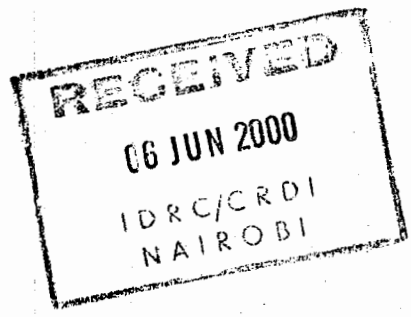
# TERMINAL REPORT OF RESEARCH 1998 TO 2000

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ELANGATA WUAS ECOSYSTEM MANAGEMENT PROGRAMME

NATIONAL MUSUEMS OF KENYA

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## SUMMARY

The report summarizes the research activities undertaken by EWEMP and its partners during the report period. It recognises that the experience differs from other co-resources management arrangements because in EWEMP the land is individually owned, but resources are shared, and the wildlife that abound in the area is communally owned. Results generated under individual study themes are reported. Progress in building community governance structure and its operative organs is noted. The work on sustainable management of the dry woodland reports progress in accumulating baseline mensturation data, sustainability/degradation assessment. The trends show continued wood encroachment on the uplands, a decline in the grass cover on the one hand, and growing loss of the woody vegetation in the flat plains. This background provides the attempt to establish quantified data on vegetation dynamics under the changing landuse practices among the pastoral Maasai. Experiences of the first wave of adoption of crop production in the area shows some success with dry zone sorghum and bean varieties. A marked progress in tree introduction and kitchen gardens is noted. Progress in consumptive and non-consumptive use of wildlife is highlighted. Completion of a checklist of resident bird and animal populations, important features for ecotourism in the programme area is also noted. Pioneering work on pasture renewal, including rotational grazing, development of grazing reserves and rehabilitation of degraded sites is also discussed. The pioneering adoption of beekeeping technology by the community has attracted many families so far. The impressive yield in quantity and quality of honey, for fresh innovators is noteworthy. Completed work on traditional technologies, food and medicinal plants are featured. It is noted that an artist is currently working on illustrations of key items before they can go for printing.

## 1.0 INTRODUCTION

The Elangata Wuas Ecosystem Management Programme (EWEMP) is a community-driven partnership that is promoted by the NMK, the KWS and members of the community. Pioneering discussions on the concept between the main promoters and the Elangata Wuas and Kilonito communities date from early 1990s. Its mission that was developed in 1992, is to promote sustainable development of the areas through wise and innovative management of natural resources including rehabilitation, and restoration of degraded sites and biodiversity so as to expand income sources and open new livelihoods.

The objective of the study is to establish a community-based approach to sustainable management of natural resources.

### Specific Objectives

1. To develop community-driven sustainable woodland management systems by local communities for their benefits.
2. To develop methodologies for sustainable management of dry woodlands to enhance quality and income generation.
3. To promote crop production and farm forestry in Elangata Wuas as a supplementary landuse option for enhanced security.
4. To domesticate and manage wildlife resources for sustainable production of goods and services.
5. To promote beekeeping as an additional income generating activity.
6. To identify and document indigenous knowledge systems by different life styles.

The programme strategy was focussed on working with local communities in evolving a community governance structure to promote sustainable management of renewable natural resources (NRM). Emphasis is accorded to developing replicable methods for NRM that are socially acceptable, economically viable and ecologically sustainable. It was therefore crucial from inception to foster a clear understanding of the dynamics of local biodiversity, its status, renewal trends and interactions with use processes. Implementation is based on a two-pronged approach (i) promoting the development of best-bet activities, and (ii) developing replicable methodologies through research. According to this scenario, knowledge gained through research was used in guiding development, while lessons learned from development interventions is fed in the development initiatives.

The present report covers work in the following seven areas: strengthening community organizations, woodland management, farm forestry and crop production, ecotourism and wildlife management, pasture renewal, beekeeping and traditional technologies. A number of studies have not been concluded and data from recent measurements in the woodlands are still been analyzed. The analysis of these results will be incorporated in the body of the final results for each experiment as each study matures.

## 2.0 STRENGTHENING OF COMMUNITY-BASED ORGANIZATIONS

Objective 1: To develop community-driven sustainable woodland management systems by local communities for their benefits.

Hypothesis

The dry woodlands are capable of providing multiple products and benefits sustainable to communities, when managed under innovative models to be developed through participatory research.

Output 1

Community-led sustainable natural resources management paradigms developed and increased community participation realized.

Activities

- Develop community-driven strategies and notes for training, planning and implementation of projects by stakeholders to achieve effective empowerment and awareness.
- Develop community-driven rules, regulations and laws for governance assuring sustainable management of resource bases.
- Document and evaluate social sanctions, pressures, maxims, and taboos on biodiversity use promising entry points for valorising these through infusion with modern systems.
- Promote mechanisms for adoption and surveillance instruments that would foster internalization of proven practices and their full integration in land use systems while assuring their legitimacy.
- Strengthen existing management structures and mobilize the people to join Land Owners Association.

### 2.1 Methodology

The work focussed on relevant areas identified under the study on traditional technologies and from other fora. Group discussions, PRAs and management meetings were further used to

identify priority areas for training, and capacity building to enhance community empowerment, and to create legitimacy of the CBO.

### 2.2 Results

The study confirmed that the community enjoys a traditional governance system based on a unique social, cultural, and economic instruments that are articulated under customary laws which cover interpersonal relations, property ownership, resources use, environmental management, etc. Shared beliefs provide a strong sense of group solidarity and cohesion. Each community member is concerned about the welfare of the family, the entire community, and its total well-being. In the past, beliefs, taboos and curbs regulated resource use, societal attitudes toward biodiversity sustainability and the natural environment stability.

Culturally prescribed norms defined division of tasks and responsibility between age groups and sexes with adult married men being responsible for governance, managerial duties, property ownership and political affairs. The spirit of mutual support, family relations and age-set loyalty and ties provides a strong base for developing strategies, tactics and alliances for ensuring food and economic security. This is still demonstrated in self-help programmes, sharing the use of resources, such as well digging, site rehabilitation activities, the use of water resources and reciprocal exchange in grazing during hard times.

The widespread application of traditional technologies in different livelihood systems is particularly noteworthy (see section 8).

Different members of the groups were trained in specific skills under the thematic programme activities, reported in subsequent chapters, and during workshop sessions and meetings. Study tours and exchange visits were made to Marigat in Baringo district and to women groups in Machakos.

Results of monitoring and evaluation exercises undertaken in November 1999, revealed that attempts to nurture a common community organization to serve Elangata Wuas and Kilonito communities on all development activities had failed to attract credibility and confidence from the two communities. It was evident that the Kilonito community did not feel comfortable with the element of domination, real or imagined from the members of Elangata Wuas where the headquarters is also located.

Results obtained through day to day observations and an evaluation conducted in November 1999, are being analyzed in-depth for a more comprehensive reporting and will also be incorporated in future work. Time did not allow for adequate implementation of all activities that had been planned for realizing output 1 of objective 1.

## 3.0 WOODLAND ECOLOGY

### 3.1.1 Introduction

Results of reconstruction of past vegetation cover had confirmed that some patches in the uplands had experienced wood encroachment, while the open savannas and the surrounds of settlements, had been heavily deforested. This contradicting state of the vegetation in common landscapes had presented an unusual challenge to management. It was therefore felt necessary to establish a benchmark of the state of the vegetation through emperical studies in sample plots. The following parameters were assessed:

(i) the growth pattern of the major species in the woodlands and the open savannas.
(ii) The structure and species composition of the woodland savanna mosaic including diameter distribution, diversity, growth, and logical sustainability vs degradation.

(iii) ecological dynamics of the vegetation with a focus on cover trends (woody plant biomass vs the grass layer).

Hypothesis

The dry woodlands have potential for providing multiple benefits when maintained under sustainable management.

Objective 2

To develop methodologies for sustainable management of dry woodlands to enhance quality and income generation.

Output

Woodland productivity of wood and non-wood products (volume yield per unit land per year) and levels of low impact offtake per unit area per year determined and used to guide sustainable harvesting models.

Activities

- Measuring the volume of standing stock of woody plants and where it is relevant, growth and yield.
- Survey the life forms/species composition of plant cover ranging from trees, shrubs, forbs, climbers and grasses.
- Measure and monitor regeneration of the above species, their growth, yield and trends.
- Record the major species association and the manner in which they interact with the biotic and abiotic factors.
- Assess and analyse the woody plant and grass cover from time to time to document changes in the plant population.

### 3.1.2 Methodology

Belt transects of 3600m stretching from the hills to the plains were established in May 1996, on Emartiokimpar Hill, comprising 3 transects per vegetation type, at intervals of 5km to study changes in the landscape cover under intensive pastoral landuse. These constituted a total of 15 quadrants, (five quadrants A, B, C, D, E, and F along each belt transect. Figure 1). The belt transects traversed three recognizable vegetation types: woodland, wooded grassland and open grassland (the typical savanna).

Trees were measured in 10m x 100m quadrants (stations A to F), placed at intervals of 400m along each belt. Within each quadrant, saplings were enumerated in 10mx10m and seedlings, forbs, herbs and grasses in 5mx5m sub-quadrants, one of each at the ends of the quadrant (station).

### 3.13 Results

Results of the first vegetative cover assessment conducted in 1996 in June revealed that tree life forms occupied 17.4%, shrubs 27.5%, forbs 29.4% and grasses 25.7% in the study area. Station A was situated on a gently dipping plateau, B on the steep slope, C on a moderate slope, D on a gentle gradient E on a light gradient while F was on a flat plain. A profile of the gradient and associated plant species in the permanent plots are shown in figure 1.

| Stations | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Terrain Unit | Gently dipping plateau | Steep slope | Moderately steep | Sloping | Gentle Sloping | Plain |
| Geomorphological processes | Slow weathering, some sheet wash | Sheet and rill erosion | Deposition of material | Sheet, rill and gully erosion | Sheet and rill erosion | Waterlog during rainy season |
| Vegetation | Open woodland | Bushland | Dense bushland | Shrubland | Dwarf shrubland | Grassland |
| Soil types | Block cotton, clay and sandy clay soils. Rock pavement | Clay sandy with rock pebbles | Loose sandy clay soil | Shallow sandy clay soil | Shallow clay soil | Black cotton soil |
| Plants recorded | A.drepanolobium<br>C.africana<br>Asparagus sp<br>G.bicolor<br>G.tembensis<br>Groton dichogamus<br>G. similis<br>Euclea divinorum<br>A.brevispica<br>Rhus quartiniana<br>A.etbaica<br>Cordia monoica<br>Dombeya<br>C.schimperii<br>Lycium | A.etbaica<br>G.bicolor<br>A.mellifera<br>Cordia monoica<br>Rhus vulgaris<br>G.similis<br>G.Schimperii<br>G.tembensis<br>Cissus rotundifolia/<br>Dombeya<br>E.divinorum<br>Maerua triphylla | Maerua triphylla<br>Balanites eagyptiaca<br>G. bicolor<br>A.mellifera<br>A.tortilis<br>Cadaba farinosa<br>A.etbaica<br>Cordia Monoica<br>S. parsica<br>A.brevispica<br>B.angustifolia<br>C.africana<br>c.schimperii | Maerua triphylla<br>B. aegyptiaca<br>C.africana<br>G.bicolor<br>G.tembensis<br>C.schimperii<br>A.mellifera<br>A.tortilis<br>Cadaba farinosa<br>Lycium | Mearua triphylla<br>B.aegyptiaca<br>C.africana<br>Asparagus<br>G.tembensis<br>C.schimperii<br>A.tortilis<br>C.farinosa<br>Lycium<br>A.nubica | A.drepanolobium<br>C.africana<br>A.mellifera<br>A.tortilis<br>A.nubica |

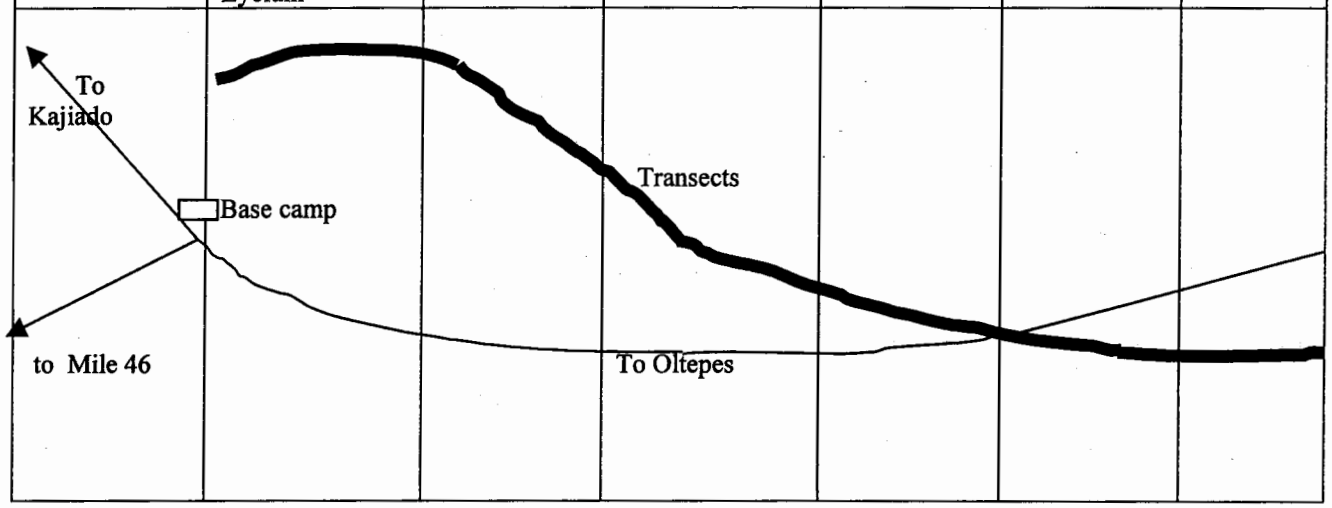


Figure 1

**A Summary of the Vegetation Survey along Land Gradient From Woodland to the Plains**

Results of plant distribution in June 1996, by percentage cover in the six stations was as follows:

- Station A had grass cover of 56% while woody plants covered 15%.
- In station B, grasses were mostly overshadowed by woody plants. Herbaceous layer was dominated by *Digiteria* and *Aristida adscensioni* with a grass cover of 15% and a woody cover of 40%.
- In station C, grass covered 3%, dominated by *Enteropogon macrostachyu., Digeteria macroblephara* and *Brachiaria* species, and wood cover was at 58%.
- Station D, which had experienced heavy human interference, the plants cover was dominated mostly by small shrubs, with a woody plant cover of 15% mostly *Balanites*. Grass cover was at 6% mainly *Digiteria, Pennisetum* and *Sporobolus.*
- Station E had dwarf trees and shrubs mainly *Cadaba* and *Balanites*. Grasses were dominated by *Cynodon dactylon, Sporobolus featívus* and bits of *Pennisetum mezianum.*
- Station F was dominated by *Pennisetum* grassland.

Results of a follow-up assessment taken three and four years later, have revealed marginal changes in nearly all stations. A comparison of 1996 and 2000 assessments from two stations B and D shows that:

i) In station B, there was a decrease of grass cover from 15% in 1996 to 10% in 2000 while woody plant cover remained at the same level 40%. Dominant grass species were P*ennisetum mezianum, Chloris roxybhurgiana, Cynodon dactylon and Entormorphogon. Commiphora schimperii* dominated the tree layer. The table 1 below details the major woody species.

**Table 1: Plant measurement data from station B**

| Name of tree | DBH in cm | Height in m | Crown Diameters in M | | Average Crown Diameter | Name of associated climber |
|---|---|---|---|---|---|---|
| *Commiphora schimperii* | 38.31 | 6.9 | 9.6 | 9.9 | 9.8 | Cissus |
| *Balanites aegyptiaca* | 6.62 | 3.4 | 1.83 | 1.62 | 1.73 | rotundifolia |
| *Balanites aegyptiaca (m)* | 13.25,11.15 | 4.9 | 4.8 | 4.7 | 4.75 | |
| *Balanites aegyptiace* | 12.10 | 5.2 | 2.42 | 2.68 | 2.55 | |
| *Balanites aegyptiaca (m)* | 11.78,7.96 | 4m | 5.5 | 1.3 | 3.4 | |
| *Commiphora schimperii* | 23.57 | 4.1 | 5.2 | 4.4 | 4.8 | |
| *Commiphora schimperii (m)* | 15.92,21.97 | 6.5 | 6 | 5.5 | 5.75 | |
| *Commiphora schimperii (m)* | 36.94 | 6.1 | 10 | 8.8 | 9.4 | |
| *Acacia tortilis (m)* | 20.7,13.7 | 6.7 | 10.5 | 8.1 | 9.3 | |
| *Acacia tortilis (m)* | 22.3,21.0 | 6.67 | 9.3 | 9.2 | 9.25 | Cissus |
| *Acacia tortilis (m)* | 8.28,7.64 | 4 | 4.8 | 4 | 4.4 | rotundifolia |
| *Acacia tortilis (m)* | 17.83 | 4.9 | 3.8 | 3.3 | 3.55 | |
| *Acacia tortilis (m)* | 14.33,18.15 | 5 | 5.5 | 6.6 | 6.05 | |

m = multistemed woody plants

ii) In station D, there was also reduction of grass cover from 6% to 4%, while the woody cover had increased from 25% to 35% in the year 2000. The grass layer was dorminated by *Pennisetum mezianum, Digiteria macrobiaphora, Chloris*

*roxybhurgiana and "Enkansirangi", Balanites aegyptiaca* dorminated the tree layer. The table 2 below gives details of the tree population.

**Table 2. Plant measurement data from station D.**

| Trees | DBH in cm | Height in m | Crown diameters | | Average | Name of associated climber |
|---|---|---|---|---|---|---|
| *Balanites aegyptiaca (m)* | 10.5,6.69 | 4.8 | 3.2 | 2.8 | 3 | |
| *Balanites aegyptiaca* | 6.05 | 3.6 | 2.0 | 2.2 | 2.1 | |
| *Balanites aegyptiaca (m)* | 8.92 | 3.7 | 3.5 | 3.2 | 3.35 | |
| *Acacia mellifera (m)* | 8.92,8.28 | 5.75 | 9.5 | 7.7 | 8.6 | |
| *Balanites aegyptaeca (m)* | 11.95,14.01 | 5 | 3.5 | 4.2 | 3.85 | |
| *Commiphora schimperii* | 12.74 | 3.7 | 4.8 | 4.7 | 1.75 | |
| *Balanites aegypticae* | 13.70,17.20 | 4.6 | 3.5 | 4.0 | 3.75 | |
| *Balanites aegypticae* | 8.60 | 3.5 | 3 | 1.7 | 2.35 | |
| *Balanites aegyptiaca (m)* | 6.37,7.32,7.32 | 4.4 | 5.1 | 4.0 | 4.55 | |
| *Commiphora schimperii* | 19.11 | 4.6 | 5.5 | 5 | 5.25 | |
| *Commiphora schimperii* | 20.38,15.29 | 4.5 | 5.6 | 5.5 | 5.55 | |
| *Balanites aegyptiacae* | 7.00,6.05 | 3.5 | 2.5 | 3 | 2.75 | |
| *(m)* | 31.85 | 6.9 | 11.7 | 12.2 | 11.95 | Cissus |
| *Acacia tortilis* | 6.37,7.32 | 3.2 | 1.9 | 1.7 | 1.8 | rotundifoli |
| *Balanites aegyptiacae* | 7.96,8.60 | 4.5 | 2.4 | 2.0 | 2.2 | a |
| *(m)* | 8.6 | 3.7 | 2.9 | 2.3 | 2.6 | monodica |
| *Balanites aegyptiacae* | 11.46,8.92 | 4.5 | 3.2 | 4.5 | 3.85 | |
| *(m)* | 7.32 | 3.7 | 2.4 | 2.4 | 2.4 | |
| *Balanites "* | 7.96 | 4.5 | 1.3 | 1.4 | 1.35 | |
| *Balanites "(m)* | | | | | | |
| *Balanites "* | | | | | | |
| *Balanites "* | | | | | | |

### 3.1.4 Discussion

Three species of woody plants were conspicuous in Station B, *Balanites aegyptiaca, Acacia tortilis and Commiphora schimperii,* for which mean measurements are presented in table 3.

Table 3. Mean growth measurements for trees from station B.

| Species | DBH (cm) | Dorminant Height (m) | Crown diameter (M) | No of stems/ per station |
|---|---|---|---|---|
| Commiphora schimperii | 27.34 | 5.9 | 7.43 | 4 |
| Balanites aegyptiaca | 10.48 | 4.38 | 3.1 | 4 |
| Acacia tortilis | 16.00 | 5.45 | 6.51 | 5 |

From these measurements, it is noted that C*ommiphora schimperii,* was the dorminant woodland tree species along the steep slopes in terms of DBH, crown diameter and height followed by *Acacia tortilis*. Abundance in number did not vary significantly among the woody species types. *Commiphora schimperii* and *Balanites aegyptiaca* had four stems while *Acacia tortilis* had five stems per station.

Results from the smaller plots reveal that *Chloris roxybhurgiana* was abundant in the lower section of station B, while "Entormoghon" dorminated the upper sections. "Entormoghon" grew well under the shade of *Commiphora schimperii.*

Other species recorded in the grass layer were *Pennisetum mezianumm* and *Cynodon dactylon,* which were prevalent in the lower section of station B. Grass diversity was higher in the lower section (four different species) while in the upper section only two grass species of *Chloris roxybhurgiana* and Entormoghon were noted.

Five species of forbs were identified with *Commelina bengalensis* dominating in both lower and upper sections of station A. The lower section had high diversity of four species which include goats onion, *Tribulus terrestris,* "Olawuii" and *Cissus rotundifolia,* while *Commelina bengalensis* and *Cissus rotundifolia* occurred in upper section of station B.

The shrub layer was dorminated by *Sericocompsis hilderbrantii* in upper section while *Justicia odora* and *Berleria eranthemoides* dorminated the lower section in abundancy. Species occurrence also varied between the two sections: *J. odora, S. hilderbrantii, B. eranthemoides, "Olmagiririan", M. rostrata* and *Solanum incanum* occured in upper section while *Grewia tembensis, Ocimum, B. eranthenoides, J. odora, S. hilderbrantii* and one unknown species occured in the lower section.

Occurrence of shrub and tree regens was rather low. *Commiphora* species occurred once in the lower section while *Grewia bicolor, Cordia sinensis* and *M. triphylla* had less stems regens in the upper section. Species diversity of regens was high toward the lower regions.

*Balanites aegyptiaca* dorminated station D in terms of numbers and captured over 70% of the number of stems that occurred in this station. *Acacia* species occurrence was low in station B. *Commiphora schimperii* had the dorminant mean DBH while *Acacia tortilis* had the highest crown diameter (Table 4).

Table 4. Mean growth measurements for trees from station D.

| Species | DBH (cm) | Dorminant height (m) | Crown diameter (m) | No of stems per station |
|---|---|---|---|---|
| *Balanites aegyptiaca* | 9.37 | 4.1 | 2.85 | 14 |
| *Acacia mellifera* | 8.6 | 5.75 | 8.6 | 1 |
| *Commiphora* | 16.88 | 4.3 | 4.18 | 3 |
| *schimperii* | 31.85 | 6.9 | 11.95 | 1 |
| *Acacia tortilis* | | | | |

*Chloris roxybhurgiana* dorminated the grass species by number. Both in upper and lower sections of station B, the abundance of *Chloris* was significantly higher. *Pennisetum mezianum* was also high in the upper section of station D. *Digiteria* species occurred in both upper and lower sections of station D. "Enkansiriaya" grass occurred only in the lower section of this station.

*Commelina bengalensis* dorminated station D as it did station B, where it had the highest occurrence. The lower section of station D had higher forb diversity dominated by *Craebia,* morning glory, "olawuii", "Angaisichoyi", than upper section. *Justicia odora* dorminated the shrub layer followed by *Berleria eranthemoides* in both sections of station D, with scattered individuals of *S. incanum, Crabea species, Ocimum* and *S. hilderbrantii.* Regens occurrence was high as compared to station B. *Balanites* regens was high in the upper zone, with a fair

distribution of *C. schimperii, Maerua triphylla, Acacia mellifera* and Asparagus species regens in both upper and lower sections of station D.

A Comparison of plant forms in stations B and D reveals that:

- Regens of shrubs/tree occurence was more prominent in station D than station B.
- Diversity of species of grasses, herbs and shrubs varied greatly between the two stations.
- While *B.aegyptiaca* dorminated in numbers in station D which was on a gentle slope, *Commiphora schimperii* dorminated in DBH, height and crown diameter in station B where the slope was steeper.
- A glance at the distribution of age classes of the major tree species reveals an unbalanced population structure (inversed J curve) thus posing a problem in terms of succession and sustainability of particular tree species in both stations B and D.

It is noted that the recent assessment was carried during the dry season and results of the grass and forbs abundance are likely to differ when assessments are made during the wet season.

**A Comparison of 1996 and 2000 Plant Assessments**

Results presented in table 5 shows life forms spectra of plants in the study area in 1996 in comparison to results from a recent assessment.

Table 5: Plant life form cover in station B.

| Life forms | % cover 1996 | % cover 2000 |
|---|---|---|
| Trees | 17.4 | 33.3 |
| Shrubs | 27.5 | 27.8 |
| Forbs | 29.4 | 22.2 |
| Grasses | 25.7 | 16.7 |

The results reveal little variation in percentage cover of shrubs with a range from 27.5% to 27.8%. A major switch is noted in tree and grass where trees have increased from 17.4% to 33.3% while grasses have decreased significantly from 25.7% to 16.7%. The sharp rise in tree cover was not clear and will be examined further.

A comparison of woody plant by abundance, height and crown diameter (Table 6) in station B. indicates a reduction in the density of *Commiphora africana, Acacia mellifera, Balanites aegyptiaca, commiphora africana, Grewia tembensis* and *Maerua triphylla*, while an increment or a recruitment has been recorded for *Commiphora schimperii, Acacia tortilis* and *Grewia bicolor. Balanites aegyptica* has shown an increment in height from 2.7m to 4.4m and *Commiphora schimperii* recorded an increment from 3.7m to 5.9m.

The dorminant *Balanites aegyptiaca* showed an increment of crown diameter from 2.2m to 3.1m, while *Commiphora schimperii* increased from 4.0m to 7.4m in station B.

**Table 6. A comparison of station B results of 1996 with those of 2000.**

| Plant species | No. of stems | | Height (m) | | Crown (m) | |
|---|---|---|---|---|---|---|
| | 1996 | 2000 | 1996 | 2000 | 1996 | 2000 |
| *Acacia mellifera* | 2 | - | - | | - | |
| *Balanites aegyptica* | 9 | 4 | 2.7 | 4.4 | 2.2 | 3.1 |
| *Commiphora schimperii* | 3 | 4 | 3.7 | 5.9 | 4.0 | 7.43 |
| *Commiphora africana* | 3 | - | - | | | |
| *Maerua triphylla* | 2 | 1 | - | | | |
| *Acacia tortilis* | 5 | 6 | - | 5.6 | 3.0 | 6.51 |
| *Grewia tembensis* | 5 | 1 | | | | |
| *Grewia bicolor* | | | | | | |

The dorminant grasses were: *Chloris roxybhurgiana, Sporobolus and Digetaria* (Grass cover 15%).
Results of a similar comparison for statation D shown in table 7, reveals an increase in the number of *Balanites, Commiphora schimperii* and *Cadaba*, while the number of stems of *Acacia millifera* had decreased from 1996 to 2000. A similar number of stems were recorded for *Acacia tortilis* and *Commiphora africana*. Invaders which were originally not there include *Maerua triphylla*.

**Table 7. A comparison of station D results of 1996 and with those of 2000**

| Plant species | No.of stems | | Height (M) | | Crown diameter (M) | |
|---|---|---|---|---|---|---|
| | 1996 | 2000 | 1996 | 2000 | 1996 | 2000 |
| *Balanites aegyptiaca* | 10 | 19 | 1.92 | 4.1 | 1.7 | 2.9 |
| *Acacia tortilis* | 1 | 1 | - | 6.9 | - | 11.95 |
| *Cadaba* | 1 | 1 | 2.7 | - | - | - |
| *Acacia millifera* | 2 | 1 | - | 5.75 | 4.8 | 8.6 |
| *Commiphora schimperii* | 1 | 3 | - | 4.3 | - | 4.2 |
| *Commiphora africana* | 1 | 1 | - | - | - | - |
| *Maerua tripylla* | - | 1 | - | - | - | - |

Assessments between the two periods show similarities in tree dorminance e.g *C. shimperii* is still the main dorminant species in terms of DBH, crown diameter while *Balanites* remained abundant in station D.

Similarly, *Berleria eranthemoides* and *Justicia odora* maintained a high dorminance in both stations in the shrub layer. Slight difference is recorded in station B where *Heliotropium* an invader shrub was high four years ago, but has declined in the latest assessments.

Four years ago, regens of *Balanites aegyptiaca, Acacia mellifera, Commiphora schimperii* and *Maerua triphylla* were recorded in all the stations but the latest finding indicates a low occurrence of *Acacia mellifera* in both stations. Notable grass species absent in both stations were *Sporobolus* and *Setaria* but which had given a moderate occurrence four year ago in the stations.

Although the seasons varied, the findings reveal an increase in woody species and a decrease in grass species.

A more detailed comparison of results, station by station and between the two assessment intervals has not been concluded. This trend seems indicative of the usefulness of the data. Critical statistical anlysis is in progress, in which attempts are made to relate changes to prevailing edaphic factors and associated intra-plant population interactions.

## 3.2 WOODLAND MANAGEMENT

During the previous period, the programme had addressed woodland productivity, dynamics and factors actuating change on the vegetation and role the community should play in management of the woodlands.

Draft rules and guidelines were developed to strengthen the management of the woodlands. Sensitization of the community on the consequences of alternative options, action, benefits/dis-benefits for given activities was found to be pre-requisite for a workable management plan.

Hypothesis

The drywoodlands have potential of providing multiple benefits when maintained under sustainable management.

Objective 2

To develop methodologies for sustainable management of dry woodlands to enhance pasture quality and income generation.

Output

Woodland productivity of wood and non-wood products (volume yield per unit land per year) and levels of low impact offtake per unit area per year determined and used to determine sustainable harvesting models.

Activities

- Develop databases and information on woodland productivity based on low impact harvesting methods.
- Document and appraise the range of wood and non-wood products that can be produced in the area.
- Develop rotational grazing patterns that are consistent with range capacity.
- Develop guidelines, rules, regulations to forster sustainable management of woodlands.
- Develop market outlets.

### 3.2.1 Materials and Methods

- Interested ranchers in Oltepesi area were identified and sensitized on the need to manage the woodlands on a sustainable basis through rotation scheme coordinated by the programme staff.
- Assessment of the blocks identified in Oltepesi was carried where the woody plants were categorized into 3 categories.

Category (1) involved: Multipurpose trees, providing fodder, food, medicine, construction and seared values of the community;

Category (2): of secondary importance, providing one two functions only;

Category (3): the remaining woody plants, without immediately identifiable value to the community.

It is from these three categories that the former would select and fell the trees for any intended purpose as follows:

Starting with category (3) woody plants, the farmer would select the woody material required for charcoal burning, fuelwood etc. The dead and dry standing trees fall under this category.

Where selection from category (3) plants did not fulfill the intended requirements, the selection process was extended to juvenile, and multisterred category (2) plants and to category (1) woody plants. The programme maintains a file for each farmer, with clear management prescription.

To create a workable rotational harvesting cycle, the woodland block was subdivided into 15 coupes. The study assumed rotational cycle of 15 years thus due coupe is to be harvested per year.

Although the study assures that a coupe is to harvested annually, rules and guidelines have been set to regulate levels of allowable cut. These rules include:

i. Complete harvesting/debranching of blue marked trees
ii. Coupes border are marked with white paint to indicate that one is not supposed to harvest or cut outside the white border in any one particular year.
iii. To ensure sustainability, the rancher is expected to harvest 1 out of 15 of the red marked trees for charcoal production, and other forms of use.

### 3.2.2 Results

The results of the standing woodland vegetation inventory is still being processed and efforts are being made to move in other areas such as Kilonito woodland, within the programme zone. The trials in Oltepesi area indicated that the community still needs to be sensitized on rules, guidelines to effectively manage the woodlands. Experience from one farmer (Mr. Naishoyua Nkongoni), indicate that the casuals that are hired to fell the trees do not strictly adhere to rules and guidelines. The casuals sometimes overexploit some coupes in the process of debranching. This calls for strict supervision of the work by the programme leaders.

Overexploitation of *Acacia tortilis* for charcoal production has also been reported from other ranches in Oltepesi and in future the programme intends to strengthen guidelines on harvesting of particular species and to stimulate community management to enforce compliance to the rules.

A notable decrease in careless harvesting and intensity of cropping of medicinal plants was noted following participatory demonstrations.

### 3.2.3 Discussion

The rules and guidelines of harvesting of woody plants need to be strengthened. Positive results have been noted in harvesting the woody plants for medicinal use but charcoal production still offers a challenge to the programme.

Surveillance on charcoal production should also be intensified because quick payback to the ranchers precipitated by an increasing number of is likely to stimulate an increased harvesting.

Research on non-wood products from the region should also be intensified to enhance production of goods and services from products such as resins, gums, which can be harvested from the woody plants that abound in the experimental blocks.

With proper harvesting of the woodland blocks, the growth of grass species is expected to be enhanced as finding from permanent plots have indicated that grass cover increases with decrease in woody cover.

## 4.0 FARM FORESTRY AND CROP PRODUCTION

### 4.1 Introduction

Despite rainfall and edaphic constraints, dryland farming remains a viable landuse option for Elangata Wuas community. Trials of Agrosilvopastoral systems where tree crops and fodder components are integrated were developed through consultation with scientists working elsewhere on dryland research programmes in areas such as Kibwezi and Kitui. Preference had been given to early maturity, drought tolerance and varieties that require short periods of wetness.

Hypothesis

Despite harsh conditions, farming and farm forestry systems constitute promising options for EWEMP communities that can be enhanced for food security.

Objective 3

To promote crop production and farm forestry in EW as a supplementary landuse option for enhanced food security.

Output

Appropriate dryland multidisciplinary system developed and enhanced food productivity realized.

Activities

- Examine promising site preparation techniques such as contour banks, bench terraces and ditches, and agronomic practices such as multi-cropping systems
- Promote development of MPTs/high value especially those with fodder values
- Establish multi strata home gardens

### 4.2 Methods

Woodlots, shelterbelts and home gardens were established in the program sites in Kilonito and Elangata Wuas. Interested farmers also gave portion of their plots to be used for trials under multicrop dryland farming systems.

Crop production trials were located on sites deemed promising for providing desirable yields. Three plots at Sinya Omelok Base camp, one plot at Kilonito camp and other plots in individuals ranches in Kilonito area were selected and prepared for the trials. The plots

varied in size ranging from the smallest measuring 15m X 15m to the biggest measuring 40m x 40m.

The plots were demarcated and then fenced off heavily using thorny tree branches of *Commiphora schimperii* and *Acacia mellifera* that were readily available. This was done to control interference from either livestock, or wild animals. Bench terraces comprising a series of more or less horizontal steps cut along the contours were used on gently sloppy areas such that the cuts and fills created stops which level into platforms for crop cultivation.

On more flat areas, basin catchments were created by digging ditches of 45cm deep and 30cm wide to create a ditch-cum-mound all round the basin where rainwater would collect for crop production. Ground preparation favoured minimum tillage and staggered furrows supported with stripping and nutrient cycling. The contour banks, bench terraces, interception and diversion ditches helped in trapping run-off for crop production.

Further, in Kilonito, small woodlot plots ranging from 8mx8m to 14mx15m were planted with various tree species.

The tree species raised in the woodlots include *Acacia albida, Moringa oleifera, Jatropha carcus, Dalbergia melanoxylon, Azadirachta indica* (neem tree) *Jacaranda mimosifolia, Leucena leucecophala, Casuarina equisefolia, Schinus molle* (pepper tree), among others. Some of these species were grown to provide shelterbelts and live fences around the two base camps.

### 4.3 Results

#### 4.3.1 Crop Production

Promising results on growth of dryland crops have been recorded in demonstration plots at the base camp and with the farmers. Some crops indicated potential to survive long drought spell e.g. Cajanus cajan (pigeon pea), beans and millet.

Prior to the on-set of the of the long rains in February, a small number of promising dryzone food crops such as serena millet, cajan peas and rosecoco beans Kitui cultivars were procured for planting. Sowing of the crops was done after the first heavy rainfall. The crops were fast maturing, drought evading and require only a short period of wetness. At Kilonito, the crops were planted in association with agroforestry tree species such as *Leucena leucophela, Dalbergia melanoxylon.* Harvesting of the millet and beans was done after three months (pegion pea is perennial). Tables 8,9,10 and 11 gives the results of the trials in Kilonito and Sinya Omelok.

**Table 8 Rosecoco Bean yield at the Sinya Omelok plots**

| Plot No. | Biomass yield gm/m² (dry wt.) | Grain Yield per ha (kg) |
|---|---|---|
| 1 | 5.3 | 10.9 |
| 2 | 7.8 | 31.25 |
| 3 | 6.6 | 22.22 |
| 4 | 6.9 | 25.04 |
| 5 | 7.2 | 28.04 |

**Table 9 Rosecoco Bean yield at Kilonito plots**

| Plot No. | Biomass yield gm/m² (dry wt.) | Grain Yield per ha (kg) |
|---|---|---|
| 1 | 30.4 | 89.2 |
| 2 | 35.2 | 102.4 |
| 3 | 7.0 | 8.0 |
| 4 | 27.6 | 94.5 |
| 5 | 12.3 | 60.1 |

**Table 10 Millet yield at the Sinya Omelok plots**

| Plot No. | Biomass yield gm/m² (dry wt.) | Grain Yield per ha (kg) |
|---|---|---|
| 1 | 9.0 | 70.2 |
| 2 | 14.1 | 117.2 |
| 3 | 8.3 | 69.4 |
| 4 | 9.2 | 73.9 |
| 5 | - | - |

**Table 11 Millet yield at Kilonito plots**

| Plot No. | Biomass yield gm/m² (dry wt.) | GrainYield per ha (kg) |
|---|---|---|
| 1 | 8.3 | 69.7 |
| 2 | 26.4 | 219.2 |
| 3 | 13.6 | 113.6 |
| 4 | 9.5 | 78.1 |
| 5 | 12.1 | 105.6 |

Results of grain yield presented above show that:

i) The highest yield per hectare for beans was 102.4kg, while the lowest was 8kg in Kilonito area.

ii) The highest yield per hectare for millet was 219.2 kg in Kilonito and117.2 kg in Sinya Omelok, while the lowest was 69kg at Sinya Omelok and Kilonito respectively.

iii) The yields from Kilonito plots were generally higher than Sinya Omelok, due to the more favourable soil condition at Kilonito.

Further analysis of biomass was yield carried to assess potential of crop dry matter yield for livestock feed. This is also important in nutrient cycling and soil maintenance can further be used to enhance mulching,soil cover and thus reduce the rate of evaporation which is high in drylands and surface runoff.

Results of biomass analysis presented in the same tables above indicate that millet provided substantial biomass yield compared to beans at Kilonito and Sinya Omelok plots.

The highest recorded biomass of millet per square metre was 26.24 gms and the lowest was 8.33gm, while the highest recorded biomass production of beans per square metre was 35.2gm and the lowest recorded was 6.6gms.

4.3.2 Farm Forestry

Farm forestry and homestead tree planting proved to be viable but a challenging activity during the report period. Efforts were oriented toward improving survival of tree seedlings both in the demonstration sites in the camps and in the ranches.

Casuarina seedlings had the lowest survival, with a low 5% in the woodlots and shelterbelts. *Leucena leucocephala* grew to the sapling size before showing signs of flowering and releasing pods at a tender age. This is an indicator of stress. Goats were also fond of feeding on the bark of *Leucena* in cases where the seedlings were grown in the homesteads. Survival rate was generally low (about 25%).

*Schinus molle* grew moderately with a 45% survival rate in Elangata Wuas while in Kilonito the situation was not impressive at 10%. The research to explore why the results are different in the two sites are underway.

*Moringa oleifera* had moderate survival rates and performed fairly well in Kilonito than Elangata Wuas area. *Azadirachta indica* (neem tree) showed the greatest potential for survival in the region. It recorded the highest survival rate of 80% in Kilonito plots.

Results from (on-farm) farmers plots varied from those recorded in the demonstration site at Kilonito. One farmer (Mr Ntupsat Marete) recorded 33% survival rate of trees grown out of 60 trees of various seedling species.

Another farmer (Kaparo Naikolo) had zero survival out of 35 seedlings planted although he harvested 8kg/ha of beans. He cited lack of water as the main problem.

In general 558 tree seedlings were planted in Elangata Wuas base camp with 72.7% survival rates. Recently another batch of 120 tree seedlings were planted to replace the dead ones.

At the Kilonito site, 452 tree seedlings were planted with survival rate of 69.9%.

**4.4 Discussion**

The grain yields had surprised the farmers and many expressed satisfaction with the trial. Many have confessed that this was their first time to harvest food crops from their own lands. Crop production remains a viable source of income with potentials for enhancing food security in Elangata Wuas. Critical timing of the rains and use of appropriate seed remains vital for success.

The tree seedlings planted were collected from various dryland locations e.g. Gede, Kitui and Kibwezi. This probably contributed to varied survival rates. For example *Casuarina* and *Schinus molle* had different survival rates. Shock seemed a probable cause for *S. molle* low survival particularly at Kilonito.

A follow-up performance assessment of the planted trees showed that post establishment survival and growth was encouraging. On the whole, survival of the trees planted around the dams had the highest survival rate compared to other sites. The least survival rate was 40% and the highest had 68%. While homestead planting had at most 37% survival. The better performance of the trees planted around the dams was attributed to the availability of water (from the dams) for regular watering.

Lack of water remains the biggest obstacle to growth of dryland crops and tree components. The research team intends to strengthen dryland farming and agroforestry in the region by

enhancing rain water harvesting technique to maximize water usage. Another strategy in the on going research will be based on reduction of damage caused by animals and pests. Rock hyrax and termites affected the young seedlings, a situation that was aggravated by grazing animals in homesteads. Future efforts will try to maximize protection by maintaining enclosures and fences around demonstration sites.

## 5.0 ECOTOURISM AND WILDLIFE MANAGEMENT

### 5.1 Introduction

During this report period, the program maintained activities on the pastoralist ostrich husbandry and wildlife inventory. The program intensified discusions with the KWS on game hunting and the role of community in wildlife conservation. Also trials on domestication of Guinea fowl continued during the period.

Objective 4: To domesticate and manage wildlife resources for sustainable production of goods and services.

Output: Potentials of non-wood products for income generation established and appreciated.

Methodologies on biodiversity management to promote enhanced food security and income generation developed.

Activities

- Monitor behavioural habits of target species and identify their breeding sites.
- Harvest eggs, incubate them, and rear the young (guinea fowl chicks).
- Document guinea fowl food range, and explore avenues for incorporating these in their meal.
- Explore market outlets
- Establish demonstration sites and promote community adoption of herbal grooves and domestication of high value crops in the ranches.

### 5.2 Materials and Methods

Field surveys were undertaken to determine occurrence, distribution and abundance of wildlife resource in the region. Study on domestication of ostrich and guinea fowl was intensified as a means of enhancing income generation.
Several tourists have also visited the camp for bird shooting.

A vermin-proofed shade for guinea fowls was erected during this period.

### 5.3 Results.

5.3.1 Ostrich Husbandry

Ostrich husbandry is on going in both Kilonito and Elangata Wuas base camps. The cost of domesticating ostrich has been reduced by allowing them to feed in the wilderness. The major problem experienced, in raising ostriches were frequent young chick pneumonia attack, and tapeworms and bacterial infections of all age groups.

Poaching of ostrich eggs and chicks in the wild was evident in several occassions but with increased community involvement, the ratio of poaching reduced.

The young chicks were maintained on a diet of chick mash and finely chopped leaves of *Cissus rotundifolia* . The birds were weaned at four months, from when they were herded with livestock, especially sheep and goats.

5.3.2 Domestication of Guineafowls

A total of 14 eggs of guinea fowls were harvested from three nests in the wild in November 1998, and given to a brooding hen to hatch. Out of eight chicks that emerged, two chicks died leaving six birds that were reared to maturity. Young birds had their ears plugged with wax and raised on chick mash, greens from different sources and later transferred into a large pen at the age four months. The major feed stock consisted of sorghum, crushed maize grains, supplemented with growers mash and greens. They showed preference for cabbages, kales and amaranthus whole plants.

The birds started laying at six to seven months. The first batch of eggs were given to a brooding hen and the first generation of chicks raised. Management maintained critical notes on bird behaviour, food preferences, and related development and management parameters.

The potentials for guinea fowl farming is supported by their simple diets, relative hardiness (they do not succumb to common poultry diseases) and in captivity appear to continue egg laying over a long period.

Young chicks were raised by the mother hens together with those of her own. One month old chicks had their ears pluggged to avoid distraction from wild populations. The chicks are generally hardy, but one developed an acute respiratory disease during the cold season and had to be treated.

Observations recorded in 1999, the study pens show that the birds are monogamous and pair just before the rains. Egg laying start at the on-set of the rains. Caging two males and four females had created serious behavioural problems at the time of pairing. This has since been improved by keeping pairs separately.

Each female lays from 14 to 18 eggs. But all females failed to sit on eggs. Fertilized eggs were therefore given to brooding hens.

Egg laying resumed during the current (March 2000) long rains but was interrupted with the break of the rains. In the absence of an incubator the programme has experienced setbacks due to lack of brooding hens at the right time for the Guinea fowl eggs.

An incubator is required to enable the programme generate an adequate of stock birds to passed to the community. Meanwhile, a search for appropriate conditions for Guinea fowl hens to sit on eggs continues.

## 6.0 PASTURE RENEWAL

### 6.1 Introduction

It had been observed that the majority of the community relies on livestock and its products. Production is based on maintaining a critical level of livestock population, and a critical level of animal portfolio. The average herd population ranged from 10 to 40 cattle, with the rich members having upto 600 cattle, 700 sheep and goats per household. But the exact number has changed during the report period following large losses that occurred during the drought of 1997 and 1998.

Rangeland rehabilitation was followed from two fronts (i) combating wood encroachment, and (ii) healing the vegetative cover.

Hypothesis: Land degradation in drylands resulting from inappropriate land use practices and climate change can be averted and reversed by employing appropriate resource management paradigms

Objective 2

To develop methodologies for sustainable renewable of natural resources and management paradigms aimed at enhancing income generation, drought recovery and to effect food security.

Output 1

The state of degradation determined and mapped out with accompanying information on causative practices and avenues form containing these determined.

Output 2

Prototype affordable methods for rehabilitation of degraded sites developed and demonstrations of sustainability managed pastures established.

Activities

- Identify and rate degraded sites in each landscape in each case strive to reconstruct the history of degradation, pin-point cusative factors and identify remedial measures.
- Identify, document and appraise traditional technologies and modern low cost practices used to promote pasture sustainability and rehabilitation of degraded sites.
- Test and assess effectiveness of agronomic and mechanical remedial measures in the rehabilitation of the affected sites.
- Develop rotational grazing patterns for average size ranches, supplementary feeding option, reappraise and rescale stock sizea.
- Establish demonstration sites.

**6.2 Materials and Methods**

Monitoring the demonstration plots established in 1996 continued. In 1996 two blocks of four plots each 100 x 50 were established on gentle terrain, separated by untreated strip of 20m wide. The plots on one block were subsequently treated by a pitting technique, to rehabilitate grossly degraded, eroded, and unproductive patches by creating a series of small pits of varying widths and lengths for water management. The pits collected water and allowed it to infiltrate. This block remained closed to allow natural regeneration of grass between the trenches.

A mixture of ½kg *Digiteria macroblaphara, Pennisetum strameineum, Sprobolus pellicidus, Dactyloctenium aegyptium* seeds before the rain.

The severe drought of 1996/97 had interfered with germination and growth of the grass. Fresh grass seed was therefore replanted, and the plots maintained, and the state monitored and assessed regularly.

All remaining trees were pruned and singled as was necessary to open the stand to minimize shading. Brush wood was used for fending the protected plots, while poles and logs were cleaned and sold as poles of use in the biomass energy study.

The second block also of the same size, 100mx50m, was marked out but left open and untreated.

### 6.3 Results

The performance of grass regrowth in the four plots was not significant between plots within treatment (block) and the results of assessment from the treated block have been pooled for comparison with the scores from the control plots (block also pooled).

Table 12 Treated Plots

| | Percentage Cover | | | | | | Rating |
|---|---|---|---|---|---|---|---|
| Date | Base | Litter | Forbs | | Grasses | | |
| | | | unpalatable | palatable | annuals | perennial | |
| Oct. 97 | 18 | 5 | 23 | 21 | 21 | 17 | 1.5 |
| Nov. 98 | 20 | 8 | 21 | 23 | 16 | 20 | 1.4 |
| Nov. 99 | 15 | 14 | 20 | 28 | 15 | 22 | 0.8 |

Table 13 Control Plots

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oct. 97 | 17 | 6 | 22 | 21 | 22 | 18 | 1.6 |
| Nov. 98 | 20 | 5 | 24 | 20 | 24 | 12 | 1.8 |
| Nov. 99 | 24 | 6 | 28 | 20 | 16 | 12 | 2.4 |

The rating of the pasture revealed that overgrazing pressure that had accumulated in the area over the last two decades or so has resulted in marked degradation of the vegetation and the entire ecosystem. Successive trampling and selective grazing has subsequently led to dominance of unpalatable species of forbs and grasses and invasion of weeds and woody plants. This has concomittantly led to a reduction of palatable woody plants, perennial forbs and grasses and an expansion of annual species. During the study period, the rating of the range in the control block has declined from poor to very poor, while the condition in the treated area has appreciated to a "good" status. Subsequent work will examine biomass yield and attempt to relate this to use by livestock.

Attempts to measure the total volume offtake of wood from the managed plots were frustrated by sale of poles and charcoal from the plots secretly by the farmers and subsquent decision not to reveal the vlaue of the products. The presence of the local forest officers, at the time of setting the study had led the two families to believe that the government would demand a share of the revenue.

The potential production of other non-wood products were not assessed due to lack of demand. Discussions on possible use of *Commiphora* gums are being pursued.

A steady process of renewal was recorded in the treated plots where run-off had decreased with attendant enhanced grass growth. The survival rate of the trees planted on the trench embarkments was found to be very low ( below 10% survival rate). This was attributed mostly to lack of water which was crucial at the initial establishment stage and secondly to browsing from kids of the goats which passed through the very small openings accross thorny fence.

Farmers whose ranches were selected for these trials expressed satisfaction with the outcome as they saw the benefit of the intervention in pasture renewal.

## 7.0 BEE KEEPING

### 7.1 Introduction

Beekeeping was introduced in the area to expand the base of activities and sources of food production. The results of PRA studies that had been conducted in the area had confirmed honey to be an important ingredient of the Maasai diet, with good potential for income generation. Honey products have also been used since time immemorial by the Maasai in dowry exchange, traditional liquor and for medicinal purpose.

There is a big potential for production of honey for domestic use and sale to urban makets in Kajiado, Namanga and Nairobi.

Both Kilonito and Elangata Wuas areas are endowed with Acacia bushes which flower even when it is dry. While water is generally scarce there is adequate supply around the few operational boreholes and sand wells along rivers Toroka and Kilonito.

Objective 5

To promote beekeeping as an additional income generating activity.

Output: Production bases broadened and new sources of economic activity introduced.

Activities

- Training of local communities on modern beekeeping.
- Study bee foraging habits.
- Procure beekeeping equipments.
- Explore market outlets for honey and other hive products.

### 7.2 Materials and Methods

Eighteen beehives were established in Kilonito and Elangata Wuas base camps. Training sessions on beekeeping were organised for interested villagers, and 20 beehives were distributed to participating community members thereafter. The programme staff established and maintained apiary units in the two base camps for studies and demonstrations. Currently the programme is monitoring progress of beekeeping by the villagers who have adopted the technology.

Two training workshops were held on beekeeping, hive management, supplementary feeding, harvesting and processing of honey and beeswax.

### 7.3 Results

Promising results on honey harvest have been recorded from the demonstration apiary units based in both camps as follows:

**Table 14 Honey Yield Per Hive**

| Date | Site | No. of Hives | Avg. Quantity harvested Per hive (kg) |
|---|---|---|---|
| October 1999 | EW | 8 | 5.9 |
| March 2000 | Kilonito | 12 | 7.4 |
| October 1999 | EW | 11 | 6.5 |
| April 2000 | Kilonito | 16 | 6.8 |

Average hive productivity based on October 1999 and March/April 2000 harvests shows that each hive is likely to produce 13.5 kg of honey per year. This is slightly below the annual hive average of 20 kg; but has a sale value of Kshs. 3,780/= at current farm prices. The value of wax has not been assessed.

The programme initiated planting of woody species and encouraging the growth of Cissus spp. which flower and provide bee forages e.g *Acacia albida* and others in Mimosaceae family around the camp boundaries. Plants in this family are known to flower in dry season.

It was noted that the bees spend considerable time searching for water during the dry season. Many congregate around water taps and containers holding water near the kitchen and the bath rooms. A relatively smaller number visited water trays and dishes holding sugar solutions that had been placed close to their hives.

The shortage of pollen was also evident at this time. This is because only a limited number of plants such as acacias, euphobes, and species of Aloe, and Cissus flower during this time. Consequently the programme, in collaboration with relevant officers of the department of Livestock Development had initiated work on phenological studies of prime pollen producing plants in the area, with emphasis on those that flower during the dry season. A strong attempt will be made to cultivate these in the beekeeping area.

## 8.0 AN INVENTORY OF COMMON TRADITIONAL TECHNOLOGIES OF THE MAASAI OF ELANGATA WUAS

### 8.1 Introduction

Traditional technologies recognized in this survey include sets of emperical information and packages on improving site quality, animal production, food processing and storage, management of health of man and livestock, water and wildlife resources.

Objective 6

(i) To identify and document indigenous knowledge systems by different life styles.

Hypothesis

Maasai's traditional knowledge hitherto inadequately explored by modern institutions are likely to open up avenues for new economic activities in drylands.

Output 1

An inventory of traditional knowledge system developed, and availed.

Activities

- Identify and document salient TKs through open-ended discussions with communities, making critical observations on the way they manage the resource bases.
- Appraise these through simple criteria, such as its role and benefits to development, efficienty in meeting set goals, and economy of scale; to provide an understanding of its potential for application in development and valorization through scientific processes.

Output 2

Increased awareness of the value of tradtional knowledge created and the challenges to valorize promising ones passed to relevant agencies and institutions.

Activities

- Concentrating on a small range of promising TK, undertake intensive appraisal using knowledgeable people in the field, to assess their potentials for development and avenues for value adding.
- Produce information packaged for different constituencies, particularly the local communities.
- Train local communities.

Output 3

A system for evaluating TK developed and gainful ones incorporated in use.

**8.2 Study Methods**

Ethnobotanical and traditional technology field surveys were conducted using several PRA methods i.e semi-structured interviews, group discusssions, and transect walks.

(i) Semi-structured questionnaire

This was accomplished through interviews which were held at:

- homes/manyattas
- schools
- clinics of healers
- market centres
- grazing pastures
- others

(ii) Group discussions

This method was used when dealing with women groups and group ranch members or farmers in Elangata Wuas and its environs. It had the advantage of generating lots of data within a short time and on the spot collective verification.

(iii) Transect walks

This method has been used with farmers in the irrigation schemes.

(iv) Workshops

The workshop participants were requested to narrate vegetation changes (causes and solutions) along the paths they used coming to the workshop venue. During specimen collection expeditions, the researchers, and community members undertook vegetation zonation from the plains to the hill-tops. Researchers mounted ecological dynamics studies to document the state of the woody plant resource base in the area. Plant samples were collected for identification. The interviewees were made up of willing participant set men and women all age groups.

The interviewees ranged from:

- Traditional healers
- Old knowledgeable persons
- Teachers
- Government officers
- NGOs
- Parents through their school pupils
- Women groups, and
- Church elders

The data on: indigenous knowledge on the different life styles and livelihood systems were documented. The value and use of different trees to the community were recorded as follows:

- Indigenous medicinal plants (human and livestock)
- Indigenous food plants
- Indigenous fodder plants
- Plants used as indicators of:
    - seasonality
    - saline soils
    - fertile soils
    - water source/table
- Plants used to light houses
- Plants used for:
    - making firewood
    - firewood/charcoal
    - house construction
    - soup (for different sexes/ages)
- Plants used as source of pollen and nectar
- Traditional conservation techniques
- Sacred plants
- Others

**8.3 Results ***

8.3.1 Site Amelioration Practices

*A full text will be released substantively in an appropriate medium.

The people prefer to clear the vegetation around their villages (manyatta) to facilitate detection of wild animals and strangers. The manyatta are fenced with thorny brush wood for the same purpose. However, recent experience has shown that this practice exposes the residences to wind storms that are common during the dry seasons.

### 8.3.2 Agricultural Practices

A relatively small portion of drylands is amanable to rainfed crop production. The harsh climatic conditions make crop production a risky undertaking leaving pastoralism as the mainstay of the economy. Currently agricultural production is limited to pockets of relatively wet areas where crop production is possible under in irrigation such as in the Nguruman area, and in wetland areas, and in the flat plains under seasonal floods.

### 8.3.3 Water Management Techniques And Practices

The area is characterized by deficient and erratic rainfall. Water is generally scarce, underground water where available, is exceedingly brackish with very few pockets of sweet water for drinking. Droughts which can extend upto 3-5 years, results in much distress to the population and animals. At this time people and livestock are forced to travel over long distances in search of water.

During the dry season water is obtained from shallow wells along the Toroka river on sites choked with sand, and also from private and community boreholes, and springs in Torosei areas. A number of technologies on water harvesting and conservation, detention, dispersion and diversion structures and/or their modifications are found in the area, such as:

#### Diversion Structures

These structures are designed to divert partial flood through a channel other than the main flow line in order to benefit a shallow pan.

#### Dispersion Structures

Dispersion structures are overflow structures designed to spread flood water over larger areas in the flood plain. The rainy season brings river-flooding , covering huge floodplains with biomas, water, silt and nutrients. This regular flooding gives rise to localised areas of nutritious grassland for grazing of wildlife and livestock, and also provides the basis for floodplain agriculture. Common examples are found in Torosei (Fig 1), in also areas which also support severe dry season grazing.

#### Shallow wells

These are constituted by the recharge from surface water and rain that filters into the ground until it reaches the base-rock where it sits in spaces in the soil or in porous and fractured rock as aquifers. Groundwater is very important all year-round throughout the area, particularly during the dry season.

Wells are dug by hand, may be helicoidal in shape and wider at the bottom with narrow platforms at various depths to enable the drawers of water to pass the buckets from hand to hand to the surface or may be more-or-less vertical, where the water is drawn off by buckets with ropes, or with motorized pumps. The latter have been introduced recently by individuals or groups.

Improvements in well-digging techniques aimed at making the work easier and safer, and at the same time, improving the sanitary integrity of the well to prevent pollution have been introduced.

One advantage of a dug well over a borehole is that community participation is assured from the start. Self-help labour is usually used to dig the well, and women and children can all help with the fetching and carrying of sand and gravel. The immediate rural economy thus identifies itself with the construction of the dug well, establishes a sense of communal ownership that is vital for the sustainability of the water point.
Ownership of the wells was formerly based on kinship (social) units, politically regulated or a mixture of tenure types. Currently the number of private wells has risen markedly.

Wetland Patches

Wetlands include flood plains, banks of streams and rivers, that are dotted in the southern corner of dryland landscape. They provide water for domestic, livestock and wildlife as well as for irrigation. They are also important dry season grazing areas but also provide temporary habitats for wild species, migratory species, such as birds and are a refuge for some wildlife during droughts.

The Elangata Wuas community has developed sustainable packages for wetland management, practices that constitutes valuable drought coping strategies. Under these use patterns, pastoralists keep away from wetlands during the wet season to avoid cattle foot fungal diseases, while at the same time observing unwritten rules of reserving area for dry season grazing, and allowing off-season crops to mature. Wetland farming increases food security by providing crops when other plots fail and hence opens up opportunities for cash cropping of vegetables and other utility products.

8.3.4 Energy

Wood is still by far the most widely used domestic fuel in drylands and virtually every family relies on wood for all its domestic heating, cooking and to some extent lighting needs. Fuelwood accounts for more than 90% of total energy use. In most places, dead wood which has naturally dried is collected in the form of twigs and branches. Even where cutting tools are available, the felling of whole trees for domestic rural firewood is rare, though live branches and twigs are frequently lopped. These are stored and dried, preferably during the dry season. Preference is of given to particular species of wood for cooking and heating. The manyattas are conveniently partitioned to enable cooking to be done under one roof: thus ensuring efficient room warming during the cold months.

8.3.5 Pastures and Range

Livestock keeping is the most widespread form of land-use in the study area and animal production dominates land use with crop cultivation being limited to irrigation, riverine agriculture and wetlands. Pasturage and water are the two most important elements which are essential for pastoral production, and were until recently primarily managed by the customary principles which sanctioned their unlimited access. Pastoralism has been practised widely for centuries over large areas in harmony with the environment and holds primacy in land use. Cattle, sheeps and goats are common. Donkey and poultry are also widespread. Camels, recent introduction in the area, are becoming popular. Partial domestication of wild fauna such as ostriches, and the honey bee is gaining popularity.

Herd Diversification and Flexibility

Pastoralists often maintain a diverse portfolio of animals: cattle, goats, sheep, in some donkeys, camels, and poultry, cattle are often in separate herds according to age, sex, type, productivity, etc. Herd diversification constitutes an efficient land use option, by assuring a broad spectrum of animal products and secures a steadier supply of products, spreading risks and maximising opportunities for tidying over difficult times.

Sheep and goats are particularly important in household nutrition, being sources of milk, meat and cash income. Camels and goats give milk even in dry periods while lactating cows can hardly be milked at these times. As well as the overall milk yield, the waiting time for the first availability of milk after a drought is vital for the household: goats lactate after 5 months, cattle after 9 months and camels, lactate the longest, after one year. The other aspect of herd's productivity is its fertility. Camels are fertile at 4 years old, cattle at 3 and sheep and goats at 1 year old. Goats and sheep which have a 30-40% yearly reproduction rates readily compensate for the high cattle losses which occur in times of drought. Since they can be exchanged later against cattle, they play an important role in post-drought recovery.

Livestock Breeding

Indigenous cattle are resilient and well adapted to the harsh environment. On-going traditional cattle breeding strategy emphasises drought and disease resistant animals with only strong and healthy bulls used for breeding. The community has resisted pressure from governments for adoption of exotic breeds. Increasing efforts on domestication of wildlife such as ostriches and Guinea fowls are also noteworthy.

Herd Management and Production Technologies

Pastoralism is a highly specialised subsistence economy in the dryland ecosystems and is sharply synchronised with the productivity, security, and continuity, of the main resource bases that are also the most important building blocks for achieving sustainability in these ecosystems.

Mobility

The "transhumance" a system that uses rationally the forage resources in time and space relies on opportunistic mobility of herds. The head of the household chooses a different grazing orbit at least every two days according to the herd's forage needs and to prevent deterioration of particular points in the pasture. Daily migration rarely exceeds 5km distance from the homestead.

Small blocks of upto 400 ha per household, (range reserves) are maintained around the homestead for grazing small stock and sick cattle.

(a) Seasonal Migration

This is a regular pattern of land use and pasture management. In the past, they have managed to carry on this activity in a sustainable manner despite keeping herd sizes much larger than the carrying capacity. The traditional routes of movements were strictly followed and the length of stay at a particular point is determined by the amount of forage available.

With the introduction of group ranches in the early 1960s the Elangata Wuas community adopted a new system of seasonal grazing pattern, a kin to the traditional transhumance. According to this new arrangement, the large animals are grazed communally in a seasonal sequence (Figure 1). The lowlands provide the wet season grazing ground at the onset of the rains for a period of about three months. Between June and July to October the animals are shifted to the mid-elevation areas extending to the hill bottoms, for another three months or

so. The hills and plateau are utilized between November and January, when the area is generally dry. During this time the animals are watered from boreholes and all-season wells along Toroka river. With prolonged droughts the animals are moved to the swamps bordering springs and flood plains in Torosei.

This pattern of opportunistic grazing has ceased following the recent subdivision and introduction of private land holding rights. Consequently each family is currently obliged to restrict grazing of its livestock to the family land unit. In the event of rain failure, in a given area, a feature that is widespread in the community, a new grazing arrangement in which families in the affected areas shift their livestock to less affected area based on family ties and alliances, such as marriage, age-set, or friendship has emerged. This may be compensated through a reciprocal exchange, or paid for through cash or kind. The animals are returned at the on set of the rains.

(b) Shifting of Household

Among the Maasais, migration of entire households used to occur once every five or more years, mostly in times of severe drought. The main reasons for shifting the household were decreasing quality of the pasture or shortage of water in the neighbourhood.

Herd Dispersion

All forms of herd dispersion have the same goal: minimising risks and hedging options by spreading chances. The cattle herd is often divided up during the dry season with the sub-herds of small ruminants, camels, some lactating cows remaining close to the family settlement in the pasture reserves. A few lactating cows accompany the herders to supply them with milk during this time away. However, in hard times like during severe droughts, when there is very little decent pasture to be found, the whole herd migrates. Some communities spread risk by distributing their cattle to relatives and friends, in different ecozones. Some families have kept parts of their herds in open fields in Nairobi suburbs and around Naivasha. Processed milk and other products are repatriated regularly to families in Elangata Wuas.

Dry Season Reserves

The community maintained designated areas of up to 400ha as dry season reserves. The dry season grazing reserves were kept closed during the wet season so that the vegetation can recover. The elders decided when to open and close the pastures, after a prior inspection. The closed areas were guarded with fines imposed by elders on violators. This system does not only allow the pasture to rest, but also provides a reservoir of seed of the palatable species that are likely to be selectively depleted in the open areas.

Division of Labour and Production

Community has strong culturally prescribed norms for the division of tasks and responsibilities between age groups and sexes. Adult married men are responsible for governance and political affairs. They further enjoy overall managerial responsibility for planning grazing orbits, herding movements, animal health and welfare, herd splitting, watering and sale. They also organise and undertake construction and maintenance of water points and enclosures for livestock.

The children and women are responsible for herding animals. Generally, adult women make all major domestic decisions particularly those relating to childcare, food preparation, collection of water and fuelwood, milking, looking after young and sick animals, and other duties. In practice, the women shoulder numerous and heavy duties and responsibilities, but

their contributions to the traditional economies remains shielded by the "Kitchen and household curtains". The children do almost all the herding and house chores.

8. 3. 6 Traditional Management Systems

The community has a well established governance structures, with well articulated customary laws that accommodated interpersonal relations, property ownership and protocols for resources use. Such structures have evolved as unique social, economic and political grassroot governance organs, that provided effective mechanisms for environmental conservation. Primacy of community ownership and/or access to land with specific rights of individual families and collective obligations for the care of the resource bases is strongly established.

All community members are responsible for overseeing what the others are doing and any act of violation is reported to the elders. Shared beliefs provide a strong sense of group solidarity and cohesion. An infringement of a taboo or act that compromises the community's security is a concern of the whole community.

The creation of institutional curbs such as sacred areas for purposes of worshipping ancestral spirits, spirit mediums and rain-making oracles served to regulate societal attitudes toward the natural environment. Spirit mediums, particularly, controlled large ritual groves and protected forests where no one was allowed to graze livestock or settle.

Harvesting of Wood and Non-Wood Products. (NWFPs)

The community is cognisant of the importance of biodiversity conservation practices that they have evolved over many years. Such conservation rules are all associated with respect for all forms of life (plants and animals), a feature that is strongly embedded in taboos and respect for ancestral spirits.

This practice is particularly important for resource poor communities and ensured sustainable resource use when the population was low.

Human and Animal Health

Community recognises and avoid areas infested with pests, such as tsetse fly on the woodland on the hills, which transmits trypanosomiasis, and resort to such vegetation only during the peak dry season when flies are considerably reduced (see Figure 1) and when alternative pastures are impoverished. The riverines and the wetlands are also avoided during the rainy season. This is because wet heavy soils carry fungal foot diseases if the herd is kept in them for a long period of time during the rainy season.

A wide range of plants in treating sick animals against common diseases, such as intestinal worms, East Coast fever, and ticks. Notable examples include vaccination against infectious diseases such as Bovine pleuro-pneumonia. Even where modern medicine is available, there is continued reliance on traditional methods for animal health care.

They use a wide range of plants in treating themselves and their sick animals against common diseases with different levels of specialisation on specific conditions, such as cases of pregnancies, infants, physiology, digestive diseases, etc.

Biodiversity Management

The Maasai regard wildlife as a last resort resource and is only used after livestock is gone. Many cultural beliefs pronounced abstinence from wanton killing of wild animals, escpecially

those which the society holds in contempt such as hyenas, monkeys, and the young of all species.

Knowledge of Crafts and Fittings

Artesenal knowledge ranging from skills in house construction, and thatching, furniture, woodcarving and basketry and beadwork, leather tanning to steel and metal works are well developed. But apart from a few areas where beadwork has found lucrative markets in the tourism industry, these potentials remain largely untapped.

Adaptations in Food Habits

The traditional diet is based on milk, meat, and blood but is recently accompanied by maize, millet and sugar. During the wet season when the cattle stay in the plains, fresh milk is the only food for some households. Soured milk produced by adding charcoal to the milk which is kept in a gourd washed out with cow's urine, can be stored for some months. During the dry season when milk is scarce, consumption of maize meal and meat rises. Blood can be drawn from live or slaughtered animals and is mixed with milk. Most families kill a goat every few months, although sharing with others means goat meat is consumed around once a month. Oxen are slaughtered for celebrations once a year at the most. Dead livestock and drought emancipated animals are also consumed.

Generally the diets of the people has changed significantly during the last three decades with cereals increasing and milk decreasing. In more difficult times, plant products can make up a considerable proportion of the diet and the community's extensive knowledge of edible plants is brought to the fore. This knowledge is also decisive for the herdsmen when they are out in the dry season grazing areas or cattle posts, and must rely on alternative food sources and medical herbs. Fruits, roots and tubers are consumed with a few plants being used as vegetables (e.g. Amaranthus graecizans – African spinach).

Processing and storing of milk, blood and meat for leaner times is particularly intriguing. The meat may be smoked or boiled in fat and stored for long periods of time. During times of severe food shortages skins of animals are processed and cooked for food.

Knowledge of Climatic and Weather Variations

The community uses a calender based on the major events and a composite of a wide array of indicators. Sets of thumb rules for predicting the immediate future in terms of good or bad rains are respected. The coming of rain or dry spells are detected from studying the tilt of the crescent of the first phase of the moon, the position of certain stars, the pattern of cloud patches at night, flowering or indigenous trees such as species of *Acacia,* the wind direction and intensity, and presence of absence of dew in the morning.

Fire as a Management Tool

Community members use fire deliberately in the management of their pastures, to clear dry grass and to control tick-borne diseases. The use of fire as a management tool relies on a precise and clear knowledge of the range ecology, weather and climatic parameters to enable proper timing and frequency of application. In the past this had enabled maintenance of a good balance of woody species and a forage grass component. The use of fire was proscribed by the colonial government, forcing the community to revert to its secret application, at night and during times when the administration was not likely to visit. This had subsequently led to a grave distortion of the range ecology, following delayed, non-application or in-opportune timing of fires.

## 8.4 A SUMMARY OF MEDICINAL PLANTS OF ELANGATA WUAS MAASAIS *

| Vernacular | lang: | Botanical name | FAMILY |
|---|---|---|---|
| MUNGAATHA | Maa: | Solanum incanum | SOLANACEAE |
| OLBIBIYIA | Maa: | Leonotis mollisma | LABIATAE |
| | | L. nepetifolia | |
| LOODUA | Maa: | Myrsine african | MYRSINACEA |
| OL-MUGUSHE | Maa: | Rhus vulgaris | ANACARDIACEAE |
| ENGILAI | Maa: | Teclea noblis } | RUTACEAE |
| | | T. trichocarpa } | |
| | | T. simplicifolia } | |
| OLKOKOLA | Maa: | Rhamnus staddo | RHAMNACEAE |
| OLKONYIL | Maa: | Rhamnus prinoides | RHAMNACEAE |
| ELMIM | Maa: | Indigofera arrecta | PAPILIONACEAE |
| OLMTOO | Maa: | Azanza garckeana | MALVACEAE |
| | | Dombeya rotundifolia | STERCULIACEAE |
| OSOKONOI | Maa: | Warburgia ugandensis | CANELLACEAE |
| ENKAMAI | Maa; | Ximenia americana | OLACACEAE |
| OLKINYIE | Maa: | Euclea divinorum | EBENACEAE |
| OSIAMALILEI | Maa: | Acacia etbaica | MIMOSACEAE |
| OLERAI | Maa: | Acacia seyal | MIMOSACEAE |
| OLKILORIT | Maa: | Acacia seyal | MIMOSACEAE |
| | | A. xanthophloea | MIMOSACEAE |
| OLUAI | Maa: | Acacia drepanolobium | MIMOSACEAE |
| OITI | Maa: | Acacia mellifera | MIMOSACEAE |
| OLCHURAI | Maa; | Acacia ancistracloda | MIMOSACEAE |
| OLMAME | Maa: | Acacia nubica | MIMOSACEAE |
| ENCHANI ENKASHE | Maa: | Turraea mombassana | MELIACEAE |
| | | T. holstii | |
| ENKILOILO | Maa: | Harrisonia abyssinica | SIMAROUBACEAE |
| ENTEMELUA | Maa: | Solanum renschii | SOLANACEAE |
| OLTALELEENI | Maa:} | | |
| OLTAILUAI | Maa:} | | |
| OLTLELEENI | Maa: | | |
| OLMUKUTAN | Maa: | Ablizia anthelmintica | MIMOSACEAE |
| OLMANGUALI | Maa: | Grewia villosa | TILIACEAE |
| ENKODUAI | Maa: | Myrsine african | MYRSINACEAE |
| ESINANTEI | Maa: | Periploca linearifolia | ASCLEPIADACEAE |
| ESINANTEI | Maa: | | |
| OLTEMUAI | Maa: | | |
| OLTIMIGOMI | Maa: | Pappea capensis | SAPINDACEAE |
| OLOIRIEN | Maa: | Olea africana | OLEACEAE |
| OCCILICHILI | Maa: | Commiphora africana | BURSERACEAE |
| OLDAMPOI | Maa: | | |
| OLOSHOLO | Maa: | Hymenodictyon parvifolium | RUBIACEAE |
| OLORODO | Maa: | Cyphostemma orondo | VITACEAE |
| OLTISA | Maa: | Conyza hypoleuca A. Rich. | COMPOSITAE |
| OLPOROKUAI | Maa: | Melhania velutina Forsk | STERCULIACEAE |
| OLOSESIAI | Maa: | Osyris abyssinica | SANTALACEAE |

* The text is currently with a scientific artist who is working on illustrations prior to printing.

| | | | |
|---|---|---|---|
| OLMOMOI | Maa: | Cobretum molle | COMBRECTACEAE |
| OREMIT | Maa: | Salvadora persica | SALVADORACEAE |
| OLMEQUET | Maa: | Croton megalocarpus | EUPHORBIACEAE |
| OSINONI | Maa: | Lippia jvanica | VERBENACEAE |
| OLMATASIA | Maa: | Clausena anisata | RUTACEAE |
| OLBILA | Maa: | Commiphora sp | BURSERACEAE |
| ENTUKUSHI | Maa: | Jasminum sp. | OLEACEAE |
| OLOISUGI | Maa: | Xanthoxylum usambarenses | RUTACEAE |
| OSUKOROI | Maa: | Kigelia africana | BORAGINACEAE |
| OLTUKAI | Maa: | Phoenix rochetiana | PALMAE |
| OLPIRO | | | |
| MUARUMBAINI | Maa: | Azadirachta indica | MELLIACEAE |
| OLMESERA | Maa: | Adansonia digitata | BOMBACEAE |
| ORNGERIANDUS | Maa: | Rubia cordifolia | RUBIACEAE |
| ENGIRIANDUSI | Maa: | | |
| ENJILEWA | Maa: | Ipomea longituba | CONVOLVULACEAE |
| OLOIBOR BENEK | Maa: | Croton dichogamus | EUPHORBIACEAE |
| ENDISA | Maa: | Cronyza hypoleuca A. Rich | COMPOSITAE |
| EKOKURUI | Maa: | Euphorbia heterochroma | EUPHORBIACEAE |
| OLANGUNGAI | Maa | | |
| OLIASURIAK | Maa | | |
| ETORONIKI | Maa | | |
| OLCHANI ONYOIKIE | Maa: | Bridelia micrantha | EUPHORBIACEAE |
| MUTAA | Maa: | Ocimum kilimandischaricum | LABIATAE |
| ENANGELEO | Maa: | | |
| OLOIYAPIYAP | Maa: | Croton macrostachys | EUPHORBIACEAE |
| ENGOKURAI | Maa: | Euphorbia sp | EUPHORBIACEAE |
| ONGABOLOI | Maa: | Ficus spp. (F. sur, F.sycamorus | MORACEAE |
| LEKIPIEI | Maa: | CAESALPINIACEAE | |
| OLDARAKRUAI | Maa: | Lonchocarpus eriocalyx | PAPILIONACEAE |
| OLKINYOR OSHOKE | Maa: | Bridelia micrantha Baill | EUPHORBIACEAE |
| OSILALEI LE NAI NGORRE | Maa; | Acacia senegal | MIMOSACEAE |
| ENCHNI PUS | Maa: | Artemisia afra | COMPOSITAE |
| EIMIM | Maa: | Indigofera | PAPILLONACEAE |
| OLE KIMOJIK | Maa; | Dryopteris inaequalis (schlect.)o.Kuntze | ASPLENIACEAE |

**WOODS AND BURNS**

| | | | |
|---|---|---|---|
| OLBIBIYIAI | Maa: | Leonotis mollisma<br>L. nepetifolia | LABIATAE |
| ENGILAI | Maa: | Teclea trichocarpa<br>T. simplicifolia<br>T. nobilis | RUTACEA |
| OLKONYIL | Maa: | Rhamnus prinoides | RHAMNACEAE |
| OLDEPE | Maa: | Acacia nubica | MIMOSACEAE |
| OLAMURIAK | Maa: | Carissa edulis | APOCYNACEAE |
| OLKILORIT | Maa; | Acacia nilotica | MIMOSACEAE |
| OLTIMINGOMI | Maa: | Pappear capensis | SAPINDACEAE |
| OCHILICHILI | Maa: | Commiphora africana | BURSERACEAE |
| MCHIMBA-KABURI | Maa: | Jatropha curcas | EUPHORBIACEAE |
| OSUKOROI LEMOMO | | Aloe secundiflora | LILIACEAE |
| OLTEPESI | Maa: | Acacia tortilis | MIMOCACEAE |

| | | |
|---|---|---|
| OITI | Maa: Acacia mellifera | MIMOCACEAE |
| OLAGATETI | Maa: Ficus sur | MORACEAE |
| | F. sycamorus | |
| | Ficus spp. | |
| OLERUBAT | Maa: Achyranthes aspera | AMARANTHACEAE |
| OLMUSIGIYIOI | Maa: Rhus natalensis | |
| OLOISUGI | Maa: Xanthoxylum usambarense | |
| RUTACEAE | | |
| EMPRERE-EPAPA | Maa: Asparagus setaceus | |
| LILIACEAE | | |
| | Asparagus sp. | |
| OLDULE | Maa: Ricinus communis | |
| EUPHORBIACEAE | | |
| OLDULE-ONGU | Maa: Datura stramonium | SOLANACEAE |
| ENKAMAI | Maa: Ximenia americana | OLACACEAE |
| OSIYANDET | Maa: Algae | |
| ENCHOKO | Maa: Cajanus cajan | PAPILIONACEAE |
| OLAPAI | Maa: (Fungus) | |
| OLORIKA LOLTULAL | Maa: (Mushroom) | |
| ENKIRASHAI | Maa: Opilia celtidifolia | OPILIACEAE |

**MOUTH: (Blisters and bad smell)**

| | | |
|---|---|---|
| OLTEPESI | Maa: Acacia tortilis | MIMOCEAE |
| OLDEPE | Maa: Acacia nubica | MIMOCEAE |
| AGAMALOKI | Maa: Maerua triphylla | CAPRARACEAE |
| OLENKA BURRA | Maa: | |
| EIKOM | Maa: spilanthes mauritiana | COMPOSITAE |
| OLTIMIGOMI | Maa: Pappea capensis | SAPINDACEAE |
| OLCHOKI | Maa: | |
| OLMMUNYI | Maa: Acacia robusta | MIMOSACEAE |

ALLERGY TO MEAT

| | | |
|---|---|---|
| OLPUJO | Maa: Pranus africana | ROSACEAE |
| OLAIRAMIRAMI | Maa: Phytolacca dodecandra | PHYTOLACCACEAE |
| ENGILAI | Maa: Teclea simplicifolia | RUTACEAE |
| | T. trichocarpa | |
| | T. nobilis | |
| OLMUCUCUA | Maa: Zanthoxylum usambarense | RUTACAEA |

**WORMS**

| | | |
|---|---|---|
| OLAMANGULAI | Maa: Grewia villosa | TILIACEAE |
| ENTULELE | Maa: Solanum incanum | SOLANACEAE |
| LOODUA | Maa: Myrsine africana | MYRSINACEAE |
| OLMUKUTAN | Maa: Albizia anthelmintica | MIMOSACEAE |
| OLGIRGIR | Maa: Acacia brevispica | MIMOSACEAE |
| OLAIMURINYAI | Maa: Acokanthera oppositufolia | APOCYNACEAE |
| OLAISAI | Maa: Pupalia lappacea (L.) juss | AMARNTHACEAE |

**EPILEPSY**

| | | |
|---|---|---|
| ENKISUGI-OLE-NARRIO | Maa: Clematis hirsuta | RANUNCULACEAE |

| | | | |
|---|---|---|---|
| NDULELE | Maa: | Solanum incanum | SOLANACEAE |
| OLKONYIL | Maa: | Rhamnus prinodes | RHAMNACEAE |
| OLDULE-ONGU | Maa: | Datura stramonium | SOLANACEAE |
| EGUTIANE | Maa: | Heteromorpha trifoliata | UMBELLIFERAE |
| EIGUYIANE | Maa: | | |
| OLMOMOI | Maa: | Kigelia africana | BORAGINIACEAE |
| OLOPANTE | Maa: | Lannea schweinfurthii | ANACARDIACEAE |

**SNAKE BITE**

| | | | |
|---|---|---|---|
| OSARAGI | Maa: | Balanites sp. | |
| OLOKUNONOI | Maa: | Ozoroa insignis | ANACARDIACEAE |
| OLEMUATENI | Maa: | Chenopodium album L. | CHENOPODIACEAE |
| OLIASURIAK | Maa: | | |
| OLE KIKARRETA | Maa: | Heliotropium rariflorum stocks | BORAGINACEAE |
| OLKUNYI NTULELE | Maa: | | |
| ENKODUAI | Maa: | Myrsine african | |
| BILHARZIA | | | |

| | | | |
|---|---|---|---|
| OLKOKOLA | Maa: | Rhamnus staddo | RHAMNACEAE |
| EMAME | Maa: | Acacia nubica | MYRSINACEAE |

**THROAT CONDITIONS**

| | | | |
|---|---|---|---|
| EKITUGUU ANGATA | Maa: | | LILIACEAE |
| OLE BITIRO | Maa: | Neorautanenia mitis | PAPILIONACEA |
| OLE-RAI | Maa: | Acacia seyal<br>A. xanthophloew | MIMOSACEAE |
| ENTULELEI | Maa: | Solanum indicum | SOLANACEAE |
| COFTA YA MSITU | Maa: | Spilanthes mauritiana | COMPOSITAE |
| OSOKONOI | Maa: | Warburgia ugandensis | CANELLACEAE |
| OITI | Maa: | Spilanthes mauritiana | COMPOSITAE |
| ENCHANI OLTOROROB | Maa: | Vernonia cinarescens | COMPOSITAE |

**FLEAS**

| | | | |
|---|---|---|---|
| OLESAYIET | Maa: | Withania somnifera | SOLANACEAE |
| OLEISUSU | Maa: | | |
| OLTIANGOSHONG | Maa: | Hypoestes verticillaris | ACANTHACEAE |

**JIGGERS**

| | | | |
|---|---|---|---|
| OLTEMWAI | Maa: | | BURSERACEAE |
| OLCHILICHILI | Maa: | Commiphora sp | |
| OLSOKONOI | Maa: | Warburgia ugandensis | CANELLACEAE |
| ENTULELEI | Maa: | Withania somnifera | SOLANACEAE |

**BED BUGS**

| | | | |
|---|---|---|---|
| OLKILORIT | Maa: | Acacia nilotica | MIMOSACEAE |

**VOMITING**

| | | | |
|---|---|---|---|
| ENKIRRASHAI | Maa: | Opilia amentacea<br>O. campestris | OPILIACEAE |

| | | | |
|---|---|---|---|
| OLMOKOTAN | Maa: | Albizia anthelmintica | MIMOSACEAE |
| ESUMEITA | Maa: | | |
| ENTUKUSHI | Maa: | Jasminum sp | OLEACEAE |
| OLBOLBOLI | Maa: | (Two types) | |

**OEDEMA**

| | | | |
|---|---|---|---|
| ENKI-KAMPAUS | Maa | Omorcaprpum trichocarpum | PAPILIONACEAE |
| LERUBAT | Maa: | Achyranthes aspera | AMARANTHACEA |
| ENKAMAI | Maa: | Ximenia americana | |

**FLAVOUR GOURDS/SMOKE GOURDS**

| | | | |
|---|---|---|---|
| OLOIRIEN | Maa: | Olea africana | OLEACEAE |
| OSEKI | Maa: | Cordia ovalis | BORAGINACEAE |
| OMAPITETI | Maa; | Cordia sinensis lam. | BORAGINACEAE |
| OLETEPESI | Maa: | Acacia tortilis | MIMOSACEAE |

**FAINTING AND DIZZINESS**

| | | | |
|---|---|---|---|
| OLOIROROI | Maa; | Boscia angustifolia | CAPPARACEAE |

**PANCREAS**

| | | | |
|---|---|---|---|
| LOODUA | Maa: | Myrsine africana | MYRSINACEAE |

**STOMACH ULCERS**

| | | | |
|---|---|---|---|
| OLDULE | Maa: | Ricinus communis | EUPHORBIACEA |
| OSUKOROI-LEMMO | Maa: | Aloe secundiflora | LILIACEAE |

**BOILS**

| | | | |
|---|---|---|---|
| EMPERE EPAPA | Maa: | Asparagus setaceus<br>A. Falcatus | LILIACEAE |

**TUBERCULOSIS**

| | | | |
|---|---|---|---|
| OLPOPOGI | Maa: | Euphorbia candelabrum | EUPHORBIACEAE |
| OLMAGUTGUT | Maa: | Clerodendrum myricoides | VERBENACEAE |

**IMPOTENCY/APHRODISIACS:**

| | | | |
|---|---|---|---|
| OLTIMINGOMI | Maa; | Pappea capensis | SAPINDACEAE |
| OLKONYIL | Maa: | Rhamnus prinoides | RHAMNACEAE |
| OLKOKOLA | Maa: | Rhamnus staddo | RHAMNACEAE |
| OLOSESIAI | Maa: | Osyris abyssinica | SANTALACEAE |

**ABORTIFICIENT**

| | | | |
|---|---|---|---|
| OLCHANI ONYOKIE | Maa: | Bridelia micrantha | EUPHORBIACEAE |

| | | | |
|---|---|---|---|
| OLGERIATO | Maa: | | |
| ENGOSIRIANJOI | Maa: | Ormocarpum trichocarpum | PAPILIONACEAE |

| | | |
|---|---|---|
| OLMANGULA | Maa: Grewia villosa | TILIACEAE |
| ESITETI | Maa: Grewia bicolor | |
| LOODUA | Maa: Myrsine africana | MYRSINACEAE |

**ELEPHANTIASIS**

| | | |
|---|---|---|
| OSUKUROI-LENOMOI | Maa: Aloe secundiflora | LILIACEAE |
| MURTUTI | Maa: | |

FAT from Alligator lizard, Python

**STERILITY IN WOMEN**

| | | |
|---|---|---|
| OLPOPOGI | Maa: Euphorbia candelabrum | EUPHORBIACEAE |
| OLPOMBOI LO NTARE | Maa: Lablab purpureus | PAPILIONACEAE |

KWASHIOKOR

| | | |
|---|---|---|
| ENJELEWANI | Maa: Impomea longituba | CONVOLVULACEAE |
| OLKILORIT | Maa: Acacia nilotica | MIMOSACEAE |
| LOPOROKWAI | Maa: Sida ovata | MALVACEAE |

**MADNESS**

| | | |
|---|---|---|
| OLDULE | Maa: Ricinus communs | EUPHORBIACEAE |
| OLDULE-ONGU | Maa; Datura stramonium | SOLANACEAE |

**EAR PROBLEMS**

| | | |
|---|---|---|
| OLBIBIYIAI | Maa: Leonotis mollisma L. NEPETIFOLIA | LABITAE |
| OLMATASIA | Maa: clausena anisata | RUTACEAE |
| OLONKII | Maa: Lycium elokii | SOLANACEAE |
| ORBANGI | Maa: Canabis sativa | Compositae |
| LEMOMO | Maa: Solanum nigrum | SOLANACEAE |

**TOOTH ACHES**

| | | |
|---|---|---|
| ELERYMBAT | Maa: | |
| OLTIMINGOMI | Maa; Pappea capensis | SAPINDACEAE |
| OLMATASIA | Maa: Clausena anisata | RUTACEAE |
| OLMUKUTAN | Maa: Albizia anthelminitica | MIMOSACEAE |

**WHOOPING COUGH**

| | | |
|---|---|---|
| LOODUA | Maa: Myrsine africana | MYRSINACEAE |
| OITI | Maa: Acacia mellifera | MIMOSACEAE |

**ASTHMA**

| | | |
|---|---|---|
| OLKIRENYI | Maa: Euclea divinorum | EBENACEAE |
| ENKAMAI | Maa: Ximenia sp. | OLACACEAE |
| OLSOKONOI | Maa: Warburgia ugandensis | CANELLACEAE |
| OSERE | Maa: Typha domingensis | TYPHACEAE |

**REDUCED BLOOD IN THE BODY**

| | | | |
|---|---|---|---|
| OLTIMINGOMI | Maa: | Pappear capensis | SAPINDACEAE |
| ORPARNTEI | Maa: | lannea schwinfurthii | ANACARDIACEAE |
| OLKILORIT | Maa: | Acacia nilotica | MIMOSACEAE |
| OLPERELONGO | Maa: | Allophyllus rubifolius | SAPINDACEAE |

**LIVER DISEASES**

| | | | |
|---|---|---|---|
| OLBIBIYIAI | Maa: | Leonotis nepetifolia | LABIATAE |
| ENCHANI NAROK | Maa: | Turraea mombassan | MELIACEAE |
| OLNGIOSUA | Maa: | Balanites aegyptica | Balanitaceae |
| LOODUA | Maa: | Myrsine africana | MYRSINACEAE |

**CONTINUOS MENSTRUATION**

| | | | |
|---|---|---|---|
| OLKIRENYI | Maa: | Euclea divinorum | EBENACEAE |
| LERUBAT | Maa; | Achyranthes aspera | AMARANTHACEAE |
| OLOPONI | Maa: | Erythrina abyssinica | PAPILIONACEAE |
| ENGISARAGATUNY | Maa: | Harrisonia abyssinica | |

| | | | |
|---|---|---|---|
| OLCHILICHILI | Maa: | Commiphora africana | BURSERACEAE |
| OLTEMUAI | Maa: | | |
| ALAMURIAK | Maa: | Carissa edulis | SOLANACEAE |
| ORINYAL | Maa: | | |

**KIDNEY AND RELATED (e.g. Problems in passing Urine)**

| | | | |
|---|---|---|---|
| OLOPONI | Maa: | Erythrina abyssinica | PAPILIONACEAE |
| LERUBAT | Maa: | Acyranthes aspera | AMARANTHACEAE |
| ENGISAGARTUNY | Maa: | Harrisonia abyssinica | SIMAROUBACEAE |
| OLOIYAPIYAP | Maa: | Croton macrostachys | EUPHORBIACEAE |

**GENERAL TREATMENT PLANTS: Aches & Pains General Body Pains:**

| | | | |
|---|---|---|---|
| OLGABOLI | Maa: | Ficus sycamorus | MORACEAE |
| OLOPONI | Maa: | Erythrina abyssinica | PAPILIONACEAE |
| LERUBAT | Maa: | Achyranthes aspera | AMARANTHACEAE |
| NDULELE | Maa: | Solanum incanum | SOLANACEAE |

**STDs: Gonorrhoea**

| | | | |
|---|---|---|---|
| MUCETHI | Maa: | (Fern) | |
| ALAMURIAK | Maa: | Carissa edulis | APOCYNACEAE |
| OLBIBIYIAI | Maa: | Leonotis mollisma l. nepotifolia | LABITAE |
| NDULELE | Maa: | Solanum incanum | SOLANACEAE |

**HEADACHE**

| | | | |
|---|---|---|---|
| ENKISUGI OLE NARIO | Maa: | Clematis hirsuta | RANUNCULACEAE |

| | | | |
|---|---|---|---|
| OKKIRENTI | Maa: | Euclea divinorum | EBENACEAE |
| OLMUSIGIYIOI | Maa: | Rhus natalensis<br>R. vulgaris | ANACARDIACEAE |
| MUVELENGWA | Maa: | Rhoicissus tridentata | VITACEAE |

**EYES**

| | | | |
|---|---|---|---|
| MARARASHI | Maa: | Calodendrum capense | RUTACEAE |
| ENGELENYAI | Maa: | Rhoicissus tridentata | VITACEAE |
| EMAISILING | Maa: | Kalanchoe densiflora Rolfe | CRASSULACEAE |
| OLODO-ANYIEKI | Maa: | | |

**PREGNANCY and related condition**
**(e.g. Birth complications, Placenta retention, Irregular monthly periods, Miscarrieage, etc)**

| | | | |
|---|---|---|---|
| OLDEPE | Maa: | Acacia nubica | MIMOSACEAE |
| OLUAI | Maa: | Acacia drepanolobium | MIMOSACEAE |
| ENKAMAI | Maa: | Ximenia americana | OLACACEAE |
| MUNUGA | Maa: | Grewia similis | TILIACEAE |

HONEY

| | | | |
|---|---|---|---|
| OLAISAI | Maa: | Pupalia lappacea | AMARANTHACEAE |
| OITI | Maa: | Acacia meliffera | MIMOSACEAE |
| EPERE EPAPA | Maa: | Asparagus setaceus | LILIACEAE |
| ENKOSIKIRIA-NCHOI | Maa; | Ormocarpum kirkii | PAPILIONACEAE |

**CONSTIPATION:**

| | | | |
|---|---|---|---|
| OLOISAI | Maa: | Pupalia lappaceae | AMARANTHACEAE |
| ENKIRASHAI | Maa: | Opilia campestris | OPILIACEAE |
| OLKILORIT | Maa: | Acacia nilotica | MIMOSACEAE |
| OSOKONOI | Maa: | Warburgia ugandensis | CANELLACEAE |

*RHEUMATID AND ATHRITIS*

| | | | |
|---|---|---|---|
| OLTIMIGOMI | Maa: | Pappea capensis | SAPINDACEAE |
| OLKONYIL | Maa: | Rhamnus prinoides | RHAMNACEAE |
| OLOISUGI | Maa: | Zanthoxylum chalybeum | RUTACEAE |
| ENKISARGATUNY | Maa: | Harrisonia abyssinica | SIMOURABACEAE |

*DYSENTERY*

| | | | |
|---|---|---|---|
| OLTIMIGOMI | Maa: | Pappea capensis | SAPINDACEAE |
| OLNGOSUA | Maa: | Balanites aegyptiaca | BALANITACEAE |
| OPOROKWAI | Maa: | Sida ovata | MALVACEAE |
| OLMUSIGIYOI | Maa: | Rhus vulgaris | ANACARDIACEAE |

*MALARIA AND YELLOW FEVER*

| | | | |
|---|---|---|---|
| OLKONYIL | Maa: | Rhamnus prinoides | RHAMNACEAE |
| OLKOKOLA | Maa: | Rhamnus staddo | RHAMNACEAE |
| OLOISUGI | Maa: | Fagara usambarense | RUTACEAE |
| OLOPONI | Maa: | Erythrina abyssinica | PAPILIONACEAE |

*LIVESTOCK DISEASES*

| | | |
|---|---|---|
| OLPIRO | Maa: Phoenix reclinata Jacq. | PALMAE |
| OLORONDO | Maa: Cyphostemma orondo | VITACEAE |
| OLKOKOLA | Maa; Rhamnus staddo | RHAMNACEAE |
| OLE KIUSHIN | Maa: Boerhavia errecta L. | NYCTANGINACEAE |

**HEART CONDITIONS ( Heart conditions Hyper-Hypo)**

| | | |
|---|---|---|
| LERUBAT | Maa: Achyranthes aspera | AMARANTHACEAE |
| OLOPONI | Maa: Erythrina abyssinica | PAPILIONACEAE |
| ENKAMAI | Maa: Ximenia sp. | OLACACEAE |
| OLOIYPIYAP | Maa: Cassis singnena | CAESALPINIACEAE |

*COUGHING AND CHEST PAINS*

| | | |
|---|---|---|
| ONDARAPOI | Maa: | |
| Empere epapa | Maa: Asparagus setaceus | LILIACEAE |
| OLOISUKI | Maa: Zanthoxylum chalybeum | RUTACEAE |
| ENTEMELUA | Maa: Solanum sp. | SOLANACEAE |

## GENERAL REMARKS

The programme had embarked on a rather broad front of research and development activities at its inception. Some adjustments were made during the second half of 1996, when it was the programme's activities. It has laid working guidelines and procedures for sustainable management of resources with prospects for opening new economic activities at the village level. There are clear indications that the processes on capacity building and empowerment initiated during the report period will nurture these institutions to become dependable instruments for planning, advocacy and change not only on issues on resources use but in all developmental work in the area and beyond.

## CONSRAINTS

The low productivity biological of the area had made it difficult for the programme to realize concrete results speedily enough to provide the people with much needed solutions and adoption of new livelihoods as they settle and adopt new lifestyles. Lack of reliable water supply at the base camp had severely curtailed work on agroforestry, home gardens and ecotourism. Conservatism and suspicion of new ideas had tended to distract attention of the people from considering adopting holistic solutions of pastoral technologies, particularly destocking. The average members of the community continue to shy away from culling even when the consequences of drought have been repeated. Alternative economic actives are still seen as hobbies to be undertaken to supplement the pastoral economy. Thus, these activities tend be shelved into a backseat when the animals have to be moved to greener pastures during the dry season.

The productivity of the few field staff was also limited by deficient supervision. Supervisors were generally handicapped in instilling disciple on people connected to them, a development that had introduced different yard sticks for performance evaluation. But with a change in duty assignment and punitive lay-offs of non-achievers under guidelines that were approved by PMC in 1998, a significant improvement has been recorded. It was also realized towards

the end of 1996 that many studies were being carried blindly without clear research themes, objectives and hypothesis making it difficult for the research effort to gain mileage. Consequently some time was devoted to problem analysis and assessment of the resource bases to enable development of themes, objectives and working assumptions to support the development of specific research proposals. The research conducted from this time constitute the substance of what is reported here.

At the same time, during the report period implementation was disrupted from time to time due to disjuncts in the release of funds. This arose from two fronts: funds channelled through the promoter took long to reach the programme. This in time led to delays in providing progress reports with concomitant lags in subsequent releases from the donor. Two vehicles that were stationed at the project site had led to high operating costs with proportionately low returns. Attempts made in 1997 to rectify this arrangement following arrival a new vehicle were soon frustrated by lack of a post sale service for the vehicle, a Dacia model, with virtually no steady spares back-up in the local market. The vehicle that had been purchased for the Co-ordinator was also crippled with chronic breakdowns rendering it unsafe for field trips and yet the poor road conditions precluded the use of a small private car. These were rectified in due course. The fieldwork was also constrained by unseasonal weather, particularly the drought of 1999 to 2000. Currently the rains have not been good this year but hopefully they will come soon.

On the whole, EWEMP undertook most of its work according to the planned work programme. It established a cohesive local level resource governance structure that has taken ownership of the programme. It is evident that the processes of empowerment and capacity building initiated during the report period will nurture it into a dependable vehicle for managing change and development in the area. Results of the research effort in narrative dryland resources management are also encouraging, although many of these have not covered both the good and bad rain years. It is hoped that cumulative work based on the ground established during the report period will provide more conclusive results and information.

## THE TEAM

## MEMBERS OF THE PROGRAMME MANAGEMENT COMMITTEE

| | |
|---|---|
| Suakei Lemanta | Chairman |
| Jonathan Loontasati | Member Elangata Wuas |
| Kanchori Sinkeen | Member/Chairman Elangata Wuas Ranch |
| Kimorosh Sankau | Member Kilonito |
| Mopiyian Nkongoni | Women representative |
| Daniel Raria | Finance |
| Kennedy Matapash | Member Kilonito |
| Judah Ncharo | Chief Loodokilani - Ex officio |
| Kennedy Matapash | Member Kilonito |
| Parkau Nkurrao | Kilonito G. R. Chairman |

## MEMBERS OF THE FINANCE COMMITTEE

| | |
|---|---|
| Daniel Raria | Finance Committee Chairman |
| Jonathan Loontasati | Finance Committee member |
| William Sinkira | Committee member |
| Suakei Lemanta | Management Committee Chairman |
| Daniel Moile | Community Coordinator |
| Joel Keton | Accountant |

## MEMBERS OF THE MANAGEMENT COMMITTEE

| | |
|---|---|
| Suakei Lemanta | Chairman |
| Parkau Nkurrao | Member |
| Kanchori Sinkeen | Member |
| Daniel Raria | Member |
| Jonathan Loontasati | Member |
| Yudah Ncharo | Member |
| Kimorosh Tikan | Member |
| William Sinkira | Member |
| Mopiyian Nkongone | Member |
| Jeff Odera | Programme Coordinator |
| Daniel Moile | Community Coordinator |
| Philip Maora | Field Manager |
| Joel Keton | Accountant |
| Agnes Nashipae | Women Coordinator |
| Joseph Katitia | Ex-officio |
| John Meroso | Ex-officio |
| Moses Maora | Ex-officio |
| Paramount chief Maora | Ex-officio |

## STAFF MEMBERS

Daniel Moile
Philip Maora
Joel Keton
Agnes Setei
George Toris
Nixon Setei
Duncan Suakei
Ezekiel Roimen
Meikan Naekip
Oiboo Buaa
Lanchoo Mereso
Parkush Kipiroi
David Sirim
Peter Chichai
Meshack Nankuyien
Saoina Siare
Asha Namunyak
Judith Liama
Meeli Kunte

## COLLABORATORS

Thomas Ochuodho
Paul Opanga
Moses Olang

**Papers Published and those under Preparation**

Odera, J.A. 1996: The present state of degradation of fragile ecosystems in drylands and the role of forestry in their restoration. A paper presented to an international expert meeting on rehabilitation of degraded forest ecosystems 24th to 28th June, 1996. Lisbon, Portugal.

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B.N. Chikamai and Odera. J.: The Drylands of Kenya. A book being co-authored with Chikamai et al.

**Papers under Preparation**

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Odera, J.A. and Opanga, P. Experiences in evolving local natural resources management institutions in Elangata Wuas.

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Odera, J.A. and Opanga, P. Marketing on non-wood forest products from Elangata Wuas: the way ahead.

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