LAIKIPIA RESEARCH PROGRAMME

DROUGHT MONITORING PROJECT – MWINGI DISTRICT

A Framework for Developing Benchmarks and Indices for Drought Risk Assessment:

Contributions from Socio-Economics

Prepared by:

Joseph M. Mathuva
Laikipia Research Programme
P.O. Box 144
NANYUKII

E-mail: lrp@africaonline.co.ke

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Drought – some impressions!

"The one commonality of definitions of droughts seems to be the arbitrariness…" (Anonymous)

"What is drought? If I am not asked, I know what it is; If I want to explain it, I don't know" (St. Augustine)

"From a pragmatic socio-economic point of view, the definition of drought considers not only water supply but also water demand. This means that drought depends on the type of water use as well as on the density and distribution of users. The consideration of deficits of water for periods ? If I am not asked, I know what it is; If I want to explain it, I don't know" (St. Augustine).

Abbreviations

DPIRP	- Drought Preparedness Intervention and Recovery Programme
DMS	- Drought Monitoring System
DMP	- Drought Monitoring Project
DEWS	- Drought Early Warning Systems
DTM	- Digital Terrain Model
ASAL	- Arid and semi-arid lands
LRP	- Laikipia Research Programme
GTZ	- German Technical Co-operation
IFSP-E	- Integrated Food Security Programme - Eastern
RS	- Remote sensing
GIS	- Geographical Information Systems
AEZ	- Agro-ecological zones
ZCO	- Zonal Co-ordination Office(s) [of IFSP-E]
CDE	- Centre for Development and Environment
MoU	- Memorandum of Understanding
DM	- Drought Monitoring
DRA	- Drought Risk Assessment
RAs	- Research Assistants

Acknowledgements

The Drought Monitoring Project Mwingi, an initiative of Laikipia Research Programme and GTZ/IFSP-E, dates back to the year 2000 when concretisation of the ideas was agreed upon. Funding was provided later in the same year under a Memorandum of Understanding between the two institutions. This project would in the process have two component that have a direct tie to drought and food access; assessment of ecology and livelihoods. By its magnitude, the project was designed to carry four modules, each of which would have independent outputs, but feeding into one process.

The aim of the first two modules was to develop and present base data for which a monitoring framework would be composed. Specifically, the socio-economic component would provide essential reflections on livelihood, drought occurrence, impacts and essential benchmarks that would present some understanding on the overall district situation. This assignment was carried out through the collaboration and support of various individuals, and of particular importance was the team of Research Assistants who were instrumental in field-data gathering, entry and control. The project was led by Joseph Mathuva from Laikipia Research Programme, in association with Boniface P. Kiteme, who took particular charge of co-ordinating the project as a whole. Grace Wambugu assisted in leading the field research team especially in the absence of the local team leader.

The success of this component owes a lot to individual RAs: Grace Wambugu and Jane Wacuma were active in data-gathering too formulation. In addition, they took lead in data collection, entry and control. Others such as John Kyalo, Ruth Ndunge, Everrett Kyongo, Jeniffer Kinoti and Festus Munyao the late Beth Kyalo provided particular input in the fieldwork. Without them and their support, the results of this component would not have been realised.

Preface

The Drought Monitoring Project (DMP) Mwingi has been undertaken within the confines of Memorandum of Understanding (MoU) between Laikipia Research Programme and GTZ /IFSP-E Mwingi. The two institutions have run this joint project for more than a year in which GTZ, being the ultimate client, agreed to fund for a GIS-based technical capacity input in the rationalisation of drought monitoring and advisory support in the district. The broader project has two components; ecological process analysis, and socio-economics data gathering and preparation of a status report as well as projections of processes required in the sector. The former calls for production of GIS base-layers for the district with a wide range of information as products of the first phase of the project. This is towards the satisfaction of the requirements of Module A. This specific component, and in particular the socio-economic aspects, brings into the broader view key social baseline input that forms the basis of understanding the people's social organisation and the localisation of the drought problem in the district. In its formulation, the report and associated data and data-gathering procedures and processes have been founded and expounded on technical guidance in the project document. Additional support has been sourced based on consultations in the development process with the GTZ Mwingi office.

Though Mwingi district is made up of 9 administrative divisions, the research input forming the base of this report did not take the administrative units as the critical basis of sampling. Rather strong emphasis was laid on the representation of the co-ordination units of GTZ bases as well as ecological considerations. All the 4 zones are represented in this survey while nearly all agro-ecological zones in the district have been sampled. In total, five villages were sampled and 10 to 16 households interviewed per each. In addition, discussions were organised and held with representative of Provincial Administration and selected schools within the sampled villages visited and education data gathered.

As much as possible, the primary reliance of the report is field-based data though in addition, attempts have been made to refer to both published and unpublished materials specifically with social and economic information and livelihood systems in the district. This has proved necessary especially where comparative presentation is required. The report has been prepared with the aim of providing in-depth socio-economic information required to support the worth course of general drought management in Mwingi. Specifically, it offers some key inputs in the process by providing needed benchmarks for the productive and welfare sectors that provide a launching pad for the preparation and operationalisation of the indices required in drought assessment and severity determination. Within its scope, this report is organised in the following sections:

- *Chapter 1*: provides a detailed background of the Laikipia Research Programme – GTZ/IFSP-E project's overview. It also gives a brief on the project's purpose as well as the methodology applied during this study.

- *Chapter 2*: illustrates an understanding of the Mwingi district within the socio-economics perspective. This section focuses on the socio-economic fabric with a bias on food and fodder availability and approaches to addressing related shortfall. This provides an important basis for justification and need for a refined and detailed drought monitoring initiative using concise data.

- *Chapter 3*: marks the starting point of the main contents of this report with a presentation of the framework for risk assessment. The Emphasis is placed on relevant sectors and the Mwingi situation reflecting on the sector-situation from which baseline data has been acquired. These sectors are used in the later parts of the section to determine the benchmarks and indices for monitoring application.

- *Chapter 4*: illustrates some essential consideration in designing the suggested drought monitoring tool using the gathered socio-economic data as the foundation. Of particular importance in the section is determining severity of drought, ascertaining of data ranges within determined benchmarks and development and application of risk assessment matrix.

- *Chapter 5*: is a presentation of essential steps that require consideration within this new framework. Attempts are made to ensure that all necessary activities are in place to ensure the results are applicable and useful at the community level.

- *Chapter 6*: forms the last part of the report, and outlines the emerging lessons and associated conclusions from the document. The key lessons form the critical drive of the section, as well as laying emphasis on action beyond the report.

Executive Summary

This report

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1.0 Introduction

1.1 Project Details

The Project: The Integrated Food Security Programme – Eastern Province (IFSP-E), a bilateral programme of the Federal Government of Germany and Government of Kenya, has been operating in Mwingi since 1994. The programme was established to help stabilise food security in the district, in order to contribute to a reduction of rural poverty and related negative impacts. To achieve this goal, the programme has committed itself to work in partnership with relevant and supportive stakeholders to develop mechanisms of:

- Enabling local communities within their development agenda to plan, implement and control projects as per their needs and priorities;

- Enabling relevant organisations (government as well as non-governmental) t adequately support communities and organisations in their endeavours;

- Initiating and securing application of participatory bottom-up planning processes, of dialogue-oriented extension and innovation development as well as gender-differentiated and ecologically sustainable approaches towards rural development by all concerned (LRP and IFSP-E, 2000).

In pursuance to the above goals and within the working framework, food security among the rural population is a central and moving theme of this agency. Food situation assessment, commonly appreciated as synonymous with or associated drought occurrence is currently an important focus of IFSP-E taking into consideration that Mwingi falls within an ASAL belt. It is the need for a coherent drought monitoring framework and technical support that led IFSP-E and Laikipia Research Programme (LRP) to develop and sign an operational Memorandum of Understanding (MoU). The aim of the MoU, drawn in late year 2000 is based on functional cooperation on, among other operations, resource monitoring, GIS and Remote Sensing applications, modeling, and policy management in food security and in particular in developing and operationalising a drought risk assessment tool. Laikipia Research Programme comes in as a partner in the project is acquired expertise in this field out of accumulated experience in its collaboration efforts with the Centre for Development and Environment (CDE) in other areas such as Ethiopia and South East Asia.

The guidelines and activities of the collaborative IFSP-E /LRP project, having been discussed at length among its key persons, have also been outlined and documented in two important documents (see Drought Monitoring for Mwingi District – Project outline, by LRP and the LRP /IFSP-E MoU). In addition, the two organisations have had various meetings in the past since the start of the project to review progress as well as update one another.

As illustrated in the project proposal, the Drought Monitoring Project for Mwingi District, Kenya is the first initiative in the collaborative arrangements between the two organisations. The project's activities fall in four broad modules (refer to page 3 of the approved project proposal):

A) *Establishment of a GIS centered data base for Mwingi District*
   - to collect existing geographical base data
   - to generate a detailed Digital Terrain Model (DTM)
   - to analyse present vegetation and land cover (with RS and field checks)
   - to initiate surveys for lacking data and information.

B) *Analysis of drought occurrence and impacts*

- to carry out comparisons based on vegetation conditions between the present situation and past drought periods
- to determine the spectral conditions of vegetation cover before /during /after past drought periods
- to develop a register of the spectral properties of land cover at drought and normal periods
- to establish the impact of drought in the local economy.

C) *Establishment of drought monitoring system*

- to gain experience from drought monitoring projects
- to develop and test base models for rainfall and economic impacts based on GIS, RS and field data
- to evaluate the models and establish a drought risk map
- to develop a drought monitoring application based on ArcView.

D) *Transfer of know-how to local partners*

- to train the local staff in GIS and RS data handling
- to organise workshops and seminars
- to create awareness on drought-related issues through mass media
- to transfer know-how and responsibilities for managing the drought monitoring system to local partners /authorities.

This report is prepared at the moment in time to contribute in addressing specific requirements within Module B, in particular Item 4 establishing the impact of drought in the local economy. A key manageable task within this item calls for a development of socio-economic base information about the district as well as upgrading associated data to create sector-specific benchmarks required in indices validation. It is therefore the essence of this survey to present the base data within an appropriate background of the project. It is expected that this report would act as an important tool and input in concretizing Modules C and D especially on the key components required for running the Drought Monitoring Systems (DMS) and the general Drought Early Warning Systems (DEWS).

The above expectations and associated planned outputs have been occassioned by the so far unpredicted trends of drought occurance in the ASAL areas. Mwingi, being a typical case study, it becomes important to develop a drought emergence pattern that could be used to prepare farmers early in terms. An important concern and purpose of this report is to provide some light on the development of guidelines for coping during such times.

<u>*Some Essential Background Information:*</u> On a general scale, drought could be understood differently depending on areas. As well, its manifestations and impacts are bound to differ based on the ecological conditions and economy. Though, it is on a common understanding that;

"When drought comes, everybody is concerned,

when drought lasts everybody is trying to do something without succeeding,

when drought is over, everybody forgets except those who have been hurt" (Yevjevich et al*, 1983).*

Of all disasters in ASALs in Kenya, nothing has been experienced more frequently than drought and its associated manifestations. Of particular interest to this project is the drought situation as its indicator sectors as well as how this can be noted in Mwingi district, Eastern Province.

Mwingi is basically a drought prone region as it falls in volatile and vulnerable agro-climatic zones. On a time scale, this has been notable in crop failures, diminishing water resources, enhanced mortality in livestock, fallen livestock prices, recognisable out-migration and general declining livelihood systems. It is not new for Mwingi that as drought sets in, foods become rather scarce leading to escalation cereals' prices. Once such drought occurrences are over, rarely are there plans to prepare for future related situations. At the same time, as much as this is evident, it has not been possible to pin and point out the severity of the situation as per occurrence. At the same time, comparison across board has rather been impaired by lack of appropriate advisory data and required systems. Such a lax situation means that synchronisation of shelf and contingency plans as well as general preparedness would consequently lack essential basis.

Understanding Drought in Mwingi context: An important question is, what can be considered to be and /or not to be drought in the Mwingi situation! A look at this region of dominant Lower Midland Livestock (LM5) and Lowland Ranching (IL6) zones, it rather disturbs a layman as to when we can say there is no drought. Generally, drought is believed to be both a natural as well as a human-induced phenomenon and occur irregularly, hence is often difficult to predict.

For the Mwingi case, adopting the universal definition fits the overall understanding; drought is an irregular water deficiency or failure to satisfy water requirements for crops, water-based industrial activities and urban water supplies. The Mwingi situation considers a combination of meteorological, hydrological, agricultural and socio-economic components of droughts (for a detailed classification, see Annex 3.0 of this report).

Recalling from the 1970s, Mwingi has often been subjected to drought and its impacts. Various livestock have been lost, crop production dramatically reduced or failed, people have been dislocated and social instabilities locally encountered. Mwingi, over time, as singled out from agrarian regions in Eastern Province, has proved to be less resistant to drought impacts relative to the neighbouring districts. The high vulnerability of the district to the impacts of drought since the colonial period is associated with both climatic and socio-economic conditions. Of particular prominence in this report are the socio-economic issues in place.

The Glaring Need for Drought Monitoring as a Tool for Sustaining Development: The The Drought Monitoring Project (DMP) in Mwingi has been conceived by IFSP-E in association with Laikipia Research Programme (LRP) for the district with three clear objectives;

- To provide departmental heads and other development agents working in the district with early warning information on drought situation and its consequences in order to engender timely preparations and intervention

- To provide information for preparedness during drought and associated period to guide and articulate support. Such include monitoring food availability during relief operations in order to inform relevant offices and agencies on timing and targeting of food aid.

- To build up a comprehensive, rational and reflective database focussed on livelihood support and food economy of the district based on its pillar potential as a baseline information for local development projects.

The operational direction of this project, the DMP – Mwingi is organised in its monitoring agenda to establish "norms" to be used as yardsticks by which to determine the abnormal changes. To this

particular project and by extension the IFSP-E office, the times of deficit and inadequacy form the critical drive towards developing adjusting interventions. These are therefore the project-specific important times. These abnormal changes can only be determined against the "norms" and the cyclical behavioural organization of local economies and environmental processes. Thus, the whole basis of early warning and preparedness would rest on the statistical establishment of long-term trends in productive sectors and some service (such as schools' attendance, market operations, etc.) performance and access to essential inputs and basic needs.

With the emphasis on the importance of statistical input leading to adoption of dedicated computer-based packages on drought monitoring and related environment such as the Geographical Information Systems (GIS), complacency in interpretation must however be avoided. Instead, Drought Monitoring if it has to provide reflective reaction and action at the community level, it must recognise the social dimension. The process must illustrate openness to review especially of how established patterns are changing, as the result of people in different parts of the district adopting new strategies for survival, or perhaps due to the onset of s new stresses. It is expected that such openness can thrive only if the lead agency is keen on developing close partnerships with the local communities and establishments working at the grassroot. It is expected that by opening dialogue with local people, interpretation of findings would remain flexible and especially taking into account the systems' subjection to continual change and growth.

The essence and need for monitoring drought in Mwingi therefore should present an important turning point in the whole process, and especially providing room for the local population to provide their input to as well as become consumers of related information. Monitoring should therefore not be viewed as a one-way flow of information where monitors undertake routine work of taking information from the rural villages and feed it upward into the national planning structures. Instead, this socio-economic monitoring component should be appreciated and adopted wholly as a two-way flow of communication between communities and relevant offices under the direct coordination of the IFSP-E office with the monitor providing a bridging role.

With the above understanding and strategy adoption, it is believed that the new and enhanced approach being fronted by Laikipia Research Programme within the current partnership should be;

- To build a rigorous data collection system based on the identified benchmarks (see details in this report) and continuous conversion into usable indices for risk assessment in the district. The initiative should engender to benefit the lead agency, related and partnering offices, and the local community facing stress.

- To enhance simplification, understanding and timely application as well as all-stakeholders response to drought and associated stress. It is expected, by simplifying the socio-economic component, the community will have a role in the process and will be accommodated in monitoring, and interpretation of information required in the formal planning and response processes.

1.2 Purpose

The purpose of the whole Drought Monitoring Project is to provide appropriate systems required to instill preparedness in times of drought stress. The project aims at streamlining and rationalising approaches to food security using drought as one of the proliferation and manifestation of a negative situation. To address such need, socio-economic organisation of the society in Mwingi becomes essential since it forms the basis of situation assessment. In particular, the purpose of Module B under which this study falls is to provide essential information considered necessary to support the development of the risk assessment and determination models. By extension, the data is being used as a basis for developing a framework and tools for drought assessment through benchmarking and indices formulation.

It is expected that, the framework that this document provides as well as its associated findings would become an important reference point for preparing the monitoring tools required in specific productive and service sectors considered in drought assessment. It is also on the basis of this document that some essential considerations and steps required in designing the DM tool and running the Drought Risk Assessment (DRA) have been formulated from the socio-economic perspective.

While long-term production patterns can be established through continuous assessment and statistical analysis, careful interpretation is required since occurrence of drought requires localisation for appropriate and action. It is important to support openness to review how established patterns are changing and what it means where the Mwingi community has to adopt new strategies for survival, or perhaps due to onset of new stress. It is within the confines of this component to encourage for openness through some development of close partnership in the monitoring process and transfer of information between the responsible institution, other development agencies in the district that may find the information useful and the local community. Elaboration and opening up of dialogue with the local people is considered essential to ensure that interpretation of the associated findings from this expected continuous process does not remain rigid but takes into account emergent dynamics and associated changes in the society.

1.3 Methodological Notes

Initial Considerations

The expectations of this survey called for a fusion of methodological approaches in an attempt to fill the socio-economic data gap. This called for;

- The need to develop a comprehensive questionnaire and administer it widely in order for the resulting data to illustrate appropriate focus towards providing essential inputs from the target population to answer a wide range of queries on the community's social dimension, livelihood and food security situation.
- Some informed demarcation of the district for the purpose of this survey and selection of sample sites that would be representative enough to generalise the district situation taking into consideration the balanced importance varying environments.
- Extensive desk research on the social fabric of the district and its people. This was essential to augment the field data as well as make presentable comparisons where appropriate. In addition, there exists scattered information about the district that could be brought together through the desk research.

District's Segmentation as a Prerequisite for Sites' Selection

To pave way for sampling of sites for the field survey, attempts were made to develop some segments in the district based on a number of considerations. Although the district falls into various administrative units, these divisions do not in any way reflect variations as per planning and development needs. Large portions share a wide range of characteristics such climatic, ecological, socio-anthropological, and livelihood systems, among others. Focussing on these definitive parameters is of special importance in determining clusters of common traits based on which in-depth surveys for such as study as the current one could be based.

Based on a review of the conditions and potentials, including social patterns, three broad segments were created in which various parts of the districts were positioned depending on the emerging characteristics. The basis for the above segmentation takes into consideration divergent agro-climatic and agro-ecological conditions exhibited by different sections. The broad segments have been delineated, for the purpose of this study, taking into cognizance and recognition of the farming systems though emphasis has been placed on the agricultural productivity potentials. In adopting simplicity of the whole process, the lead factors were agro-ecology and zonations for the management and identification opportunities for the

IFSP-E interventions. Mwingi falls into 6 agro-ecological zones, and is a district that is apportioned into 4 co-ordination zones. The 6 AEZs are (see the map below for details):

- UM (Upper Midland) [semi-humid] 3: Marginal coffee zone – lower parts of Migwani. Comprises about 0.2% (20.1 km^2) of the district.
- UM (Upper Midland) [transitional] 4: Sunflower – Maize zone – some parts of Migwani. Comprises about 1.3% (130.4 km^2) of the district.
- LM (Lower Midland) [transitional] 4: Marginal cotton zone – some parts of Migwani, Central, Mumoni and Kyuso. Comprise about 10.2% (1023.1 km^2) of the district.
- LM (Lower Midland) [semi-arid] 5: Livestock – millet zone – widespread in the district covering 50.6% (5075.3 km^2) of the land surface.
- IL (Inner Lowland) [semi-arid] 5: Livestock – millet zone – parts of Nguni, Nuu, Tseikuru and Mumoni. Accounts for only 5.5% (552 km^2) of the district.
- IL (Inner Lowland) [arid] 6: Ranching zone – eastern horizon of the district covering 32.2% (3239.8 km^2) of the district.

The coordination zones under which IFSP-E has been running its operations are:

- Migwani: Central and Migwani Divisions
- Tseikuru: Tseikuru and Ngomeni Divisions
- Nguni: Nguni, Nuu and Mui Divisions
- Katse: Kyuso and Mumoni Divisions.

Analysis of the District's Population as a basis for Sampling

According to the 1999 National Population and Housing census, this district had a total population of 303,828 persons and a corresponding number of 58,863 households. On average, a household had about 5 persons (CBS, 2000). Based on the IFSP-E zones, the population of the district and related details are presented here below as synthesised from the CBS data.

Table 1.1: Population by zone, sex and household size in Mwingi District

Zone	Division	Land (sq.km)	1999					
			Male	Female	Total	HHs	Density	Pers./HH
Migwani	Migwani	565.6	39726	43961	83687	16912	*148.0*	4.9
	Central	1204.5	26150	30757	56907	10529	*47.2*	5.4
Sub-total		1770.1	65876	74718	140594	27441	*79.4*	5.1
Tseikuru	Tseikuru	1326.1	10765	12902	23667	4772	*17.8*	5.0
	Ngomeni	1618.1	5083	5629	10712	2165	*6.6*	4.9
Sub-total		2944.2	15848	18531	34379	6937	*11.7*	5.0
Nguni	Nguni	1751.1	9570	10845	20415	4018	*11.7*	5.1
	Nuu & Mui	1694.2	17258	19303	36561	7185	*21.6*	5.1
Sub-total		3445.3	26828	30148	56976	11203	*16.5*	5.1
Katse	Kyuso	804.4	15728	18544	34272	6291	*42.6*	5.4
	Mumoni	1066.3	17498	20109	37607	6991	*35.3*	5.4
Sub-total		1870.7	33226	38653	71879	13282	*38.4*	5.4
District Total		10030.3	141778	162050	303828	58863	*30.3*	5.2

Source: 1999 National Population and Housing Census results (CBS, 2000)

Framework for Sampling and Sites' Selection

In determination of the sample size, the study took into consideration the following:

a) Spread, homo-, heterogeneity and disparities of Mwingi
b) Social economic attributes
c) Representation and its relationship to agro-ecological potential.

Representation in this sampling design formed an important part in determining the number of sites to be included. Of particular importance was the need to ensure that nearly all agro-ecological zones were captured while at the same time taking care of spatial spread. Initially, six sites were pre-selected pending confirmations and visits in the field. Adequate care was taken to ensure that the input of IFSP-E was taken into considerations. From this office and in the selection process, there was need to;

- Incorporate the zonal coordination office in the final selection of the site,
- Liaise with the Farm Management Specialist from the Ministry of Agriculture is final site selection and location,
- Discuss with the zonal coordination offices on the support required, and
- Ensure that sites that had recently been sampled and participated in recent surveys including the Food for Work Programme evaluation and the monitoring points for the on-going drought assessment project were avoided to guard against research fatigue,

Based on some reconnaissance survey in the course of this assignment, five sample villages were approved for detailed data collection.[1] Due to their spread and spacing in the district as well as taking into recognition the agro-ecological conditions, the five selected villages were considered representative (refer to Map: Locations, AEZ + Divisions). In each of these villages, whose selection was supported by the Provincial Administration based on the guidance provided by the research team, the ultimate number of household planned for selection were 15. This was guided by some initial identification of the village boundaries based on which the households' selection would be randomised to ensure appropriate representation both spatially as well as the economic categorisation. In some cases, the 15 sample mark was either exceed or fell short due to some variations.

Discussions were held with the Assistant Chief and some technical officers on matters of livelihoods support and project implementation. Selected primary schools for which children in the village attend to where selected and discussions held with senior teachers on the development, enrolment and performance trends in an attempt to link drought and famines with the happenings in these schools. Though it was planned that health institutions would be incorporated within this survey, this is a component that was left out in the end due to time constraints and logistical inelasticity. The table below illustrates details of the sample sites' selection and results of the process.

Table 1.2: Benchmarking survey sampling frame

Zone	Location	Village	AEZ	Village HHs	Population[2]	Sampling		
						HHs	Schools	Markets
Migwani	Nguutani	Kitumbi	LM4	87	518	16	1	1
	Migwani	Ithambwa Ngau	LM4	46	305	15	2	1
Tseikuru	Tseikuru	Kalimbui	IL5	52	260	15	1	2

[1] The sixth site was dropped after detailed appraisal. Though distantly separated from the nearest, it had strong sharing of operational characteristics, including agro-ecological zone, administrative division, zone co-ordination, settlement patterns, access to services and general farming systems.

[2] The two values for sites in Migwani are based on reports from the local administrators while for the other three sites, figures are calculated based on the average number of persons per households. The local administrators did not have updated figures during the time of the survey.

Nguni	Nuu	Mbia	LM5	41	209	10	2	2
Katse	Kakuyu	Kativa Ngii	LM5	85	459	15	2	2

In total, 71 questionnaire-based household interviews were conducted. The sample size represents 23% of all the households in the selected villages. The selection process ensured a balanced random selection hence the views expressed would be representative of specified zones, AEZ and broad community units. The survey is spread in 4 out of the 9 administrative divisions, representing 44% coverage. These are Migwani, Nuu, Mumoni and Tseikuru.

Field Operations and Data Gathering

The 5 sites in which this survey has been carried illustrated high level of disparity and therefore were seen as a good basis for understanding societal dynamics and livelihoods as well as a basis for determining drought-monitoring benchmarks in the district. A triangular approach was preferred;

- The household-based interviews together with discussions with local administrators and primary schools' management were carried out during the months of August and September 2001. In each of the villages, the research team would spend 2 to 3 days to ensure that adequate coverage was achieved.
- Discussions with primary school-management and data collection from their records were undertaken. In some instances where the survey operations were started before the schools opened, and in particular, Nguutani Location, it was necessary to allocate a later day to make visit to the selected schools.
- Market assessment for purchasing and selling of livestock and foodstuffs was undertaken. This was an independent activity in some cases undertaken outside and beyond the village boundaries but in recognition of the periodic markets frequented by the resident population. Attempts were made to ensure that the focus was emphasized on outlying markets by deliberately avoiding the main centre, Mwingi. In total, 8 markets were visited during the market days. These are Migwani, Kithyoko, Tseikuru, Kyuso, Nuu, Nguni, Kamuwongo and Katse. Some of these nodes are shared as central places by more than one village population of the sites selected for the survey.

Gathering data in the field was organised in such a way that a team of two Research Assistants undertook a single visit. The strategy was adopted to ensure that the data collection process was smooth and expansive enough to collect all required information without lapses. In order to ease the process of entry into the villages, the research coordination team sought the support of the local administration. In each household visited, the team was introduced by the local village elder who acted as the local contact and point person while the subject matters were left to the RAs. For schools, the whole team made a single and organised visit to ensure that data recording process was quick while for the markets, a single visit was preferred while thematic distribution was apportioned with later collation and reporting adopted for authentication and compilation. This ensured that at least two foodstuff stores were visited while another lot visited and held discussions with livestock dealers. Where truck-based long-distance dealership in cereals was noted, attempts were made to collect relevant information from this group.

Data Analysis

The questionnaire called for a simplified analysis. The use of frequencies and comparative criteria across the zones in the district received prominence. Percentages and use of illustrative tables as the most appropriate way of data presentation has been adopted. Data analysis has been made achievable through coding and entry into worksheets within the MSExcel interface for simple statistical computations. Using the simple statistical results, some indices have been compiled that are presumed important for the continuity of the project. Further, attempts have been made in this report to augment the field-based results with essential readings about the district to add value as well authenticate the findings. A whole pack of the field data together with the accompanying legend is provided separately.

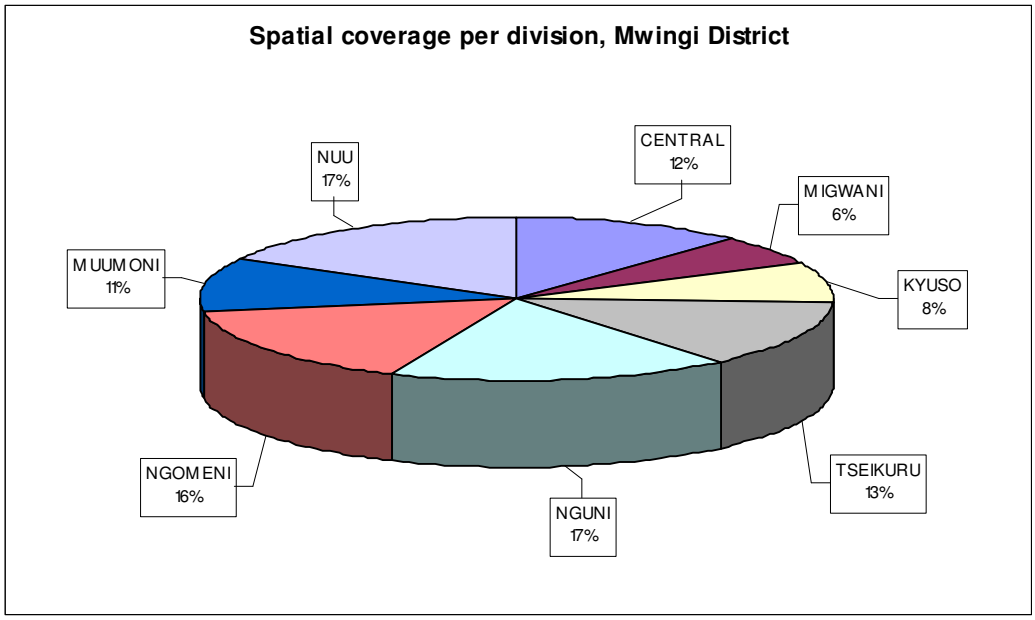
2.0 Mwingi District –The Socio-Economic Set-up

2.1 Socio-Economic and Cultural Structure

2.1.1 Introductory Overview

Physiology

Location and size: Mwingi District, curved out of Kitui District in 1993, forms one of the administrative units in Eastern Province. By size, the district covers 9,791 km^2. The District lies within latitude 0^0 03' and 1^0 12'S and longitude 37^0 47' and 38^0 57'E. Mwingi District borders Isiolo District to the north and borders Tana River District to the east, and Meru North and Meru South Districts to the north-west. Mbeere and Machakos Districts lie to the west while Kitui District is found to the south. The district has 9 administrative divisions, namely, Central, Migwani, Mumoni, Nguni, Nuu, Kyuso, Ngomeni, Mui and Tseikuru.[3]



Topography**:** The district is generally a low-lying area with an undulating landscape giving way to plains towards the eastern extent. The central, and northern as well as the western parts are comparatively higher. These areas have some isolated hills rising above the plateau which are spread in areas such as Mumoni, and Migwani Divisions. Mumoni hill is the highest (up to 1737 metres above sea level) in the District, while Kwasiku area lies at an altitude of 1457m above sea level and it is the highest in Migwani Division. The lowest altitude reading is 340 metres above sea level adjacent to Tana River and within Kyuso Division.

Geology**:** The District is covered by rocks of the basement system, together with minor intrusions. The young rocks consist of sedimentary series of tertiary age, while the basement system_consists of vast

[3] By the time of undertaking the 1999 population census, the district had 8 administrative divisions. The write-up is composed on the basis of the situation as per that year.

succession of heterogeneous para-gneisses, quarzites, crystalline, limestone, calc-silicates and graphite gneisses. The area is also invaded by minor intrusions of acid and basic rocks. Banded pelitic gneisses, semi-pelitic gneisses and banded biotite gneisses are found in northern, western and western part of the district, respectively (Crowther, 1957; Wright, 1964; Dodson, 1955).

Climate**:** The climate of Mwingi is generally characterised of hot and dry days for most of the year, and is classified as Arid and Semi-arid (ASAL). Some of its common characteristics include periodic crop failure as a result of limited and unreliable rainfall.[4] There are two rainy seasons, the "long rains" of March-May, which are unreliable, and the "short rains" of October-November, which are considered more reliable. The annual rainfall is between 600 and 850 mm per year, decreasing towards the north and the east.[5] Temperatures and evaporation rates are generally high in February and September. September is the hottest month with minimum temperatures varying between 14^0C and 22^0C and maximum temperatures ranging between 26^0C and 34^0C, with resultant high evaporation rates. Due to the unreliability of rainfall, the district is faced with recurrent droughts that lead to high cattle mortality and severe food shortages.

Mwingi: Socio-economic stratification

Administrative units: Within the 9 division, there are 33 locations that further have 127 sub-locations. On average, there are about 14 sub-locations per division.

Household structure: Both polygamous and monogamous families are found. This giving rise to complex and simple family structures. Complex structures are mainly due to polygamy and strongly influence recognition of the extended family relationships. Ties exist between the different households in a homestead. These ties are established through marriage and clan lineage.

Population and ethnicity: According to the population census data of 1999, the district had 303,828 persons compared to the 1994 estimates that indicated a total of about 316,990 persons. This could either indicate a drop in population growth or some accelerated out-migration to other lands or to the major urban centres outside the district. The district is inhabited mainly by the Akamba and some Atharaka in the north-western part towards Nithi. The Akamba community account for more than 80% of the total population. In 1994, the average population density for the district was estimated at 33 persons per Km^2 compared t the 1999 figures of 30 persons per Km^2. Going by the recent 1999 population census data, it is evident that population is widely varying per division. This is accounted for by the diversity and disparities in agricultural potential, history of settlement, long-term livelihood systems and resource endowment.

Going by the structure of the population pyramid, the population of this district is typical of a developing economy with the female population being comparatively higher.[6] Of the total 61.3% account for the under 20 years of age population while the labour active population (within the 20 to 54 years age bracket) account for 30.3% of the total district population. The fact that only 8.4% account for the population within the 55 years plus category illustrate a low life expectancy.

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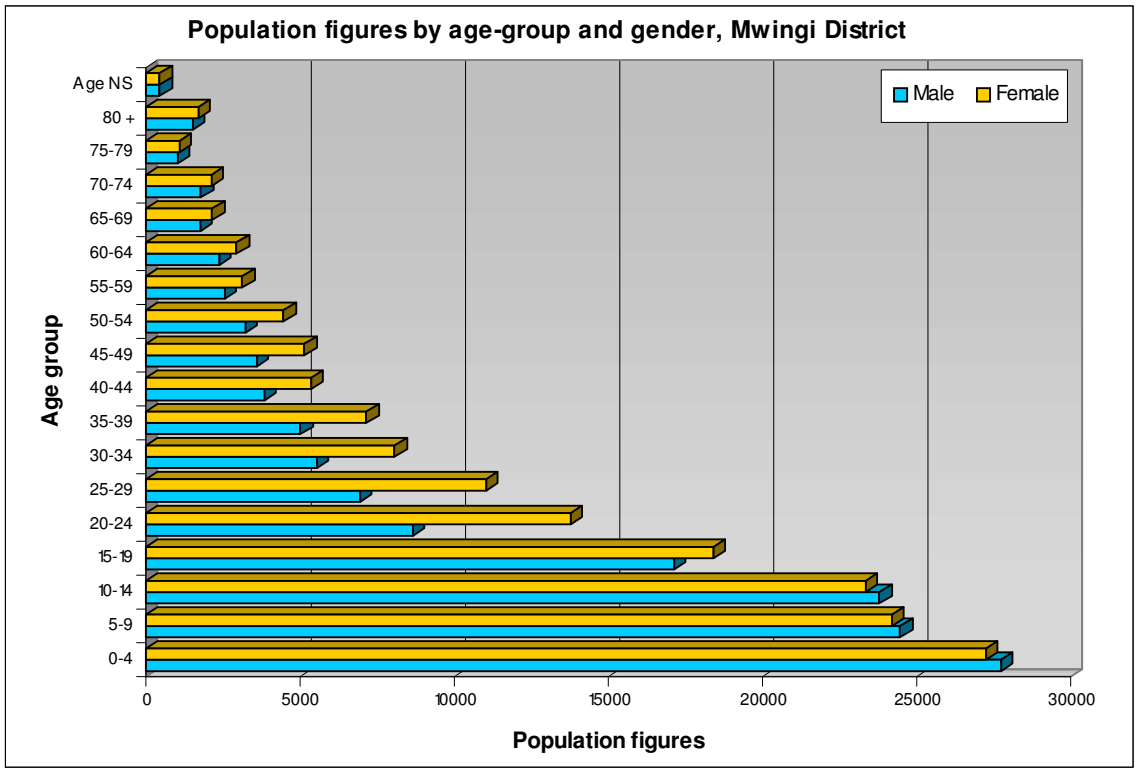
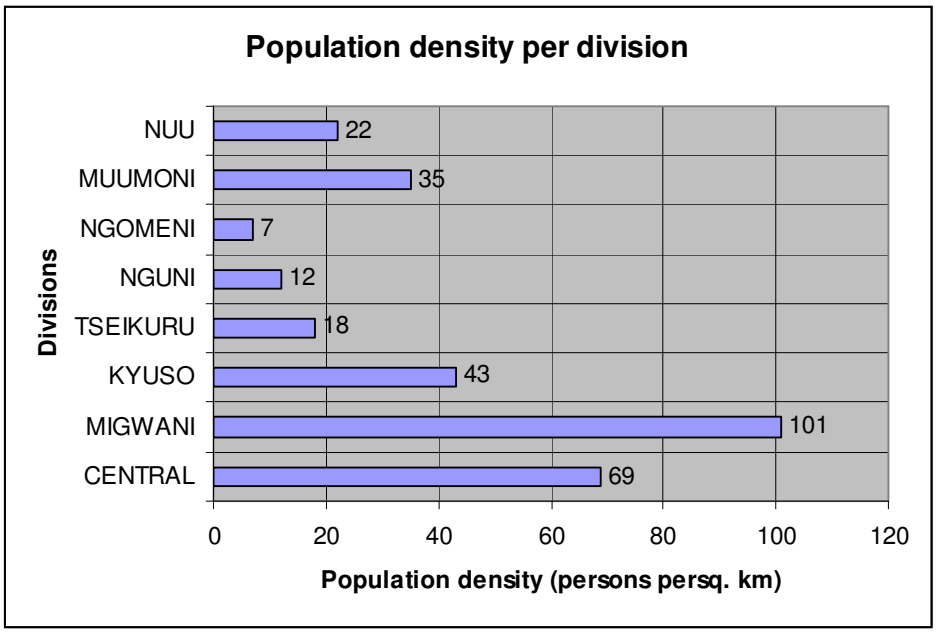
4 With 60% rainfall reliability during the long rains.

5 Rainfall intensity is influenced by the topographical features. Hilly areas such as Mumoni receive between 500 and 760 mm of rainfall per year while the eastern lowlands receive about 500 mm annually.

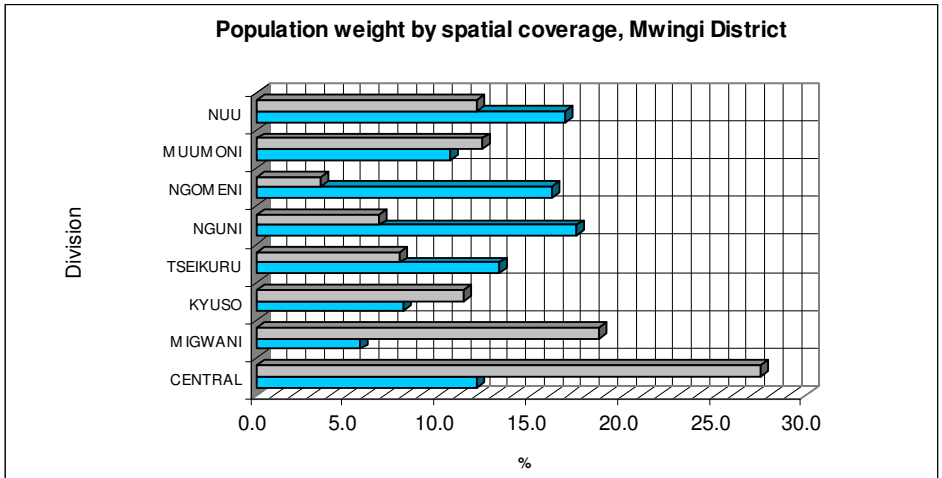
6 The male to female ratio is however insignificant – 1:1.14. The female population in the district account for 53.3% of the total.



Population density and household size: The district data shows that there are 58863 household in the whole district and a settlement density of about 30 persons per square kilometre. However, the situation at the division location and sub-location levels are wide varied due to disparities in resource endowment. At the locational level, the range is widely varying with the lowest density noted in Ngomeni (Ngomeni Division) of 6 persons per square kilometre compared to 164 persons per square kilometre in Migwani (Migwani Division). At the sub-locational level, Mwingi is leading with a population density of 1006 persons per square kilometre. This is due to its urban nature and characteristics. At the divisional level, the highest population density can be found in Migwani while the lowest is evident in Ngomeni. On a comparative scale, Migwani Division is known for its high agricultural potential. It is also the zone that was first colonised by human settlement within Mwingi while the population has simply trickled to the other areas in the later years.



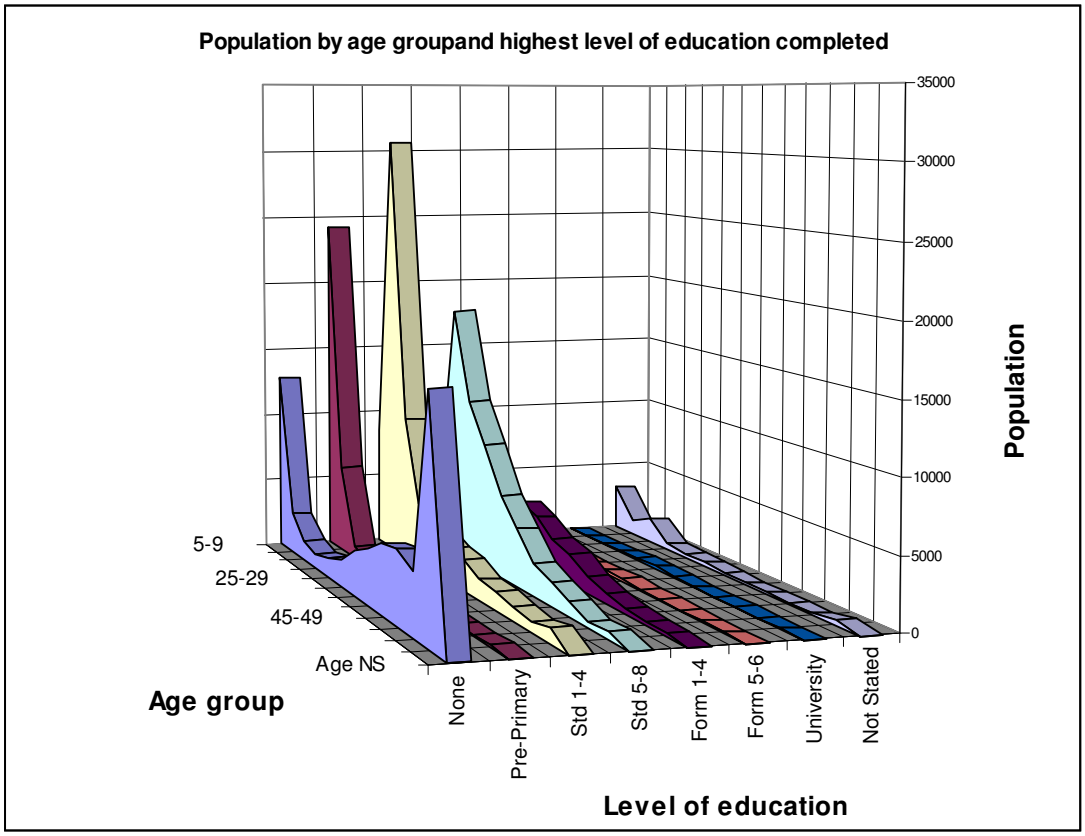
A comparison of the area per division and the resident population, it is evident that Central Division is catering for population that is twice the area while Migwani divison carries the heaviest load of population in excess of three-times the spatial coverage. Based on these calculations, Ngomeni Division is the less-exploited division; its spatial coverage is almost five times the population size giving the area the smallest population density ever in the district.



	CENTRAL	MIGWANI	KYUSO	TSEIKURU	NGUNI	NGOMENI	MUUMONI	NUU
% of resident population	27.5	18.7	11.3	7.8	6.7	3.5	12.4	12.0
% of area	12.0	5.6	8.0	13.2	17.5	16.1	10.6	16.9

The general review of the household size in the area based on sub-locational, locational, divisional and district-based data show a clear trend of uniformity. The average household size is generally 5 persons.

Population and education: Going by the 1999 population data, there is a clear indication that the level of literacy in the district is assuming an increasing trend. Of the district's 62 % is considered literate while it is only 38% of the population that has not attended any formal schooling system whatsoever. Of the illiterate population, 11% are below 10 years. It could be probable that they have not gone to school due



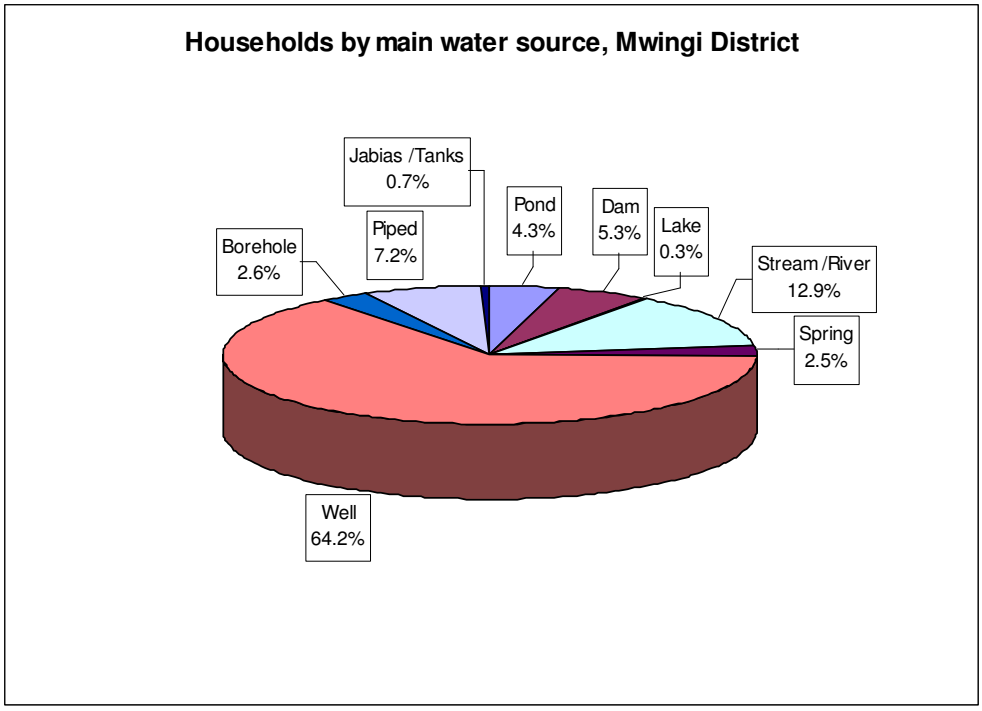
to their age limit; the general pattern in the countryside reflects later school entry. It is not strange in some areas to find children starting school attendance at the age of 10 years although this is currently changing. This data evidently shows that majority of the illiterate population in Mwingi fall in the age bracket of 50 years and above. This accounts for 44% of the total illiterate population. These results are in agreement with the area's history of settlement and education; in the 1940s to the 50s, education had not yet become universal. The areas that were yet to be opened and reached were left without elaborate educational infrastructure for a long time. In addition, there are other factors that could be associated with relatively low literacy levels in the district. Among them are long distances to schools, lack of awareness and poor priority setting among the parents, and general poverty.

From the gender perspective, the available data shows that the number of educated female is lower than that of male though the female population is the highest. This is illustrated through comparative ratios and proportions. In every 17 females, there are 10 that are literate. On the same scale, in every 15 males, 10 are literate. From the proportional perspective, 59% and 65% of the female and male populations respectively are literate.

Population and economic activity: Of the total population of the district, 38% is made up of economically inactive group. This category is evident in all groups. Child labour is evident in the district and especially the group working for a pay. This accounts for about 5% of the population within the 5 to 19 age bracket. The total employed (for pay) population is about 10% of the total population in the district. This number is rather wanting especially in an environment, which is prone to droughts and famine and where dependence on off-farm activities and income generating ventures is expected to be one of the highest.

Considering "work for" as the key source of income, it is expected that dependence in Mwingi could be one of the highest in the country; the dependence is about 10 to 1.

Main sources of water: Topographic information available about this district provides adequate evidence of lack of dependable sources of water. More than 90% of the streams within the district are seasonal and often at long distances. The population therefore has to source water from a variety of sources. However,



private wells form the bulk of the water sources in this area and account for nearly two-thirds of all. By importance ranking, other sources include streams, piped systems, dams, springs, ponds, boreholes, among others. Rain-water harvest is however least developed in this area. This could be associated with the low amounts of rainfall received due to the raid nature. The nature of the roofing material in this case may not be a contributory factor in the current level of unexploited rain-water harvesting mechanisms since more than half of the dwelling units are covered with favourable materials.

Most of the dams in the district dry up during the dry season. Roof catchments are limited due to the high cost of constructing storage facilities. Tap water is too limited in the district and divisional levels; only Migwani division, however, has fairly sufficient water supplies.

Some welfare indicators

Employment levels: The district's labour-force was estimated at 109,673 with 43,501 (37%) males and 57,172 (63%) females (1989 census). Projections for 1997 and 2001 are 138,677 (47%) and 156,912 (53%), respectively. The largest employer is agriculture and livestock sector, followed by the commercial sector (retail, wholesale, transport, manufacturing and distribution). The third largest employer is the public service. The informal sector mainly constitutes self-employed labour-force. Out-migration to seek jobs in other districts is pronounced (GoK, 1997).

Incomes: Most of the earnings are from sale of agricultural produce. Generally, these returns are often low.

Infant mortality rates: This stood at 120 deaths per 1000 live births in 1986. Major causes are Malaria, acute respiratory track infections and diarrhea. Others include low immunization coverage and inadequate maternal/health care facilities (GoK, 1997).

Disease incidences: The major diseases in the district are Malaria, respiratory diseases, urinary tract infections, eye/ear infections, pneumonia and anaemia (GoK, 1997). Others are abdominal pains/parasites, body aches, witchcraft, measles and snakebites (Ng'ethe and Chege, 1982). HIV/AIDS cases were first reported in the district in 1988 and the cases are increasing. Majority of HIV positive cases are in central division and within 16-50 years age bracket (GoK, 1997).

Nutrition: 50% of the children surveyed in a 1994 household nutrition survey suffered from stunted growth; 36% were underweight and 8.1% were wasted. The chronic malnutrition is highest in Kyuso /Tseikuru and Nguni divisions and lowest in Mumoni division (CBS, 1987).

Food availability: The district suffers from recurrent food shortages and hence relies on food from outside the district during droughts. Relief food is given to alleviate severe food shortages (GoK, 1997).

Sanitation: More than half of the population use open-bush or unsanitary methods, for faecal disposal. Only about 45% of the households use pit latrines (MPND & UNICEF, 1990).

2.1.2 Test Areas; Household and Population Characterisation

Survey Interviewees and Leadership: This survey was concentrated in 5 villages well distributed in the district. A questionnaire was the main tool used in the data collection process and focussing on household as the principal response unit. In total, 71 household interviews were undertaken that were taken as representative of the district based on agro-ecological zones of the district. The selection or representation among the interviewees took recognition of the selected villages and the responsible individuals found within the settlement. All attempts were made to ensure that it is either the household head or the spouse who was included as a strategy of ensuring data authenticity as well as reliability especially in respect to critical survival issues and household representation in perceptions.

Of the interviewees reached during the survey, 34% and 66% were male and female, respectively. This survey was carried out during the August – October period, a time when the area is generally dry. The seasonal trends in Mwingi illustrate a general out-migration of men during such the dry period and in such of additional livelihood systems for their households. The general pattern dictates the abundant presence of men within the local environment especially after times of bumper harvest or at the turn of the year. It is based on this anti-thesis that this survey reached two-thirds of women respondents. Of all the respondents, 41% were household heads while 54% were wives to the household heads in their capacity as household managers. About 5% of the respondents was made of others, including children and members of associate sub-households. The fact that there are more household heads in the sample compared to the gender consideration attests to confirm existence of women headed households in the area. Such an occurrence has implications on survival burden and tactics in as far as it relates to food insecurity in the district as a whole. About 92% of the households in the district are men-headed though of these, 62% are women-managed.

Table 2.1: Interviews and household leadership by gender

Village	Interviewee		Household leadership		
	Male	Female	Male-headed	Female-headed	Female-managed[7]
Kitumbi	25% (4)	75% (12)	25% (4)	6% (1)	69% (11)
Ithambwa Ngau	20% (3)	80% (12)	20% (3)	7% (1)	73% (11)
Mbia	60% (6)	40% (4)	70% (7)	20% (2)	10% (1)
Kativa Ngii	47% (7)	53% (8)	47% (7)	6 (1)	47% (7)
Kalimbui	27% (4)	73% (11)	27% (4)	6% (1)	67% (10)
Total	34% (24)	66% (47)	35% (25)	9% (6)	56% (40)

[7] But male-headed – in this case, the men do not live within the compound but either have other homes or are working in distant areas.

Source: Field survey, Aug. - Sept. 2001

Household Size: Generally, households in Mwingi are of small to medium cadre with on average up to 5 persons (CBS, 2000). However, taking into consideration the kinship ties and familial networks common in a typical Kamba structure, the families are generally large. During this survey during which 71 households were reached, each family had an average of 10 persons, of which the sex ratio was relatively even. The situation as it stands is nor a contradiction of the household size but stands to emphasise the levels of networks and extension of support beyond the smaller unit. What of particular importance in this respect is the variance in family sizes ranging between 2 and 26 persons per unit. The bigger the family the heavier the burden is of satisfying the needs of all the individuals per the unit. The implications of the large families are notable in resource allocation and sharing as well as the burden bestowed on the household head.

Table 2.2: Household agglomeration distribution

Agglomeration category	Kitumbi	Ithambwa Ngau	Mbia	Kativa Ngii	Kalimbui	Overall
Below 5 members (small)	31.3% 13% (5)	12.5% 13% (2)	12.5% 6.7% (2)	25% 26.7% (4)	18.8% 40% (3)	22.5% (16)
5 to 7 members (medium)	23.5% 17.9% (4)	17.6% 14.3% (3)	11.8% 17.9% (2)	29.4% 42.9% (5)	17.6% 7.1% (3)	23.9% (17)
8 to 15 members (large)	11.1% (3)	29.6% 9.1% (8)	18.5% 22.7% (5)	18.5% 36.4% (5)	22.2% 31.8% (6)	38% (27)
Above 15 members (v. large)	36.4% 20% (4)	18.2% 20% (2)	9.1% 30% (1)	9.1% 20% (1)	27.3% 10% (3)	15.5% (11)
District status	(16) 22.5%	(15) 21.1%	(10) 14.1%	(15) 21.1%	(15) 21.1%	(71) 100%

Source: Field survey, Aug. - Sept. 2001

The emergent family sizes show minimal variations though providing evidence to the fact that generally, families in the district are large to very large. Of all, only about 23% are small and fall within the average range of a household size. About a quarter are medium with 5 to 7 members. The fact that over half of the families (54%) have above 7 persons testifies to strong kinship association and familial ties.

Data from the Family Trees for respective households affirms the low proportion of nuclues families in the district. The sample data shows that on average, only one out of every three households have nucleus families. There is a tendency in the district to assume agglomeration in settlement as well as utilisation of common resources. On the overall, only about a third of the households exist as nucleus units while two-thirds have extensions in form of other family members or living with parents for livelihood support. The importance of extended families is well illustrated by sample site data; in the five sites, the proportion of extended families in itself per any single site is not less than 50%.

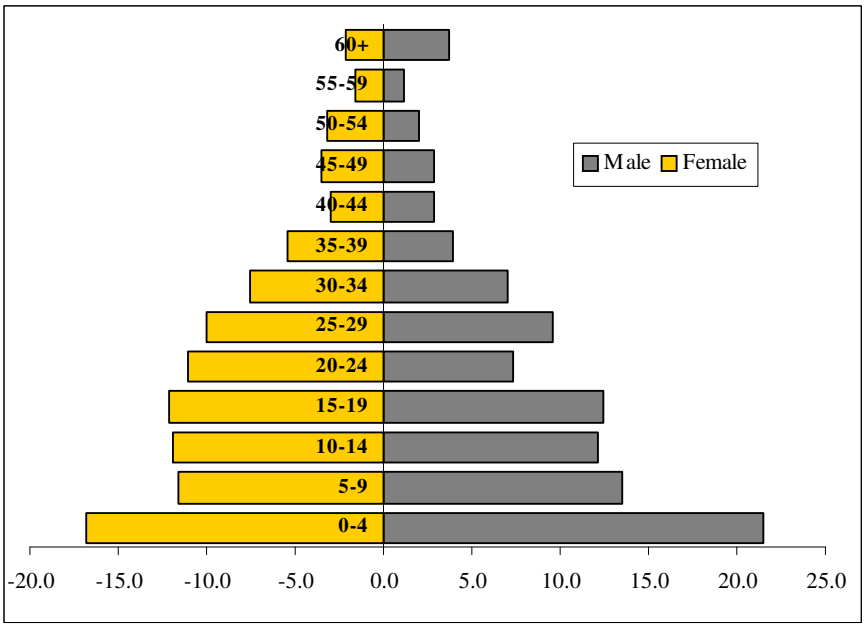
Table 2.3: Nature of households

Site	Total sample	Nucleus of total		Nucleus proportion	Nucleus	Extended
Kitumbi	16	7	2.3	1 out of every 2.3 households	43.8	56.3
Ithambwa Ngau	15	2	7.5	1 out of every 7.5 households	13.3	86.7
Mbia	10	5	2	1 out of every 2 households	50	50
Kativa Ngii	15	3	5	1 out of every 5 households	20	80
Kalimbui	15	7	2.1	1 out of every 2.1 households	46.7	53.3
Mwingi status	71	24	3.0	1 out of every 3 households	33.8	66.2

Source: Field survey, Aug. - Sept. 2001

Population Structure and its relation to vulnerability: Based on data acquired from the Family Trees, an attempt has been made to compare the representative population structure of the 5 sites with that of the

district. By all means, there is essential basis for comparison using the emerging population pyramid. The population in the 0 to 4 age group accounts for the highest proportion of the total. Taking the 0 to 19 years group as the young age category yet to be engaged in income generating activities and those above 54 years as another inactive category, it is imperative that the about 60.2% of the population is merely depending on 39.8% of the district's population. Based on this data and assuming that all those in the labour active category are working, the dependence ratio is in the rate of 2.[8]



% value	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60+
Male	21.5	13.6	12.1	12.4	7.3	9.6	7.1	4.0	2.8	2.8	2.0	1.1	3.7
Female	16.8	11.6	11.9	12.2	11.1	10.0	7.6	5.4	3.0	3.5	3.2	1.6	2.2
Total	19.1	12.6	12.0	12.3	9.3	9.8	7.3	4.7	2.9	3.2	2.6	1.4	2.9

Source: Field survey, Aug. - Sept. 2001

A review of field data based on the family trees and working with discreet data show a deeper scenario on dependence. Of the 742 persons identified within this survey and from 71 households, only 113 are earning some income, either informally or formally. Based on this data, dependence in the district is as high as one to every 6 persons. Of the district's population, only about 15% are earning some income. However, not all these earners are dependable since a greater proportion of them is in seasonal employment, mainly casual engagement. Of the income earners, 88% fall within the active age category. The fact that 11% of the income-earners are below 20 years of age is a testimony of use of child labour while about 2% are accounted by population of above 54 years of age. Where this is quite frequent, the situation is associated with high levels of poverty and vulnerability. Of those earning income, about 41% are in formal employment (that is production and repair, trade and transport, hospitality industry, education and health, and civil service). This represents about 6.4% of the total population in the district. Again, this is a deplorable situation especially viewed in the light of livelihood systems and drought occurrence. The fact that 32.4 % of the district's population lives outside their home environments is a further elaboration of the non-dependability of the situation. Apart of children attending school elsewhere, people are in constant search of food and other needs.

Land holding and Family scatter: The primary productivity potential coupled with agricultural productions systems in Mwingi are low. The identified agro-ecological zones found in the district together with the agro-climatic regime confirm this assertion. This situation explains for the favourable settlement density of 30 persons per square kilometre (CBS, 2000). By this value, it is imperative that the

[8] This figure is largely low due to the accompanying assumption.

land holding is also favourable. However, the uses these lands are put into often do not support the livelihoods of the residents on an annual level. Currently, the land holding is on average 9 acres while land holding per capita is about 0.8 acres. Generally, land distribution is widely varied. Around the southern highlands of Migwani area, land holding per household as well as land holding per capita is relatively low. These are climatically favourable sections relatively to Mwingi district as a whole. To the eastern parts of the district, aridity coupled with occasional banditry would explain the availability of large tracts of land as well as the 0.9 acres of land per capita. To the extreme north, the poor resource base has contributed to recorded high margin of land holding per capita. From the sample survey, this is evident in lower parts of Kakuyu and Tseikuru.

Site /Location	Land holding per household (acres)	Land holding per capita (acres)
Nguutani	5.13	0.43
Migwani	5.21	0.4
Nuu	10.42	0.91
Kakuyu	11	1.33
Tseikuru	13.37	1.3
Average	8.93	0.84

Source: Field survey, Aug. - Sept. 2001

The capabilities of land in Mwingi to produce as per the demands of the local population, taking into considerations the land potentials and limitation, is rather inadequate. Often, the people have to develop coping mechanisms with increased drought and famines' incidences. An important coping mechanism noted was for the active population to move out of the local environment in search of paid jobs in other areas. This way, the population in the local environment is re-sized while the working population is dependent on to make transfer payments for food purchase and support of other activities. As already illustrated, about 15% of the population in the district is engaged in paid employment, majority of whom work away from their homes. Currently, about 32% of the district's own population live off-plot. By all means, this is a coping mechanism. The availability of supportive resources is still a major concern to the survival of the population. Of the 15% population engaged in paid activities, only 41% (6.4% of the total population) are in the formal sector while only 16.8% earn more than Ksh. 5,000 per month. This is an indication of a survivalist regional economy whose ability to function without external support is limited.

2.2 Food Security and Livestock Scenario – a situational analysis

The current situation in Mwingi generally illustrates a food insecure district. Rarely are households noticing food surplus as frequently as expected and while available, the food is often sold immediately after harvest to cover essential household needs.[9] Surplus food, in particular surplus millet, is storable in large wicker baskets. After a good harvest, surpluses that are not required for immediate or foreseeable consumption are stored away for sale in the next drought. Drought periods generate sellers' markets for grain and buyers' markets for livestock. Selling surplus food even under favourable market conditions is usually only sufficient to obtain small stock.

In the district, food is home-grown (millet, cow-peas and less importantly sorghum, beans, maize and green grams) while at times of deficit, nearly all have to be bought. The ratio of home grown food to shop bought food depends on the crop yields of the previous season and harvest. When harvests are abundant the greater part of food eaten is home produced. In exceptional years surplus food is stored or sold. Millet is durable and is stored in specially made large dome-shaped wicker baskets. After poor harvests, home grown foods are substituted or supplemented by shop bought foodstuffs. Even after good to middling harvests people tend to lengthen the life span of their home grown stores by combining shop bought food with home grown food in the household diet.

[9] Some of these selling are often associated with post-harvesting handling challenges.

Mwingi is potentially an important hub for millet and sorghum production. This has been realised in the past through recorded output. The argument for the decline is associated with withdrawn labour. The opening up of schools denied households the labour of children in protecting gardens from marauding birds, and millet as well as sorghum gradually ceased to be an important crop. At present, in the productive highland parts of the district the major crops are maize and beans. In the lowlands, the major crops are millet and cow-peas, and the diet there is constituted by these crops and by maize and beans mainly bought at the local stores.

When food is plentiful, people have three meals a day – two relatively light repasts, one in the morning and one at mid-day, and the principal meal is eaten in late evening. In times of food shortages the number of meals for adults and older children is reduced to one or two meals daily, and when the food scarcity is particularly severe, adults do without food on some days. Providing food during lean years become problematic for those without regular non-farm incomes and it reduces the saving capacity of those with such incomes. The principal foods eaten in times of scarcity are shop bought foodstuffs – maize, maize flour and beans. There are a variety of ways of raising cash to buy food during severe food shortages: the sale of livestock, canteen business, sale of local beer, and paid employment (local or urban, casual or permanent). Not all households have equal access to these means.

On livestock scenario, majority of households in Mwingi own at least some cattle. In 1977, about 84.2% of households in the greater Kitui region had at least one or two heads of cattle; 15.8% had herds with more than eight heads of cattle (O'leary, 1977). Currently, the Mwingi situation illustrates ability and capability to build large cattle herds in part through keeping strong checks on family spending at the household level. However, it is important to note that selling of livestock is appreciated as a safety net at times of food inadequacy and an important fall-back resource for varying financial needs. Where careless habits in herding and husbandry have been taken up, reduction of herds is notable. Some cattle owning locals invest cattle wealth in some form of non-farm businesses as a logical strategy; capital in cattle herded in harsh natural conditions carries a greater risk than that invested in enterprises, which are independent of uncertain and unpredictable climatic conditions.

The main causes of herd depletion or slow herd growth are drought and poor herd management practices. During drought periods the older cattle and calves are most vulnerable, and heifers and dams fail to calve because of poor physical condition. Drought often gives rise to cattle diseases (foot and mouth, rinderpest, bovine, contagious pluro-pneumonia, east cost fever) which increase further livestock mortality. The adverse effects of drought can be minimised if herders increase the rangelands used. The quality of herd management varies from herd to herd, and it affects the number of stock which die from starvation during droughts. Based on information gathered during the survey, it was evident that during the 1996/7 and 1999 drought periods, a number of livestock keepers lost some of their stock on drought-related developments. Of particular reference here were lack of pasture. What is important to consider during such occurrences is stock optimisation against poor browse and water access conditions.

The degree of dependence on herd and flock varies from household to household. This dependence is never direct in the sense that the household depends directly on the consumption of livestock products (meat and milk) for subsistence. Even in times of drought, livestock are sold for cash to purchase maize and beans, which become the primary constituent of the household's diet. Amongst the Mwingi community, reliance on livestock for subsistence is less acute and more indirect.

2.3 Coping with Shortfalls – local approaches and strategies

Farmers adopting new practices of agriculture in low potential agriculture zones of Mwingi do not necessarily disengage from non-farm occupations. The uncertainties arising from cultivating in a harsh unpredictable environment encourage involvement in non-farm occupations (Mbithi and Wisner, 1973).

In the past and during times of drought, households with large herds tended to parcel out some of their cattle to kin living in a variety of localities to herd until the drought passes. Also men without the

requisite herding labor would place their livestock in the care of kin commanding the necessary labor, but usually in such cases only small numbers of livestock have been involved. The households taking care of the livestock of kin in this manner have the right to the milk of the female stock while they are in their custody.

Throughout the district the slack in the ecological safety net both for crop and livestock production is tightening due to population growth, and any slack in the district is found in the lowlands. Since the 1930s migration has adopted a new form – entry into the urban labour market. The menfolk are the first to go out in substantial numbers onto the urban labour market, and today higher percentages of adult males are away from the their homes in search of a diversity of systems for livelihood support.

Generally, Mwingi district is a marginal area of unpredicted rainfall and subject to periodic drought. Ecologically it is divisible into two regions – the highlands and the lowlands. The former has more favourable climatic conditions and higher population densities. The lowlands possess the more extensive grazing grounds and are consequently all the more suitable for animal husbandry. Since the beginning of the century the population of the district has trebled. The cultivators have opened up new gardens in range-lands once assigned to grazing; while the grazers have moved in to use range-lands once the preserve of wildlife. This mechanism to meet population growth has however become less effective with time as most unused lands available is occupied or used for grazing. Land shortage has reached chronic proportions. Since the 1930s labour migrancy has become a necessary means of livelihood for many households, and reliance on it is more pronounced in the highland region of the district.

At times of inadequate food supplies, financial resources for purchase supplementation are accessible through selling of livestock, which unfortunately fetch low prices. A major source of income is urban and local paid employment especially for those households with working members. A small proportion of the local population earn their income from trade – running a local general store, buying and selling livestock, managing *hotelis*, producing and selling local beer. Minor sources of income are honey and beeswax production.

It is the concern of each and every rational household head is to find sufficient means to provide food in good and bad years and clothing for the members of his/her household. The provision of primary education is regarded as essential but not all households can support children in school for many years. Those with necessary means go a step further and build permanent living houses made from either cement blocks or mud bricks plastered and with corrugated iron roofing.

The copping mechanisms for the Mwingi population are diverse especially in relation to food access at times of low supply and production. It is widely evident that to maintain some level of survival, women from weak households have to work for money; fetching water for the urban population as well as making sisal-based products for sale. A greater majority of the households, at times of inadequacy, persist and survive on loans and /or transfer payments from their working kin, relatives settled in relatively better areas, perhaps outside Mwingi district, and diverse forms of assistance received from affines. Charcoal burning is also an important activity in the district as a survival mechanism. Some irrational decisions, though based on need, have a lot to offer; food is mainly is sold immediately after harvesting when prices are low.

Within the livestock sector, there are times of reduced pastures and inadequate water. Profound impacts are witnessed within the sector at such times. Up to the early 1970s, the local population had access to two types of grazing grounds; the home grazing grounds consisting of rangelands within or close to the vicinage and the distant grazing grounds, popularly known as *syengo*. The latter are extensive and were used as seasonal dry season grazing grounds. However, these areas have been extensively settled leading to a significant reduction of the range. A recent coping mechanism adopted at the household level has been to keep small numbers of stock which can depend on the available grazing area. As part of the supplement, individual households have a challenge to store maize stovers, other crop residues and dry

acacia pods for livestock feeding at times of drought. In most cases, these reserves tend to be limiting though with some ability to cushion the extended risks.

Generally, more than 60% of Mwingi population live in a "marginal" and dependant economic environment. This marginality is manifested in erratic and unevenly distributed rainfall, relatively high population density and land shortage. The residents are aware that the land they own and live in is unable to support them all based on the present land use and post-harvest practices. Total dependence on farming for their livelihood is impossible. The farming sector of the economy is only able to provide 20% of the active male adults of the vicinage with employment, the others seek employment elsewhere, the majority as migrant labourers. Sixty percent of the houses (the majority of which contain high levels of child dependents) rely primarily on non-farm incomes for their livelihood.

3.0 Framework for Risk Assessment – The Mwingi Case

3.1 Relevant Sectors for Drought Assessment

The situation in Mwingi is a typical semi-arid environment with a high frequency of drought. Preliminary assessment associates this with the people's lifestyles and ecological conditions. The levels of hardships experienced in the area as well as long experience and knowledge plus accustomisation to drought, drought stress and famine has taking the locals a step further. In nearly all these circumstances, it is possible to foretell with a high level of accuracy eminence of any of these conditions based on local locally recognised indicators. What is however unaccommodated in the local forecasting systems in severity, length of the period, expected ramifications as well as levels of preparedness. Again, the level of prediction is not common knowledge locally and therefore the understanding is not standardised.

is is not common the he Integrated Food Security Programme – Eastern Province (IFSP-E), a bilateral programme of the Federal Government of Germany and Government of Kenya, has been operating in Mwingi since 1994. The programme was established to help stabilise food security in the district, in order to contribute to a reduction of rural poverty and related negative impacts. To achieve this goal, the programme has committed itself to work in partnership with relevant and supportive stakeholders to develop mechanisms of:

2.4

MONITORING AND PREDICTION

Drought management can be improved by developing monitoring programmes that record changes in the ecosystem, and by using predictive models that present alternative courses of action for up to six months ahead. The models must indicate the probabilities of success of each action and be given early enough for a landholder to act upon them. While monitoring is not well regarded as a traditional science, it is in this area that the biggest gains in management are likely to occur.

Statistical summaries of crop yield and livestock numbers are provided yearly in Australia and occasional analyses of yield trends are made. Rainfall summaries are given monthly but these are not always interpreted adequately for different regions, for a meteorological drought for a few months may not be an agricultural drought. More effective decisions could be made if the monitoring included soil water contents, as is done in Canada, temperature accumulations, and estimates of seasonal and long-term growth.

Monitoring is particularly valuable in arid lands, as shown by Lay (1979) in a re-evaluation of bush density in northern South Australia (annual rainfall of 160 mm). After 22 years, bush death was negligible around a watering point, even within a radius of 0.3 km when more than 350 sheep were run together as a group. Further extensive monitoring is now being carried out in this area by the use of the photo-points technique. Photos are taken every six months and changes in vegetation are related to season and stocking rate.

Monitoring is also an essential part of regeneration studies, but it is necessary to fence off the area to exclude domestic and feral animals and pets because little regeneration occurs in unprotected areas of South Australia, even after more than 30 years (Hall et al. 1964). Rabbit plagues often coincide with the good seasons and kill the new seedling growth.

It is in the area of prediction that the greatest time and effort needs to be concentrated, and the variables used in the prediction must be readily available from recording centers near the landholders. In arid lands, regression analysis has been used to relate future cattle numbers to existing numbers and rainfall over three years (Young and Wilson 1978), and sheep numbers have been related to average annual rainfall (Condon 1968).

The output from regressions like these have some value in monitoring trends, but they are of limited value for prediction in the current season. Their usefulness would be improved if the regressions were updated during the season. A simple aid to help estimate rainfall probability during the growing season is the use of rainfall deciles.

At the end of August, for example, the total April-to-August rainfall is compared with the range of decile values for April-to-October. The probability of the amounts of rainfall required in

September-October to equal stated values for April-October can be calculated, e.g. for the April-August rainfall is 185 mm, then the amount needed in September-October to give an average season (decile 5) is 96 mm. This amount occurs in decile 8 of the September-October deciles. The probability of getting sufficient rain in September-October is therefore 2 years in 10.

In recent years, there has been a great increase in the use of models to estimate productivity. These have ranged active growth to more complex models with production and economic outputs. Many models however, only show the goodness of fit of data from past seasons – they show the rules of the game but not the current situation. In general, they have made little contribution to management decisions either for commerce or for the landholder. The major limitations seem to be the use of data from research trials rather than field populations, the lack of involvement of the potential users in the planning and interpretation of the model, and the lack of validation of their success in predicting outcomes. Thus it is difficult for the user to see how these models can improve his decision making.

However, more comprehensive models are now being tested. A water balance model was used to help relate animal production to livestock numbers, rainfall and soil moisture in areas where it was impossible to measure forage production (Reid and Thomas 1973). A similar approach was used by Easter (1975) to relate sheep production to soil water and pasture growth. Further developments by White (1978) and Toft and O'Hanlon (1979) have factors, various costs of production, and these are being tested on farming properties. Landholders are now becoming involved in modeling and the Flexcropping model in Montana, USA, includes questions asked by the landholder (Kresge and Halvorsen 1979).

An additional feature which we believe is necessary in models, is the capacity to update yield estimates during the progression of the growing season. We are developing such a model for wheat and pasture in South Australia. This model includes the water balance model of Greacen and Hignett (1976), time of sowing, a phenological-temperature sub-model and a relation between fry matter, water use and evaporation.

Yields are estimated several times during the growing season. Actual weather for the season is included regressively in the model and the rest of the growing season uses weather from both a decile 9 and a decile 1 season. The reduction in range of yield potentials and the season progresses is shown for wheat and pasture in Fig. 7-5. An early indication of yield can help commerce, plan its transport and marketing programs, and help farmers decide on the best strategies for livestock management, harvest needs and future finance.

An obvious valuable aid in management will be the use of remote sensing. Models using satellite data are already estimating soil water contents in the root zone, water use by crops and crop yields (Dalsted and Worchester 1979; Idso at al. 1978; Kanemasu et al. 1977). Such data are particularly useful in predicting trends in soil moisture and in vegetation condition during a growing season, and will be more widely used in the future.

INVOLVEMENT OF LANDHOLDERS IN LAND USE AND DROUGHT STRATEGIES

Landholders are generally reluctant to accept new innovations unless these can be seen to immediately improve their lot. In many cases, however, drastic changes in their existing methods are required, e.g., a big reduction in stock numbers in overgrazed areas, before any technical improvements can be made. Yet these people themselves have a lot of experience and

knowledge of coping with unreliable rainfall and improvement cannot be achieved unless they cooperate and unless they are helped to change their lifestyle.

Any projects aimed at coping with drought must, therefore, incorporate these people from the beginning. They should be encouraged to form their own local groups that can communicate with the administrators and research staff. Financial assistance will usually be needed to help the landholders adopt new practices or to leave the industry.

A suitable district organization could be one that follows the role of soil conservation boards. The boards comprise mainly landholders whose job is to work with government and promote and foster soil conservation activities, including group projects, amongst the landholders. By this means, the landholders share in their own destinies.

DROUGHT INDICES

Introduction: A number of drought indices have been used. A chronological list of drought indices can be found in WMO (1975). The simple indices make use only of the mean annual precipitation, such as Lang's rain factor index (Lang 1915) and Martonne's (1926) index of aridity. Others, in addition to the annual or monthly precipitation, use monthly temperature, annual evaporation or evapotranspiration, annual potential evapotranspiration, soil moisture losses, antecedent soil moisture, and others. Among the latter kind of indices, the most used is the Palmer index, (Palmer 1965), a function of accumulated weighted differences between actual precipitation and precipitation requirement in terms of evapotranspiration. Two indices of different type, namely the variability and annual precipitation deciles have also been frequently used in literature on drought. These two indices are applied to Portugal in this text.

Variability of annual precipitation: The coefficient of variation or the variability of annual precipitation, defined as the ration of the standard deviation to the mean, is frequently used as drought index. Chow (1964) shows that for the Western United States, where droughts occur frequently, the coefficient of variation of annual precipitation exceeds 0.35, while in the East, where droughts are less frequent, it ranges from 0.15 to 0.25. The variability is also used by Sancho and Arias (1978), who state that in Mexico the high variability in precipitation coincides also with arid or semi-arid lands.

A direct relationship may not exist between the high variability and the region aridity. For the Portuguese case, no clear relationship exists between variability of annual precipitation and mean precipitation of the four climatic regions. Also, the smaller the mean annual precipitation the smaller the corresponding standard deviation, implying approximately a constant variability for both dry and wet regions, with values ranging from 0.25 to 0.41.

Deciles of annual precipitation distributions. Another drought index used is the k-th decile of annual precipitation. This is the value which is not exceeded by the lowest 10k percent of annual precipitations observed in a sample of years.

Gibbs and Maher (1976) used annual precipitation at a set of stations observed from 1885 to 1965, in order to characterize droughts in Australia. They classified the observed annual precipitation according to their sample frequency (in percentage) as follows:

Classification	Frequency Limits (percentage)	Decile range
Very much above average	90-100	10
Much above average	80-90	9
Above average	70-80	9
Average	30-70	7 to 4
Below average	20-30	3
Much below average	10-20	2
Very much below average	0-10	1

It can be assumed that in a given year, areas with annual precipitation in the first decile are “drought areas”. This index was also for Portugal by the writers.

6.4 Food Security and Livestock Scenario – a situational analysis

2.2 Food and Fodder Security Scenario – situational analysis

2.3

3.0 Framework for Risk Assessment – based on the Mwingi situational analysis

"Drought-prone regions should develop response plans for drought monitoring, establishment of selected indices for identification of thresholds for onset and cessation of drought and for following the impact of drought in all areas of the economy especially in agriculture, water supply, energy and industry" (Obasi, 1986).

3.1 Relevant Sectors for Drought Assessment

3.2 What to Assess within the Sectors – Current Situation

3.2.1 *Crop Production Systems*

There are two rain seasons per annum: the March/April rains which fall from February until May and the November/December rains occurring from September until January the following year. (In compiling the seasonal returns the March/April rain statistics are estimated by adding the monthly returns of February, March, April and May; and the returns of November/December rain season are tabulated by adding the monthly returns of October, November, December and January of the following year. The rainfall returns of all these months together represent over 98% of the annual rainfall of the stations recorded). The rainfall statistics of three stations are selected – these are Kitui Town (latitude $1^0$22'S, longitude $38^0$01É, altitude 3,680ft.) which is situated in the highlands of Kitui, Mivukoni (latitude 0 24S, Longitude 14E, altitude 2,900 ft.) located in the northern lowlands, and Kanziku (latitude1.58S, longitude 38.20E, altitude 3,000 ft) situated in the southern lowlands of Kitui. The statistics indicate that (I) during 1942-60 more rain fell on average during the November/December rains than in the March/April rains both in the highlands and the lowlands; (ii) in both seasons on average the highlands receive sustainability more rain than the lowlands. Kitui Town receives on average approximately twice the rainfall Mivukoni obtains; the difference is slightly less between the returns of Kitui Town and Kanziku.

Another rainfall characteristic is rainfall reliability. It refers to the probability that the rainfall of any particular season is adequate and sufficient to provide an abundant harvest. Reliability depends on the type of crops grown. Maize and beans, the dominant crops of highland Kitui, require 15 inches (381mm) of rainfall per season (assuming and adequately even distribution), while millet and cow-peas, the major crop of lowland Kitui need 10 inches (254mm) of rainfall per season (again assuming an adequately even distribution). During 1942-60 at Kitui Town 24 out of 35 rain seasons recorded received sufficient rainfall.

Millet is more favoured in November/December rains and cow-peas in the March/April rains, since millet requires rainfall over a longer period when maturing, and in general the November/December rains have a wider span than the March/April rains.

The 10 inch and 15 inch minimum seasonal levels were derived from the annual minimum levels of 20 inches for sorghum and of 30 inches for maize over two seasons given by Glover, Robinson and Henderson 1954;604.

The highland area of Kitui has a rate of successful harvests although its crop regime requires more rain per season than the cropping system of the lowlands.

A major feature of the climate in Kitui District is the regular occurrence of drought and famine. Famine usually does not result from the failure of one season's rains but comes as an accumulative effect of a succession of poor seasons. Famines are the principal contingencies featured in the event calendars of the Kitui Akamba. Famine names relate to some characteristic of famine, or trait of the people's response to the famine. Sometimes people from different localities assign the one and same famine different names. Not all famines were widespread throughout the district. Some famines were confined to certain localities within the district; and usually the central highlands escaped more frequently from the ravages of long and severe droughts than localities of the lowlands.

Drought means a situation where rainfall is below what is normally required for adequate harvests and pastures (cf.Derrick 1977: 538). In Kitui District, where there are two rain seasons interspersed by dry seasons every year, drought is often localized, and in general the lowlands suffer more from it than the highlands. Drought only gives rise to high numbers of livestock deaths and severe food shortages when the rains fails over a succession of seasons. In some years there are short period of hunger (nzaa) just before the new crops are harvested. The Akamba term for famine is yua and it refers to a long period of hunger. By famine I refer to a severe shortage of food, which lasts a longer period of time, arising from failure of crops. This use of the term is in line with that used by the administration both in the colonial period and since Independence (1963). It is also in line with Rigby's use of the term in relation to the Gogo, who live in a similar environment in Tanzania. (Rigby 1969:20-22)

3.2.2 *Livestock Production*

3.2.3 *Water Access and Availability*

3.2.4 *Health Care and Nutritional Status*

3.2.5 *Welfare and Wealth Determination*

3.2.6 *Education and Literacy*

3.2.7 *State of Infrastructure*

3.2.8 *Marketing and Market Dynamics*

3.3 Determining Sector-specific Benchmarks

3.4 Validating Drought Monitoring Indices

4.0 Designing the Drought Monitoring Tool – What to consider

Designing the Drought Monitoring Tool – What to consider

4.1 Drought Occurrence; Trends and Levels

An operational system of drought level stages has been developed for application in the Mwingi situation in an attempt to make it easy to understand as well as differentiate drought intensity. It is presumed that these stages denote the severity of drought and is directly related to the associated impacts. The warning stages would be best viewed in the light of indicating the potential direction and level of threat to food and fodder security for the Mwingi economy. The stages are:

- *Normal*: Environmental, livestock, crop production, human development, education, nutritional and general welfare indicators show no unusual fluctuations and remain in the expected seasonal range. Normal is considered as the District Drought Line (DDL). This is rather an appropriate situation though without surpluses.

- *Alert*: Environmental indicators show unusual fluctuations outside expected seasonal ranges. This occurs within the entire district, or within localised regions. The indices' variance is within a range of up to 33% from normal stage. OR: Asset levels of households are still low to provide an adequate subsistence level and vulnerability of food insecurity is still high. At this level, the drought situation would be considered moderate or mild.

- *Alarm*: Environmental, livestock, crop production, human development, education, nutritional and general welfare indicators fluctuate outside expected seasonal ranges, affecting the local economy. This fluctuation is generally between 33 – 67% from the normal stage. This condition occurs in 75% plus parts of the district, and directly, and indirectly threatens food and fodder security of the livestock keepers of the north and eastern sections as well as communities heavily dependent on crop production. At the alarm stage, the situation is transitional – oscillating between moderate and severe. It therefore could be seen as high impact (though not extreme)

- *Emergency*: All indicators (used in drought risk assessment) are fluctuating heavily. 75% of these indicators are within the above 67% margin from the normal situation. Local production systems are depleted and completely collapsed as well as the dominant economy within the district. This situation affects the asset status and purchasing power of the population to an extent that welfare levels have worsened resulting in famine threat. The stage can be, though not always, indicated intra-migration and especially for livestock in search of water, livestock deaths, depleted home-based cereals storage, among others. This is the worst situation in the district's economy. In local terms, this could be seen as severe drought and extreme as indicated by the associated manifestations.

4.2 Essential Data and its Margins within the Benchmarks

4.3 Matrix Development; Operationalising the Indices

5.0 Guidance - Essential Steps in Drought Risk Assessment

5.1 What Variable and Parameters to Apply

5.2 Selection of Monitoring Sites

5.3 Data Gathering Tool and Frequency

5.4 Data Calibration and Formats

5.5 Initial Matrices and Interpretation

5.6 Preparation of Drought Situation Bulletins

5.7 Information Transfer and Preparedness

6.0 Emerging Lessons and Conclusions

6.1 Key Lessons – what emerges from the in-depth survey

6.2 Conclusions

6.3 Way Forward

Annexes

Annex 1.0: Survey Team Operations and Composition

a). Team Diversity:

The team undertaking this socio-economic survey was diverse and well experienced in field-based operations. Though the assignment was guided by a structured questionnaire, there was also need for personal Research Assistant input in observations, guiding questions and probing for answers from our respondents. Basically, this was because the Mwingi population has all along lived with drought and therefore developing mechanisms of isolating extremes required concise and knowledge-equipped individuals. As a matter of principle, it was therefore necessary to recruit heavily from the locals and by extension, people with a base of understanding of ASAL economies.

In total, this team was made up of 9 persons, including the team leader. By name, the individual persons forming the team were;

- Joseph Mathuva: The field team leader and also a Research Scientist in charge of the in-depth socio-economic study. Mathuva, being the project leader, was charged with the responsibilities of reviewing field data, developing data entry and cleaning strategies as well as producing this report.
- Grace Wambugu: The assistant field team leader and also a Research Assistant with the socio-economics section, Laikipia Research Programme. Grace was charged with the task of joint-development of the data gathering tool and entry for analysis.
- Jane Wacuma: An experienced Research Assistant with field-based expertise in a wide range of studies undertaken in the framework of Laikipia Research Programme. Jane took time to assist in data entry and cleaning for analysis.
- Beth Kyalo: An experienced Research Assistant with field-based expertise in the Mwingi situation. She has previously worked with Laikipia Research Programme for a separate project in the area and therefore was considered useful in the process due to her hand-on experience both with the local economy and the language.
- Ruth Ndunge: An experienced Research Assistant both in socio-economics and agroforestry with field-based expertise in the Mwingi situation. She has previously worked with Laikipia Research Programme for a separate project in the area and hence her knowledge proved useful in the assignment. She was a useful sub-team leader.
- Jeniffer Kinoti: An experienced Researcher in social ecology and Geographical Information Systems (GIS). Kinoti has previously worked in Mwingi under Laikipia Research Programme on a separate assignment assessing the local economy support and hence her experience was found useful in this project.
- John Kyalo: A Research Assistant with a fresh conceptual mind. He was considered useful for his knowledge of the local economy, capacity to reflect and language advantage.
- Festus Munyao: A Research Assistant with a fresh conceptual mind. He was considered useful for his knowledge of the local economy, capacity to reflect and language advantage.

- Everett Kyongo: A Research Assistant with concise expertise based on his "working with rural communities" in Machakos experience with essential language advantage and knowledge of the area.

b). Activities and Organisation:

During the field campaigns, the team was re-organised into four teams each with two individuals. All attempts were made to ensure that, in each of theme, there was at least one person who understood and comprehended the local language since about 40% of the population in the sampled sites were considered illiterate. One person in each sub-team would therefore guide the questions during the sitting while to the other recorded the responses. By the end of each day, these sub-groups would clean up their interviews by making revisions later to hand over the outputs of the day to the team leader for review. For each particular day in the field, each sub-team would be expected to visit and interview at least three randomly selected households.

A schedule of working sites was pre-developed in the office after selection of the villages to be visited. This meant that at any day the whole team was in the field, the working area was known to each and every member. The day-to-day running and work organisation was guided through an itinerary discussed and agreed upon among the team members. By the close of the operations, the spread of the exercise over the allocated days and achievement against targets is provided in details in the operational programme the field component [see c) below].

c). Operational Programme:

August 2001

Tue. 21st:	- Travel to Mwingi from Nanyuki.
Wed. 22nd:	- Visit Kavoloi Sub-location and make initial contacts with the local administration for site selection.
	- Pay a courtesy call and briefing to the GTZ/IFSP-E offices, Mwingi, meet the Katse GTZ/IFSP-E Zone staff.
	- Travel to Nguni GTZ/IFSP-E Zone Co-ordinator for briefing and make preparations for support in site selection.
Thur. 23rd /Fri. 24th:	- Kavoloi in-depth field campaigns – Kitumbi village.
	- Visit Migwani GTZ/IFSP-E Zone offices for briefing and develop basis site selection, initial visit to Migwani Market.
Sat. 25th:	- Nuu Market for market dynamics.
Mon. 27th /Tue. 28th:	- Migwani – working in Kaliluni for the in-depth survey – Ithambwa Ngau village.
Wed. 29th /Thur. 30th:	- Nuu – working in Mwambiu for the in-depth survey – Mbia village.
	- Travel to Nanyuki for field-break and data consolidation.

September 2001

Wed. 5th:	- Travel to Mwingi from Nanyuki.
Thur. 6th:	- Nuu – completing in-depth campaigns within Mbia village.

	- Visit Ukasi for discussions with the area Chief on possibilities and basis for village sampling.
Fri. 7th:	- Tseikuru – meet the area Chief and site administrator for benchmarking village selection and organising for later data collection.
	- Travel to Katse market for market data collection.
	- Visit Kakuyu area and hold discussions with the Local Administrators on the objectives of the project mission as well as select site.
Sat. 8th:	- Kakuyu – holding discussions with the assistant chief and initiating in-depth data collection – field campaigns within Kativa Ngii village.
Mon. 10th:	- Kakuyu – completing in-depth campaigns within Kativa Ngii village.
Tue. 11th /Thur. 13th:	- Tseikuru /Nziitu – in-depth field campaigns in Kalimbui village and assessment of market dynamics in Tseikuru market.
Fri. 14th:	- Migwani – data collection from schools and market dynamics assessment, Migwani.
Sat. 15th:	- Kyuso centre – market dynamics assessment.
Mon. 17th:	- Nguni, Nuu and Kavoloi – market dynamics assessment and data collection from schools.
Tue. 18th:	- Travel from Mwingi to Nanyuki.

Annex 2.0: Sample Sites and Basis for Selection

The commissioning of this in-depth socio-economic survey in Mwingi called for appropriate selection of sites owing to the fact that it was being undertaken during a relatively dry year, at a time when it is not possible to draw regional distinctions. This survey has been carried out to provide some horizons and basis for regional generalisation and comparison in the processing of setting acceptable benchmarks for drought monitoring. Selection of the sites was therefore guided by four organisational and operational principles;

- *The call for scientific considerations in designing survey tools and sampling*: Laikipia Research Programme, having been involved in scientific studies with an experience of over 16 years in research considers the design as an essential determinant of the output quality. This lead to the adoption and development of a household questionnaire complemented by short discussions with lead persons, market surveys, search for health-related and school attendance data. The initial sampling design for representative areas were considered based on the recent landsat images (February 1999) especially in view of the varying land cover characteristics. In this respect, it was essential to ensure that more than 50 households were generally reached and baseline data collected. There was also need to cover other sectors such as markets, schools and health facilities to ensure that all points that would illustrate signals of drought influence were reached and evaluated.

- *Recognition of divergent agro-ecological zones:* Laikipia Research Programme considered a distributive spread over the district taking into cognisance varying land-use systems, farming systems, and agricultural potentials based on the existing agro-ecological zones of Mwingi. The district falls within 3 broad AE belts that provide a breakdown of 6 zones. In selecting the sites, all attempts have been made to include the 6 zones within the confines of the survey (see selected sites on AEZ overlay – Figure**).

- *Recognition of local administration:* Working in Mwingi, like any other district in Kenya, as a matter of protocol it is important to recognise the local administration. The village, in this situation, was considered to be the smallest unit of operation and application. Again, the village forms the lowest monitoring unit under which drought assessment can is operationalised. This survey has therefore been carried out using village as the delimiting unit.

- *Taking care of GTZ/IFSP-E's logistics and organisational interests:* To ensure that the client's interests are put at heart, attempts have been made to recognise the four important zones under which the operations of IFSP-E are founded and based. By IFSP-E's delineation, Mwingi is divided into 4 zones; Migwani Zone (Migwani and Central divisions), Tseikuru Zone (Tseikuru and Ngomeni divisions), Katse Zone (Katse and Mumoni divisions), and Nguni Zone (Nuu, Nguni and Mui divisions). In selecting the working sites, each of the four zones has been represented. In addition, the selection process of these villages has ensured that due consideration is made on the level of involvement of GTZ/IFSP-E; this office considers it important to ensure that this survey is perhaps undertaken in areas where it has had little involvement. Local smallholders, being the key target group may be getting fatigued by unending questioning.

Founded on the above bases, Laikipia Research Programme identified six villages achieving a wide spread, falling within nearly 85% of all the zones and at least one site in each of the 4 coordination zones. However, though the six sites were selected in the office, the operations in the field brought in their own challenges. One site was dropped from the list after its characteristics were found quite similar to a site falling in the same Coordination Zone. In addition, there were various challenges faced such as long

walking distances between homesteads hence stretching the allocated field period beyond expectation. In the end, only 5 villages were at last used as data gathering sites for the household-based interviews while markets were spread in centres of significance. The villages are;

Village	S/location	Division	Coord. Zone	AEZ
Kitumbi	Kavoloi	Central	Migwani	UM4, LM4
Ithambwa Ngau	Kaliluni	Central	Migwani	UM4, LM4 (with some UM3 influence
Mbia	Mwambiu	Nuu	Nguni	LM5
Kativa Ngii	Kakuyu	Mumoni	Katse	LM5, LM4, UM4
Nziitu	Kalimbui	Tseikuru	Tseikuru	IL5, LM5

Most of the centres fell outside the villages of operation. Centres sampled for market dynamics include;

- Kamuwongo
- Migwani
- Nuu
- Nguni
- Kyuso
- Katse
- Tseikuru

Annex 3.0: The Concept of Drought – A detailed categorisation[10]

Drought has been classified into the following 4 categories:

- *Meteorological drought*: Refers to a condition when precipitation amounts are below the expected normal /average. The assumption here is that ecosystems and human activities are adapted to the average precipitation of the area and below average departures will induce moisture stress on the ecosystem. The impact of below normal rainfall is reflected in poor crop yield, reduced biomass, low level of surface run-off in rivers and streams, and scarcity of pastures.

- *Hydrological drought*: Is a condition when the aggregate run-off is less than a long-term average run-off. This is a period during which stream flows are inadequate to supply established uses under a given water management system, and is a situation reflected on multi-purpose dams, irrigation schemes, water-driven industries such as water mills.

- *Socio-economic drought*: This is the effect of droughts on the demand and supply of goods. Drought, as per the socio-economic approach, occurs when supply falls below an established level of requirement or demand due to shortages of rainfall. The impact of drought in this case is often exaggerated because people tend to blame it wrongly for all sorts of shortages associated with other externalities such as hoarding.

- *Agricultural drought*: Refers to a condition where the water needs of plants and animals are not met. This type can be illustrated in terms of incipience, permanence, and /or seasonality.

[10] After Abate, 1997; *The Concept of Drought – Are we really helpless?*

Annex 4.0: Baseline Data Gathering Tool - Socio-Economics

a). Household Questionnaire:

LAIKIPIA RESEARCH PROGRAMME & GTZ/IFSP-E MWINGI

DROUGHT MONITORING FRAMEWORK – IN-DEPTH SOCIO-ECONOMICS SURVEY

I. SITE DETAILS

Division	
Location	
Sub-location	
Village	

II. INTERVIEW DETAILS

Interviewer(s)		
Date		
Number		

III. RESPONDENT'S DETAILS

Name				
Age (years)				
Gender	Male		Female	
Position in the household				
Religion				
Education level				

IV. HOUSEHOLD CHARACTERISTICS

(*Family Tree*)

Age
Activity (e.g. schooling, working – by sector)
Income levels
Highest level of education attained
Circle all those persons on-plot
Place of residence for those outside the plot

V. CROP PRODUCTION SECTOR

1. Which crops do you normally grow? Indicate their general acreage.

Crops Grown	Acreage
Maize	
Millet	
Sorghum	
Green grams	
Cow peas	
Pigeon peas	
Beans	
Others (specify)	

2. Elaborate on the farming systems applied)…….

3. Total size of land under crops (Observation)…….

4. Size of land under fallow ……..

5. Size of land devoted to livestock /grazing ……..

6. Size of land under irrigation:……..

7. Crops grown under irrigation:…….……..

8. Other land(s) elsewhere: Yes /No

9. Sizes of these land(s):…….……

10. Uses of these other lands:…….……..

11. Total land size of the household:…….

12. Which crops did you harvest during the last season and how much? For how long could it last your household?

Crops Grown	Amount harvested (in bags or *debes* or kgs)	Months to last
Maize		
Millet		
Sorghum		
Green grams		
Cow peas		
Pigeon peas		
Beans		
Others (specify)		

13. Was this a good /normal /bad season to you? ……. Explain
……
……

14. Apart from these food crops, are there other forms of farm produce that are considered important food supplements

Crops Grown	Amount harvested (State the units)	Months to last
Pumpkin		
Cassava		
Sweet potatoes		

15. Did you sell /buy any of the food crops during the last season?
Sold: Yes /No
Bought: Yes /No

16. How much?

Crops	Amount sold(kg)	Average Selling Price (per kg)	Amount bought (kg)	Average Buying price (per kg)
Maize				
Millet				
Sorghum				
Green grams				
Cow peas				
Pigeon peas				
Beans				
Others (specify)				

17. Where do you normally sell your food crops? …….. How far is it …….. Km? /hrs?

18. What do you use the money for? (Prioritise the first 5 uses)

1. ……
2. ……
3. ……
4 ……
5. ……

19. Where do you normally buy you food from? …… How far is it? …… Km/hrs.

20. Where do you get money to buy food? (by order of importance)

1. ……
2. ……
3. ……
4. ……
5. ……

21. How do you store your farm produce?

1. ……
2. ……
3. ……

22. Do you face any storage problems? Yes/No

23. Which are these storage problems?

1. ……
2. ……
3. ……
4. ……
5. ……

24. How do you control these storage problems?

Storage Problem	Control
1.	
2.	
3.	
4.	
5.	

25. Have you faced any shortfall in food supply since the beginning of year 2000? Yes/No.

26. Which months did you face the shortfall?

……
……

27. What caused this shortfall (if any)?

……
……

28. How do you normally face the shortfall?

……
……
……

29. Did your family receive any relief food/FFW during the last season? Yes /No

30. If yes, when and how much?

When	Amount

31. Which organisations were involved in distributing relief food?
……
……

32. Is there a crop production extension officer in your area? Yes/No

33. Has the officer ever visited your farm? Yes/No

34. What assistance /advice did he/she offer to you?
……
……
……

35. How effective was the advice to you? Explain
……
……
……

36. What services /advice do you think the officers should offer
……
……
……

37. Briefly explain some major problems facing crop production in this area?
……
……
……

VI. LIVESTOCK DEVELOPMENT SECTOR

1. Number of livestock for the household;
   1. Cattle: ……..
   2. Sheep: ……..
   3. Goats: ……..
   4. Donkeys: ……..
   5. Poultry: ……..
   6. Beehives (By typology); (log type /traditional, KTBH, Langstroth etc.) ……..

2. What type of livestock breeds do you keep – in numbers?

Animal	Traditional (1)	Exotic (cross-breeds) (2)	Pure (3)
Cattle			
Sheep			
Goats			
Donkeys			
Poultry			
Others (specify)			

3. How do you feed your livestock – by breed?

Animal	Breed types	Mode of feeding
Cattle		
Goats		
Sheep		
Poultry		
Donkeys		
Others (specify)		

4. Source of feeds;

1. ……
2. ……
3. ……

5. If pasture, is there land set aside for this? Yes/No

6. Size of the pasture land…….(acres)

7. Where do you water your livestock? …… (place) Give distance …… km/hrs

8. Provide the following details:

Season	Water sources	Distance (km/hrs)	Reliability (months in use)
Wet season			
Dry season			

9. What are the main livestock products?

1. ……
2. ……
3. ……
4. ……
5. ……

10. How much of the livestock products is produced, sold and at what price?

Product	Amount Produced	Duration	Amount Sold	Price	Months available

11. For what purpose do you sell these products? (Prioritise)

1. ……
2. ……
3. ……

12. About how many stock heads do you breed in a normal year?

Animal	Number bred in a normal year
Cattle	
Sheep	
Goats	
Poultry	
Donkeys	
Others	

13. About how many stock heads do you sell in a normal year and for what purpose?

Livestock type	Units sold	Purpose
Cattle		
Goats		
Sheep		
Chicken		
Donkeys		
Others		

14. Describe the condition of livestock market by indicating prices for different types of animals in a normal, bad and good season:

Livestock	Price (Normal Season)	Price (Good Season)	Price (Bad Season)
Cattle: milk cow			
Cattle: bull			
Cattle: heifer			
Sheep			
Goats			
Chicken: cock			
Chicken: hen			
Donkey			

15. What are the characteristics of a good, normal and a bad season?

Type of the season	Characteristics
Good season	
Normal season	
Bad season	

16. Where do you normally sell your livestock? ……..…… (place) Give distance …..… km/hr

17. What is the mode of transport to the market?
……

18. Where are most of the livestock buyers coming from?
1. ……
2. ……
3. ……

19. About how many livestock do you consume per year?)

Type of consumption	Number
Slaughtering	
Given out as gifts	
Dowry	

20. What are the main diseases affecting livestock and their possible causes?

Animal	Disease	Possible Cause e.g. pests	Common Season or Months
Cattle			
Sheep			
Goats			
Poultry			
Donkeys			
Bees			
Others (specify)			

21. How many animals have you lost in the last one-year?

Animal	Death	Loss	Theft	Cause of death
Cattle				
Sheep				
Goats				
Poultry				
Donkey				
Others (specify)				

22. What kind of extension services /advice do you get from your extension officer?
……
……

23. If none, what advice would you require for better livestock production?
……
……

24. What are the main constraints in livestock production?
……
……
……
……

VII WATER SECTOR

1. Your current water sources: Indicate distance and time taken (to & from), and ownership.

Source	Distance (km)	Time to source (hrs.)	Time at source(hrs)	Months used (per year)	Ownership
Shallow well					
Water hole					
Borehole					
Tank /Jar					
Dam					
River/stream					
Others					

2. What are the main uses of water in the homestead?
   1. ……
   2. ……
   3. ……

3. Which water sources remained in use over the last dry period?
   1. ……
   2. ……
   3. ……

4. Which water sources did you use when you settled here? Indicate type, distance and time taken.

Source (Type)	Name of source /place	Distance to source (km)	Time taken to source

5. Which of these are not in use today? Explain why?
……
……

6. Do you have a private water source? Yes /No

7 If yes, what type?
   Type:……

8. What necessitated you to develop this source?
   ……
   ……

9. For how long is this source feeding the household with water in a year?
   ……

10. What are the uses of water from this private water source?
    1. ……
    2. ……
    3. ……

11. What is the total amount of water fetched daily?
    ……

12. What is the amount of water used daily?
    ……

13. Source(s) of labour for water fetching /who fetches water?
    1. ……
    2. ……
    3. ……

14. Are there specific days /hrs for fetching water? Yes/No

15. Which ones?
    ……
    ……
    ……

16. Mode(s) of transporting water to the homestead (in order of importance)
    1. ……
    2. ……
    3. ……
    4. ……

17. If more than one mode, determine the proportion (out of 10)
    1. ……
    2. ……
    3. ……
    4. ……

18. How many trips do you make per week to fetch water from the main source? – by mode

Type of mode	Number of trips per week	Litres per trip

19. Which months do you use each specific water source?

Water source	Months of use (in a year)

20. What types of water storage facility or facilities are in the homestead? Indicate capacity.

Type of storage facility	Capacity (litres)

21. What major water problems do you experience here?
……
……
……
……

VIII HEALTH SECTOR

1. Indicate common human diseases in the household, what do you think are the causes and season of occurrence.

Disease	Possible cause	Common season of occurrence
1.		
2.		
3.		
4.		
5.		
6.		

2. How are these diseases normally treated?

1. ……
2. ……
3. ……
4. ……

3. How far is the nearest public, private, mission health facility? (in Km /hrs)

Facility type	Name /& centre	Distance (Km /Hr)
Public		
Private		
Mission or NGO-operated		

4. Which services are offered in each of these health facilities?

Facility type	Services
Public	
Private	
Mission or NGO-operated	

5. Have all your children undergone the immunisation programme? Yes/No

6. If no, why?
……
……
……
……

7. Do you have a toilet /latrine? Yes/No

8. If yes, what type?

9. Assess the present status, materials of construction, general cleanliness, hole cover etc.
……
……

IX. WELFARE /WEALTH INDICATORS

1. What are the main sources of income?

1. ……
2. ……
3. ……

2. Assets of the household (Indicate where the asset type is more than one)

1. ……
2. ……
3. ……
4. ……

3. Main fuel sources:

For Cooking	For Lighting

4. If charcoal is among the sources used, is it from own production? Yes/No

5. If no, is there charcoal burning around? Yes/No

6. Which tree species /woody plants are commonly used?

1. ……
2. ……
3. ……

7. About how many bags of charcoal do you produce per month? …….

8. How many bags do you sell? …….

9. Price per bag /*debe*? ……..

10. How much charcoal do you use at home per month? ……

X EDUCATION SECTOR

1. What is the distance to the nearest nursery /primary /secondary school?

Educational facility type	Name	Distance (km/hrs)
Nursery		
Primary		
Secondary		

2. Number of children that are in school in the household:

(*Confirm from the Family tree*)
Nursery
Primary
Secondary
University
Other (specify)

3. If there are some who have dropped out of school, give reasons.

……
……

4. About how much money do you spend on education per year?

……
……

5. Give some problems associated with education.
……
……
……

XI. INFRASTRUCTURE

1. What is the distance to the nearest shopping centre? (in Km) ……

2. What kind of services /enterprises are found in this centre?
   1. ……
   2. ……
   3. ……
   4. ……

3. What important services /facilities /enterprises do you think are missing?
   1. ……
   2. ……
   3. ……
   4. ……

4. Where else do you go for these missing services?
   1. ……
   2. ……

5. Is there a market day in this centre? Yes/No

6. If yes, which day? ……

7. If you access the centre by road, how is the condition of this road?
……

8. What mode of transport do you use to this centre?
……

9. If by public means, what is the cost?
……

10. What is the distance to the nearest tarmac road?
……

11. Since when have you been using this centre? ……
……

b). Assistant Chief /Resource Person /Elder Discussion Issues:

LAIKIPIA RESEARCH PROGRAMME & GTZ/IFSP-E MWINGI

DROUGHT MONITORING FRAMEWORK – IN-DEPTH SOCIO-ECONOMICS SURVEY

INTERVIEW DETAILS

Interviewer(s)		
Date		
Respondent		
Position in society		
Village /Sub-location		

Issues of Discussion

ASSISTANT CHIEF /RESOURCE PERSON /ELDER

1. Number of villages in the sub-location
2. Number of schools in the village /sub-location
3. Number of households in the village
4. Security situation, local brewing, charcoal burning
5. Community's mechanisms for accessing food during times of shortfall
6. Average number of livestock per household
7. State of Infrastructure in the village
8. Religious distribution of the locals
9. Sources of water and their reliability
10. Services to the livestock sector and their access
11. Number of shopping centres
12. Community groups in place and their activities, working days and management
13. Numbers of NGOs in the village, history and activities
14. Development agenda of the area

c). Primary Schools' Management Discussion Issues:

LAIKIPIA RESEARCH PROGRAMME & GTZ/IFSP-E MWINGI

DROUGHT MONITORING FRAMEWORK – IN-DEPTH SOCIO-ECONOMICS SURVEY

INTERVIEW DETAILS

Interviewer(s)		
Date		
Respondent		
Position in school		
Name of school		
Village		

Issues of Discussion

Basic Education Sector - HEADMASTER

1. History of the school, changes in enrolment over time (5 years last)
2. Number of children enrolled per class by gender for the last three years (5 years [since 1996])
3. Attendance trends per class by gender per month (Year 2001 [last two terms])
4. Number of teachers in the school – How has this changed over time?
5. Problems affecting education in the area

d). Primary Schools' Management Data Needs:

LAIKIPIA RESEARCH PROGRAMME & GTZ/IFSP-E MWINGI

DROUGHT MONITORING FRAMEWORK – IN-DEPTH SOCIO-ECONOMICS SURVEY

Attachment (for individual primary schools)

INTERVIEW DETAILS

Data collectors:		Date:	
Name of school:		Village:	
Contact person:		Position:	

Enrolment for the last 5 years + number of teachers.

	CLASS 1		CLASS 2		CLASS 3		CLASS 4		CLASS 5		CLASS 6		CLASS 7		CLASS 8		TEACHERS
	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	
1996																	
1997																	
1998																	
1999																	
2000																	
2001																	

Attendance trends per class by gender per month (year 2001)

	CLASS 1		CLASS 2		CLASS 3		CLASS 4		CLASS 5		CLASS 6		CLASS 7		CLASS 8		
	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	TOTAL
JAN																	
FEB																	
MAR																	
APR																	
MAY																	
JUNE																	
JULY																	
AUG																	
SEPT																	

e). Health Sector Data Needs:

LAIKIPIA RESEARCH PROGRAMME & GTZ/IFSP-E MWINGI

DROUGHT MONITORING FRAMEWORK – IN-DEPTH SOCIO-ECONOMICS SURVEY

INTERVIEW DETAILS

Interviewer(s)		
Date		
Number		
Respondent		
Position in H. Facility		
Name of facility		

Issues of Discussion

HEALTH SECTOR - HEALTH OFFICER
1. History of the health facility
2. Services offered in the health facility
3. Major diseases and disease incidences
4. Malnutrition cases of children under 5 years per month for the last 6 months (per village if possible)
5. Signs of malnutrition on children
6. General health situation

f). Assessment Tool for Market Dynamics:

LAIKIPIA RESEARCH PROGRAMME & GTZ/IFSP-E MWINGI

DROUGHT MONITORING FRAMEWORK – IN-DEPTH SOCIO-ECONOMICS SURVEY

INTERVIEW DETAILS

Interviewer(s)		
Date		
Number		
Respondent		
Position in market		
Market centre		

Discussion Issues and Observation Aspects

MARKET DYNAMICS

I. CROP SALES - STORE OWNERS

1. Current store prices of staple foods / cereals (per Kg)
2. Average number of buyers per store per day (current situation)
3. Average amount bought per individual per day
4. Average number of sellers of cereals per store per day (current situation)
5. Average amount sold per individual per day
6. Sources of food-stuffs at the store
7. Restocking frequencies (per month) and quantities per stocking time

II. LIVESTOCK SALES

1. Livestock numbers per type on a market day
2. Market gate average prices per livestock type
3. Livestock sources within the area and their distances
4. Sources of buyers

Annex 5.0: Classification of Drought-related Impacts

Economic Sector

- Loss from crop production
  - annual and perennial crop losses; damage to crop quality
  - reduced productivity of cropland (wind erosion, etc)
  - insect infestation
  - wildlife damage to crops

- Loss from dairy and livestock production
  - reduced productivity of range-land
  - forced reduction of foundation stock
  - closure/limitation of public lands to grazing
  - high cost /unavailability of water for livestock
  - high cost /unavailability of feed for livestock
  - high livestock mortality rates
  - increased predation
  - range fires

- Loss from timber production
  - forest fires
  - tree disease
  - insect infestation
  - impaired productivity of forest land

- Loss from fishery production
  - damage to fish habitat
  - loss of young fish due to decreased flows

- Loss of national economic growth, retardation of economic development
- Income loss for farmers and others directly affected
- Loss from recreational businesses
- Loss to manufacturers and sellers of recreational equipment
- Increased energy demands and reduced supply because of drought-related power curtailments
- Costs to energy industry and consumers associated with substituting more expensive fuels (oil) for hydroelectric power
- Loss to industries directly dependent on agricultural production (e.g, machinery and fertilizer manufacturers, food processors, etc.)
- Decline in food production/disrupted food supply
  - increase in food prices
  - increased importation of food (higher costs)

- Unemployment from drought-related production declines
- Strain on financial institution (foreclosures, greater credit risks, capital shortfalls, etc.)
- Revenue losses to federal, state, and local governments (from reduced tax base)
- Revenue to water supply firms
  - revenue shortfalls
  - windfall profits

- Loss from impaired navigability of streams, rivers and canals
- Cost of water transport or transfer
- Cost of new or supplemental water resource development

Environmental Sector

- Damage to animal species
    - wildlife habitat
    - lack of feed and drinking water
    - disease
    - increased vulnerability to predation (e.g., from species concentration near water)

- Wind and water erosion of soils
- Damage to fish species
- Damage to plant species
- Water quality effects (e.g. salt concentration)
- Air quality effects (dust, pollutants)
- Visual and landscape quality (dust, vegetative cover, etc.)

Social Sector

- Food shortages (decreased nutritional level, malnutrition, famine)
- Loss of human life (e.g. food shortages, heat)
- Public safety from forest and range fires
- Conflicts between water users
- Health related low flow problems (e.g. diminished sewage flows, increased pollutant concentration, etc.)
- Inequality in the distribution of drought impacts /relief
- Decreased living conditions in rural areas
- Increased poverty
- Reduced quality of life
- Social unrest, civil strife
- Population migration (rural to urban areas)

Source: *UNEP, 1992; 12 – 13.*

Annex 6.0: Some Essential Data Benchmarks for Mwingi District[11]

Sector	Impact	Normal	Alert (mild)	Alarm (transitional)	Emergency (extreme)
Livestock	Death	0	Up to 15%	16 – 30%	31 – 40%
	Weight loss				
Water	Distance	No change			
	Time taken				
	Recharge rate				
Food	Market prices				
	Qty. in store				
	Rate of purchase				
	Food exp. From income				
Income					

[11] Based on data gathered during this baseline Survey – Understanding the Mwingi's socio-economic patterns and general fabric as a basis of developing a drough monitoring system.

To be framed for this section

1/2/02

- Saving capacity
- Outflow versus inflow – back home because of normacy
- Outward due to fewer resources.
- The times of falling back to friends for help
- Temporary transfer of part of stock to friends and members of kin at times of low pasture availability.
- Frequency of clothing purchase and timing
- Livestock for food selling
- Fluctuations in monthly food bill
- Monthly proportionate of luxury foods, preparation and consumption – chapati
- The rate of general school dues payments – to be assessed at the school level

Survivalist activities

- Local brewing
- Roadside kiosks
- Casual labor engagements – local environment
- Loaning