agroforestry and the forest environment
2. Research in the forest protection and support programme
3. Research in forest products
4. Social forestry and information systems

These new projects, which are summarized in Table 2-7, have been submitted to, and approved by, the government ministries and agencies concerned.

Table 2-7 Strategic Plan

Field	Programme
1. Silviculture, Agroforestry and Tree Improvement	(1) species and provenance research (2) agroforestry technologies/management system (3) tree improvement for different agroclimatic zones (4) forest/tree establishment techniques (5) research on tree improvement
2. Management of Forest, Soil and Water Resources	(1) forest ecology, natural forest and indigenous tree species (2) woody vegetation in arid and semi-arid lands (3) tree seed technology development (4) forest management practices on soil and water resources (5) soil productivity
3. Forest/Tree Protection	(1) forest and tree diseases (2) forest entomology and zoology • insect pests and millipedes • control of termite damage • control of animal damage
4. Forest Socio-Economic	(1) potentials of farm tree for on-farm cash incomes (2) efficient management of small scale farms
5. Utilization Potentials of Industrial Woody Species	(1) wood quality of industrial plantation species (2) potential for gainful economic activities
6. Utilization of Wood and Exploitation of Wood Products	(1) identification of woody species with potential for production (2) develop markets and products (3) timber properties and behaviors
7. Information Systems and Forestry Extension Methods	(1) establishment of national a forestry data management system (2) development of extension methods
8. Human Resources Development	(1) post-graduate training (2) training in research management (3) upgrading of technical staff

While the research programme of these strategic plans are all on extensions of KEFRI's ongoing programmes, the scope of each plan will be expanded. It is, therefore, imperative to secure the necessary number of staff members and to improve KEFRI's facilities and equipment. For this reason, the total programme implementation cost for the decade is estimated at about 2,281,000,000 Kshs, which amount is about 30 times the size of KEFRI's current annual budget.

2-2-3 Management and Operation

(1) Personnel

Table 2-8 shows the size of KEFRI's staff of researchers, including those working at its centres.

Table 2-8 KEFRI's Research Officer

Designation	Qualifications	Nos.	Remarks
Chief Research Officer	PhD/Msc	2	
Principal Research Officer	PhD/Msc	6	Post graduate
Senior Research Officer	Msc	13	Post graduate studies at PhD
Research Officer	Msc	36	Post graduate studies at PhD
Assistant Research Officer	Bsc	59	Most merit post-graduate studies at Msc and PhD
Biometrician	Msc	1	Merit post-graduate training
Training Officer	Bsc	8	Merit post-graduate training
Planner	Bsc	2	Merit post-graduate training
Information Officer	Bsc	1	Merit post-graduate training
Senior Technologist	Higher Diploma	6	Bsc training

Of the 100 researchers, 50 have the degree of Master of Science or Doctor of Philosophy. Since KEFRI has a relatively short history, most of its researchers are young. For this reason, KEFRI attaches great importance to the education and training of these young researchers. It

offers 53 training courses a year for these young researchers to enhance their technical capabilities.

In addition to these researchers who are its key personnel, KEFRI has a clerical staff of about 200 and a staff of about 1,000 part-timers, who are working at pilot forest lots and tree nurseries.

(2) Budget

Shown in figure 2-7 is the changes in KEFRI's annual budget.

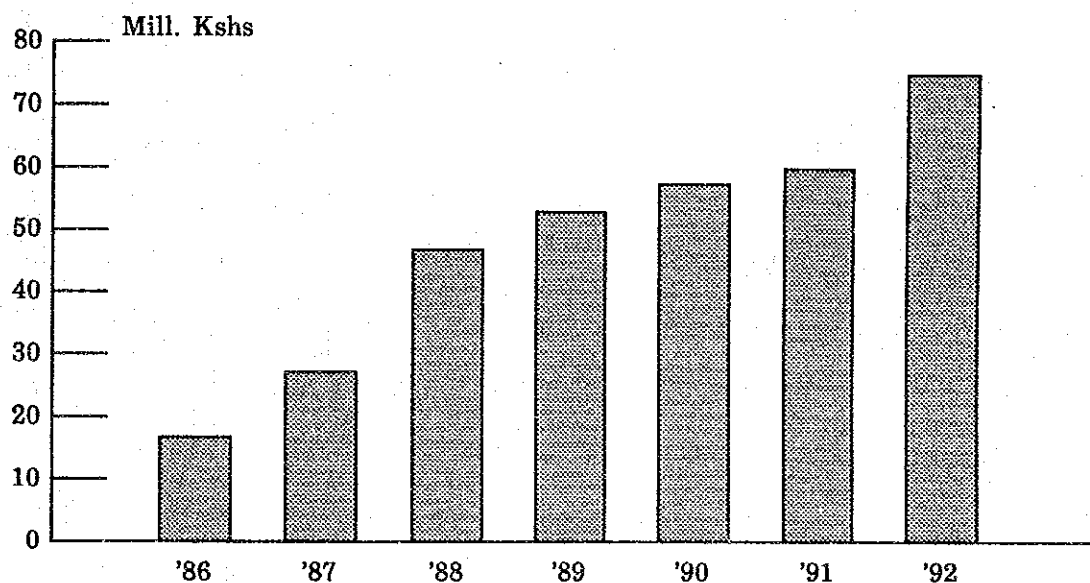


Fig. 2-7 KEFRI's Annual Budget

On the other hand, figure 2-8 shows the trends in the annual operating budgets (personnel expenses not included) of Muguga Centre and Kitui Centre, at which the government of Japan's technical cooperation project is implemented.

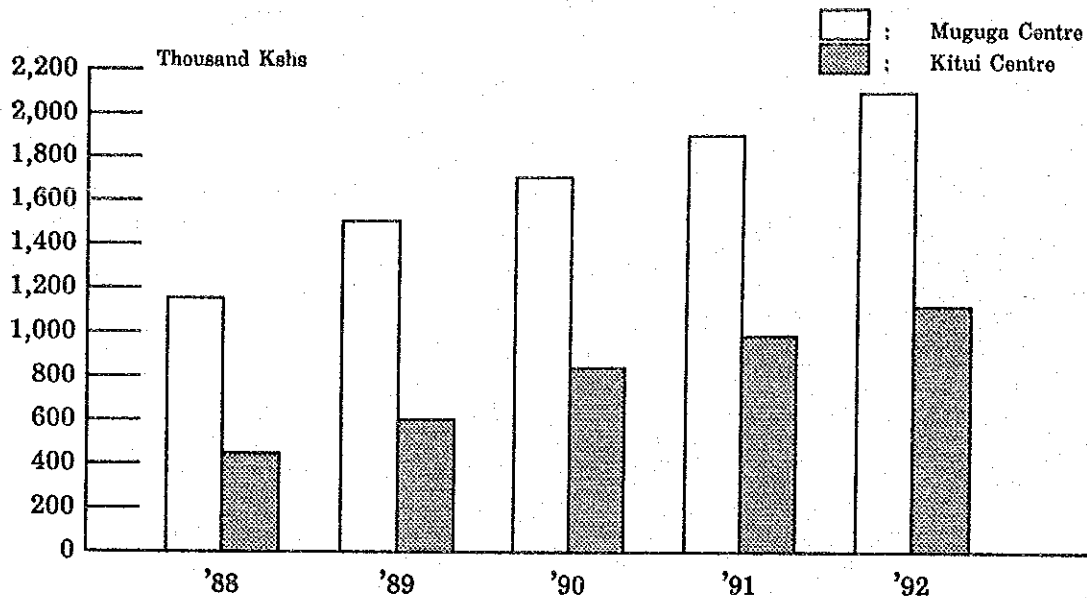


Fig. 2-8 Operating Expenses for Muguga and Kitui

As is clear from the above tables, KEFRI's annual budget increased by about 60 percent during a five-year period from 1988 to 1992. On the other hand, however, the operating expenses except for personnel expenses increased by about 80 percent at Muguga Centre and by about 145 percent at Kitui Centre during the same period. This means that other expenses than personnel expenses, such as research expenses and facility operation expenses, have increased reflecting the price escalation during this period.

The annual budget for fiscal 1992 of the Ministry of Research, Technical Training and Technology, which supervises the operations of KEFRI, is about 424 million Kshs, about 18 percent of which is KEFRI's annual budget for the same fiscal year.

(3) Facilities

The facilities of KEFRI's headquarters and Muguga Centre, which are the main facility of KEFRI, were constructed in 1986 under the Government

of Japan's grant aid. Table 2-9 gives an outline of the present state of these facilities and those of KEFRI's other major centres.

Table 2-9 KEFRI's Facilities

Centre	Office	Laboratory	Staff House
Headquarter	office 5	small store 2	trainer 4
Muguga	office 8	Lab. 7	trainee 20
Karura	office 1 (with 3 rms)	small Lab. 1	--
Londiani	timber office 1	old store 1	intermediate 1
turbo	small office 1	small store 1	intermediate 1
Gede	small office 1	--	intermediate 3
Kibuwezi	official 1 (with 3 rms)	store-cum Lab. 1	intermediate 4
Ramogi	official 1 (with 3 rms)	store-cum Lab. 1	intermediate 1
Hola	official 1 (with 3 rms)	store 1	intermediate 1
Tukana	office 1 (with 3 rms)	Lab. 1	intermediate 1
Kitui	office 6	--	trainer 6 trainee 15
Maseno	office 1 (with 4 rms)	Lab. 2	--
Marigat	office 1 (with 4 rms)	--	--

As can be seen from the present state of the regional centres' facilities shown in table 2-9, facilities of the regional centres are insufficient in light of the importance of research conducted at these centres. For example, Marigat Regional Centre, which is located in a semi-arid area, is equipped with only a room, which serves both as an office and as a meeting room, and a nursery tree warehouse. Furthermore, all these facilities are leased from the Forest Department. At Maseno Centre, which is actually functioning as a national centre, 2 laboratories, 4 offices, a nursery tree warehouse and other facilities are operated and managed by ICRAF, an international research organizations, but there is no facilities owned by KEFRI. The expansion and improvement of the facilities of these regional centres is one of the indispensable matters of KEFRI.

(4) Factors constraining effective forestry research

KEFRI is carrying out a wide variety of research and training programmes with the aim of the extension of social forestry. However, the following problems relating to its facilities have yet to be addressed.

1) Dispersion of laboratories at Muguga Centre

At present, KEFRI has a total of 19 research departments, 12 of which are using facilities borrowed from the Agricultural Research Institute and a regional forestry office of the Forest Department. These borrowed facilities are located outside of the premises of KEFRI. Furthermore, most of these laboratories are superannuated, and most items of equipment used at these facilities are also borrowed from the above mentioned organizations. It is difficult for KEFRI to conduct research necessary in implementing the new strategic plan by the use of such facilities and equipment. It is necessary to create an environment conducive to the effective carrying out of research by bringing together the dispersed research facilities. Table 2-10 shows the forestry research departments, the size and the location of each of the research departments of Muguga Centre.

Table 2-10 KEFRI's Laboratory

Field	Research officer	Technical staff	Supporting Staff	location
• agroforestry	15	8	150	Muguga Centre
• biotechnology-1	3	5	10	
• biotechnology-2	4	6	18	
• soil science	4	7	14	
• pathology 1	2	3	25	
• dryland silviculture	12	6	105	
• social forestry	6	7	144	
• timber products	10	7	120	Forest Department's Nairobi office
• non-timber products	2	1	6	
• forest ecology 1	6	1	20	KARI's Lab.
• physiology	1	2	4	
• pathology 2	1	1	5	
• tree breeding	6	7	100	
• entomology	4	7	29	
• socio-economics	3	4	19	Forest Department's temporary office
• forest ecology 2	1	1	4	
• plantation silviculture	8	3	210	
• forest mensuration	1	1	4	
• tree seed technology	5	14	220	
(total)	94	91	1207)	

2) Shortage of facilities and equipment for use in training and extension activities

KEFRI plans to organize various conferences and training courses as part of its new strategic plan. These events are important in that they are designed as ones for publishing and reviewing the results of KEFRI's research activities, as well as for making full use of such results in training and extension activities. At Muguga Centre, which is to play a pivotal role in carrying out these plans, there is a serious shortage of facilities for use in training and extension activities, which might make it very difficult to conduct KEFRI's strategic plans. At KEFRI, there is also a shortage of printing equipment which is necessary for the preparation of training materials

and research reports, as well as information management equipment. In order for KEFRI to play a central role in the field of forestry research, it is necessary to improve the facilities and equipment for use in training and extension activities of Muguga Centre, in particular.

3) Lack of research facilities at the regional centres

KEFRI is carrying out pilot forest plantation and extension activities in various parts of the country through its 20 regional centres -- including those in the planning stage. Although six of them, except Muguga Centre which is actually serving as a national centre, have necessary research facilities, other "regional centres" and "sub-centres" have no research facilities. The regional centre in Kitui, a semi-arid area, has no research facilities despite the fact that a technical cooperation is being conducted by the Government of Japan, which makes it impossible to carry out forestry research activities, reflecting the results of pilot forest plantation and training activities under the Japan's technical cooperation. As can be seen from the case of Kitui, because of lack of research facilities at KEFRI's regional centres, it is difficult to extend social forestry satisfactorily that meets local conditions through them. KEFRI is a national research organization specializing in forestry research, as such it is required to improve and expand its operations in proportion as social demand for preservation of forests resources. It is, therefore, urgently necessary to improve the research institute's facilities with particular emphasis on the improvement of facilities for use in research and extension activities, especially at regional centres.

2-3 Outline of the Related Project

(1) Development Plan 1983-93

Under the Development Plan 1983-93, the following long-term targets are set in the field of forestry.

1. Management of natural resources, including the recovery and maintenance of forest resources
2. Promotion of regional development through the stabilization of the country's agricultural base
3. Promotion of effective use of domestic recycled energy, including conventional energy

In light of these targets, the Government of Kenya is attaching great importance to finding a solution to the problem of poverty and the environmental problem in the arid and semi-arid areas, and is implementing a comprehensive agrarian development plan in four designated priority districts. Under the plan, special emphasis is placed on the development of technologies suited for use in the semi-arid areas and the promotion of the spread of such technologies -- more specifically, on the introduction of methods of agroforestry and social forestry. In this connection, the implementation of this project, which concerns forestry research and the extension of its spread, is considered one to support the plan. The objective of this project is consistent with that of the Development Plan.

It should be added that two of the above-mentioned four designated priority districts are located adjacent to the premises of the Kitui Centre, where part of this project is to be implemented.

(2) Forest Plantation Development

This development plan, which the Forest Department is to implement in accordance with the resource and environment management policy included in the Development Plan, is aimed at preserving and increasing forest resources. Under the plan, the Forest Department intends to promote agroforestry, social forestry and farm forestry in close cooperation with KEFRI, putting particular emphasis on the following.

- Collaboration with KEFRI
- Promotion of seed development
- Promotion of the production and distribution of nursery trees, support for the production of nursery tree by farmers
- Implementation of projects aimed at the promotion of forest plantation in agricultural villages
- Training of extension staff

This project, which is aimed at integrating the functions and facilities of the research department of KEFRI, is directly related to the above-mentioned plan. This means that this project will contribute to the progress of the Development Plan 1983-93 through the Forest Department.

(3) The Kenya/Japan Social Forestry Training Project

A technical cooperation titled "The Kenya/Japan Social Forestry Training Project" is being implemented by the Government of Japan at the KEFRI's Muguga Centre and Kitui Centre. The preliminary phase of this technical cooperation was carried out from 1985 to 1987, and its first phase from 1987 to 1992. At present, its second phase (1992-98) is being carried out. The scope of technical cooperation limited to "training" and

"pilot forest" schemes. Outline of the training and pilot forest schemes are given in table 2-11.

Table 2-11 Scope of Technical Cooperation

Centre	Training	Pilot Forest
Muguga	<ul style="list-style-type: none"> ● National Seminar ● Extension Officer Course ● Refresher Course 	
Kitui	<ul style="list-style-type: none"> ● Farmers Course ● Nursery Foremen Course ● Field Technical Assistant Staff Course ● Teachers Course 	<ul style="list-style-type: none"> ● Pilot Forest Plantation ● Nursery ● Extension <ul style="list-style-type: none"> — People's Plantation — Small Scale Nursery — Demonstration Plot — Model Farmer — Seedling Distribution ● Experiment in Plant

The contents of the technical cooperation is not directly related to the scope of activities under this project. As the functions and facilities of KEFRI's forestry research department are to be integrated under this project, however, the results of the forestry research can be utilized in the operations carried out under the technical cooperation. Under this project, lecture rooms and a printing room will be constructed. The ongoing technical cooperation has been suffering from a shortage of such facilities. Therefore, when this project is implemented, it is expected that Japan's grant aid cooperation and technical cooperation will serve as a complement to each other and thereby greatly contribute the advancement of social forestry in Kenya.

2-4 Background and Contents of the Request

2-4-1 Background of the Request

In Kenya, closed forest land has a total area of about 1,700,000 ha, which is only about 3 percent of the country's total land area. Furthermore, it is estimated that forest land area is decreasing by 19,000 ha a year because of excessive felling, plantation and cultivation. Shrub forest land has a total area of about 37,500,000 ha, which is about 65 percent of the country's total land area. In the case of shrub forest land, too, the increase in consumption of fuelwood and charcoal wood as a result of the increase in the country's population is eroding shrub forest resources. According to the Ministry of Energy of Kenya, the country's present annual rate of population growth stays at a high level of 3.3 percent, and it is predicted that the country's population will reach 30 million in the year 2000 and that supplies of fuelwood and charcoal wood will be short by about 45 million tons in that year. Such a decline in forest resources is accelerating the desertification of the country's arid and semi-arid land areas, as well as the shortage of fuelwood, the decrease in topsoil, the siltation of rivers and the decrease in the number of wild animals.

The Government of Kenya has introduced the concept and techniques of "social forestry", in which community residents are encouraged to participate, as an effective means of promoting the production of fuelwood and charcoal wood while preserving forest resources. However, problems in the areas of technology, personnel and facilities have surfaced in the process of the promotion of the extension of social forestry, and related government bodies and other organizations are in the process of seeking solutions to these problems. While top priority is given to basic forestry research and satisfactory research results have been obtained, the

extension of social forestry, which is the final goal of the central government, is still in its early stage. It is therefore imperative to improve the quality of, and expand the scope of, basic forestry research.

KEFRI is Kenya's public full-scale forestry research organization. It is an independent public organization operating under the supervision and advice of the Ministry of Research, Technical Training and Technology. Its headquarters in Muguga and its centres are jointly carrying out research, training/extension, pilot forest and information activities. At KEFRI's centres in Muguga and Kitui, in particular, a grant aid project titled "Establishment Project of Nursery Training Centre for Social Forestry" was conducted in 1985, and a technical cooperation project titled "Kenya/Japan Social Forestry Training Project (Phase 1 and Phase 2), by the government of Japan, both of which have greatly contributed to the extension of social forestry in the country. However, the Muguga Centre's research facilities, which are central research facilities of the research institute, are dispersed, and in addition, the research institute does not have sufficient training and extension facilities. The institute's regional centres are also poorly equipped. As a result, KEFRI is finding it very difficult to carry out research activities which it ought to carry out.

Under such circumstances, the Government of Kenya requested the Government of Japan to provide grant aid for the improvement of the facilities and equipment of KEFRI's centres in Muguga, Kitui, Maseno and Marigat, in an attempt to promote the extension of social forestry and to strengthen the country's forestry research system.

In response, the Government of Japan decided to have a basic design study conducted concerning the request. In June 1993, the Japan International Cooperation Agency (JICA) send a basic design study team to

Kenya to study the possibility of the Government of Japan's grant aid in response to the Government of Kenya's request.

2-4-2 Contents of the Request

Given below is the outline of the contents of the Government of Kenya's request for the Government of Japan's grant aid which were confirmed in the course of the above-mentioned basic design study.

(1) Objective

To expand and improve the facilities and equipment of KEFRI's centres in Muguga, Kitui, Maseno and Marigat to strengthen the country's forestry research system which forms the basis for the extension of social forestry in the country.

(2) The Project Implementing Organization

The Ministry of Research, Technical Training and Technology is the organization to supervise the project and the Kenya Forestry Research Institute (KEFRI) is the organization to implement the project.

(3) Project sites

- Muguga
- Kitui
- Maseno
- Marigat

(4) Facilities

Table 2-12 Facilities Requested

Centre	Facilities	Floor Area (m ²)
Muguga	1. Research Building	2,740
	2. Information Centre	1,660
	3. Administration Building	1,500
	4. Guest House	230
	5. Central Store	430
	6. Kitchen Expansion	1,230
	7. Central Workshop	230
	8. Library Expansion	460
	9. Dormitory	960
	10. Repairing	
Kitui	1. Research Building	950
	2. Repairing	
Maseno	1. Administration and Lab. Building	880
	2. Dining Hall	320
	3. Guest House	120
	4. Dormitory	370
Marigat	1. Research Building	300
Total		12,380

(5) Equipment

Main items of equipment requested for Muguga and Kitui centre are as shown below.

- Muguga centre

- 1) Analytical and experimental equipment

Auto analyzer, Mass spectrometer, Atomic absorption spectrophotometer, N/C analyzer, Scanning electron microscope, Cation exchange capacity analyser, Compound microscope (with phase contrast lens, epifluorescence lens and camera), Gas chromatograph, Shaker, Incubating shaker, Portable rainfall simulator, Plant drying oven, Soil drying oven, Sterilizing oven, Ultrasonic cleaner, Glassware

dryer, Plant sectioning equipment, Water bath, Electronic balance, Potoron, Incubator, Plant grinding mill, Blender/ homogenizer, Stereo microscope, Water still, Autoclave (horizontal/ vertical), pH meter, Pressure bomb, Plant canopy analyzer, Surveying equipment, Tree measuring equipment, Planimeter, Camping set, Hot Plate, Rotary evaporator, Soil moisture meter, Gel electrophoresis apparatus, Clean bench, Draft chamber, Colony counter, Micro pipet, Altimeter, Auto dispensing pipet, Laboratory table, Cabinet, Chair, Soil auger, Centrifuge, Calorimeter, Freeze dryer, Deep freezer, Light assessment meter, Glassware, Personal computer

2) Training and information equipment

Electric typewriter, Overhead projector, Slide film projector, Video camera, Video cassette recorder, Video projector set, Audio visual set, Video editing set, 35mm camera

3) Vehicle

Pickup truck, Bus

4) Equipment for maintenance and repair

Oscilloscope, Automatic in circuit tester, Digital multimeter, Logic analyzer, Drafting equipment, Refrigeration engineer's service equipment and tools, Electrical engineer's tool kit, Electronics engineer's tool kit, Mechanical engineer's tool kit

● Kitui centre

1) Analytical and experimental equipment

Microscope (scanning electron, compound dissecting, with camera), Shakers (rotary, sieves), Water still, Centrifuge, Autoclave, Oven,

Plant moisture meter, Leaf area meter, Hot plate, Incubator, Pressure bomb, Hypsometer, Glassware, pH meter, Tree measuring equipment, Soil auger, Mist propagation unit

2) Training and information equipment

Personal computer, Electric typewriter, Photo copier, Overhead projector, Tape recorder, Radio cassette player, 35mm camera, Video recorder, Video editing machine, Public addressing system

3) Vehicles

Pickup truck, Bus, Water tank truck

(6) Others

1) Deep tube well at Kitui Centre

2) Improvement of electrical system of existing buildings at Muguga and Kitui centers

CHAPTER 3 CONTENTS OF THE PROJECT

CHAPTER 3 CONTENTS OF THE PROJECT

3-1 Objectives

This project is aimed at improving the functions of Kenya Forestry Research Institute (KEFRI), which is responsible for conducting basic forestry research necessary for the extension of social forestry in the Republic of Kenya. More specifically, it is aimed at integrating and improving the research and training/extension facilities of KEFRI's Muguga Centre, as well as constructing the research facilities at Kitui Centre. This project is planned to improve research activities in social forestry and agroforestry and to promote social forestry by providing the results to farmers. Thus the project will help prevent further destruction of closed forests and shrubbery while increasing production of fuelwood and charcoal wood.

3-2 Examination of the Contents of the Request

3-2-1 Examination of the Appropriateness and Necessity of the Project

The appropriateness and necessity of this project are examined in terms of the positioning of social forestry in Kenya and the present condition of KEFRI, which is the organization to take charge of the implementation of this project.

(1) Positioning of Social Forestry in Kenya

1) Present Condition of Forestry in Kenya

In Kenya, the total area of closed forest land is about 1,700,000 ha which is only about 3 percent of the country's total land area.

Furthermore, it is reported that the total area of forest land is decreasing by about 19,000 ha a year as a result of excessive felling and clearing forest land for cultivation. The total area of shrub forest land is about 3,700,000 which is about 65 percent of the country's total land area. In the case of shrub forest land, excessive felling of shrubs to meet the increasing demand for fuelwood and charcoal wood is eroding shrub forest resources. The decrease in forest and shrub forest resources is accelerating the desertification in the arid and semi-arid areas. It is also the cause of such social problems as the shortage of fuelwood and charcoal wood, the siltation of rivers and the decrease in the number of wild animals.

In order to cope with such a situation, the Government of Kenya has shifted from forestry policy oriented toward production of wood products for industrial use to one oriented more toward social forestry, which is centered on production of fuelwood and charcoal. Since 1986, the new forestry policy has been positioned as one of the government of Kenya's most important economic policies.

2) Measures to Extend Social Forestry

It is pointed out that in Kenya the following measures are required to extend social forestry.

1. Promotion of forestry research and development on types of trees which are suited for Kenya's natural environment, plant forestry technologies, forest land productivity
2. Nurturing of experts to take charge of the promotion of the results of forestry research and development among farmers
3. Improvement of the system for the extension of social forestry

Kenya's government bodies concerned, as well as foreign aid-providing organizations, have been conducting various research and development projects required to extend social forestry, and these projects are beginning to produce satisfactory results. KEFRI which is positioned as the country's comprehensive forestry research organization, is responsible for conducting research on social forestry and extending social forestry. Furthermore, KEFRI is the designated organization to take charge of the implementation of the Kenya/Japan Social Forestry Training Project Phase 2, which is a technical cooperation being implemented by the Government of Japan for the purpose of extending social forestry. The effort to improve the functions of KEFRI will certainly support the Government of Kenya's social forestry policy and, coupled with the results of the technical cooperation, will contribute to the advancement of social forestry in Kenya. For this reason, it is urgently necessary to implement this project.

(2) Present Condition of KEFRI

KEFRI, which is a government agency operating under the control of the Ministry of Research, Technical Training and Technology, is responsible for conducting research on forestry, including social forestry. Its headquarters in Muguga and centres located in various parts of the country are carrying out operation in the fields of research and development, training and extension, pilot forestry and public relations. However, KEFRI's facilities and equipment are insufficient both qualitatively and quantitatively. As a result, KEFRI is unable to carry out all the operations it ought to do. For instance, at Muguga Centre, research facilities for use in 12 of the 19 fields of research are located outside of KEFRI's premises. They are leased from and/or shared with other institutions and located in four different places. This makes it

difficult for KEFRI to conduct necessary research work. At Kitui Centre, which is responsible for conducting research work in the semi-arid areas and promoting the results of such research work, is so poorly equipped despite the fact that it is the base for the extension of social forestry in the region. Due to such constraints in terms of facility, it is hard to say that KEFRI's operations are carried out smoothly.

Under this project, the functions and facilities of the research department of Muguga Centre are to be integrated, its training, extension and information facilities are to be improved, and research facilities of Kitui Centre are to be constructed. It is expected that the implementation of this project will result in more efficient research work at KEFRI, as well as in an increase in efficiency of its social forestry training and extension activities. Furthermore, this project is designed to support operations under the Kenya/Japan Social Forestry Training Project Phase 2. Thus, it is expected that the two projects will jointly contribute to the extension of social forestry in Kenya.

3-2-2 Examination of the Project Management System

This project is aimed at improving the existing facilities of KEFRI. For this reason, there is no need to increase the number of its researchers and clerical staff members in implementing this project, although there will be a slight increase in the cost of facility operation. Described below are the results of our examination of the Kenyan side's personnel and budget plans and their feasibility.

(1) Personnel

Table 3-1 shows the present allocation of staff members at the four centres of the research institute, where this project is to be implemented.

Table 3-1 Present Allocation of Staff Members

Centre	Department	Staff Members					
		Scientists	Management	Technicians	Office Workers	Support Staff	Total
Muguga Headquarter	Administration		13	56	213	143	425
	Research · Training	79		70		867*	1016
Kitui Centre	Research · Training	8		6	5	} 106*	140
	Silviculture	4		8	3		
Maseno Centre	Extension	5		4	10	40	59
Marigat Centre	Silviculture	1		3	3	30*	37

* Includes field workers

When this project is implemented, the dispersed facilities of the research department of Muguga Centre will be integrated but there will be no change in the total number of staff members. At the other centres, too, it will be possible to carry out operations with the present personnel or with the dispatch of some staff members from the headquarters. In other words, the implementation of this project will not necessitate any increase in the personnel of KEFRI as a whole.

(2) Budget

The Government of Kenya strongly requested the early implementation of the project because the project, which the Government of Kenya recognizes as indispensable project to the extension of social forestry in the country, is one of the most important projects under the Ministry of