MANAGEMENT PLAN FOR TIVA DRYLAND RESEARCH AND DEMONSTRATION WOODLAND

KITUI DISTRICT

2001 – 2010

KENYA FORESTRY RESEARCH INSTITUTE
NAIROBI, KENYA

2002

FOREWORD

KEFRI'S vision in woodland resource management in the dry areas of Kenya is that these resources should be managed on sustainable basis. However, the current reality is that due to the increasing human population, the resources are under increasing pressure leading to their degradation or depletion.

In 1987, with the support of JICA, KEFRI initiated a Social Forestry Training Project and used Tiva Woodland, donated by the Kitui county council, to experiment on various tree screening, tree planting and management technologies. In its various phases, including the on-going Social Forestry Model Development Project, useful information on tree planting has been generated. In 1997, the Kitui County Council leased the land to KEFRI for long term research and development. It is the intention of the Institute to use this woodland for testing and demonstrating successful technologies for use not only in adjacent areas, but also for the entire drylands of Kenya. This Management Plan has therefore been prepared to provide a frame-work for research, conservation activities, piloting of tree plantations and demonstration of successful dryland forest technologies.

Paul K. A. Konuche (Dr.)
Director – KEFRI

ACKNOWLEDGEMENTS

The compilation of the plan would not have been possible without the efforts and dedications of very many people and organizations. KEFRI therefore, highly acknowledges the contributions of the following persons:

- KEFRI Board of management came up with the idea following a visit to the site and some of its members contributed useful ideas during preparation.

- Dr. B.N. Kigomo and B.N. Chikamai were responsible for the over-rall preparation of the plan and guided scientists at various stages. Mr. M. Segawa (SOFEM Chief Advisor at the time of preparing the report) provided useful comments to the plan.

- Messrs J. Cheboiwo and J. Kimondo organized acquisition of various reports and visits to the site by scientist beside contributing own experience to the plan.

- Messrs, J. A. Aucha, C.J. Amwatta and A.M. Luvanda were the implementing scientists. They carried out desk studies, field verification and prepared the draft report.

INTRODUCTION

The dry areas of Kenya account for approximately 80 percent of the total land area. These areas exhibit severe climatic conditions, which hinder the application of forestry technologies developed in high potential areas. This plan is therefore intended to enhance the development and application of forestry technologies, which will contribute to increased productivity of the drylands of Kenya in general.

This management plan covers Tiva field site; which is a sub-centre of the Kitui Regional Research Centre whose mandate is to develop technologies for dryland forestry. It has been developed as a tool to guide the station's research and development activities for the next ten years. The plan is divided into two parts i.e part one gives the background information for the site while part two provides the description for future management. Data for the preparation of the plan were mainly generated from past research and development activities in Tiva supplemented by records at the Kitui Regional Forestry Research Centre.

PART I

BACKGROUND INFORMATION

1.0 DESCRIPTION OF THE WOODLAND

1.1 Name and Situation

This management plan refers to Tiva Field Station prepared for use between 2001 and 2010. This is a Field Station of Kitui Forestry Research Centre.

Tiva woodland is situated in Kwa-vonza Location, Yatta Division, Kitui District in the Eastern Province. It is 21 km north-west of Kitui town along the Nairobi – Kitui road. The woodland lies between longitude 37 ° 47'E to 37 ° 52'E; latitude 1° 19'S to 1° 22'S and an altitude of 1000 to 1200 m above sea level. Figure 1 shows the location of the station.

1.2 Legal ownership and Boundaries

Through Min. 33/97 Resolution No. 11/97 of 9 July 1997, the Kitui County Council gave the land to KEFRI on a 99-year lease effective from 1st July 2000. A copy of the letter of allotment is attached in Appendix I. The land has been surveyed and given Land Reference No. 2460 and Lease Title Grant No.IR 86318 (Appendix II). The external boundaries have been demarcated using beacons. The internal boundaries have been demarcated using different vegetation types and experimental plots layout. These boundaries are vulnerable to change hence the need for precise subdivision into blocks and compartments through the use of natural boundaries such as vegetation types, rivers, streams, valleys and ridges.

1.3 Description of the Woodland

The woodland has an area of 1150 ha in two blocks: the Eastern and the Western Blocks covering approximately 820 and 330 ha respectively (Figure I and Appendix II). Out of the total area, 172 ha have been used for experiments. The area under natural woodland is approximately 978 ha.

1.4 Topography and Drainage

The site has a rolling terrain but does not from a distinct drainage pattern. The Tiva River is the only reliable water source and its catchment is beyond the woodland. The Maviani hills have a potential for local catchment but this needs some management. The woodland borders the Manzi-Ituma stream on the northern region

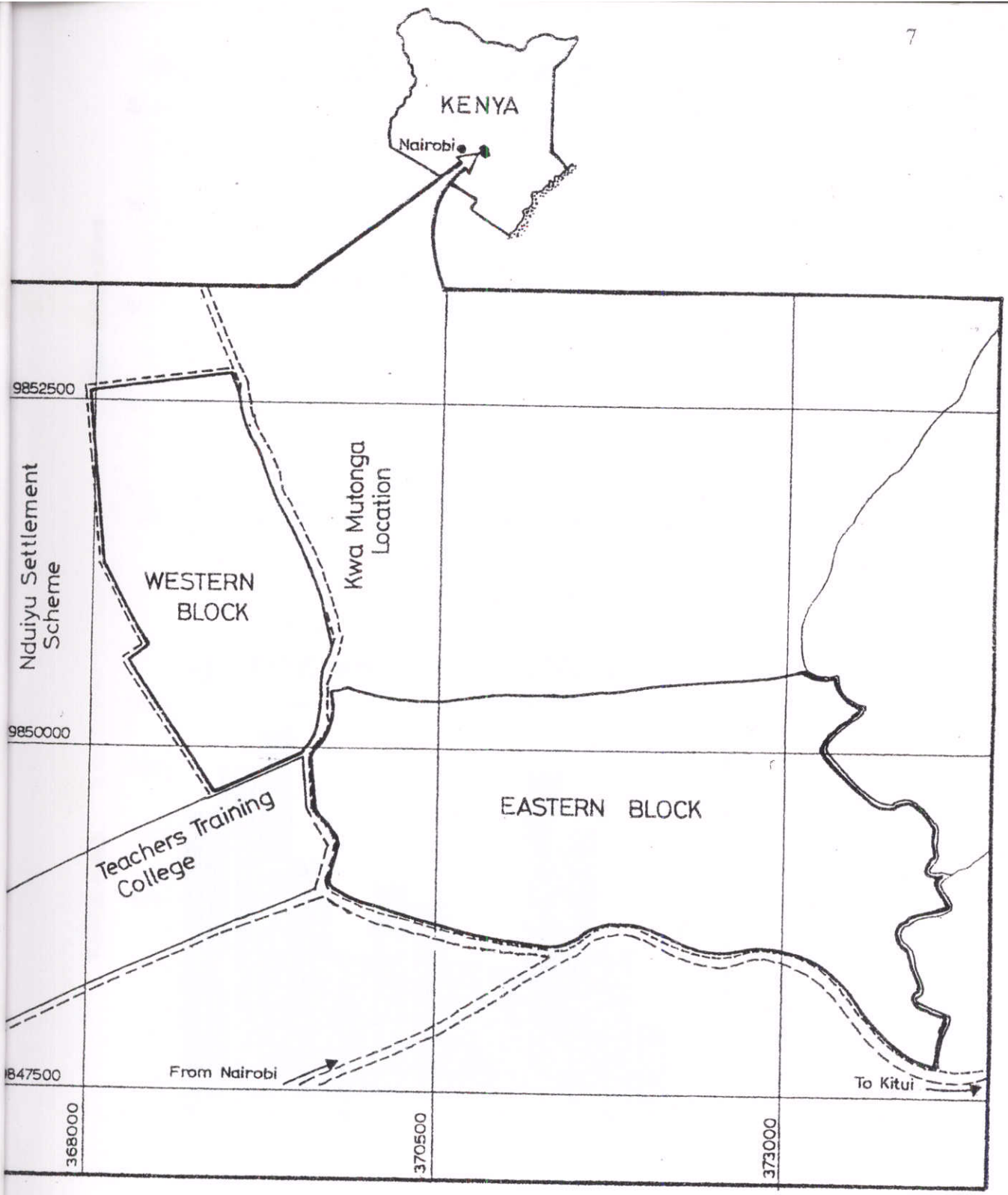


Fig. 1. Map Showing Location of Tiva Field Station

Fig. 2 Mean monthly temperatures

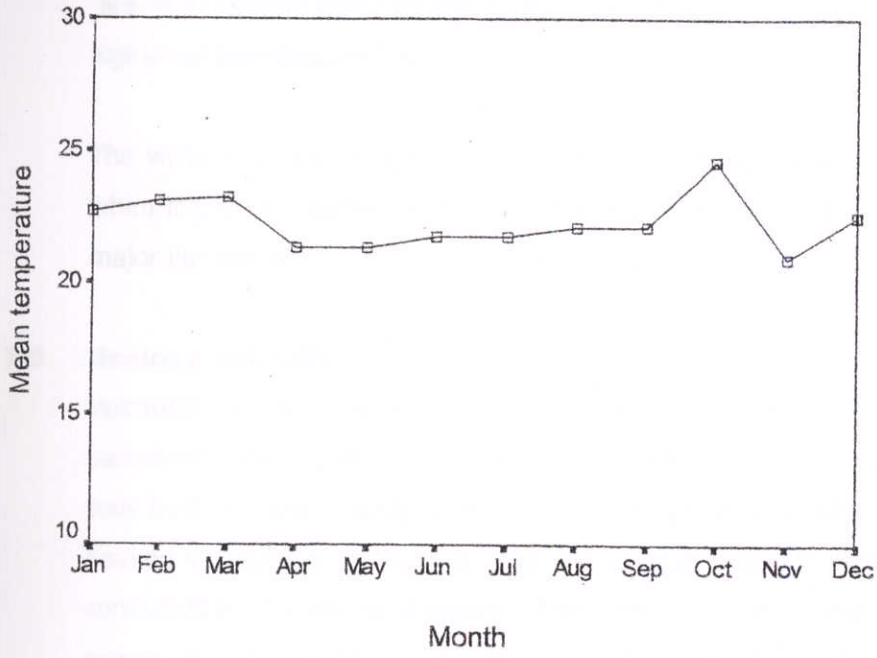
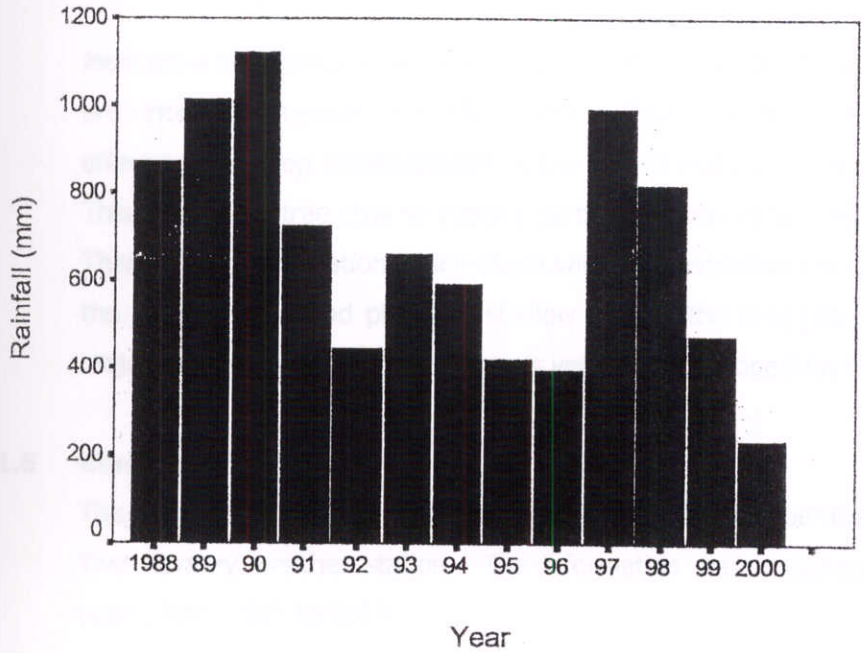


Fig.3 Total rainfall (1988 to 2000)



and Muvwongoni River on the eastern region. These are, however, seasonal with a highly variable stream-flow.

The woodland has an artificial dam that stores water only during the rainy season when it gets the surface run-off mainly from the Maviani hills. Water scarcity is a major impediment to the tree establishment.

1.5 Geology and Soils

Volcanicity is the main soil forming process in the area. Murram constitutes the parent material, giving rise to ferralitic soils characterized by the reddish colour. The soils have a coarse sandy texture with a moderate to shallow profile. Their water-holding capacity is quite poor and erosion has reduced the effective soil depth considerably. The elevated regions of the woodland have luvisols that are dark red in colour while the slopes are dominated by light red acrisols. In the valleys, there are vertisols formed from deposits of erosion. These are more fertile than the reddish soils, but with a lower infiltration capacity.

Moisture stress and soil management with regard to depth and hard plan formation are critical in effective tree establishment. The shallow soil depth has far reaching effect on tree crop establishment as the parent material is very close to the surface. This makes the tree crop to subsist on the shallow profile, which often become dry. There is a good variation in soil depth within the woodland ranging from deep soils in the plateau and flood plains to shallow soils in the lower sloping land towards the major drainage system. A soil map is yet to be developed for the woodland.

1.6 Climate

The climatic factors discussed here are rainfall and temperature as recorded at the Tiva Nursery weather station. The information was collected over a period of 13 years, from 1988 to 2000.

Tiva station receives a bimodal rainfall pattern with the "short rains" occurring between March and May and "long rains" between mid-October and December (Figs. 2 & 3) with a peak in November. Over the last 13 years the area received annual rainfall of 670mm which ranged from 237 to 1120 mm. Fig. 3 shows that the year

2000 had exceptionally low mean annual rainfall. There is a dry season from mid-May to mid-October.

Mean maximum temperatures range between 20^{0}C to 30^{0}C mean minimum range between 15 °C to 17 °C. The months of July and August have low mean temperatures, but this is a fire risk period because it coincides with the dry season. Tree growth is also minimal due to lack of moisture.

1.7 Natural Vegetation

The natural vegetation in the area falls under the deciduous *Acacia-Commiphora* woodland. The tree cover is discontinous but there is a continous shrub layer. The woodland is dominated by five main drought resistant species, namely *Acacia mellifera, Acacia tortilis, Albizia anthelmintica, Commiphora species* and *Terminalia brownii.* These species cover the entire region in a mixed pattern with the shallow soil mainly inhibited by *T. brownii.* The isolated black cotton soil patches favour *Balanites aegyptica.* The economically important species like *Melia volkensii* (makau), *Dalbergia melanoxylon* (ebony or mpingo), *T. brownii* and *A. tortilis* have been over exploited leading to their sparse occurrence in the woodland.

1.8 Benefits to the Local communities

The adjacent farmers have traditionally used the woodland for grazing and firewood collection, but with some restrictions. It is worth noting that there has been a tendency to abuse these privileges and this is drawback in both the sustainability of the existing privileges and the further conferment of others. The existing privileges will apply where the interests of the local community are not in conflict with the conservation strategies.

1.9 Access and Communication

The woodland is linked to Kitui town and Nairobi City by a tarmac road class B7 (Fig. 1). Within the woodland are forest roads which are regularly maintained by KEFRI hence are always motorable during the dry season. Excessive rainfall renders them impassable, but this is rare. The present road transport and the telecommunication services seem adequate.

2.0 PAST ACTIVITIES AND MANAGEMENT SYSTEMS

2.1 History of the Forest

The woodland was declared a crown land during the colonial days and remained like that a few years after independence. The local communities used the land for grazing. In 1967, Kitui County Council leased part of the location for settlement and group ranches. The new settlers had free access to the forest and this led to uncontrolled use. The forest was further subjected to over-exploitation following the construction of Machakos-Kitui road. In 1987, the Kitui county council handed over the woodland to KEFRI to use for research and development. Research efforts have been directed at species and provenance trials and developing tree establishment techniques.

Illegal grazing and harvesting of trees for charcoal burning takes place in areas far away from the office and where accessibility by road (Fig.1) is not easy.

2.2 Past Research and Development Activities

Past research has enabled the ranking of fast growing drought resistant species of economic importance. Major challenges of afforestation in the region have been brought to light. Though there have been no management plans, implementation of research activities in the past has followed 5–year work-plans detailed on annual basis. Priority research activities carried out in the woodland are summarised below and Appendix IV gives details of what has been achieved from 1993 to 1997.

2.2.1 Species and provenance Trials

Over 50 indigenous and exotic species have been tried and the following have shown encouraging results: Mpingo, Makau, *T. brownii, T. prunoides, Senna siamea, Azadirachta indica* (neem) and *Tamarindus indica. Eucalyptus camaldulensis* and *E. tereticornis* showed a fair performance while *Grevillea robusta* showed high susceptibility to termite damage. *Prosopis juliflora*, Jacaranda *mimosifolia* and *Acacia crassicarpa* were found to perform well under intensive management system, but were also susceptible to termite attack. Indigenous acacias (*A. senegal, A. tortilis* and *A. polyacantha*) also showed promising results. *Moringa oleifera* and *M. stenopetala* (an indigenous species) have also been tried.

2.2.2 Improvement of Seed Germination

Seed germination studies have been undertaken with Mukau, *T. brownii* and *T. prunoides*. A seed extractor has been developed for Mukau which has improved the rate of seed extraction. Seed germination has also been improved through various pre-treatments methods. However, a major problem that still requires research is the high rate of post-germination mortality with this species. Termites were found to be effective and economical in extraction of *T. brownii* seed.

2.2.3 Land Preparation

Various methods of land preparation, ranging from manual to mechanical, have been tries to improve tree survival and growth. Tractor ploughing showed the best results although the costs were higher compared with manual methods. The underlying principle was, however, found to be the ploughing depth which resulted in improved soil infiltration and moisture retention. Moisture harvesting and retention techniques such as suitable micro-catchments and timely weed control have contributed to successful tree establishment.

V-shaped, W-shaped and circular shaped micro-catchments were constructed prior to tree planting to direct rain water into the planting holes. The performance of *S. siamea* was assessed on these planting designs over a period of ten years. V-shaped and W-shaped micro-catchments were found to be more efficient than the circular ones.

2.2.4 Weeding

The performance was investigated in respect to clear weeding and slash weeding. Clear weeding gave better results in height (45.9%) diameter (50%) and survival (16.6%) over the slash weeding.

Preliminary results of mulching using sand and murram showed that murram mulch was superior although its use by farmers require further research and appropriate guidelines.

2.2.5 Silviculture of *Senna siamea*

Trials on spacing, pruning and thinning have been carried out with *S. siamea*. The results showed that the pruning intensity was found to influence height growth with

increased intensity reducing growth rate. For the production of a straight bole, pruning is absolutely necessary. It also reduces evapo-transpiration rate by reducing the leaf area.

Preliminary results four years after thinning showed that high thinning intensities increased growth. However, more studies are needed to establish the most economical thinning regime.

On spacing, preliminary results showed that spacing of 4 m x 4 m is the most appropriate for this species.

2.2.6 Ecological Studies

A check list of the plant species (Annex III) was carried out in the late 1980s and result published by Hayashi and Gachathi (1998). A total of 133 plant species in 92 genera distributed in 48 families were recorded.

2.2.7 Domestication of Indigenous Fruit Trees

This activity was initiated recently and the current work has focused on *Sclerocarya birrea*, a popular species occurring in the area.

PART II

PRESCRIPTION FOR FUTURE MANAGEMENT

3.0 MANAGEMENT OBJECTIVES

Four objectives are proposed for managing this woodland. The first is to use the woodland to undertake research and development to generate technologies for drylands forestry. The second objective is to demonstrate successful technologies. These objectives must be give first priority. The third objective is the conservation of the unique biological diversity of the woodland. Fourthly, the woodland will be used to generate income to support research, development and conservation activities.

3.1 Research and Development

Research and development activities will focus on the following priorities:

- Species and provenance research;
- Domestication of indigenous wild fruit trees;
- Developing propagation methods to improve seedling production of Mukau;
- Costing of tree plantations establishment and tending operations;
- Developing tree plantations silviculture schedules;
- Establishment of seed orchards and gene conservation stands; and
- Monitoring of biodiversity in the woodland.

3.2 Demonstration of Successful Technologies

There is need to improve adoption of technologies developed within or outside Tiva through establishment of demonstration plots.

3.3 Biodiversity Conservation

As woodlands in Kenya are undergoing rapid degradation, a large proportion of Tiva woodland will be set aside for conservation of biodiversity. This will provide an opportunity fro KEFRI to demonstrate successful approaches to conservation and sustainable management of dry forests ecosystems. The activities undertaken in the woodland and its unique biodiversity will be publicized to attract local and international support.

3.4 Establishment of Commercial Tree Plantations

Part of the wood will be put under intensively managed plantations. The target species are Mukau and Mpingo. Mukau will be grown for production of general purpose timber for local use while Mpingo will be grown to supply material for the

wood carving industry. There is a growing demand for these products due to increasing population. For along time Mpingo was the most preferred wood for wood carving, but the resource has been depleted. Recent trials, however, shown that with intensive management, the species may be grown at much shorter rotation than earlier thought.

3.5 Division of Tiva Woodland into Blocks and Compartments

The woodland will be subdivided into blocks and compartments determined by the objectives of management and will follow boundaries of roads, rivers, etc. The size of the compartment will vary according to the requirements of each object of management. The following is the proposed area allocation for the object of management:

Management and development	**Area, hectares**
Research and development	80
Tree plantations	120
Seed stands and seed orchards	50
Demonstration plots	100
Biodiversity conservation	800
Total	**1150**

4.0 MANAGEMENT PLAN PROGRAMMES

4.1 Research and Development Programme

4.1.1 Selection of Species and Provenances

The objective is to identify or choose species and provenances suitable for growing in Tiva and other dry areas with similar conditions for production of wood, food (fruits), forage and other tree-based products. Although many species screening trials have been carried out, most of them were not conducted systematically and few were fully replicated. Further, the provenances of species selected for commercial plantations, have not been tested. Also the eucalyptus hybrids recently introduced to Kenya have not been tried. No research has also been carried on forage plants. It is therefore necessary to conduct further species and provenance trials of both indigenous and exotic species. With species trials, emphasis should be given to *Eucalyptus grandis* and E. *camaldulensis* (GC) hybrids from South Africa. Attention should also be directed to screening of dryland forage plants.

Provenance trials should focus on *M. volkensii, D. melanoxylon* and *T. brownii*. Seed sources of *M. volkensii*, should be obtained from Kitui, Kibwezi, Mbere, Tharaka, Taita Taveta, several areas in Northern Kenya, southern Somalia, Northern Tanzania, etc. As Mpingo is widely distributed in the dry zone of Africa it is important to obtain seed from as many countries as possible. Several local provenances should also be included in the trials. Provenances of *T. brownii* should include those from south Nyanza, Nandi Hills, Kerio Valley, Baringo, Kibwezi etc.

The trials should be fully replicated and planted in well prepared sites. They will be clean weeded until the plants have grown sufficiently to close canopy and suppress herbaceous or grass vegetation. This will take two to three years, but this is probably longer for the slower growing Mpingo.

Assessment of the trials should be done annually, important parameters to assess are height, diameter, stem form or crown thickness in the case of forage plants. The duration of the experiments should at least be 10 years, but seed of superior provenances identified should be collected for establishment of commercial plantations, orchards, and initiating a tree breeding programme.

4.1.2 Domestication of Wildfruit Trees

The indigenous fruit tree are important to people living in the dryland. However, due to clearing of woodlands, wild fruit species are rapidly disappearing. The objective of this activity is to domesticate prioritized wild fruit trees in order to supplement the traditionally cultivated fruit trees such as mangoes. The second objective is to develop strategies for conservation of endangered indigenous species. The study should build on the on-going work on *Sclerocarya birrea*.

The priority species are:

- *Ziziphus mauritiana*
- *Vangueria rotundata*
- *Vitex doniana*
- *Berchamia discolor*
- *Sclerocarya birrea*
- *Tamarindus indica*
- *Darium orientalis*

The main activity is testing the growth of the above species. The method used to establish species and provenance trials should generally be used for testing indigenous fruit trees. Important parameters to be assessed are height, diameter, age of first flowering and fruiting.

Genetic diversity of all species should be studies and conservation stands established.

4.1.3 Propagation of *Melia volkensii*

The main constraint to increased planting of Mukau is availability of planting material. The seed of this species exhibits dormancy and needs to be pre-treated to improve germination. Seedlings are also susceptible to fungal attack after germination resulting in the high post-germination mortality. Other nursery techniques needed to produce high quality planting material should be given attention.

4.1.4 Costing of Tree Establishment and Tending Operations

Much work has been done to develop effective methods of establishment, but attention has not been given to the costs of various operations. The objective of this programme is to determine cost-effective methods of establishing tree plantations. Costs of various operations such as seedling production, site preparation, planting and weeding should be recorded and information generated used to determine the economics of tree growing.

4.1.5 Developing Silviculture Management Schedules for Plantations

There is little information available for recommending initial spacing and subsequent pruning and thinning regimes for Makau and Mpingo. Various spacing and pruning trials should therefore be established. Research on stem singling should also be carried out with Mpingo. Spacing , pruning and singling treatments that show encouraging results in the first four years should be recommended for wider scale application.

4.1.6 Establishment and Management of Seed Orchards

To ensure sustained future supply of seed to meet afforestation programmes in Kenya's drylands, seed orchards of various species should be established in Tiva. These orchards should be expanded as new species are identified or when improved material becomes available. Initially, the following species should be included: *M. volkensii, D. melaxylon, S. siamea, T. brownii, Moringa* species. *E. camaldulensis, A. indica*, and promising indigenous fruit forage species.

4.17 Monitoring of Biodiversity

The objective of this programme is to generate data on biodiversity of the woodland that can be used for management planning. This will be done by establishing permanent sample plots (PSPs) for regular collection of detailed data on biodiversity.

4.2 Demonstration Plots Programme

Tiva Woodland should be used to demonstrate various technologies developed on the site and those which have been successful under similar conditions elsewhere. The target group is farmers schools and extension agencies. Demonstration activities should be combined with on-the-site training and distribution of pamphlets, manuals and videos. Demonstration plots should focus on: nursery and tree

establishment methods, new species or provenances; management of plantation species; domestication of wild fruit trees; and conservation of biodiversity.

4.3 Biodiversity Conservation Programme

A large part of the woodland (800 ha) should be managed for biodiversity conservation. To gain local support in protection and conservation activities, the local communities should be facilitated in setting up income generating activities such as bee-keeping. Such activities are likely to minimize the excessive tree exploitation and habitat destruction thereby creating a conducive environment for the conservation of small game, birds and reptiles. Efforts should also be made to establish live-fences along the boundary of the woodland using indigenous species. Biodiversity monitoring should be undertaken as part of Research and Development Programme. Funding of biodiversity conservation activities will be sought from donors and the conservation activities should be well publicized locally and internationally.

4.4 Commercial Tree Plantations Programme

The target for this programme is to establish 120 ha over the ten year period. The species selected for plantation programme are Mukau, Mpingo and *T. brownii* and their planting should be 70, 30 and 20 ha respectively. The species have been chosen because of their proven adaptability to conditions at Tiva and their wood is in high demand. The annual planting programme should be 7.0, 3.0 and 2.0 ha for Mukau, Mpingo and *T. brownii* respectively. The general approach to plantation establishment is intensive management. Planting sites should, therefore, be well prepared. Seedlings will be raised using standard containers and planted at initial spacing of 4.0 x 4.0 m (625 trees per ha). The plantations should be clean-weeded for the first three years. For Mukau, trees should be pruned to obtain a knot free bole at least 3.0 m. A tentative thinning schedule is as follows:

Treatment	Age	Trees/ha after treatment
Plant	0	625
Thin	6	400
Thin	8	200
Clear fell	10 - 15	

Thinning should be commercial and wood can be sold as poles to adjacent farmers and institutions. Material from clear felling should be sold at market price.

5.0 LABOUR PHYSICAL INFRASTRUCTURE AND FINANCIAL REQUIREMENTS

5.1 Road network and Other Communication

With the proposed division of blocks and compartments, the road network has to be altered, as more roads shall be required to access the new areas. Out of the 1050 ha. of the woodland, intensive road network cover 20 km and 10% of the woodland has been planted with trees. The rest has a limited road network due to the low level of activity. The economic viability of the proposed working cycle shall justify the construction of the extra roads. However, provision has to be made for periodic inspection and maintenance of boundaries.

5.2 Protection

(a) Fire

Besides the watchtower that is in place, a fire hazard rating board needs to be erected where sensitive programmes like biodiversity conservation and establishment of commercial tree plantations are being implemented. This is because they need a long-term evaluation and a fire outbreak shall greatly affect both the objective and the methods of attaining them.

(b) Insect

Termites are the major threat to tree growth in the site. One of the criteria for evaluating the success of a species or provenance should be its resistance or tolerance to termite damage. Regular monitoring of insect pests should be carried out in established plantations.

(c) Animals

There is illegal grazing in some areas of the woodland and this results in damage to natural regeneration. Mortality of planted trees may also increase because of animal damage. Stepping up security in the woodland can only reduce this and having a similar undertaking to the woodland neighbours (ranches) so that grazing is controlled and there is no idle pasture to attract illegal and destructive grazing. Efforts will be made to seek community-based solutions to the current grazing problems.

(d) Man

Encroachment by man can be reduced by the full occupation of the woodland. Earlier encroachments were necessitated by the fact that the land seemed idle and KEFRI was likely to surrender it to them. The proposed income generating activities through bee-keeping should aid in reducing man's interference.

5.3 Buildings

The construction of a forester's house in the woodland that is on going is quite strategic in enhancing supervision and security. Due to the problem of resident labour claiming settlement after a long time, non-resident labour shall be encouraged.

5.4 Maps Control forms and Records

A topographic map on a scale of 1:20,000 combined with existing aerial photos (1995) should be used to prepare a map for the management plan with the division of the area into blocks and compartments as the current Tiva map only shows the external boundaries. Internal boundaries shall be demarcated preceded by survey work.

Because of the specificity of the objective under each programme, the control shall simply be the comparison between the stated objective and the level of achievement. This shall be done on per year basis and then after five years. Records of each operation have to be kept so as to compare them with the prescribed targets.

5.6 Staff and Labour Requirements

Staff requirements are as follows:

Category	No.
Forest Manager	1
Forest Assistant/Technician	3
Forest Guards	3
Patrol Men	6
Office Clerk	1
Drivers	2
Nursery Workers	6

Field Workers	15
Total	37

Additional labour will be employed on temporary basis as the need arises.

Vehicles needed for implementation of the proposed activities are:

Type	**No.**
4WD	1
Motorcycles	3
Tractor	1

The motorcycles will be used for patrolling the woodland while a tractor is for soil collection, preparation of planting sites, transport of seedlings and general maintenance work.

5.7 Projected Expenditure

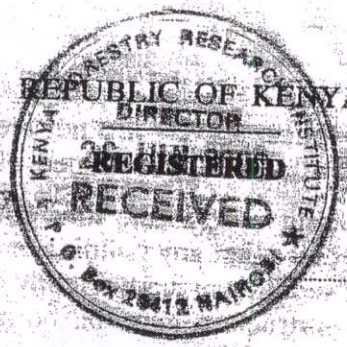
These are given in Appendix V

6.0 PERIOD OF THE PLAN, AMENDMENTS AND REVISION

The time lapse for the plan is 10 years from the year 2001 to 2010. Annual plans shall be developed to cover all the aspects of the broad management plan. Evaluation will be done yearly to facilitate forward planning.

Five year evaluation shall be done in the year 2005 to assess the past performance as a basis for future projection. This evaluation shall be crucial as besides guiding the second 5 years plan, it shall guide setting and strategies for the follow up 10 year plan. Management has to be by objectives as each object of management shall be evaluated individually and not in general.

APPENDIX I: LETTER OF LAND ALLOCATION



Telegrams: "LANDS", Nairobi
Telephone: Nairobi 718050/9

Permanent Secretary Treasury
P.O. Box 30007,
NAIROBI

REPUBLIC OF KENYA

DEPARTMENT OF LANDS
P.O. Box 30089
NAIROBI

Ref. No. 209163/3/30

22nd June 19 2000

SIR(S)/MADAM, RE: KITUI MUNICIPALITY - KEFRI RESEARCH PROGRAMME KITUI

LETTER OF ALLOTMENT

I have the honour to inform you that the Government, on behalf of ..... County Council, hereby offers you a grant of the above plot shown edged red on the attached plan No. (25)KTI/1408/2000/1 subject to your formal written acceptance of the following conditions and to the payment of the charges as prescribed hereunder:

AREA: 1151.0 hectares (approximately).

TERM: 99 years from the 1-7-2000

STAND PREMIUM: Sh. NIL

ANNUAL RENT: Sh. 72/- } Subject to adjustment on survey, but there is no claim for reduction in area on survey.

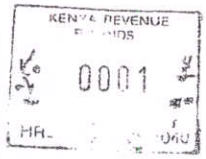
GENERAL: This Letter of Allotment is subject to, and the grant will be made under the provisions of, the Government Lands Act (Cap. 280 of the Revised Edition the Laws of Kenya) and title will be issued under the Registration of Titles Act (Cap. 281) or the Registered Land Act (Cap. 300).

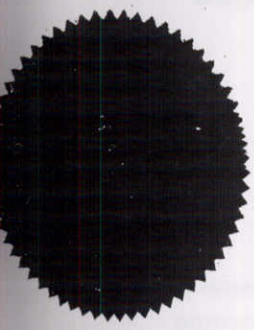
SPECIAL CONDITIONS: *See* attached.

2. I should be glad to receive your acceptance of the attached conditions together with banker's cheque for the amount as set out below within thirty (30) days of the postmark:

	Sh.
Stand Premium	"
Rent from 1-7-2000 to 31-12-2000	36.00
Conveyancing Fees	1,250.00
Registration Fees	250.00
Rates on demand	
Stamp Duty	100.00
Survey Fees	
Road and Road Drains	
Others Approval fees	2,000.00
Receipt No. ..... Less Deposit	
TOTAL Sh.	3,636.00

APPENDIX II: THE REGISTRATION OF TITLES ACT



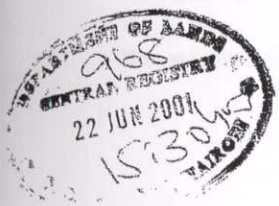


REPUBLIC OF KENYA

S/D E.I
JO
5/6/2001.

THE REGISTRATION OF TITLES ACT

(*Chapter* 281)



GRANT NO. IR 86318

ANNUAL RENT: Kshs.72/-

TERM: 99 Years from 1.7.2000

KNOW ALL MEN BY THESE PRESENTS that THE COUNTY COUNCIL OF KITUI (hereinafter called "the Council") A body corporate duly established under the Local Government Regulation Act 1963 hereby GRANTS unto KENYA FORESTRY RESEARCH INSTITUTE, a body duly incorporated under the Provisions of the Science and Technology Act (Chapter 250) of the Laws of Kenya of NAIROBI (Post Office Box Number 20412)

(hereinafter called "the Grantee") all that piece of land situate in North West of Kitui Municipality in KITUI

District containing by measurement one thousand one hundred and fifty decimal nine (1150.9) hectares

~~acres~~ or thereabouts that is to say Land Reference Number 24600

which said piece of land with the dimensions abuttals and boundaries thereof is delineated on the plan annexed hereto and more particularly on Land Survey Plan Number 234343 deposited in the Survey Records Office at Nairobi To HOLD for the term of ninety nine (99) years

from the first day of July ~~One thousand nine hundred and~~ Two thousand

SUBJECT to (*a*) the payment in advance on the first day of January in each year of the annual rent of Shillings Seventy two (Kshs.72/-) (revisable) w.e.f. 1.7.2000

(*b*) the provisions of the ~~Government~~ Trust Lands Act (Chapter ~~280~~ 288) and

(c) the following special conditions (Namely):-

Vegetation Science, 15 : 71-77, 1998.

A check list of the plant species at the site of the Kenya and Japan Social Forestry Training Project, Kitui, Kenya

Ichiroku Hayashi[1] and Francis N. Gachathi[2]

[1]Sugadaira Montane Research Center, The University of Tsukuba, Sanada, Nagano, Japan 386-2201
[2]Kenya Forestry Research Institute, P. O. Box 20412, Nairobi, Kenya

A botanical survey aimed at compiling a checklist of the common plants from the site, and its surrounding, of the Kenya and Japan Social Forestry Training Project, Kitui, Kenya, was conducted in 1989 and 1990. The purpose of the checklist was to provide basic information for an ecological study of the area. A checklist of plants arranged alphabetically by scientific names and with their local Kamba names is presented. In addition, a separate list of local names arranged alphabetically is also included to facilitate cross-reference.

Key words: Kenya, drought deciduous woodland, Kamba-language

INTRODUCTION

The site of the Kenya and Japan Social Forestry Training Project Kitui is located at ca. 01° 06′ S and 38°E at about 1,088 m above sea level (Fig. 1). The rainfall distribution is bimodal with peaks of short rains in March/April and long rains in November/December and with annual mean temperature of 20℃ and total precipitation of 800 mm (Fig. 2). This places the site in agro-climatic zone (v) which is semi-arid, characterised by a medium to low plant growth potential (Sombroek et al 1980). The area is inhabited by the Kamba ethnic community who grow subsistence crops such as maize, beans, pigeon peas, cassava etc. but also keep cattle, goats, sheep as well as donkeys, the latter mainly for transport. The predominant vegetation type is that of *Acacia-Commiphora* wooded bushland (Pratt et al 1966). The actual vegetation however is dominated by *Commiphora africana* and *Lannea triphylla* which have been left uncut since they are unsuitable for either timber or firewood.

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METHOD

Plant specimens were collected in and around the site of the Kenya and Japan Social Forestry Training Project at Kitui and identified using the Kenya Trees and Shrubs (Dale and Greenway 1961) and the Upland Kenya Wild Flowers (Agnew 1974). The local names were given by the local informants from the Kamba tribe. Specimens were pressed and dried and later confirmed at the East African Herbarium, Nairobi. The local names and spellings were verified and counter checked by specimens by a research officer who is a native of Kitui.

RESULTS

A total of 133 plant species in 92 genera distributed in 48 families were recorded as the most common plants comprising the vegetation at the vicinity of the Kenya and Japan Social Forestry Training Project at Kitui. These were tabulated into a checklist, which is appended in this paper.

ACKNOWLEDGEMENTS

We wish to thank Dr. B.N. Kigomo, deputy director research, Kenya Forestry Research Institute

APPENDIX IV: NURSERY AND FIELD ACHIEVEMENTS FOR THE YEARS 1993-1997

No.	EXPERIMENT	OBJECTIVE	STATUS	REMARKS.
1	Shading	To determine performance under different shading	11 species tried	6 to be tried in 1997
2	Hardening up	Alteration of watering intensities and potential in the field survival	19 sp. tasted	5 sp. Planned for 1997
3	Pre- germination tests.	Seed germination performance of difference species under different treatments	158 species tested	30 species planned for 1997.
4	Vegetative propagation trial	To investigate cuttings and grafting.	4 species tried through cutting & 1 through grafting.	Grafting successful with fruit trees and stem cutting only suitable for tree species
5	Stump seedlings	Possibility of obtaining stumps as planting stock.	16 species tried and completed.	
6	Termite control	Efficacy of the various chemical / extracts in controlling termites.	14 chemicals / extracted plant substances tried.	More cost effect method of control needed
7	Seeding sizes	Obtain right out planting size for difference species.	30 cm height recommended	
8	Pot size	Obtain optimal pot size for seedlings	4 x 7 inch size recommended	4 Scheduled for 1997
9	Collect seeds	Self sufficiency in seed supply	8246.4 kg collected.	
10	Tree phenology studies	Know flowering regimes & fruit maturity.	60 tree species studied.	Flowering and fruit maturity trends have been documented for priority species
11	Seed tree identification	Obtain quality seeds	57 mother trees identified.	Seeds are being collected
12	Establish scion garden	Attain self-sufficiency in quality cuttings for thorn -less *Prosopis juliflora.*	Established for P. juliflora and 36 other species.	The success was not fully realised due to shortage of funds
13	Seedling production	Supply seedling to extension and trial plantation	A total of 51600 seedlings produced	
14	Prepare nursery manual	Disseminate nursery techniques	Ready waiting printing	
15	Study root system development	Compare species survival in relation to rooting pattern.	34 species surveyed	4 species scheduled for 1997
16	Collect meteorological data.	Monitor weather pattern.	Used to determine planting time and others	Root density is enhanced at nursery level to favour field survival Data collection is continuous

APPENDIX V: ESTIMATED COST OF PLANTATION OPERATIONS PER HA PER YEAR IN KSH.

Activity	Year									
	1	2	3	4	5	6	7	8	9	10
Seed Collection	1000	1050	1100	1150	1200	1300	1400	1500	1600	1700
Raising Seedlings	7500	7900	8300	8700	9100	10000	11000	12000	14000	15000
Land Preparation	20000	21000	22050	23150	24500	25000	26000	27500	28000	30000
Fencing	9000	9450	9900	10400	11000	11500	12000	13000	15000	16000
Planting	1000	1050	1100	1150	1200	1300	1400	1500	1600	1700
Weeding including Pruning	4000	4200	4400	4600	5000	5500	6000	7500	8000	10000
Thinning	-	-								
Total ha.	42500	44650	46850	49150	52000	54600	57800	63000	68200	74400
Total for 20 ha	**850000**	**893000**	**937000**	**983000**	**1040000**	**1092000**	**1156000**	**1260000**	1364000	1488000