# REPUBLIC OF KENYA


## MINISTRY OF AGRICULTURE

# ARID AND SEMI-ARID LANDS BRANCH

# LAIKIPIA DISTRICT

## A PRE-INVESTMENT STUDY OF HUMAN AND NATURAL RESOURCES

## VOLUME I

**Overview**



**1983**

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# CHAPTER 1

# OVERVIEW

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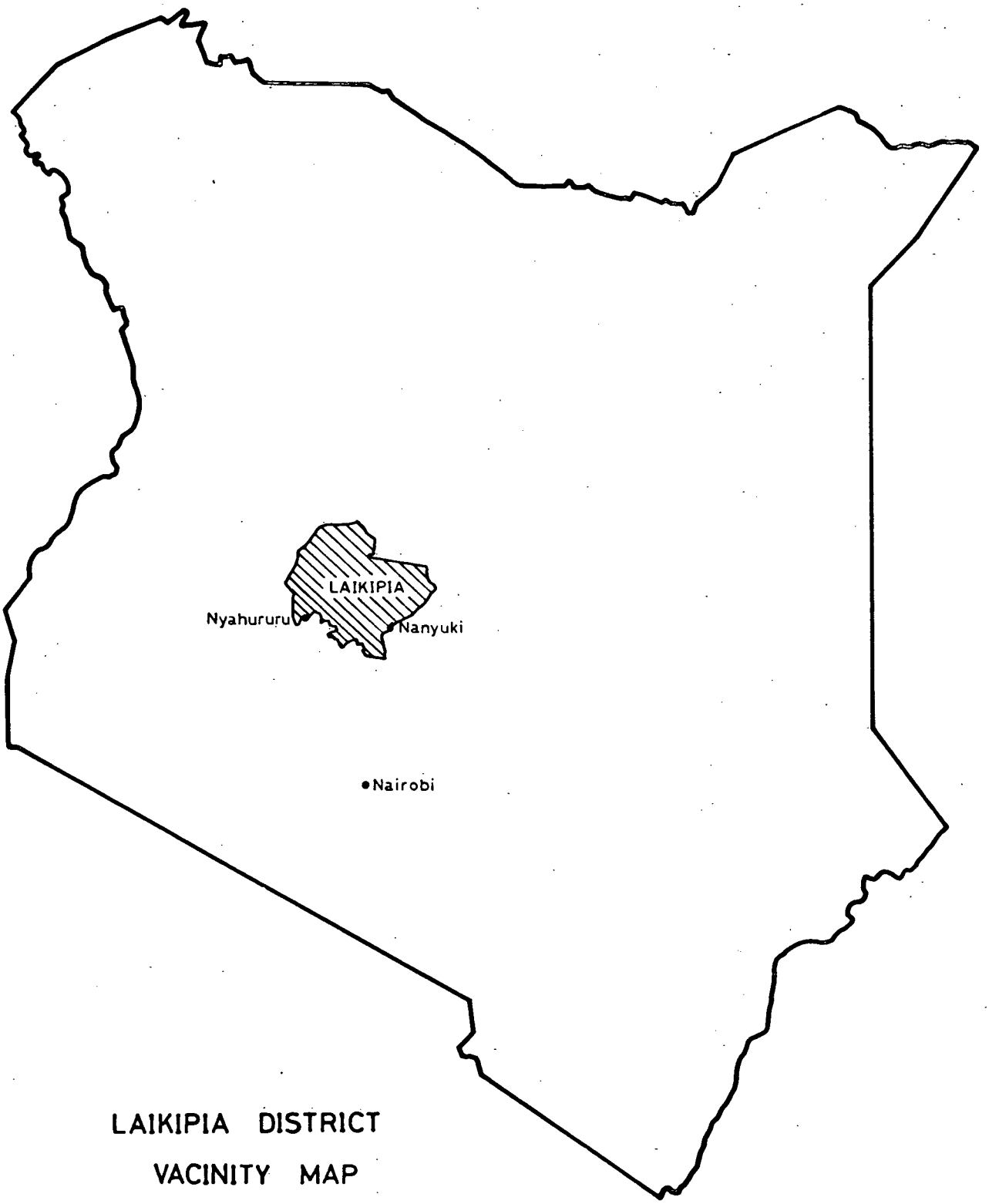


LAIKIPIA DISTRICT
VACINITY MAP

# PREFACE

This pre-investment study of the human and natural resources of the Laikipia District (see Maps 1-1 and 1-2) is a joint effort between Kenya and the United States of America. It is authorized and funded under Contract No. 615-0172 between the Government of Kenya and USAID. The members of the team conducting the study, named below, are employees of the Ministry of Agriculture, Branch of Arid and Semi Arid Lands (ASAL) and a Technical Assistance Team (TAT) composed of Louis Berger International, Inc. and its sub-contractor Texas A&M University employees:

| | |
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The study report is presented in narrative description, map, and tabular form. A unique feature of the study is the very liberal use of maps. The maps (numbering 31) in the

report are photo-reductions of original map transparencies at a scale of 1:250,000. These originals are part of permanent map file in the Arid and Semi-Arid Branch Office and are available there for review by prospective donors or other interested parties.

In addition to providing visual information, complementing tables, and text, these maps also perform another function. When one transparency is superimposed upon another, certain resource values become more readily apparent. Examples of this interplay of maps is shown in Chapter 7, Maps 7-1A and 7-3A. This technique greatly aids the analytical process for land use planning.

The study divided into four volumes made up of eleven chapters, briefly described as follows:

Volume I

Chapter 1 - Overview of the District's human and natural resources, its problems and alternative solutions.

Volume II

Chapter 2 - A review and analysis of the District's Rural Sociology and Historical Background.

Chapter 3 - A review and analysis of the District's Economy.

Volume III

Chapter 4 - An inventory, analysis and interpretation of the District's Geology, Climate and Physiography.

Chapter 5 - An inventory, description, analysis and interpretation of the District's Soils.

Volume IV

Chapter 6 - An inventory and analysis of the District's soil and water erosion conditions, and water resources.

Volume V

Chapter 7 - An inventory and analysis of the vegetative resource, and interrelated range management activities and problems.

Chapter 8 - A review of the District's livestock and the relationships with the range management and wildlife programmes.

Chapter 9 - A review of the District's wildlife resource and the interrelationships with livestock and range management.

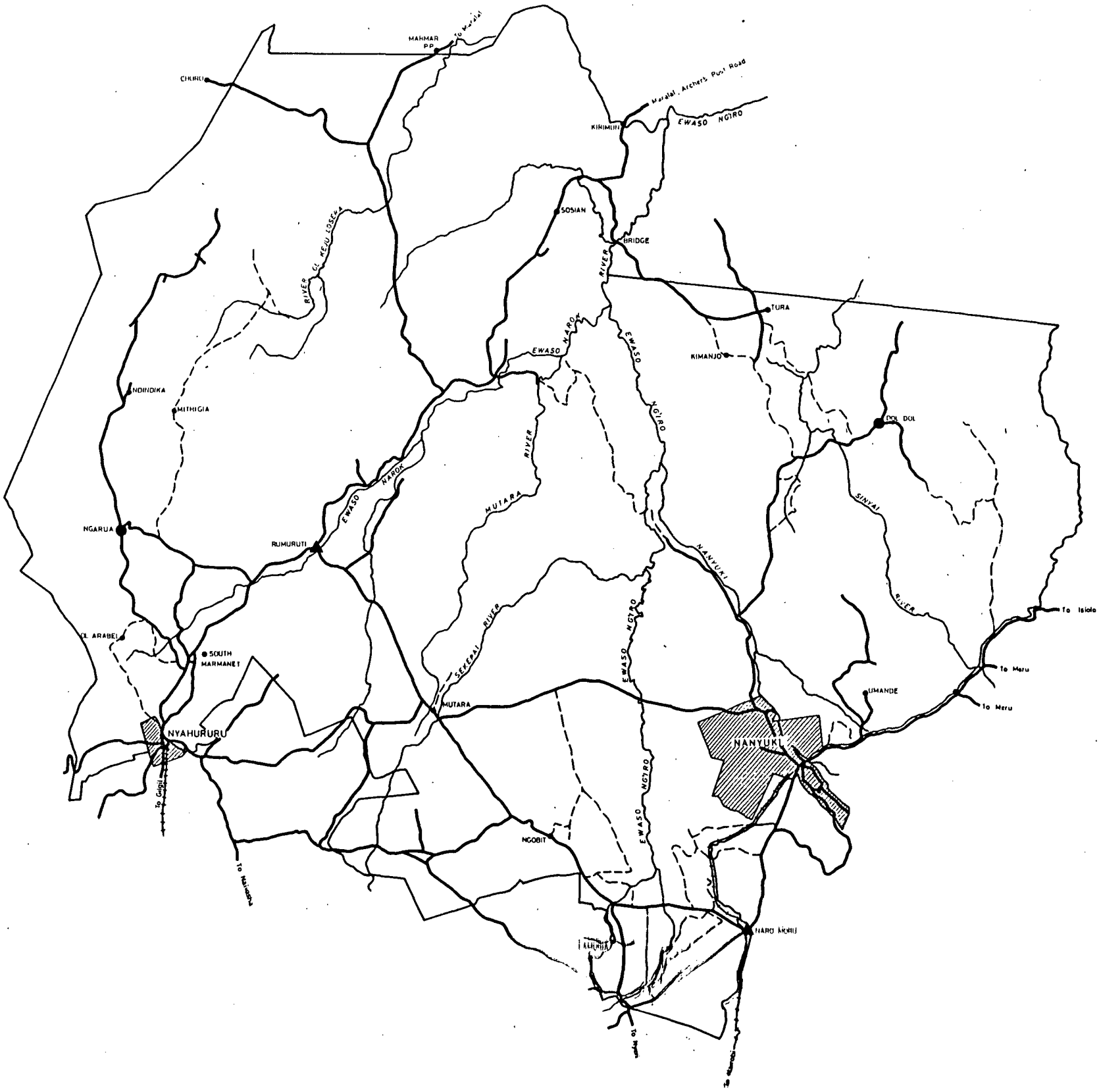
Volume VI

Chapter 10 - A review of the District's forest resource, its current and future problems and potentials.

Chapter 11 - A review of the District's current and rapidly changing farm and smallholder situation. Specific analytical relationships with soils and climatic information are provided.

It is hoped that this study will lead to a comprehensive understanding of the present situation in Laikipia District, its farm production possibilities and constraints. It will help the government to identify the developable resources and available implementable projects either with local resources or with donor assistance.

Michael Thiongo
Head: Arid & Semi Arid Lands Branch
MINISTRY OF AGRICULTURE




LEGEND

- DISTRICT BOUNDARY
- MAJOR ROADS
- MINOR ROADS
- KENYA RAILWAY
- RIVERS
- URBAN CENTRE
- RURAL CENTRE
- MARKET CENTRE
- LOCAL CENTRE

REPUBLIC OF KENYA
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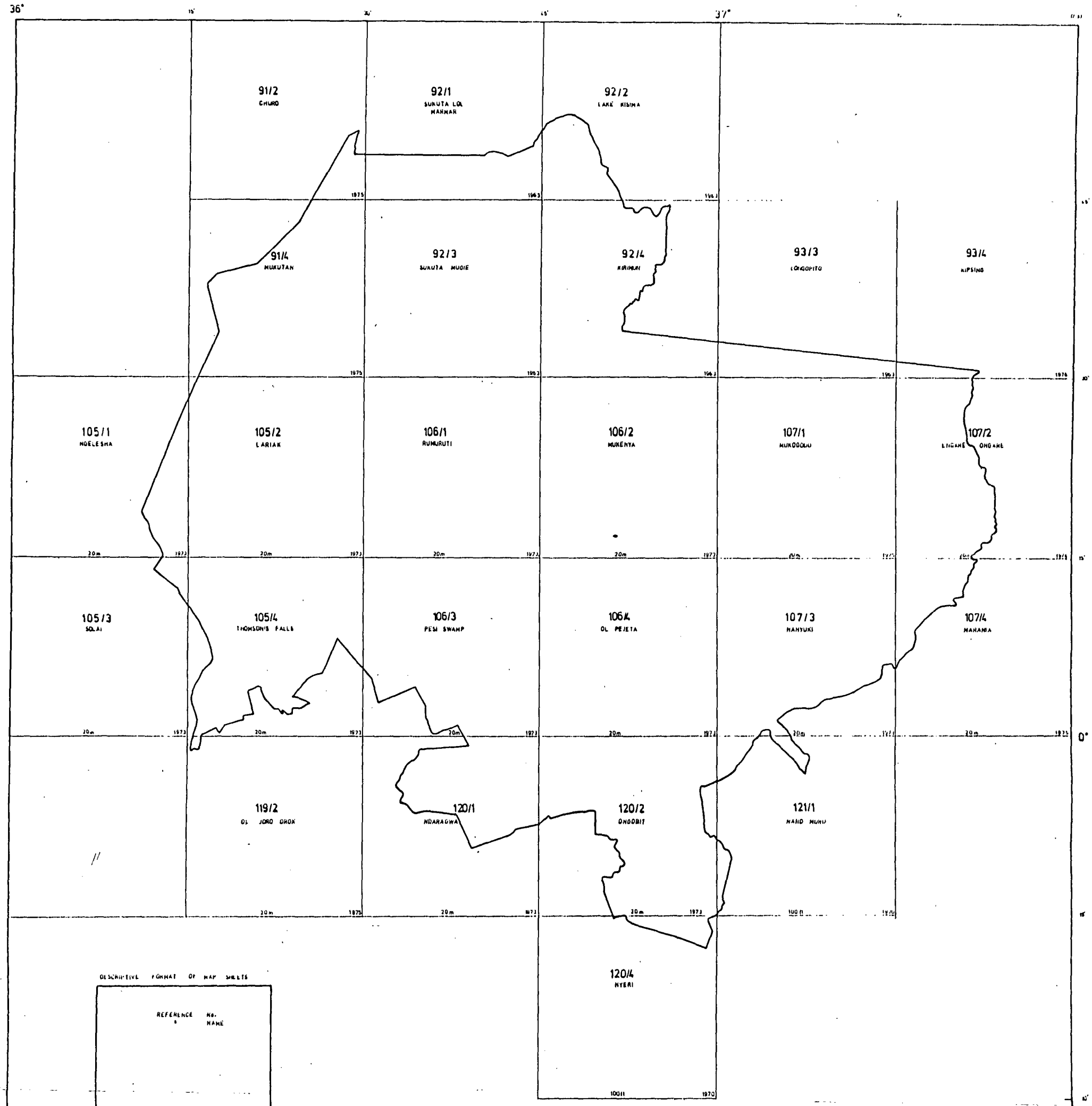
ARID AND SEMI-ARID LANDS BRANCH

LAIKIPIA DISTRICT PRE-INVESTMENT STUDY

BASE MAP

| MAP | | PLATE |
|---|---|---|
| 1-1 | 1982 - 83 | ASAL-1 |


36°
37°
0°
91/2
CHURO
92/1
SUKUTA LOL MARMAR
92/2
LAKE KISIMA
91/4
MUKUTAN
92/3
SUKUTA MUDIE
92/4
KIRIMUN
93/3
LORGOPITO
93/4
KIPSING
105/1
NGELESHA
105/2
LARIAK
106/1
RUMURUTI
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MUKENYA
107/1
MUKOGODO
107/2
LINGANE ONGAMS
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SOLAI
105/4
THOMSONS FALLS
106/3
PESI SWAMP
106/4
OL PEJETA
107/3
NANYUKI
107/4
NARAMA
119/2
OL JORO OROK
120/1
NDARAGWA
120/2
ONDOBIT
121/1
NANO NUNU
120/4
NYERI
DESCRIPTIVE FORMAT OF MAP SHEETS
REFERENCE No.
NAME
CONTOUR INTERVALS
YEAR MAP PUBLISHED
LEGEND OF LINES
DISTRICT BOUNDARY
MAP SHEET BOUNDARY
Drafted by: Caroline Adhiambo from (SK)
SCALE
REPUBLIC OF KENYA
MINISTRY OF AGRICULTURE
ARID AND SEMI-ARID LANDS BRANCH
LAIKIPIA DISTRICT PRE-INVESTMENT STUDY
INDEX: TOPOGRAPHIC MAP SHEETS (1 : 50,000).
MAP 1 - 2
1982-83
PLATE ASAL-2

# ARID/SEMI-ARID LANDS BRANCH

## I. INTRODUCTION

As stated in the Interministerial Task Force Report "Arid and Semi-Arid Lands Development in Kenya," there is a considerable concern within the Government of Kenya for the welfare of the people in the dry areas of Kenya. In the current National Development Plan (1979-83), there is, in fact, a special emphasis on the development of arid and semi-arid lands (ASALS). In order to set up strategies of tackling development in ASAL areas, the Government therefore set up a committee from various Ministries and called it a "Task Force" to look into the objectives, constraints, strategies, procedures and organization of a framework for ASAL development.

The Task Force Report of 1978 presented all of the above aspects in a detailed and orderly manner and classified ASAL areas into zones according to the moisture index. According to the classification, the semi-arid, arid, and very arid areas have moisture indices of -30 to -42 (also called Zone IC), -42 to -51 (Zone V) and -51 to -57 (Zone VI). The indices give an expression of climate, radiation, temperatures, saturation deficit, and wind speed, and are weighed for altitude and latitude.

As a follow-up of the Task Force findings and recommendations and also previous research findings, by the "Marginal Land Studies" (of 1977-78), the Arid/Semi-Arid Lands Branch has undertaken several pre-investment studies relating to projects to be implemented.

The area studied was Laikipia District. Other areas in the priority list include Samburu and Marsabit Districts. The study began in May 1982 and ended in December 1983.

## 1. Specific areas of operation

Laikipia District covers an area of 9,718 km². The District is divided into four administrative divisions namely: Central, Mukogodo, Rumuruti and Ngarua. Most of Mukogodo and Rumuruti Divisions are semi-arid and small portions of Central and Ngarua Division are semi-arid. For convenience of the study, the whole District was taken as one study area.

The area is bounded to the west by Baringo District, to the south by Nyeri and Nyandarua, to the east by Meru and Isiolo and to the north by Samburu.

## 2. Mode of operation

A comprehensive inventory of the physical, social and economic resources in the study area was undertaken. This refers to the agricultural and agriculturally related sectors. The data that was collected from the field and other secondary sources, was collated, analysed and organised into a format that facilitates the identification of opportunities for improvement of the life of less advantaged rural people in the study area. It is hoped that the identified opportunities will be organized into projects that can attract willing financiers.

As a matter of procedure, the resource inventory exercise and project identification was undertaken by performing the following tasks:

(i) Project design, which includes a brief field survey for delineation of the study area, and review of the questionnaire.

(ii) Collection of background data on Laikipia from various sources.

(iii) Primary data collection.

(iv) Secondary data collection.

(v) Collation and analysis of the data.

(vi) Inventory report write-up.

(vii) Project identification.

(viii) Project preparation (project profiles).

During data collections (Stage i-iii), each discipline operated more or less independently from each other, although for the purposes of transport economy, several disciplines shared vehicles, depending on the condition of transport prevailing at that time. Therefore, transport was streamlined in such a way that all the officers had sufficient time in the field to gather all relevant data.

3. Method of data analysis

From past experience, we have found it rather tedious and time consuming to follow the conventional research methodology, which involves administering a personal interview questionnaire on a randomly selected sample. This methodology does not present an accurate evaluation, especially where we are dealing with an area of different ecological zones.

In the past, studies have also been hampered by lack of staff in the branch with computer programming skills. Linear programming technique of analysis is usually the best and quickest analysis tool for such kinds of data. We tried other simpler techniques like cross tabulations, contingency tables, T-test and other measures of central tendencies to describe the various types of populations, but these have been found to work only for small study areas.

In this study, we have moved away from the past procedure of carrying out resources, inventory, and project preparation in different phases. This has been found to take an inordinate amount of time. In the early years of ASAL studies, emphasis was placed on pre-investment studies, and not on tangible project proposals. There is now increased pressure on the ASAL Branch to do inventory studies and prepare tangible projects, ready for financiers consideration.

It is for this reason that we have taken a different approach toward inventory study, project identification and project profile write-ups. All these were accomplished in phase 1. Each discipline investigated the present economic conditions, and the various constraints that hamper development. They then identified those resources that could be developed easily and designed a strategy for their development.

## II. SPECIFIC AREAS OF INVESTIGATION BY DISCIPLINES

### 1. Rural Economy

Attention was directed toward an understanding of the economic constraints and development opportunities surrounding subsistence farms and livestock producers in the study area. Sufficient field data was collected to establish several categories of farms. The specific aspects considered were:

Resources available and constraints for development

- Land: Land area, position, land use patterns, farm sizes, farming systems, area in each AEZ, available land for quick development, and land tenure system

- Labour: Total labour available (EAP), total labour per holding, farm labour at peak seasons, and availability/shortage of skilled labour (permanent, casual family etc.)

- Capital: Availability of agricultural credit facilities

  a) attitude of farmers towards credit
  b) credit utilization efficiency
  c) magnitude of savings and investments
  d) popular sectors of investments (agricultural vs other sectors)
  e) pattern and level of agricultural inputs used in the area
  f) entrepreneurship

Infrastructural development and constraints

- Communication Links: roads, bridges, telephones, etc., and their accessibility to market centres

- Energy: potential and existing energy sources and costs

- Structures: water structures, farm buildings, storage agricultural processing facilities etc.

Level of the economy

- Market types, location, organisation and accessibility
- Marketing institutions, price structures of farm inputs, and the volumes handled in the relevant markets
- Credit institutions and coverage
- Availability of farm inputs and level of usage
- Level and composition of gross output
- Level and pattern of present consumption
- Estimate of value of production direct costs and value added
- Level of subsistence farming and commercialization

Institutional development and constraints

- Land tenure system
- Staffing and effectiveness of existing public institutions; e.g., cooperatives, farmers associations, extension service etc.
- Nature of inter-departmental coordination

## 2. Rural Sociology

The sociologist collected, collated and analysed the human resources and social characteristics of the people living in Laikipia. Sociological guidance was given to

local people participating in development projects. Specific aspects considered were:

People

- Tribal composition and ethnic groupings
- Settlement and imigration patterns
- Household organisation and housing
- Way of life, occupation and employment

Population

- Size and structure
- Growth rate and future projections
- Density and distribution
- Family size

Social Participation Groups

- Women groups
- Youth programmes
- 4 K Clubs and Others

Change Agents and Problems Facing Them

- Public institutions
- Private organisations
- Non-government organisations (NGO)

Social Infrastructure

- Education; basic, higher, adult
- Health and distribution of health centres
- Diseases
- Nutrition
- Water availability and distribution
- Welfare, community development centres, farmers training

- Churches and other social groups
- Recreation

Social economic activities

- Manufacturing of pottery, carvings, baskets, etc.
- Trading, shopkeeping
- Importance of local markets

3. Livestock Production

Data was collected at all levels (local farmers, division, district, etc.) as well as from commercial processing and marketing sources. Production trends are shown where possible. Much of the data supplied by farmers was obtained through questionnaires. Comprehensive information was gathered on the following:

Cattle, Sheep, Goats

- Total numbers and distribution
- Average household herds
- Herd structure and sex ratios
- Birth rates, mortality, sales and offtake
- General condition of livestock
- Production systems
- Their relative contribution to family income
- Average stocking rates in each location

Poultry, Pigs, Rabbits and Beekeeping

- (Same as for Cattle, Sheep, Goats)

Production Constraints

- Disease incidence and prevention
- Pests and predators
- Dipping and tick control
- Breeding and genetic improvement (natural and artificial insemination)
- Marketing

Livestock Products

- Meat and milk
- Hides and skins
- Honey and beeswax

Others

- Potential for increased use of goat milk
- Extent of milk production under local and improved conditions
- Possibility for introduction of improved or upgraded livestock breeds
- Limitations caused by diseases, nutrition and poor management
- Livestock competition with wildlife
- Potential for improvement of forages and pastures
- Potential for improvement of beekeeping

Vegetation

A detailed map for the various vegetation units and an assessment of the Gross Primary Productivity (GPP) on each unit was prepared. The carrying capacity of pasture and general vegetation was assessed.

4. Agronomy

The agronomic aspects studied included the present cropping patterns and constraints. Where possible,

suggested solutions have been recommended. The following activities were carried out:

- Collected and prepared agro-climatic data for the project area.

- Prepared data on existing agronomic practices for each category of crops.

- Prepared data for each crop to show varieties grown, time of planting, time of harvesting, spacing and seed rate, type and rate of farm inputs application, yield per hecatre (ha) and total production in the District.

- Tabulated data for 1977 to 1982, and prepared a projection for the coming 5 years, showing annual production in tonnes/ha for each crop.

- Reviewed the main research work and results achieved for each crop, and identified results which have potential for application in the District.

- Identified the extent to which existing research meets the District requirements and proposed programmes for supporting the crop production proposals.

- List main diseases and pests, record data to show extent of loss in the field/stores, and methods of control commonly used.

- Prepared an estimate of the total food requirement in the District and hectares required for self-sufficiency in starch foods, grain legumes, vegetables and tabulated the net balances.

- Identified locations of possible areas for expansion of crop production. Prepared data to show:

  a) Soil type

  b) Hectares under crops and hectares with potential for crop production

  c) Crops recommended by Ministry of Agriculture

  d) Constraints to crop production

  e) Measures to overcome these constraints

- Investigated the potential for irrigated farming.

- Reviewed current seed production and distribution systems, and assessed the quantity and quality of seed material.

- Suggested improvements where constraints and deficiencies exist, for improved varieties, production, storage, and distribution to meet District requirements.

- Tabulated current seed requirements for each crop and estimated requirements for the District; varieties, ha, yield, etc.

- Identified the methods used for land preparation and estimated the hectares annually prepared, using each method (hand, slash and burn, oxen, tractors).

- Investigated the crop storage methods used by farmers and suggested improvements.

- Assisted the Economist to prepare farm budgets for the small farmers cropping system(s) in the District.

- Collaborated with the Economist to identify the extension services in the project area to show:

  a) number and grade of existing staff

  b) extension staff - farmer ratio (current and proposed)

  c) training facilities for extension staff and farmers

  d) estimated annual requirement for training staff and farmers

- Prepared justification for additional staffing and facilities required and estimated the associated costs.

- Itemized consumption levels and sources of supply of seed, fertilisers, and other inputs currently used.

- Collaborated with the Economist in providing details of price and subsidy policy for crop production in the District.

- Identified and listed farmer's service centres/ sales organisations, giving details of staffing and operation of the distribution network to meet the requirements of the District.

- Suggested training programmes to meet staff requirements in accordance with crop development proposals. Give details of equipment required.

## 5. Soil and Water Management

### 5.1 Soil Conservation

This section refers to the study of soil erosion caused by water. Other aspects of soil conservation are included under the soil survey section. Wind induced soil erosion is not, at this time, thought to be a significant factor in the study area. The following activities were carried out:

- Collected and prepared data on soil management practices
- Identified soil erosion causes, extent, and severity
- Reviewed soil conservation measures undertaken; type of conservation, quantity established, scope required for additional effectiveness
- Prepared budget showing, equipment and materials costs, as well as other capital and recurrent costs for nurseries

### 5.2 Water Resources

Precipitation, stream flow and subsurface water were inventoried. Effort was directed toward the assembly and interpretation of existing data. Where intermittently flowing streams traverse the area on which there are no gauging stations, flow approximations and trends were sought from local residents.

From rain gauges in and adjacent to the study area, data was collected on average daily, monthly, and annual rainfall. Probability distributions for two-week periods throughout the year were tabulated. This information was used to assess the need and probable benefits of supplemental irrigation where topography and water make this a feasible option. Several moisture adequacy indices for evaluating crop yield potential have been developed. Some include a risk parameter. These were

used to distinguish zones in the study area for crop suitability under dryland agriculture.

Precipitation and run-off data were combined to estimate water yields and opportunities for surface water storage for domestic and agricultural uses.

Streamflow

All existing streamflow data was collected and displayed quantitatively and qualitatively; the former by flow-frequency curves, the latter by sediment load and electrical conductivity which is a measure of the suitability of water for irrigation.

Groundwater

Records of the wells drilled in the study area were assembled and mapped. The interpretation of these records was carried out by a groundwater geologist. He also examined groundwater yield potentials and identified water wells and/or springs in the area. These were classified according to their suitability for human and animal as well as for agricultural uses.

6. Forestry

The forestry inventory undertook the following tasks:

- Obtained preliminary data to show demand and supply in the District for fuel wood, building poles, and other timber uses.
- Obtained data on forestry nurseries serving the project area with plant species for: (a) fuel wood production, (b) timber production.
- Obtained data for fuel wood consumption and estimate costs for establishing and harvesting forest species recommended in the District.
- Collected data related to afforestation programmes both for on-going and proposed projects in non-gazetted and other areas in the project area. Considered the following:

a) Community plantations

b) Private plantations

c) Other afforestation

- Identified local/foreign trees that could be introduced in the area based on their aerodynamics and water utilization for the purpose of reafforestation programmes.
- Identified suitable areas where fruit tree nurseries could be sited.
- Identified suitable areas for afforestation and reafforestation with close consultations with the relevant Ministries and Departments.
- Idenfied, evaluated, and quantified problems related to afforestation programme.
- Discussed the possible development of foraged trees (e.g., Lucaena, prosopis etc.) to be used as fuel wood and livestock feed, and suggested a programme for implementation.
- Prepared and documented a programme for planning and future implementation.

## 7. Soil Survey

### 7.1 Specific Activities

The approximate size of the area covered is 879,300 ha. The nature of the kind of survey undertaken was a site evaluation. Map units were related to physiographic units embracing major soils of the area, often soil associations or complexes.

The method of survey involved the carrying out of air-photo-interpretation, resulting in a photo-interpretation map showing broad physiographic units, which are thought to enclose different kinds of soils. This was followed by scattered field observations by soil auger to identify the major soils in the main photo-interpretation units, and a number of soil pits in the main mapping units. All boundaries between the map units were inferred from the photo-interpretation map, in addition to field survey investigation.

The scale of the soils map is 1:100,000 although the density of observations will be below the requirements of soils maps of that scale.

Primary physical soil properties presented to other members of the team were geology, texture to depth of approximately 1½ - 2 meters (this depended on soil depth) natural drainage depth, consistence, rockiness, stoniness, slope, pH, and natural fertility.

## 7.3 Classification

Soils were classified in accordance with the FAO Soil Classification system. This was accomplished in consultation with the Soil Survey of Kenya.

## 7.4 Operation Procedure

All available physical data relevant to the survey area was gathered and examined for impact to the area. Aerial photography of approximately the scale of 1:50,000 and topographical sheets (scale 1:50,000) were used as the basis for field observations.

A map was prepared showing the main soil types for crop production in the District. A qualified cartographer in Soils was used to prepare the final soils map from the field draft maps.

## III. STUDY FINDINGS AND RECOMMENDATIONS

### 1. Rural Sociology

This is a study of the resources (human and natural) of the Laikipia District See Maps 1-1 and 1-2. Its major purposes are two-fold:

a. To provide a resource inventory and analysis for use by various planning and action agencies which should be useful for many years.

b. To develop proposals which are supported with a substantial array of technical data - ready for donor funding.

The study team was composed of Government of Kenya specialists including Rural Sociologists, Agronomists, Soils Assistants, Livestock Specialists and an Agricultural Economist. The balance of the team were five expatriate technical experts in Climate and Geology, Soils, Soil and Water Conservation Management, Forestry and Agro-forestry, and Range and Wildlife Management.

#### 1.1.1. General

Approximately 56.3% of the current inhabitants settled in the District after independence and since the exit of the European settlers. The following programmes helped in carrying out the exercise of settling the landless: (1) the Land Development and Settlement Board - launched in 1961; (2) the Settlement Fund Trustees; and (3) the Department of Settlement - established in 1962.

Between 1967 and 1977 a total of 1,861 families were settled in Nyahururu, Marmanet, Ol Arabel, Lariak, and Marmanet Forest Extension Settlement Schemes. Acreage per family ranged from 2 hectares in the Marmanent Forest Extension to

18.38 hectares in the Nyahururu Settlement Scheme. The exercise of settling people in Ndindika and Kalalu Settlement Schemes is still continuing.

The other types of settlements are the cooperative societies or company farms which were bought by groups of people and settled by their shareholders. The acreage per family ranges from two and a half to 10 or more acres depending on the number of shares an individual had purchased.

The above category of settlers form the bulk of the district population. They are settled in very marginal areas where food production is very low and social amenities of all types are not adequately available. Included in this category of settlers are the Mukogodo pastoralists who face similar problems. In times of drought, the two categories rely on the central Government to provide them with food through the Famine Relief Programme.

### 1.1.2. Population Size and Growth Rate

The current estimated population is 173,428. Growth rate between 1962 and 1969 was negative (-0.7% per year) due to the exit of the white settlers and most of their African labourers. Between 1969 and 1979, the rate jumped to 7.3% per year due to the huge influx of immigrants. The projected population for 1990 is expected to be approximately 240,000. This has been calculated at a rate of 7.3% until 1986, and from 1987 to 1990, at a rate of 4%.

### 1.1.3. Distribution and Density

Population is more densely concentrated in the western part of the District which has agricultural potential. Other areas, except the urban towns of Nanyuki and Nyahururu, are less densely populated. The density has been calculated at 17 persons per $km^2$ for the whole District.

### 1.1.4. Structure

The fertility rate in the District has been determined to be 6, while crude mortality rate is 0.6%. The percent of the population in age categories are as follows:

| Years of Age | Percent |
|---|---|
| 0-14 | 50.45 |
| 15-59 | 48.55 |
| 60-64 | 1.00 |

The dependent population is 51.75%, males 51.6% and females 48.3% of the total population.

### 1.1.5. Migration and Characteristics of Immigrants

Immigrants are Kikuyus who migrated from the Central Province due to pressure for land in this Province, and are some 64.3% of the population. Other immigrants include Merus, Kalenjins, and Turkanas. This is based upon the rate of immigration stagnating due to the inhabitation of all arable lands by 1986.

### 1.1.6. Problems Facing the Settlers

Most of the settlers, particularly those who settled in the drier areas of Rumuruti, Central and Ngarua Divisions along with the Mukogodo pastoralists, are living below the subsistence level indices suggested for rural households by the Central Bureau of Statistics. That is, an aggregate income of less than K.Sh. 2,000/= per household per year. They also lack the basic needs of housing, health, education, water and food. The situation is exacerbated by drought.

The Government of Kenya gives famine relief at a cost of K.Sh. 80,000 per drought year. Areas receiving relief food from the Government include Anandanguru, Aljijo, Dol Dol, and Kimanju in the Mukogodo Division; Almoran, Magadi, and Luonek

in the Ngarua Division; Salama, Mutara, and Sosian in the Rumuruti Division; Loldaiga and Ngobit Segera in the Central Division, and a few squatters in Nanyuki Town.

Health facilities available are very inadequate. There is only one hospital in the whole District and 2 doctors in charge of the entire District. There are 3 health centres in the District, one at Rumuruti, one at Dol Dol, and another at Ngarua. There are a total of eleven dispensaries. The available health facilities lack adequate staff and equipment. The ratio of doctors to the population is 1:86,714; while the ratio of nurses to population is 1:18,065.

### 1.1.7. Education and Training

Schools are not adequate and training facilities are lacking. There are 137 primary schools for the District and 12 secondary schools. School-age children number approximately 49,800. Most teachers in primary schools are not trained. Most school buildings are constructed of mud and grass thatch.

### 1.1.8. Natural Resources and Infrastructure

Water: Unavailability of water in these settlement areas is a major problem. Distances to the nearest water sources range from 2 to 7 km. The water drawn per day by the women is often inadequate for the family.

Fuelwood: This is a potential problem as every seller is clearing and burning all bush on his plot to prepare it for farming.

Transport and Communication: There are no paved roads, railroads, or highways.

Market Centres: Marketing farm surplus produce becomes a major problem as there are no market centres.

Storage Facilities: These too are lacking, and the available ones are inadequate.

Wildlife: Animals destroy crops, kill livestock and pose a threat to human life.

Absenteeism: Many of those who have bought land have not settled on their plots. This means that not enough money can be raised to implement required projects by the few who have settled.

The smallholder farms are not producing enough food for the settlers' families; and therefore, the majority of the able-bodied men and women are being forced to look for off-farm employment in the urban centres to obtain cash to supplement the farm produce. This leaves the dependants, the young and old, to take care of the farms. The result is poor farm management which in turn contributes to low productivity.

## 1.2. Proposed Social Projects

### 1.2.1. Primary Schools: 67

Buildings are to include tuition blocks, science workshops, administration block, and staff quarters. Inside lavatory facilities and a water reservoir are included in the cost.

### 1.2.2. Secondary Schools: 14

Each school is to have tuition blocks, administration block, agricultural/industrial workshops, science laboratory, library, boarding units and relevant boarding facilities, staff quarters, toilets, and water reservoir.

### 1.2.3. Craft Training Centres: 21

Each is to have at least two industrial workshops, demonstration rooms, administration block, and latrines and bathrooms.

### 1.2.4. Health Facilities

These should have treatment wings, staff houses, water and electricity as well as transport.

## 2. RURAL ECONOMY

### 2.1.1. Agricultural and Livestock Sectors

Of the 972,300 ha (total area), 162,800 ha are unsuitable for farming or livestock production.

During 1982, crops in the District occupied 18,609 ha (based on trends and averages). There were no crops in Mukogodo Division. Livestock occupied a total of 790,091 ha of the District. Before independence, the European large scale farms and ranches ranged from 3,000 acres to 20,000 acres and above. Mixed farming prevailed in the upper areas (dairy and wheat production) and ranching (beef and small stock) prevailed in the lower potential areas. Now most farms have been bought and settled by smallholders (Africans), each settler owning from 1 to 10 acres. The smallholdings are 38,847 and large holdings are 687 in number.

The input-output models for some characteristic arid and semi-arid land (ASAL) crops (cotton, local maize, sorghum, pigeon peas and cowpeas) show increases in gross margins and labour requirements as the level of technology increases. However, for some crops, the return to labour declines or does not steadily increase with the corresponding increase in levels of technology, for instance, sorghum and cowpeas. Input-output models for pure maize, maize-beans mixture, potatoes and wheat in Laikipia also show similar production trends. Comparatively, the crops give better returns per ha than do livestock.

The livestock census gives the District stocking rate as 6.4 ha/Stock Unit (SU). Divisionwise, the stocking rates are 8.3 ha/Livestock Unit (LU) for Mukogodo, 4.6 ha/LU for Central, and 8.3 ha/LU for the Rumuruti and Ngarua Divisions. The stocking rates exclude wildlife.

### 2.1.2. District Income

Income from the District's private farms and government sector is based on crops and livestock production, petty trades, and wages.

In 1982, crops gave a net income (Total Gross Margins including only farmer's labour) of K.Sh. 54,227,494. Livestock gave K.Sh. 67,066,675 based on average offtake of 11% for cattle, 25% for shoats, and 100% for poultry and rabbits. Petty trades (shops, canteens, hotel/restaurants) gave an income of K.Sh. 2,172,000. Traders' incomes are based on all rural services centres except Nyahururu and Nanyuki which are urban services centres. Wage employment gave an income of K.Sh. 170,815,200.

Based on the above incomes only, a District human population of 173,428, people for 1982; the per capita income of the District was K.Sh. 1,694.

### 2.1.3. Farming Systems

The three different farm profiles (large-scale ranch, large-scale mixed farm, and small-scale mixed farm) show the various farming activities in each category. The ranch had average cattle offtake of 18% and sheep intake of 13% (mainly merinos for wool).

### 2.1.4. Land Resources

About 72% of the land suitable for crops and livestock production is in agroclimatic zone (ACZ) V and is therefore less productive for crops. This state has been worsened by uneconomic land subdivision which has adversely affected the next suitable alternative: livestock production. The total District ranch beef production has been reduced from 70% to 20% since 1975 due to the land subdivisions. Interference from wildlife has reduced livestock forage considerably.

Absenteeism also causes labour shortages during farm peak periods. Group ranches are established in Mukogodo but are ineffective in controlling overgrazing.

### 2.1.5. Labour Resource

Labour scarcity is noticeable during peak seasons due to absenteeism, exodus of shareholders from the uneconomical subdivided farms to urban areas in search of employment, pastoral nature of some tribes, and school age children being in schools during peak farming periods. Due to apparent internal labour scarcity in the District, labour is imported from neighbouring districts and has become too expensive for the poor farmers to afford (K.Sh. 20.00 to 30.00 per day). Hence the farmers respond by producing less.

Crops produced in the District in 1982 required 1,086,297 man-days (MD) (based on a standard of 6 hours for each working day), and livestock required 1,786,511 MDs (based on 7 MDs per year for large stock and 2 MDs per year for small stock). Corresponding income estimates from the two enterprises show that crops give a return per MD of K.Sh. 49.9 and livestock gives only K.Sh. 37.5. Thus crops generate better returns to labour than livestock.

With the available 41,292 households in the District (based on 4.2 people per household) the actual economically active population (EAP) is computed as 74,326 people. With the total farm labour requirement of 2,872,808 MDs (livestock and crops) the corresponding number of people required are only 11,491 (the normative EAP). Hence, notwithstanding the statement about labour scarcity in the first paragraph of this section, labour in Laikipia is a non-limiting factor.

### 2.1.6. Agricultural Inputs

Major sources of farm inputs are from Kenya Farmers Association (KFA), Ministry of Cooperative Development

(MOCD), missionaries, and Ministry of Agriculture. All farm machinery is privately owned. The private farm inputs stockist (through KFA agents) are available in the rural areas.

There are a total of about 154 tractors (4 wheeled) and 73 (2 wheeled) in the District. For a total household of 24,285, the ratio gives a total of one tractor for every 120 household, which is inadequate during peak seasons.

Credit comes from personal savings and non-institutional and institutional credit (AFA, CBK, and commercial banks). CBK administers seasonal crop credit (SCC) loans through the New Seasonal Credit Scheme, the Farm Input Supply Scheme (FISS), and the Cooperative Production Credit Scheme (CPCS). The types of loans in the District are large scale loans, small scale loans, GMR and Seasonal Crop Credit.

### 2.1.7. Marketing

Produce marketing in the District is handled by National Credit Production Board (NCPB), private traders, and a cooperative movement.

Marketing is organized through the various District Services Centres and the livestock holding grounds. The major consumers for livestock include Kenya Marketing Corporation (KMC), local butcheries in the District and Nairobi. Milk is sold to Kenya Credit Corporation (KCC), local hotels, and households. Hides and skins are sold to Sagana tanners and wool to KFA and Nanyuki for export. Honey is sold at Lamuria.

Crops are marketed through a network of buying centres where the crops go either to the NCPB, Pyrethrum Board, or KFA.

There are a total of 26 agro-marketing and miscellaneous societies in Laikipia. Most societies are not run efficiently for several reasons, the notable ones being due to dishonesty among some society members, lack of supplies by milk marketing societies, and lack of agency permits from NCPB.

## 2.2. RECOMMENDATIONS AND PROJECT PROPOSALS

### 2.2.1. Input Supplies and Marketing

Lack of funds (undercapitalisation) and weak management of the cooperative societies are the major bottlenecks hindering their effectiveness.

### 2.2.2. Honey Collection Centres for Mukogodo and Central Division

Four collection centres in Mukogodo and two additional ones in Central are proposed. For the six, a total of K.Sh. 504,000 would be required to service them during the year. Later, a revolving fund could be established. In addition, the Ruai Beekeepers Society is to be provided with a pick-up vehicle worth K.Sh. 80,000 for general administration. Total investment is K.Sh. 584,000.

### 2.2.3. Funding for Facilities to Store and Transport Milk

Eight milk societies are to be provided with coolers, tractors and trailers for transporting milk. The tractors could later be hired out for use by cultivation societies.

### 2.2.4. Funding for Facilities to Market Eggs and Broiling Chickens

It is proposed that a vehicle be provided to the society (already formed in Nanyuki) to administer the marketing of the eggs and broilers. Some funds are needed to rent an office.

### 2.2.5. Improvement of Road Network

The salient features are:

1. Poor condition of existing roads
2. Need for certain additional road segments
3. Need for new bridges.

## 3. GEOLOGY

About 20 percent of the District comprising the northwest areas (mainly the Mukogodo Division) is underlain by the basement complex which consists of metamorphic gneisses, migmatites, and granites. The rest of the District is underlain volcanic formations.

The soils over the metamorphic rocks in the northeast have a hilly, dissected topography. The soils of the upper slopes are shallow and gravelly while the soils on the lower slopes are deep sandy loams and sandy clay loams which have productive grasslands. The Loldaiga Hills for example, in this area, support excellent rangelands. However, a large area of these soils in the Mukogodo Division is severely eroded from years of overgrazing by pastoralists - Maasai and Samburu. This area poses one of the most serious conservation problems in the District. Intensive conservation measures will be needed to restore this area to normal production. In general, the soils over the metamorphic rocks are best suited for rangeland-livestock grazing because of the lack of rainfall and the moderate to strong slopes.

The soils over the volcanic formations (80 percent of the District) occur mainly on a nearly level to gently sloping plateau though some hillier areas also occur. In the south-central part and in scattered areas in the northwest are significant areas of heavy, black, cracking clays. These soils are droughty and difficult to till. They are sticky when wet and extremely hard when dry. Therefore, they support a relatively

dry type of vegetation (Red Oat, Grassland, Whistling Thorn). Most of these areas are used for ranching and are not suited for cultivation.

The associated red clays are better drained, easier to till, and store more available moisture for plant use. These red soils are of two main types. The normal red clays with dark organic matter and rich topsoil are found in the western part of the District. In the wetter southwest areas (Nyahururu and Ol Arabel) areas there are deep friable red clays. Similar to those in the highland areas, which combine excellent physical qualities including a high available water storage capacity with good fertility. These are highly productive soils for annual and perennial crops, trees, and fodder shrubs. Presently, agricultural schemes are now being developed in the Marmanet and Ol Arabel areas.

### 3.1.1. Climate

Although most of Laikipia District is semi-arid (Moisture Availability Zone V) the Nanyuki and Nyahururu areas are both wetter and cooler than the relatively dry central areas. There is considerable climatic diversity in the District, both in rainfall amount and in monthly distribution patterns, thus giving areas with distinct climate and soil combinations. Careful study and some research is needed to devise farming systems best adapted to each of them.

Both total rainfall and moisture availability are lowest in the northern and central areas of the District, which are semi-arid (Moisture Availability Zone V, with rainfalls generally 400-800mm). The Nyahururu area is the wettest part of the District (Moisture Availability Zone II with rainfalls reaching over 1400mm).

The monthly rainfall distribution pattern shows considerable variation. In the southwest areas of higher rainfall, there is a single peak pattern with a well defined

wet season in the summer months (April to August). This single wet season gives a useful 5-6 months growing period for annual crops and trees. In the central areas, south and east of Rumuruti, in contrast, the lower rainfall is more spread out during the year, with a three-peak distribution pattern with wet periods in April, in July and August, and (but less reliably) in November or November/December. Such a distribution provides no well defined wet season long enough for annual crops, but appears favourable for pasture and browse production on rangeland.

In the eastern and south-eastern parts of the District another rainfall distribution pattern emerged as dominant - the classic two-peak rainfall regime of much of the tropics away from the equator. At Dol Dol, in the dry and overgrazed Mukogodo Division, the lower total rainfall (averaging 577mm) also shows two distinct peaks, in April and in November.

The year-to-year variability (or unreliability) of the rainfall is a further constraint. For agricultural planning, this requires statistical analysis, including the calculation of rainfalls reached or exceeded on the average in 1, 2, or 3 years out of 4 (25, 50, and 75 percent probabilities) for representative stations in the District. These emphasise the greater year-to-year moisture variations in Laikipia District. The drought of 1980, when thousands of cattle died, illustrated the magnitude of these yearly rainfall fluctuations.

### 3.1.2. Soils Project Proposal

The 1:250,000 soils map, and accompanying soil descriptions and analyses, gives general information on the soils of Laikipia District. This information is sufficient for general planning purposes and, with the climatic information, helps to explain the present pattern of land use in the area and its agronomic possibilities.

Additional soil investigations needed include the following:

(a) Detailed soil surveys

Detailed soil surveys at a scale of 1:50,000 or larger (up to 1:10,000 for irrigation projects) will be required for feasibility studies and for the detailed planning on farm operations and research in relation to the following:

(i) the three proposed agricultural stations (or substations) in the District;

(ii) irrigation schemes, including feasibility studies of the Ewaso Narok Swamp Development for irrigated agriculture; and

(iii) other production schemes involving rainfed cultivation.

(b) Studies on soil properties

Studies on soil chemical and physical properties are needed in relation to the following:

(i) soil fertility studies in conjunction with field fertilizer trials; and

(ii) soil water studies relevant to water storage capacities of soils in relation to rainfall distribution in different soil/climatic areas of the District.

## 3.2. AGROCLIMATOLOGY PROJECT PROPOSAL

The climate section gives basic information on average rainfalls, rainfall distribution patterns and rainfall probabilities which together indicate (i) that within the District climate changes over short distances, and (ii) rainfalls are essentially unreliable. These two topics now require a more detailed and systematic study. The study will involve a computer analysis of all rainfall data to date, presented in five or ten day periods, and will aim at defining the wet seasons experienced in different parts of the District with particular reference to their dates of onset, rainfall, and reliability. The study will define the location and extent of climatic areas in the District distinct enough to warrant their separation for practical studies on farm cropping systems.

The agroclimatic study is estimated to require the services of an agroclimatologist who must also be aware of or able to study local soils and agronomy. The agroclimatologist will work for six months and will require access to full computer facilities.

## 4. Soil and Water Management

This chapter deals with management of the soil and water resources in two parts: Part I - Soil and Water Conservation, and Part II - Water Resources and their Development. Two project proposals have been developed to provide significant long-term improvements through the "District Focus" approach to development.

### 4.1. Part I - Soil and Water Conservation

A project proposal is presented which aims to provide an effective conservation programme for Laikipia District's high potential agricultural zone and subdivided ranching zone. This programme would be administered by the District Agricultural Officer (DAO). Donor support would be provided for five years in the aggregate amount of $1,155,110.

The primary objective is to provide soil and water conservation at an areal coverage rate of 5 percent per annum, to attain basic coverage within 20 years as follows:

| | |
|---|---|
| High Potential Agricultural Zone | 40,000 ha |
| Subdivided Ranching Zone | 150,000 ha |

A supporting objective is to strengthen the conservation programme of the DAO through removal of existing operational constraints, in order to reach the primary objective.

Mukogodo Division (110,000 ha) suffers widespread degradation of its semi-arid land, much of which has reached moderate to serious phases of erosion. Conservation must centre on proper management of the rangeland and of the

Mukogodo Forest Reserve. Respective responsibilities lie with the Ministry of Livestock Development/District Range Officer (MOLD/DRO), and the Ministry of Environment and Natural Resources/District Forest Officer (MOENR/DFO). To better meet these responsibilities, attention should be given to the recommendations and proposals in Chapters 7 and 10.

Conservation of the forest reserves (70,000 ha) is an integral management task of the MOENR/DFO. Attention should be given to the recommendations and proposals for forest management in Chapter 10. Increased production of commercial timber would generate further conservation requirements for which adequate resources and management should be applied.

The residual large-scale ranching zone (500,000 ha) is relatively self-sufficient in conservation, which is incorporated with general adequacy into the management of individual ranches. Prolonged under-utilization of the rangeland on some ranches may induce bush encroachment and retraction of grass cover, which could increase runoff and soil erosion. Deleterious changes in land use should be monitored, investigated, and appropriately reported by the MOLD/DRO. Mobilization of this activity could be assisted by the District Range Management Advisor, proposed in Chapter 7.

## 4.2. Water Resources and their Development

A project is proposed which aims to provide an assessment of the water resources in Laikipia District. The assessment would be undertaken by the Ministry of Water Development's (MOWD's) Water Resources Assessment Project (WRAP) during FYs 1984-1987. Specific objectives would be as follows:

1. Assess the availability and quality of the water resources to establish a technical basis from which to determine the feasibility and consequences of

specific projects, as well as to guide their design and management.

2. Provide a technical basis for overall planning and management of the water resources.

3. Adjust the monitoring network and the handling of its attendant data to support continuing objectives.

4. Prepare a proposal for the strategic management and general development of the water resources.

5. To the fullest extent practicable, locate and complete test boreholes such that they can be used effectively at the earliest possible date.

The assessment would be designed and executed by WRAP with continuing financial and technical support by the Netherlands Government. WRAP has prepared a plan of operation to execute the assessment during FYs 1984-1987. A progress report would be submitted by June 1985. The main report would be issued not later than March 1987.

Exploitation of the water courses has proceeded to the point that few, if any, opportunities remain for the development of projects which would require low-flow abstractions. However, the residual low-flow potential should be verified by the proposed project for assessment of the water resources.

The medium-to-high patterns of flow could be partially exploited by the construction of large dams. Drainage and irrigation within the large swamps could possibly be undertaken, but full irrigation within the Narok and Moyok Swamps would require water from storage in large dams. Development of specific projects would require feasibility studies and technical designs, which should be preceded by the proposed assessment of the water resources.

Meanwhile, the District Water Office should improve its management of water apportionment. It should consider enforcing the use of sealed recording meters to monitor permitted water abstractions. As a spin-off, more time could be applied toward control of casual use and clandestine abstractions.

Given that certain water courses are the only available sources of water for large-scale irrigation, their use for non-irrigation purposes should be discouraged. In pursuit of this approach, alternative sources of water should be developed to meet non-irrigation demands.

The prospects for attracting financial and technical support to construct/rehabilitate small dams are suppressed because of inadequate provisions to manage, monitor, and inventory the existing dams. These inadequacies should be rectified through initiatives by the District Water Office. From this strengthened position, the role and feasibility of additional dams should be assessed. As may be justified by such an assessment, technical/financial proposals should be prepared and promulgated to engage the necessary funding. To undertake these tasks, the MOWD must provide adequate expertise and funding.

There are 263 boreholes of record, among which the number of serviceable boreholes is estimated as slightly over 200. Subject to confirmation by the proposed assessment of water resources, there should be ample groundwater for substantially increasing the number of boreholes. There is no indication that sufficient yields can be obtained for large-scale irrigation. The yields of some boreholes could support minor irrigation, but the quality of water for irrigation ranges from suitable to unsuitable among individual boreholes. Borehole water is suitable for

livestock, but varies primarily because of its suitability for human consumption fluoride content. Greater reliance upon boreholes for non-irrigation purposes should be encouraged to maximize the availability of river water for irrigation.

Unserviceable boreholes should be restored in cases where their location and potential coincide with water use requirements. The District Water Office (DWO) should prepare a plan of operation and a detailed budget for restoring appropriately selected boreholes. Thereafter, the DWO should undertake to engage the necessary funding from among the DDC, MOWD, and possible donors such as the EEC.

Rainfall collection through the development of impervious catchments can provide limited amount of water for use at points where no other sources of water exist. There are limited opportunities for developing rock catchments, but there is considerable scope for developing roof catchments.

Further development of impervious catchments should be encouraged by the DWO. Attention should be given to optimizing the cost effectiveness and technical soundness of installations. Efforts should be made to identify alternative technologies which would have wide application.

Management and development of the water resources will require substantial improvements in the capabilities of the District Water Office. Given that the MOWD is reorganizing the district water offices and that this undertaking will be further guided by the impending National Water Policy, it is untimely to offer specific recommendations for improving the capabilities of the District Water Office. However, this office should be strengthened so as to discharge the tasks which are assigned to it within this Chapter.

## 5. RANGE MANAGEMENT

Until the mid-1970's, Laikipia District supplied approximately 70% of National high grade beef; since 1976 cattle numbers have dropped from 340,000 to 160,000 in 1982. Small stock (sheep and goats) increased approximately 15% during the period.

It is generally accepted that this situation is in response to the large number of commercial ranches being subdivided and removed from beef cattle production. According to the District Ranch Officer's files of 134 ranches (approximately 1,200,000 acres) before subdivision, 42 ranches (approximately 573,000 acres) have been sold.

The influence of subdivision and subsequent increased pressure on the land from human migration has resulted in major problems, including a famine relief programme which never existed previously.

Priority areas for Grazing Management Consideration are:

1. Mukogodo Division: This is an area of 135,000 acres, recently adjudicated and registered as group and individual ranches. Traditionally, heavy overgrazing has caused severe to critical soil erosion and water control problems.

2. Subdivided areas and Settlement Schemes: The considerable variation of climatic and edaphic conditions existing across this extensive area requires trials to determine minimum sizes for smallholders combining cropping and grazing operations. These trials may fit in with a Swiss Mission Project Proposals for smallholer development assistance on settlement schemes in the Central Division.

3. Forests: Although considerable grazing is permitted (with grazing fees) in the forests, little or no grazing management is practiced. The local District Range and Forestry Officers must coordinate their efforts to rectify this situation.

4. Commercial Range Operations: For the most part, these ranches are self-sufficient and have adequate experts in grazing management. Help is needed in improving livestock markets, in disease prevention and assistance in coping with and controlling wildlife depredations.

### 5.1.1. Project Proposals

1. Grazing Management Demonstration Project on Group and Individual Ranches in Mukogodo Division: The first phase will cover a 3-5 year span, involve four expatriate experts in grazing management and related fields, and five Kenyan counterparts with similar experience. Project headquarters is to be located at Dol Dol, and first phase cost is estimated at $3-4 million.

2. Range Administration Consultant/Advisor to District Ranch Office: One expatriate range expert is to be located in Nanyuki to work with the District Range Officer in all facets of ranch administration including interfacing with increasing District staff. The two-to-three year project will cost an estimated $650,000.

## 5.2. Recommendations

1. The Ministry of Livestock Development (MOLD) should take immediate steps to provide nationwide standards for technical units; i.e., livestock units, livestock equivalents, methods of determining carrying capacity, range condition and trend and forage plant desirability.

2. MOLD should arrange for training in practical Range management technology for pastoralists in the Mukogodo Division.

3. A training film on "how-to-do-it" should be produced in conjunction with the Mukogodo Division Range Management Project Proposal.

4. MOLD should mount a joint effort with the Swiss Mission Project (if their proposal is accepted) in the central division to focus on livestock-cropping as a land use for smallholders on the subdivided ranches and settlement schemes.

5. A joint effort between the Division of Range Management, MOLD, the Ministry of Environment, Natural Resources, and the Department of Forestry should focus on developing guidelines for local District officers regarding grazing on gazetted forests.

6. The DRO, with direction from the headquarters office, should prepare an analysis of the current level of range management for all the remaining commercial ranch operations.

7. The government should declare a temporary moratorium prohibiting ranch subdivision in ACZs IV and V for purposes other than large scale ranching.

## 5.3. LIVESTOCK

### 5.3.1. Types of Livestock and their Population

### 5.3.2. Beef and Dairy Cattle

At the end of 1982, there were approximately 164,023 head of cattle. Over three quarters of these were beef animals while the rest were dairy cattle.

The beef breeds found in the District include: Boran, Sahiwals, Red Polls, Aberden Angus, Charolais, Semantals Galloway, and Brown Swiss.

Common dairy breeds kept in the District include: Friesians, Guernsey, Jersey Sahiwal crosses, Semental crosses, Red Poll crosses, and Brown Swiss crosses.

### 5.3.3. Sheep and Goats

While the number of beef cattle has been declining since the subdivision of the commercial and group ranches, the number of small stocks (shoats) has been going up. At the end of 1982, there were approximately 253,540 and 179,690 sheep and goats, respectively.

### 5.3.4. Donkeys and Camels

These are found among the pastoralists within Mukogodo Division and are used as beasts of burden. The camels, however, supplement milk needs to the family.

### 5.3.5. Honey Production

The District has a very high potential for honey production. Improved husbandry techniques; e.g. introduction of Kenya Top Bar hives (KTB) proper management of the hives, and organization of market channels will bring important economic changes to the Apiary industry in the District.

There were 1,847 KTB hives, 10,300 log hives, and over 300 Longstroth hives in the District at end of 1982.

### 5.3.6. Poultry Production

The poultry population is estimated at 100,000 birds. The industry in the District is not fully exploited.

### 5.3.7. Pig Production

The number of pigs was estimated to be about 2,412 at end of 1982. This number is expected to increase as more farmers go into the enterprise.

### 5.3.8. Rabbit Production

Rabbit production is in the introductory stages. Although young people have been recruited into the 4K Clubs, funds for extension work is the major constrant.

## 5.4. MARKETING OF LIVESTOCK

### 5.4.1. Live Animals

There is very active trading in animals for both slaughter and breeding.

At present, most slaughter stocks are marketed on the ranches on the basis of "willing buyer, willing seller" method by private traders and individual livestock owners.

The Livestock Marketing Division (LMD) of the Ministry of Agriculture and Livestock Development has been buying livestock from individual group ranchers. Holding grounds have been established by the LMD at convenient centres. The holding grounds are used to test cattle bought from pastoral areas for East Coast Fever (ECF) or related diseases before the animals are released to butchers or breeders.

The District however lacks adequate facilities for marketing.

### 5.4.2. Hides and Skins

The total revenue from hides and skins can be raised by improvement of grades, licensing more hide and skin dealers, construction of more drying bandas and stores, increasing the number of hide and skin extension workers supported by adequate transport and a small scale leather workshop in one of the three village polytechnics in the District.

### 5.4.3. Milk

Milk is marketed through cooperative societies to Kenya Cooperative Creameries (KCC). However, there are some farmers who sell their milk direct to KCC, but they must have a license.

With the low milk yield in the District, and high demand for liquid milk in the area, it is possible to market additional milk if production is stepped up.

### 5.4.4. Honey and Its By-products

The Laikipia District can keep the Ruai honey refinery running throughout the year without any supply of crude honey from the surrounding districts.

Honey prices depend on grade. Honey is graded at the refinery using a honey refractory meter. Grade one honey may be down graded when beekeepers and honey dealers start handling the honey.

The wax produced at the refinery is used solely for saddle soap and furniture polish production.

### 5.4.5. Marketing through Cooperative Societies

There are thirty-six registered Farmers' Cooperative Societies (FCS) in four categories:

a. Farm Purchase Societies

b. Marketing

c. Saving and Credit Societies

d. Settlement Cooperative Societies

Only eleven deal with marketing of livestock products, mainly milk. KCC buys milk from the FCS while the Kenya Farmers Association is the sole buyer of wool. KFA also supplies farm inputs to the farmers at reasonable prices.

## 5.5. INFRASTRUCTURE

### 5.5.1. Water

Except in the Mukogodo Division and other isolated areas, Laikipia District has a permanent natural supply of water from rivers to meet both human and livestock needs. In addition, there are many dams and boreholes distributed over the District. However, where livestock is concerned, water development projects should be done in conjunction with efforts to improve feed supply and marketing. New water developments alone without well designed grazing systems may, in fact, increase overgrazing.

### 5.5.2. Dips and Spray Races

The Laikipia District does not strictly fall under the Government Tick Control Programme. Except where the

Government has taken over the management of dips, the management has been very poor resulting in tick-borne diseases killing a number of the livestock.

With the presence of wildlife which are known to transmit tick-borne diseases to livestock, there is a need for more dips and proper dip management.

### 5.5.3. Veterinary Services

Additional technical staff and adequate transport facilities are required to prevent and eradicate the livestock diseases. Education and training for the farmers is also important.

### 5.5.4. Meat Inspection

With the existence of so many livestock diseases and parasites, meat inspection becomes very important in order to safeguard the health and even lives of the people. Meat inspection is concentrated in urban areas where the rate of meat consumption is high.

Motorcycle transport would be helpful for visiting slaughter houses outside urban areas.

### 5.5.5. Extension Services

The number of technical staff is very small compared with the high demand for technical advice in the project area.

Other services (e.g. housing, office accommodations, and transport) are not adequate for the staff.

## 5.6. RECOMMENDATIONS

Having presented a general outlook of livestock industry, the following recommendations are made with the aim of rectifying production problems:

### 5.6.1. Land

Subdivision is to be discouraged in marginal farming areas.

### 5.6.2. Human Labour

Livestock production in the project area has declined both in quality and quantity due to poor management. To improve this situation, it is necessary to develop proper breeding programmes, improve animal hygiene and immunization, insure proper handling of livestock products to improve the grades and hence the prices, improve animal nutrition, and develop additional water and extension services.

### 5.6.3. Capital

The Government needs to encourage financial institutions to invest in rural areas.

The farmers should be encouraged to save through the post office or through cooperative savings and credit programmes.

A Farm Input Supply Scheme (FISS) is to be introduced to augment input supply to some areas which are far away from KFA stores.

Funds are needed for land reclamation in swamps or eroded areas.

### 5.6.4. Marketing

Farmers are to be encouraged to join cooperative societies.

Strict adherence to cooperative laws should be maintained.

Livestock routes must be improved, and buying centres established.

Honey and milk collection centres are needed.

Milk coolers must be used.

### 5.6.5. Project Proposals

To fulfil some of the recommendations mentioned above, five projects have been proposed. The main objectives of these projects are to increase the quantity and quality of livestock and livestock products which will enable the target groups to improve their standard of living both economically and socially. They are:

1. Improved forage bulking and improved smallholder dairy production.
2. Animal health and immunization
3. Breeding and genetic improvement
4. Beekeeping
    a. Improvement of hives with proper management
    b. Extension work to be intensified through demonstrations.
5. Improve the general animal protein deficiency in the project area.

## 6. WILDLIFE

### 6.1.1. Mammals

Over 25 major mammals are known to exist in the District at this time. Within the group, there are currently estimated to be over 100,000 big game animals; this includes over 2,000 elephants and several small but vigorous herds of Greater Kudu.

### 6.1.2. Problems

1. Large animals (mostly elephants) damage crop capital ranch investments. Predator/livestock relationships compete for forage and water.

2. Wildlife are hosts to many tick-borne diseases which are transmitted to domestic livestock.

### 6.1.3. Fish

There are an estimated 350 kilometers of rivers and streams in the District, originating in the Aberdares and Mt. Kenya, suitable for cold water fisheries (rainbow and brown trout). Many of these streams were stocked in the past; but due to lack of hatchery stock and fish poaching, they have declined as a sport fishery and tourist attraction.

### 6.1.4. Project Proposal

1. Donor funded construction of 162 km solar battery powered electric fence for elephant control. Estimated cost is K.Sh. 1.5 to 2.7 million.

### 6.2. Recommendations

1. Establish a game reserve or national park oriented toward large animals in Mukutan Gorge.

2. Expand game harvesting for commercial sale of meat.

3. Conduct a stream survey to identify the potential for developing a sport fishery. Consider development of a trout hatchery in Laikipia District to restock the streams.

## 7. Forestry and Agroforestry

Laikipia District had 139,000 people in 1980; by 1990 it is expected to have 250,000. It is growing at the same high rate as Nairobi. The forest area is 36,000 hectares or 3% of the total District area, yet there is potential for a developing forest industry from the present 16,000 $m^3$ (round wood equivalent) of wood products to over 100,000 $m^3$. This development could increase employment by 500-600%, or from 900 to 5,000 people directly employed, thus supporting a total of 50,000 people (or one third of the total estimated 1990 population of the District).

Western Laikipia forests are producing 50,000 tonnes of fuelwood. The present needs in the Rumuruti and Ngarua Divisions are for 84,000 tonnes, rising to 150,000 tonnes in 1990. Four thousand hectares of fast growing fuelwood plantation must be planted between 1980 and 1990 to meet this need. The forest can provide 2,500 hectares of fuelwood sites, but the small farms must also provide 1,500-2,000 hectares of fuelwood. The economics of this 4,000 hectares of fuelwood planting would indicate costs at K.Sh. 260,000/= per year with potential returns of K.Sh. 5 million per year (110,000 bags of charcoal at K.Sh. 45/= per bag).

Laikipia's large ranches are currently being bought up for subdivision into small shambas. This will be a major environmental and economic impact on the land and the people. Our study shows areas (Moisture Availability Zones III and IV) where there is a chance for small farmer success and areas (Moisture Availability Zone V) where success can only be obtained on hectarages of 160 to 300 hectares which will

provide a living from livestock for a family. Agroforestry production of fodder shrubs and fuelwood along with crops and livestock will be needed on all of these subdivisions if they are to succeed. The following projects are proposed to develop the forestry and agroforestry potential of the Laikipia District:

High Priority Project - Forestry and Agroforestry

1. Some of the highest priority projects for forestry involve production and manufacture of lumber and associated products. The monetary return to the District and the Nation from improved mills and lumber is estimated at K.Sh. 100 million per year for the estimated forest productions. This anticipates the employment of 5,000 wood and sawill workers within the logging, sawmilling, and wood processing industries.

2. Fuelwood and charcoal production is of top priority, If fuelwood plantations (4 to 6,000 hectares in size) are planted over the next ten years, a new industry of modern kilns will develop. The potential earnings of the kilns is K.Sh. 5-7 million annually. Other chemical products can also be distilled from wood fibre.

3. There will have to be new inventories, management plans, harvesting programmes and a road system developed before the forest products industry can expand. This will require donor financing.

4. New nurseries must be developed and planting programmes implemented to meet the fuelwood demands of the District and the Nation. Donor support is indicated for production of a 4 million seedlings annually for forest lands and small farms.

5. Fire protection of forest lands is critical. It is essential that a modern fire protection organization be developed. This will require financing beyond present Government of Kenya ability. In 1980-81 the loss to wildfire included 2,000 hectares of indigenous forest and 80 hectares of tree plantations.

8. AGRONOMY

The small scale farming system in Laikipia District is mainly intermediate in technology, because although most of the farmers are aware of the capital inputs necessary for

advanced farming technology, they are limited by the lack of money. A few well off farmers used advanced technology in their farming and realise very encouraging outputs from their farms. Farm inputs are supplied by the KFA Branches in Nyahururu and Nanyuki, so availability of inputs is not a limiting factor.

From a study of the agronomy, the main constraints identified as limiting crop production in the District apart from lack of money are:

1. Lack of research on approved cultivars of existing drought resistant crops which are suitable for the high altitude semi-arid conditions as found in the Laikipia District.

2. Low prices offered to farmers at harvesting time for such perishable crops as vegetables and potatoes. An organized marketing system such as a cooperative society, to enable farmers to realize higher income from such crops is lacking.

3. Lack of training facilities in which to educate farmers and staff on modern farming techniques and bring staff up to date with ever improving farming technologies.

4. Shortage of farm machinery and labour at the time when they are required by farmers.

5. Inadequate number of agricultural extension staff in the District making it difficult for staff to visit farmers as often as is desirable in order to advise and educate them.

The crops grown in the District include maize, sorghum, beans, potatoes, pigeon peas, dolichos beans, and horticultural crops. The cash crops produced in Laikipia are wheat, barley, and pyrethrum. Those with potential for production in the area are sunflower, coffee, and cotton. Other crops like arrowroot, cassava, sweet potatoes, and bananas are grown on such a negligible scale that there is no record of their hectarage in the District.

In order to improve agriculture in Laikipia, it is recommended that:

1. A research centre be established for high altitude semi-arid conditions, preferably in Laikipia District where breeding and selection of the existing drought resistant crops can be carried out in order to obtain suitable cultivars for the high altitude ASAL areas.

2. The land under irrigation to be increased and be used for the production of high value horticultural crops for export.

3. Training facilities be provided for training staff and farmers in the District.

4. The cooperative movement in the District be promoted so that what one farmer cannot achieve individually, many farmers can achieve collectively.

The projects proposed in order to improve agriculture in the project area are:

1. Financing of demonstration plots for various crops including beans, sunflower, sorghum, bullrush millet, cowpeas, pigeon peas, and cassava.

   Trial plots are also proposed for such crops as guar, guayule, jojoba and others which can grow in dry areas and have potential for the drier parts of Laikipia District.

2. Setting up of fruit tree and vegetable nurseries to supply farmers with seedlings at subsidized prices.

3. a. Setting up of research substations in Rumuruti, Loldaiga and Ongobit to carry out research on the production and distribution of selected crops and forages suitable for dryland farming.

3. b. At the research substations, investigate the feasibility of irrigated crop production.