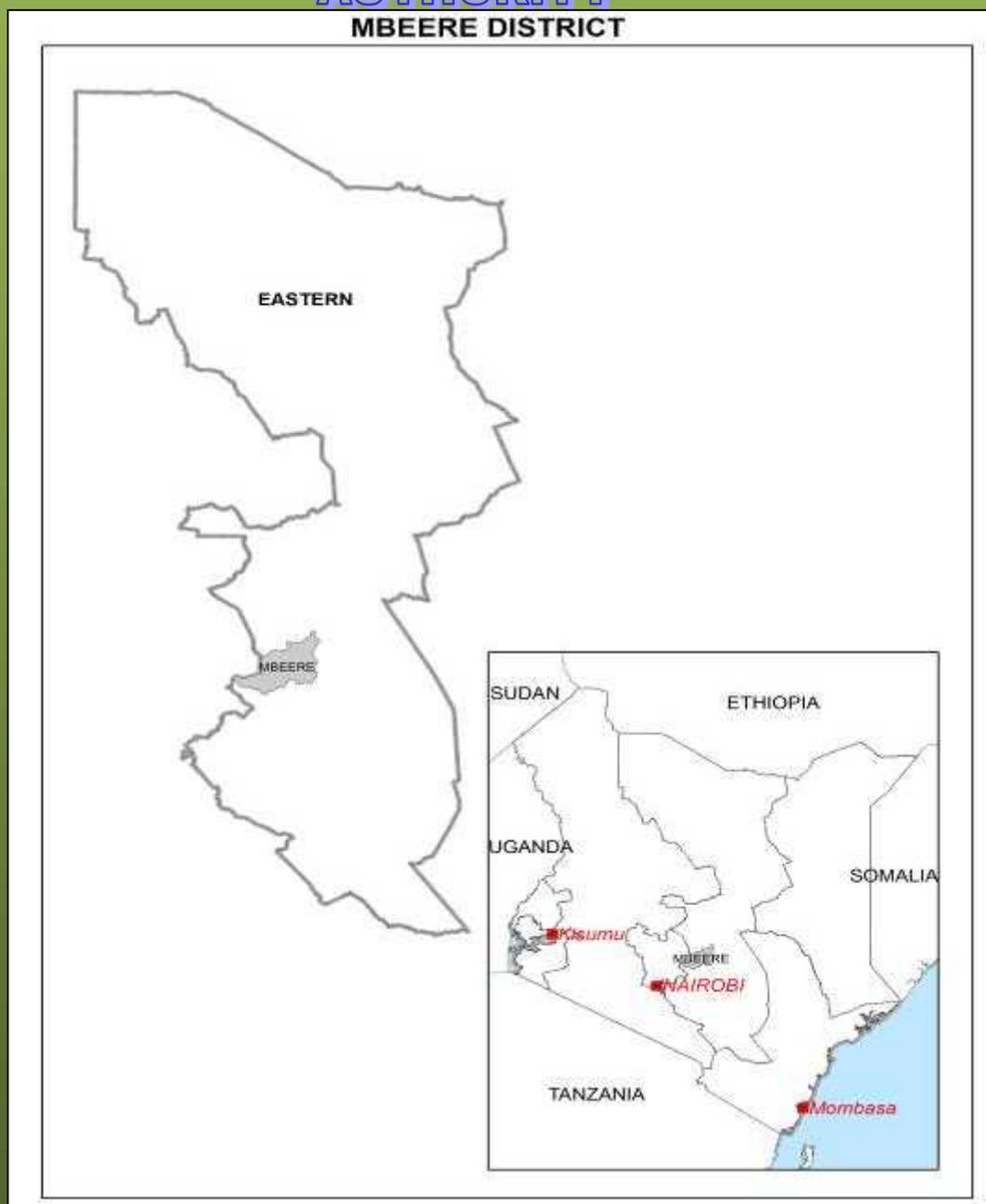




**REPUBLIC OF KENYA**  
**MINISTRY OF ENVIRONMENT AND MINERAL RESOURCES**  
**NATIONAL ENVIRONMENT MANAGEMENT**  
**AUTHORITY**



MBEERE DISTRICT  
MBEERE DISTRICT  
ENVIRONMENT ACTION PLAN  
ENVIRONMENT ACTION PLAN  
2009-2013  
2009-2013

## **EXECUTIVE SUMMARY**

The Environmental Management and Coordination Act 1999 provides for the formulation of the District Environment Action Plans every five years. This is the first District Environment Action Plan (DEAP) for Mbeere District. The preparation of the DEAP was undertaken through a participatory process both in the public, private and civil sectors. Further, this document has incorporated salient issues from the Divisions.

The DEAP highlights priority environmental issues requiring action to mitigate increasing environmental degradation for the District to achieve sustainable development. The report is divided into eight chapters. Chapter one gives the challenges of sustainable development and also describes the rationale for and preparatory process of the DEAP. It presents the district's main profile covering the physical features, demographic and agro-ecological zones.

Chapter two describes the District's Environment and Natural Resources of Land, Water, Biodiversity, rare, threatened and invader species, wetlands and agriculture, livestock and fisheries. For each resource, major environmental issues, challenges and proposed interventions have been identified.

Chapter three entails the human settlements and infrastructure in Mbeere District covering situation analysis, challenges and proposed interventions. Environmental challenges addressed include; waste management, sanitation, pollution, diseases, land use, demand for water, energy, materials for construction, land and wetlands degradation, policy and legislation..

Chapter four addresses environmental aspects in trade, industry, tourism and services sectors. The key issues under this chapter are high pollution levels from production and consumption sectors including weak enforcement of relevant legislations.

Chapter five discusses environmental hazards and disasters. The major hazards covered include those related to climate/weather and drought, flood, fire, galleys, disease outbreaks like malaria, and invasive species. Mitigations measures have been proposed for implementation.

Environmental information, networking and technology are discussed in chapter six. It emerges that environmental information and networking technology have continued to receive scanty attention. In order to achieve sustainable environmental management, it is necessary to focus on raising awareness and enhancing public participation at all levels.

Governance, Policy and Legal Framework as well as Institutional arrangements are covered in chapter Seven. The key issues addressed include, non compliance with environmental regulations, Conflicting laws and regulations, delays in approving EIA/EA, high cost of environment impact assessment and audit experts for small projects, weak enforcement of environment laws, lack of environment standards and regulations, inactive District Environment Committee. Chapter eight is the implementation Matrix.

## **FOREWORD**

The 1992 Earth Summit held in Rio de Janeiro came up with various recommendations, among them Agenda 21, a Global Environmental Action Plan. The theme of the Summit focused on how nations could attain sustainable development. The Government of Kenya embraced this idea by developing the first National Environment Action Plan (NEAP) in 1994.

Since independence, Kenya has continued to demonstrate her commitment to environmental management through various initiatives, among them the National Development Plans of 1974 and the National Environment Action Plan of 1994. Further, there have been a number of sectoral policies on environment in fields such as Agriculture, Livestock, Water, Energy, Food, Land, Wildlife, Forest, Industry, Trade, Arid Lands, Disaster Management and the Draft Sessional Paper No. 6 of 1999 on Environment and Development.

The Environmental Management and Coordination Act (EMCA, 1999) provides for the integration of environmental concerns in national policies, plans, programmes and projects. In this regard, EMCA 1999 provides for the formulation of National, Provincial and District Environment Action Plans every five years.

Environmental Action Planning is a tool that aims at integrating environmental concerns into development planning. The process followed in preparing this DEAP was participatory, involving various stakeholders from institutions and sectors, including the public, private, Non Governmental Organizations (NGOs) and local communities at District and Divisional levels. These consultative meetings provided the basis also for formulation of the District Environmental Action Plans (DEAPs) and finally the Provincial Environment Action Plan (PEAPs).

The DEAP addresses environmental issues from various sectors in an integrated manner and discusses their significance in development planning. It proposes a strategy for achieving sustainable development in line with Kenya's quest to meet the Millennium Development Goals (MDGs) Vision 2030 and Medium Term Plan (MTP). The Plan has brought out a number of proposed interventions, legal and institutional framework to be incorporated into sectoral development plans and programmes. Its implementation will be monitored by the District Environment Committee (DEC) and will be monitor through State of the Environment (SoE) Reporting

The preparation of the DEAPs for Mbeere District owes much to the technical and financial assistance provided by NEMA. This support, which included innovative community and civil society consultations, facilitation of DEC meetings, as well as final publication costs, is gratefully acknowledged

I wish to underscore that the 2009-2013 DEAP report is a broad-based strategy that will enable the District attain sustainable development as envisaged in Vision 2030.

**Dr. Ayub Macharia (PhD),  
DIRECTOR GENERAL (Ag),  
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## **ACKNOWLEDGEMENT**

On behalf of the National Environment Management Authority (NEMA) ,I would like to thank the Mbeere District Commissioner , who is also the chairman District Environment Committee (DEC) for spearheading the preparation process for this District Environment Action Plan,(2009-2013). I also wish to thank most sincerely the District Environment Committee and the District Environmental Action Plan Technical Committee for their invaluable inputs and approval of this environmental action plan.

I also acknowledge the contribution of the members of the local communities from the district who actively participated in the identification and prioritization of the environmental issues which formed part of this document.

NEMA also acknowledges the Provincial Director of Environment (Eastern), District Environment Officer, for their insights and dedication to this process. Last but not least I extend my gratitude to all those who contributed towards the finalization of this District Environmental Action Plan.

**Dr. Kennedy I. Ondimu**  
**DIRECTOR, ENVIRONMENTAL PLANNING**  
**& RESEARCH CO-ORDINATION**

## LIST OF ACRONYMS

AHI	African Highlands Initiative
AIDS	Acquired Immune Deficient Syndrome
ASAL	Arid and Semi-arid Lands
BAT	British American Tobacco
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CITES	Convention on International Trade in Endangered Species
DAO	District Agricultural Officer
DDO	District Development Officer
DDT	Dichlorodiphenyltrichloroethane
DEAPs	District Environment Action Plans
DEC	District Environment Committee
DEO	District Environment Officer
DLPO	District Livestock Production Officer
DRR	Disaster Risk Reduction
DWO	District Water Officer
EA	Environnemental Audit
EAI	Environnemental Impact Asses ment
EDP	Environmental Development Plan
EMCA	Environmental Management and Coordination Act (1999)
FDA	Focal Development Area
Ha	Hectares
IK	Indigenous Knowledge
KADI	Kamurugu Agricultural Development Initiative
KENGEN	Kenya Power Generating Company
KTDA	Kenya Tea Development Authority
KWS	Kenya Wildlife Service
LIS	Land Information System
LM	Lower Midlands
MDGs	Millennium Development Goals
MEAs	Multilateral Environmental Agreements
MKEPP	Mount Kenya East Pilot Project for Natural Resources Management
NEAP	National Environnent Action Plan
NEMA	National Environment Management Authority
NDP	National Development Plan
NGO	Non Governmental Organization
OPPP	Oil seed production and processing project
POPs	Persistent Organic Pollutants
PRSP	Poverty Reduction Strategy Paper
SEA	Strategic Environmental Assessment
SOE	State of Environment
SSIDP	Small scale irrigation development programme

TARDA	Tana and Athi River Development Authority
UM	Upper Midlands
UNCED	United Nations Conference on Environment and Development
WSSD	World Summit on Sustainable Development

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## **CHAPTER ONE**

### **1.0 Introduction**

#### **1.1 Preamble**

The United Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 had a double mandate of finding ways to protect the global environment, while ensuring that economic and social concerns are integrated into development planning. The Conference underscored the need to developing modalities for integrating environmental concerns into developing policies, plans, programmes and projects. It agreed on the guiding principles and a global plan of action for sustainable development commonly called Agenda 21.

The Government of Kenya is committed to achieving sustainable development in accordance with the Principles of Rio Declaration and Agenda 21. In this connection, the Government developed the National Environment Action Plan (NEAP), in 1994, and subsequently enacted the Environmental Management and Coordination Act (EMCA) no.8 of 1999. EMCA created the National Environment Management Authority (NEMA) to be the principal agency of government in coordinating all matters relating to the management of the environment. This includes the preparation of a State of Environment (SoE) report every year. The SoE report for 2003 was the first one under the Act.

The World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002, reaffirmed the commitments of the International community to the principles of sustainable development contained in Agenda 21 and the Millennium Development Goals (MDGs) of 2000.

Sustainable development is commonly defined as “*development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs*”. Development is also sustainable if it meets ecological, economic and social needs. This calls for the integration of environmental considerations at all levels of decision making in development planning and implementation of programmes and projects.

The 9<sup>th</sup> National Development Plan (2002-2008) states that *“The full integration of environmental concerns in development planning process at all levels of decision making remains a challenge to the country, and the need to integrate environmental concerns in development activities should be given high priority.*

The Environmental Management and Coordination Act (EMCA) of 1999 provides for the integration of environmental concerns into the national development process. The National Environment Management Authority (NEMA) is mandated to implement the Act and in particular coordinate the preparation of Environmental Action Plans (EAPs) at the District, Provincial and National levels.

## **1.2 Challenges of Sustainable Development**

Mbeere district is faced with daunting environmental challenges, which revolve around human activities and the quest for better livelihoods. In certain circumstances people, do not understand the implications of their activities on the environment. Even when they do not understand the negative impacts of certain human activities on the environment, they still engage in the same (overgrazing, encroachment on fragile areas, reclamation of wetlands and cutting of trees for charcoal production), because they form part of their short term coping mechanisms. The driving forces underlying community negative impacts on the environment are many and at times complex, but in most cases they are associated with poverty and the dire need of the people to derive livelihoods from exploitation of the limited natural resources in the district.

The search for livelihoods adversely affects the environment resulting in reduced land productivity and a reduced resource base, thus negatively affecting those same livelihoods. In essence, immediate survival needs of the population conflict with the long term needs for preserving and maintaining the viability and integrity of the environment. Ultimately, the poverty, search for livelihoods and environmental concerns in the district are intertwined and need to be addressed simultaneously.

The following are the key environmental issues as per the District Environment Committee findings:

- Soil erosion- especially on sloppy ground
- Deforestation and depletion of vegetation cover
- Overgrazing
- Water pollution
- Loss of Bio-diversity
- Waste management (Solid and liquid)
- Encroachment of catchment's areas, wetlands and watering points
- Conflicts resulting from resource use (land)
- Mining (quarrying, sand harvesting, brick making)
- Poverty (HIV, drug abuse)

Other issues indicated here below, are important in the district but were not ranked

- Unplanned human settlement
- Lack of awareness in environmental issues
- Disasters
- High population growth
- Invasion by alien species
- Air pollution

Sectoral Development Plans, Strategies and Programmes Impacting on Environment are highlighted in Table 1.

**Table 1: Sectoral Development Plans, Strategies and Programmes Impacting on Environment**

<b>SECTOR</b>	<b>PROJECT NAME</b>	<b>OBJECTIVES</b>	<b>TARGETS</b>	<b>ACTIVITY DESCRIPTION</b>
<b>Irrigation</b>	Eastern province horticultural & traditional food crops project Evurore div.	Improve small holders income, food security & create employment	Irrigate 100 hectares in Ishiara/ Kathigi scheme. Increase production of high value food crops by 100%	Rehabilitation of the scheme
	Small irrigation scale development Programme (SSIDP) District wide	Increase productivity through irrigated agriculture, create employment, & increase food security	Identify 4 individual pump fed schemes per year and 4 surface irrigation schemes during the plan period	Implement 4 individual pump fed schemes & 1 surface irrigation scheme per division per year
<b>Agriculture</b>	Oil seed production & processing project (OPPP) District wide	Increase farmer's income at household level. Employment creation, enhance nutritional status & agro-industry development	Acreage under oil crops increased by 50ha. Per year. Establish 5 oil processing sub-centers in the district per year	Establishment of oil seed processing sub-centers
<b>Water</b>	Kune water project, Evurore div	Sustain health & livestock production	More than 3,500 people will have access to safe water	Laying of distribution lines and development of the remaining springs.
	Gangara water project Siakago div	“	More than 5,000 people will have access to water	Construction of an additional intake and lying of distribution lines
	Makima water project Mwea div	“	To achieve the expected yield of 425m <sup>3</sup> /day	Replacement of pumping units and laying of extra pipeline
	Ena/Siakago water supply. Siakago &	Improve community	Distribution to all rural and	Rehabilitate the distribution

	Gachoka div.	health and welfare	urban areas for domestic, livestock & industrial use	network and laying 6mm line from Riandu tanks to Siakago district hqs
	Kanyuambora water supply (partially operational) Evurore div.	Reduce distance to safe water to promote community health and welfare	Completion by 2008	Rehabilitation of intake. Install parallel 150mm gravity main line to Kanyuambora and construct 90m <sup>3</sup> storage tank
	Kirie water project, Siakago div.	“	“	Development of Kiigi spring and laying of gravity line to serve more people
	Gachoka water project	Safe guard community health and welfare	Reduce distance to safe water to less than 4km	To construct an intake along Kiye river. Installation of a 225mm diameter gravity line to connect the existing network
	Karaba water project, Mwea div.	“	“	Construct an intake along Nyamindi river. Lay a 315mm diameter mainline to a proposed storage tank at Wamumu junction
	Boreholes and dams, district wide	To alleviate water shortage in all divisions	Increase water supply for domestic and livestock by end of 2008	Drill, develop and construct 15 or more boreholes and 6 or more dams. MKEPP activities.
	Rural afforestation and re-afforestation programme	Promote agro forestry, & reduce soil erosion	Establish tree nurseries in all divisions	Establishment of tree nurseries
<b>Livestock</b>	Tsetse/Trypanosomiasis control. District wide	Improve livestock productivity	Reduce incidence of trypanosomiasis by 50%	Spraying infected areas
	Meat inspection	Safeguard	Have meat	Construction of

		consumers health	inspected at centres	up-to-date slaughter houses in major markets
<b>Lands &amp; settlement</b>	Mwea settlement scheme	To settle the landless local people	To issue all the concerned with land certificates	Surveying demarcation and allocation of plots
<b>Forestry</b>	Establishment of tree nurseries in all divisions	To raise tree seedlings	Have tree seedling nurseries in each division	Promote tree planting activities in the district
	On farm afforestation, district wide	To control soil erosion	Benefits to farmers in terms of provision of wood products and soil conservation	Afforestation and re-afforestation of steep hills and degraded areas
<b>Fisheries</b>	Fish demonstration ponds, in all divisions	Enhance fish production, increase nutritional status and incomes at household level	Have a fish demonstration pond in each division	Construction of fish demonstration ponds for training fish farmers
	Trout development	Increase fish production, as well as create employment	Blocking all front rivers originating from Mt.Kenya	Surveying and feasibility studies.
<b>Land administration, survey and human settlement</b>	Adjudication of Gichiche, Riachina and Kasaviri sections	To issue title deeds to beneficiaries	Have all sections adjudicated during district development plan period 2002-2008	Adjudication of the concerned sections
<b>Roads</b>	Gravelling of roads, district wide	To improve inter communication in the district as well as to improve marketing of farm produce	Gravel 100% of the roads by 2008	Improvement of the side drains. Installation of side drains and installation of culverts
	Bush clearing, district wide	Improve communication	Roads to be bush cleared annually	Clearing of bushes on the district feeder roads
<b>Mbeere County Council</b>	Sinking of boreholes at Kiritiri and Makutano markets	To provide enough water and improve sanitation	Boreholes sunk by 2008	Sinking of bore holes
	Grading of feeder roads	Improve road	Feeder roads	Grading of feeder

		infrastructure	graded by 2008	roads
	Public cemetery at Siakago	Disposal of bodies	Cemetery established by 2008	Establishment of cemetery at Siakago
	Water borne toilets	Improve sanitation	Water borne toilets established by 2008	Construction of water borne toilets
	Constructions of sheds at Siakago, Ishiara, Kiritiri and makutano	Improve revenue collection and services to people	Sheds established by 2008	Establishment of market sheds
	Construction of slaughter houses at Siakago and Kiritiri towns	Provision of services to the community	Slaughter houses constructed by 2008	Construction of slaughter houses
	Construction of bus parks at Siakago, Ishiara and Kiritiri	“	Bus parks established by 2008	Construction of bus parks
<b>KWS</b>	Tourism	Develop Mwea National Reserve. Increase diversity in Mwea game reserve. Promote hydropower generation dams along Tana river sites for tourism attraction	Improve infrastructure and to promote tourism in the district as well as increasing wildlife diversity	Improvement of the existing infrastructure. Market the district outside as having tourist attractions. Diversify wildlife varieties in the game reserve
<b>Mines and Geology</b>	Development of existing quarries and sand scooping areas	Rehabilitate decommissioned quarries and come up with sustainable sand harvesting measures	All decommissioned quarries. Fencing off of disaster prone quarries. Awareness creation on sand harvesting	Encourage sustainable quarrying and sand scooping activities
<b>Trade and industry</b>	Honey refinery	Income generation, job creation & poverty reduction	Construction completed by 2008	Construction of refinery
	Development of a sport fishing camp at Masinga dam	Creation of jobs and generation of income	Camp developed by 2008	Construction of the building

<b>Social services</b>	Mbeere division stadium, Siakago	Promote community welfare	Complete stadium by 2008	Construction of the stadium
<b>Provincial administration</b>	Construction of police and AP lines at the District headquarters at Siakago division	Provide AP with better accommodation	Construct several units for AP	Construction of modern houses for the AP

*Source: Mbeere District Development Plan 2002-2008*

### **1.3. EMCA, 1999 provision on environmental planning.**

The EMCA provides that every District Environment Committee shall every five years prepare a District Environment action plan in respect of the district for which it's appointed and shall submit such plan to the chairman of the provincial environment action plan committee for incorporation into provincial environment action plan as proposed under section 39.

#### **DEAP Methodology**

The process started by holding regional workshops, which the DEAP Secretariat was appointed by the Director General in 2004. That comprised of a District Water Officer, District Development Officer (DDO) and District Environment Officer (DEO) to attend an induction course on the DEAP methodology. The District Environment Committee (DEC) members gazetted in 2003 were further requested to form a District Environment Action Planning Committee (Technical Committee comprising lead agencies and representatives from other stakeholders), chaired by the DDO and the DEO is the secretary. Once the draft DEAP is prepared, the DEC approves and submits to the Provincial Environment Committee for inclusion in the Provincial Environment Action Plan.

The District Environment Action Planning Committee spearheaded the preparation of the Mbeere DEAP. The committee requested for sectoral environment reports from the lead agencies and compiled the DEAP. The Mbeere District Environment Action Plan was further enriched through participatory planning approach in which consultation workshops at the district and locational level added more information

### **1.4 Objectives of district environment action plans**

Objectives of environmental action planning are:

- To determine the major environmental issues and challenges facing the district.
- To identify environmental management opportunities;

- To create synergy and harmony in environmental planning
- To integrate environmental concerns into social, economic planning and development; and
- To formulate appropriate environmental management strategies.

## **1.5 Mbeere Deap scope**

The preparation of the Mbeere DEAP has been realigned with Vision 2030, Midterm Plan 2008-2012 as directed by the government. The current DEAP covers the period of 2008-2012 and as per EMCA shall be revised after every five years. The DEAP will be monitored by the annual preparation of the State of Environment Reports. The environmental indicators that have been developed in the implementation matrix will be monitored by the respective lead agencies on an annual basis and incorporated in the annual State of Environment Report. The National Steering Committee and the National Environment Action Planning Committee have approved the indicators. The DEAP has been subjected to stakeholder meetings at District level.

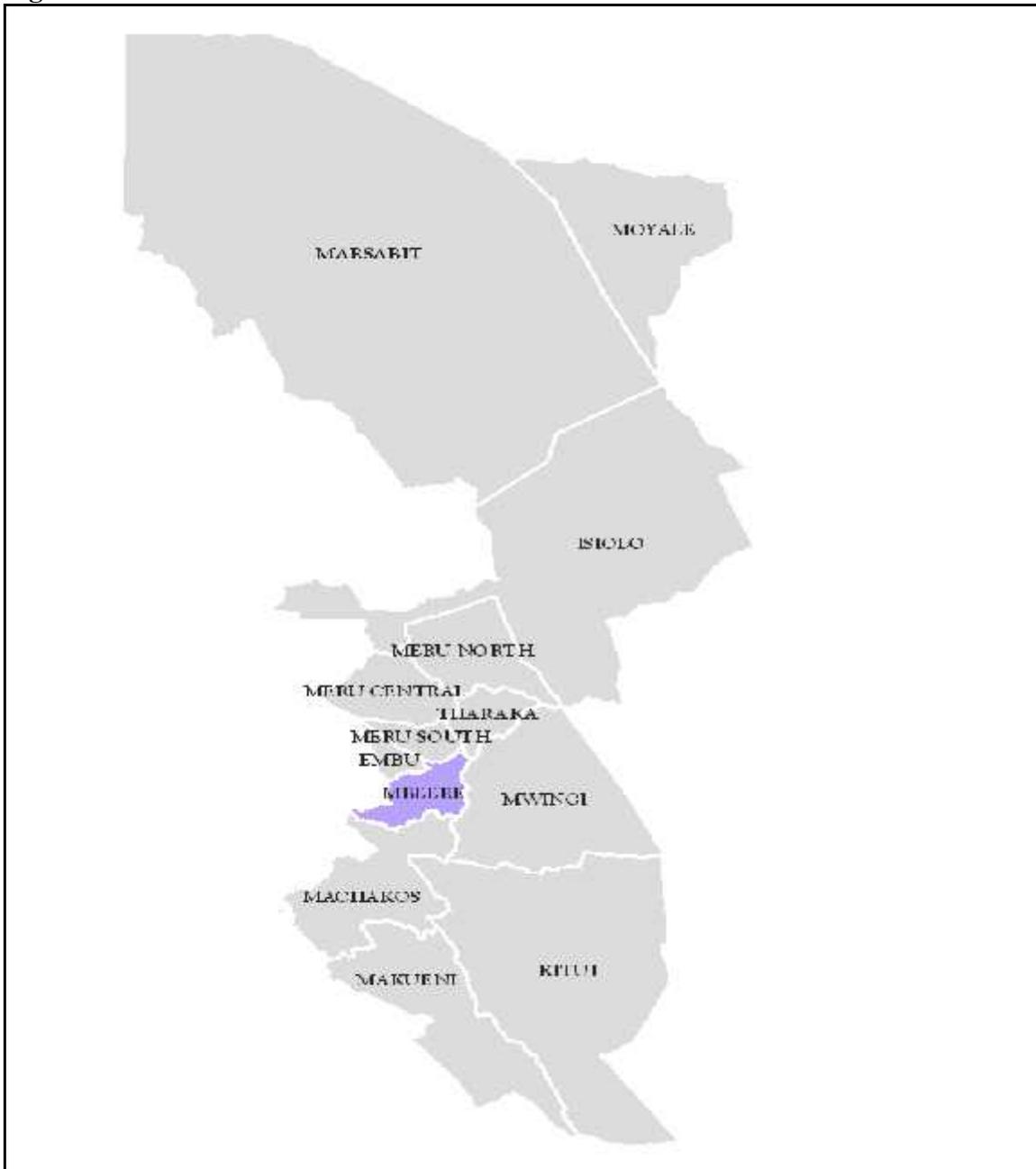
## **1.6 District profile**

### **1.6.1 Geological Location, Size and Administration Units**

Mbeere District is located in Eastern Province, and became a District in 1996. It shares common boundaries with Embu District to the Northwest, Tharaka District to the North East, Meru South to the North, Mwingi District to the South and South East and Kirinyaga to the West.

It has a total area of 2097Km<sup>2</sup>, and it is subdivided into 4 divisions and 19 locations. The district has an estimated population of 200,816 people with about 38,000 households (2006). The District is sparsely populated with an average of 80 persons per km<sup>2</sup>.

**Figure 1**



**Table 2: District Profile**

<b>DIVISION</b>	<b>AREA KM<sup>2</sup></b>	<b>PERCENT OF DISTRICT LAND AREA</b>	<b>OF TOTAL</b>	<b>LOCATION</b>
<b>Gachoka</b>	806	38.4%		8
<b>Mwea</b>	508	24.2%		3
<b>Evurore</b>	414	20%		4
<b>Siakago</b>	364	17.4%		4
<b>Total</b>	<b>2097</b>	<b>100%</b>		<b>19</b>

*Source: Mbeere District Status of Environment report 2003*

### **1.6.2 Climate and physical features**

The extensive altitude range of the District influences the temperature, which range from 20<sup>0</sup>C to 32<sup>0</sup>C. August is usually the coldest month with an average monthly minimum temperature of 15<sup>0</sup>C, while March is the warmest month with an average monthly maximum temperature rising to 30<sup>0</sup>C. There are slight climatic variations in some parts of the District, especially the South Eastern region due to proximity to the Kiambeere, Masinga, Gitaru, Kamburu, and Kindaruma dam.

The District has two rain seasons, the long rains falling between March and June, while the short rains are experienced from October to December. The rainfall however is not very reliable and range between (640-1100mm) per year. Most parts of the District receive less than 500mm of rainfall per year, giving the area a marginal status. The amount of rainfall received in most parts of the district support the cultivation of cash crops such as tobacco and cotton. *Catha endulis* (Khat) cultivation is becoming a crop of choice, while livestock farming is one of the most significant economic activities in the district.

The altitude, climate, together with the density of the underlying geology, has given rise to varying soil types which in turn influence the land use patterns. The central belt of the district, constituting, parts of Gachoka, siakago and Evurore divisions, has black and red soils, whose fertility ranges from low to moderate. The soils are generally sandy, blackish grey or reddish brown. Some murrum is also found. The soils around the hills in some

areas of Gachoka, Evurore and siakago divisions are rocky and therefore difficulty for cultivation. There has been an increase in cultivation on the hill slopes due to a decline in soil fertility and poverty.

The Mwea plains are in the Southwestern region of the district. Here the land is generally flat and characterized by the vertisols (black cotton clays), which are prone to water logging during wet periods and cracking during the dry periods.

### **1.6.3 Population size and distribution**

The district is sparsely populated with majority of the population concentrated around major market centres in Siakago, Makutano, Kiritiri, Ishiara, Karaba and Gachoka. The population is also concentrated along the major permanent water sources, such as rivers and dams where irrigation, farming and fishing are carried out.

Over the years people have been migrating from Kirinyaga, Embu and Machakos Districts. This has been mainly in search of land for agricultural production, due to lack of land in origin areas as well as declining areas for expansion.

According to the 1999 National population census report, Mbeere had a population of 170,953 and was growing at an annual rate of 2.3%. According to projections, the year 2004, Mbeere district attained a population of about 191,788. Projections for year 2006 were about 200,816, for 2008 were 210,698 and 219,883 for the year 2010. Population size and distribution (density) is as shown in table 3 below.

**Table 3: Population size and distribution (density)**

<b>DIVISION</b>	<b>LOCATION</b>	<b>AREA KM<sup>2</sup></b>	<b>DENSITY</b>	<b>1999(ACTUAL)</b>	<b>2005 (Projection)</b>
<b>GACHOKA</b>	KIAMBEERE	93.4	52	4,886	5,609
	KIANJIRU	138.9	126	17,457	20,040
	MAVURIA	211.1	81	17,140	19,676
	MBETI SOUTH	169.4	81	13,695	15,722
<b>TOTAL</b>	GACHOKA DIVISION	800.3	74	59,102	67,848
<b>MWEA</b>	KARABA	83.5	189	15786	18122
	MAKIMA	342.7	37	12822	14719
	RIAKANAU	88.7	136	12072	13858
	MWEA DIVISION	514.9	79	40680	46700
<b>SIAKAGO</b>	GITIBURI	49.2	139	6815	7823
	MUMINJI	103.7	69	7142	8199
	MUTITU	127.6	47	5993	6880
<b>TOTAL</b>	SIAKAGO DIVISION	367.3	93	34330	39410
<b>EVURORE</b>	KANYUAMBORA	46.5	213	9924	11393
	KIANG'OMBE	63.4	111	7061	8106
	NDURUMORI	165.1	50	8300	9528
	ISHIARA	135	86	11556	13266
<b>TOTAL</b>	EVURORE DIVISION	410	90	36841	42293
<b>TOTAL</b>	DISTRICT	2092.5	82	170953	196251

**Source: Central Bureau of statistics, Mbeere. 2007**

The population growth is exerting pressure on land resources, social infrastructure and basic needs. In 1999 Mbeere population was about 23,314. Gachoka division has the highest population and siakago division the least. While Siakago , Evurore Mwea, and Gachoka have 19, 23,24,34 % respectively. However population density is determined by land productivity. In this regard therefore, Evurore division has the highest population density and Gachoka division the lowest. The population densities of Evurore, Siakago, and Mwea, Divisions have been declining over time.

Evurore and Siakago divisions partially fall in the medium potential agro-ecological zones and hence a higher population density. Clusters of high population density are found in Kanyuambora area in Evurore division and Riandu area of Siakago division. Areas where land has not been adjudicated have relatively fewer people than areas adjudicated and title deeds issued.

**Table 4: Population Projections**

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Population</b>	179075	181814	184474	187051	189539	191934	194065	196173	198258	200317	202350

*Source: Central Bureau of statistics report 2007*

According to the 1999 population census Siakago town council had a population of 3230, of which 1,668 were male and 1,562 were females.

### **1.7 Social, cultural and economic characteristics**

The Mbeere people who make the highest percentage inhabit the district. The Kamba people form the next populous group followed by the Embu and the Kikuyu. The language is predominantly Kimbeere. Religion is mixed Catholics and protestant churches. Islam is also practiced as a religion but at a smaller scale. The district has bi-modal rainfall, one longer and less reliable and one shorter and more reliable. These establish the rhythm of social and economic life in the district.

Land is considered the most valuable resource. People in the District tend to settle more, in areas where land is most suitable for agricultural purposes. This exerts pressure on land resources especially in Evurore and Siakago. The main market centres, Siakago, Makutano, Kiritiri, Ishiara and Karaba are expanding rapidly, but have no sewerage systems and rely on septic and soak pits. There is no functional waste disposal system. This poses environmental health problems. Runoffs from these centres lead to water pollution. This is a major concern, and needs mitigation measures to be undertaken.

Burning of solid wastes such as plastics in the open has become one of the frequently used methods and leads to air pollution.

People have settled in Mwea ranching scheme that has yet to be adjudicated. An informal settlement arose at Ngiri market in Gachoka division during Kiambeere dam construction. This has been expanding ever since. This turn of events calls for an address to these issues together with the encroachment on TARDA land in Gachoka area.

Nationally, the number of people living below the poverty line and who subsist predominantly on natural resources has increased from 48% in 1994 to 52% in 1997 and to about 57% by 2003. In the district the poverty incidence for 2004 is about 55%.

Evurore division has the highest number of pockets of poor people followed by Mwea, Siakago, and Gachoka. Majority of the poor are found in Ndurumori and Kiangombe locations in Evurore division, Makima and Riakanau in Mwea and Mutitu and Muminji in Siakago division. Michegethiu area of Muminji has the highest poverty incidence in the district of 79.6%; other areas are Kiambeere and Mutuavari in Gachoka division. These are areas of poor soils and unreliable rainfall and have a high prevalence rate in incidences of charcoal burning and poor farming practices. Shifting cultivation and clearing land by use of fire are common occurrence. Land tenure system is a cause of poverty as is seen in some areas of the district; while poor land use planning has resulted to poverty in other areas.

Land in Siakago and Evurore divisions is registered. At the time of land adjudication, there was no proper policy; therefore, the local community who had no knowledge did the demarcation. This resulted to demarcation of about 95% of hills and valleys. The high incidence of poverty has made the community to cultivate on these hills, which they say are more fertile. Cost of farm inputs like fertilizers are inhibitive and as such the farmers cannot afford them, leading to more cultivation on hills and other fragile areas. This is leading to soil erosion, loss of Biodiversity and lowering of water quality. Cultivation on wetlands is also high, leading to the same consequences.

The clan relationship is so strong that the socio-economic activities of many people revolve around a clan. The clan, more often, is the land owning unit. There is no gender equity in land ownership; land cases take too long to be resolved. Land conflicts in Mwea division had occurred some time ago, and in Gachoka people complain that, land compensation was not fairly done by TARDA. All this has led to poverty and has an impact on environment through increased human activities such as settling in fragile areas, child labour and deforestation.

Table 5 shows District population dynamics and poverty levels.

**Table 5:** District population dynamics and poverty levels.

	1990	1993	1996	1999	2002	2004
POPULATION SIZE	140,548	143,889	167,982	170,953	183,166	191,788
POPULATION DENSITY	67	70	80	82	90	92
POVERTY INCIDENCES (%)	58%	58%	57.4%	57%	56%	55%

Source; Mbeere State of Environment report 2003

Table 6 shows population distribution by gender.

**Table 6: Population distribution by Gender**

	Male	Female	Total
<b>MBEERE</b>	<b>81885</b>	<b>89068</b>	<b>170953</b>
<b>SIAKAGO</b>	<b>16656</b>	<b>89068</b>	<b>34330</b>
<b>EVURORE</b>	<b>16764</b>	<b>3272</b>	<b>36841</b>
<b>GACHOKA</b>	<b>28772</b>	<b>2231</b>	<b>59102</b>
<b>MWEA</b>	<b>19693</b>	<b>1874</b>	<b>40680</b>
<b>MAKIMA</b>	<b>6259</b>	<b>3843</b>	<b>12822</b>
<b>RIAKANAU</b>	<b>5813</b>	<b>2243</b>	<b>12072</b>

Source, Central Bureau of statistics 2007

## CHAPTER TWO

### 2.0 Environment and natural resources

#### 2.1 Soils and land use

##### 2.1.1 Soils

The altitude, climate, and together with the density of the underlying geology, have given rise to varying soil types which in turn influence the land use patterns. The central belt of the district, constituting, parts of Gachoka, Siakago and Evurore divisions, has black and red

soils, whose fertility ranges from low to moderate. The soils are generally sandy, blackish grey or reddish brown. Some murrum is also found. The soils around the hills in some areas of Gachoka, Evurore and Siakago divisions are rocky and therefore difficult for cultivation. There has been an increase in cultivation on the hill slopes due to a decline in soil fertility and poverty.

The Mwea plains are in the southwestern region of the district. Here the land is generally flat and characterized by the vertisols (black cotton clays), which are prone to water logging during wet periods and cracking during the dry periods. Soil erosion is a major problem in the district, due to the following reasons:

**Overgrazing**-This is common in Mwea scheme, in Mwea division. The land is under the trust of county council and nobody takes responsibility of environmental conservation resulting to people grazing as many animals as one can.

**Topography and vegetation** - lack of trees in areas that are gently sloping has resulted to water and wind erosion. The nature of soils, especially in Mwea division, where vertisols are prevalent, makes it difficult to propagate some desired agroforestry trees. This has been due to water logging, soil shallowness and low soil fertility. Table 7 shows land use types in the District.

**Table 7: Land Use Types**

TYPE	AREA Km <sup>2</sup>
Total land area	2,097
Agricultural land	1,690
Medium potential land	840
Low potential land	1,260
Irrigated area	19.5
Potential irrigation area	1,050
Total arable land	944.9
Total area under crops	400

*Source DAOs Office 2006*

The need to feed the ever increasing population, provide employment to the labour force, and provide raw materials to industry, constitute the driving forces that cause environmental degradation in agricultural systems. The biggest challenge for agriculture remains, increasing food production in a sustainable manner in order to meet the needs of the growing population.

Sub-division of land has resulted into small uneconomic sizes, which cannot be sustainably utilized. Intensive cultivation and encroachment on land only marginally suitable for cultivation, however, remain the main option. Most hilltops and slopes in the district are under crop production. Significant riverbank cultivation is also prevalent. Small-scale farming is widely practiced and the average farm size range from 5-7 hectares per family.

### **2.1.2 Land use**

Mbeere is a semi-arid district, and mostly the land is used or being utilized for agro-pastoralism. Potential productivity of the land is threatened by increasing land degradation due to human related activities and adverse climatic factors. This calls for strategic interventions to minimize and mitigate negative impacts of land degradation.

Three main agro-ecological zones cover the District. The marginal cotton zone (LM4), covering the upper parts of Gachoka Division, some parts of Siakago and Evurore Divisions. The lower midland which is livestock-millet zone (LM5) covers the central belt of the District extending to Mwea plains and to the south West. The lowland livestock millet zone (L5) that covers the Eastern parts of Siakago and Evurore Divisions. In the Northwestern part, towards the boundary with Embu and Kirinyaga Districts, there are pockets of medium potential agro zones. These include cotton zone (LM3) in parts of Gachoka and Siakago divisions, the sunflower zone (UM4) and the marginal coffee zone (UM3) around Riandu and Siakago market.

## **2.2 Agriculture, livestock and fisheries**

### **2.2.1 Agriculture**

The district can be classified into a medium potential and marginal land with the latter taking up a greater part. The Central belt of the district, which includes parts of Gachoka, Siakago

and Evurore divisions have good black and red soils whose fertility range from low to moderate. The soils are generally sandy, blackish grey and reddish brown.

Cultivation in this region however, takes place mostly on the better - watered areas along the river courses. The soils around the hills in parts are mostly rocky and hence difficult to work. Mwea plains have a generally flat terrain. Soils in this region are mainly the black cotton type, which has high to moderate natural fertility. Table 8 shows the agro-ecological zones.

**Table 8:** *Agro-Ecological Zones.*

No.	Agro-ecological zone	Location	Altitude (M)	Temp (°C)	Rainfall (mm/yr)	Area (Km <sup>2</sup> )	District Cover (%)
1	UM3 - Marginal coffee zone	South of Siakago market towards Maathai	1280-1460	20.7-19.6	1000-1250	20	1
2	UM4-sunflower/maize zone.	Upper Siakago & Gachoka	1280-1400	20.7-20.0	1000-1100	51	2.4
3	LM3-Cotton zone	Upper Gachoka (Mbeti) & Siakago (Riandu)	1070-1280	22.0-20.7	900-1000	225	10.6
4	LM4-Marginal cotton zone	Upper Siakago, Kiritiri, & Evurore Location	980-1280	22.5-21.0	800-900	339	16
5	LM5-Lower midland livestock/millet zone.	Evurore, Ndurumori in Evurore division. Mutitu	830-130	23.521.7	700-900	1,247	60

		location in Siakago division & most of Mwea division					
6	L5-Lowland livestock zone.	Kiambeere location of Gachoka division and Ndurumori location of Evurore division	760-830	23.9-23.5	640-700	215	10
TOTAL	2,097	100					

*Source: Mbeere District Agricultural Office Report 2007*

Sub-division of land has resulted into small uneconomic sizes, which cannot be sustainably utilized. Intensive cultivation and encroachment on land only marginally suitable for cultivation, however, remain the main option. Most hilltops and slopes in the district are under crop production. Significant riverbank cultivation is also prevalent. Small-scale farming is widely practiced and the average farm size range from 5-7 hectares per family.

Table 9 shows the types of farming system.

**Table 9: Type of farming system**

<b>TYPE</b>	<b>AREA Km<sup>2</sup></b>
Total land area	2,097
Agricultural land	1,690
Medium potential land	840
Low potential land	1,260
Irrigated area	19.5
Potential irrigation area	1,050
Total arable land	944.9
Total area under crops	400

*Source DAOs office Repot 2007*

Most of the medium potential land is in upper Gachoka and upper Siakago divisions. Lower parts of Gachoka and Evurore divisions consist of low Potential lands while over 95% of the irrigation area is along the five main rivers. Mbeere district has a high potential for farming. The major constraint is water and for this reason, growing of drought resistant crops is encouraged. Irrigation schemes have been developed to enhance production:

These include Kathigi/Ishiara and Kiambindu in Evurore division that produces vegetables for export. About 200ha of land is under irrigation in Mwea division, and 300ha in Gachoka division along Rupingaci and Thiba rivers. High value crops like Okra, Brinjals, French beans and flowers are grown. Table 10 shows the crop statistics in the District.

**Table 10: Crop Statistics**

<b>Crop</b>	<b>Achieved (Ha)</b>	<b>Bags</b>	<b>Comments</b>
<b>Maize</b>	8200	8200	Severe moisture caused a 90% crop failure.
<b>Sorghum</b>	480	1440	Moisture stress drastically reduced yield.
<b>Millet</b>	90	270	-
Beans	2900	2000	90% wilted early
Cowpeas	2100	10500	-
Green grams	2550	1275	-
Pigeon peas	1700	6800	-
Soy-beans	30	-	Total crop - failure
Cotton	1400	700 tons	-
Sunflower	50	20 tons	-

*Source DAOs office Report 2007*

Farming on the hill tops and hill slopes, encroachment on wetlands, burning as a form of land clearing, chemical pollution from horticultural farming, are some of the environmental issues. In this regard therefore, there is need to undertake agroforestry practices, carry out environmental audits of large scale horticultural farms, soil conservation measures as well as educate the community on matters touching on the environment.

### **2.2.2 Livestock**

Beef production is the major livestock industry in the District, although there are no large commercial beef farms or ranches in the district. Main breeds are the local Zebu and a few breeds of sahiwal, borans and their crosses. Besides beef production, the animals also provide milk and draught power. Goats reared are the Galla, small East African goat, soanen and their cross-breed. A lot of upgrading of local goats with the Kenyan/German alpine and toggenburg bucks is going on with encouraging results. The sheep reared are the red Maasai, black heard Persian and their crosses. The local climate is unfavorable to the wool sheep.

The dairy cattle industry is not a major enterprise in the district due to the unfavorable weather condition. Pig production is not popular with the farmers due to high cost of commercial feeds and lack of ready market. Table 11 shows projected livestock population in the District.

**Table 11:** *Projected Livestock Population*

Type	SIAKAGO			EVURORE			MWEA			GACHOKA		
	Present 2007	2010	2015									
<b>Beef cattle</b>	10424	12092	14028	13627	15807	18336	14472	16788	19474	15192	17622	20442
<b>Dairy Cattle</b>	616	739	887	361	433	520	142	170	205	670	804	965
<b>.Meat Goat</b>	20294	23541	27308	30952	35904	41649	22454	26047	30214	36338	42152	48896
<b>Dairy Goat</b>	401	521	678	204	265	345	193	251	326	389	506	657
<b>Hair Sheep</b>	3780	4385	5086	7179	8328	9660	5068	5879	6820	8086	9380	10881
<b>Exotic Poultry</b>	42509	46760	51436	40634	44697	49167	43157	47473	52220	67053	73758	81134
<b>Pigs</b>	52	55	57	31	33	34	50	53	55	45	47	50
<b>Donkeys</b>	319	335	352	132	137	146	505	530	557	297	312	327
<b>Rabbits</b>	81	85	89	144	151	159	220	231	243	367	385	405

*Source: Mbeere District livestock office Report 2007.*

The district has a high potential for honey production. Honey production is normally proportional to the quantity and quality of forage at specific times or seasons of the year. It was difficult to establish the exact amount of honey produced due to the poor recording skills at the farm level.

**Table 12: Beehive population**

Division	Log hives	KTBH	Langstroth
Mwea	1,085	83	157
Siakago	18,460	44	50
Evurori	8,120	104	24
Gachoka	1,600	46	70
Total	29,265	277	301

Source DLPOs annual report 2007

Donkey population in the District is about 1,255 and their productivity can only be pegged to draught power. There has been a significant increase in livestock that could be attributed to improved veterinary services and the increasing importance of the activity to the community. This increase of livestock and lack of market is continuing to degrade the land in terms of overgrazing and soil erosion especially in un-alienated land, and watering points. Most of the farms are not fenced and therefore the trees planted are destroyed, when other crops on the farm are harvested. This is because of uncontrolled grazing and most of the farms being not fenced. Micro fencing around the young trees should be encouraged to mitigate against this negative impact.

### **2.2.3 Fisheries Resources**

The main fishing activities are located along the hydroelectric power dams, Masinga, Kiambeere, and Kamburu. There are no fishing activities in Gitaru and Kindaruma dams, due to the high population of crocodiles and high fluctuations of water levels in these reservoirs. Fish farming is practiced on a very small scale largely for domestic consumption, while the surplus produced is sold. Accessibility and transport to the market hinders fish production. The fishermen also use undersize nets that affect future production. Increased sedimentation has also affected fish production as a result of increased water turbidity.

Invasion in the reservoirs by Cray fish, which is carnivorous and thought to have originated from Thika catchment's area, is having an effect on fish production. It entangles the fishing nets and thus preventing more fish landings. Cray fish occupy traditional fishing traps set in the water, for the purpose of fishing, thereby preventing other fish from being trapped. The Cray fish is known to destroy native wetland vegetation, the snail and crustacean fauna of

aquatic ecosystems. It has been held responsible for the disappearance of water lilies and submerged vegetation as well as many species of snails in wetlands of Eastern and Southern Africa where it has become invasive.

### **Key environmental issues**

- Invasive species e.g. Cray fish
- Loss of biodiversity

### **Proposed interventions**

- Develop and adopt control measures for the Cray fish
- Conservation of wetlands

## **2.3 Water resources**

### **2.3.1 Water Sources**

In the district, the main Water sources includes waters from the rivers, boreholes, springs, Roof catchments, Earth dams, Sand dams, Rock catchment sand Surface runoff. Despite the above water resources, water availability for domestic and livestock consumption is a major problem to the community. Large capital expenditure is required to harness it, and the quality of the water is poor, hence most of the people consume untreated water. Pesticides especially in irrigated areas and tobacco seedling nurseries located near water sources pollute water. Overall water flow has been on decline due to increased abstraction and poor land management. Some boreholes yield saline water, while the quality of water in the shallow wells cannot be ascertained. Some are close to pit latrines which are source of water pollution. Others are disused quarries where runoff water that has high contamination levels collects.

### **Ground water**

Ground water potential in the district is low, therefore most boreholes dry up. The district is endowed with both surface and sub-surface water resources. Kiang'ombe Forest (hill) serves as an import catchment's area. Five perennial rivers, Tana (south boundary), Thuci, Thiba in the western boundary, Rupingazi (tributary of Thiba) and Ena to the north south and east flow, drain the District. Springs near the urban areas are highly polluted.

## Drainage

All rivers drain to Tana River, thus making the Tana River catchment's area. The drainage pattern is composed of 5 major rivers, which collects other seasonal rivers. Most of the rivers flow from northwest to south- east due to the landscape formation.

## Water availability and access

Rivers Tana, Thuci, Thiba, Ruingaci and Ena are permanent rivers. The district has about 37,036 households of which 8,548 households has piped water, 9,972 households has access to potable water. The number of dams in the district is 122 and the average distance to nearest potable water point is 4km. The degradation of Kiang'ombe, Kianjiru, Kiambeere, other hills and the reclamation of the wetlands in the district is having an effect on infiltration and surface run off, leading to an effect on ground water recharge rates. Tana River is brown in color due to erosion. This is having a direct impact on the quality of the water and on the life of the reservoirs for hydroelectric generation as well as irrigation channels downstream. Current water development programmes focus almost on water delivery, with little concern for demand management and conservation. Some spring sources such as Gatituri in Riandu Sub-location, Siakago division have been set-aside as conservation site. Agro forestry practices, spring source conservation, land use planning are being promoted in the district. Table 13 shows the available water resources in the district.

*Table 13: Available Water Resources:*

DIVISION	RIVERS m <sup>3</sup> /DAY	SPRINGS M <sup>3</sup> / DAY	BOREHOLES M <sup>3</sup> /DAY	DAMS M <sup>3</sup> /DAY	TOTAL M <sup>3</sup> /DAY
Siakago	33,799.68	-	732.22	667	35198.9
Gachoka	451,828.6	699.84	281.28	-	452,809.72
Evurore	55,339.2	-	-	-	55,339.2
Mwea	186,624	-	995.1	1178	188,797.1

*Table 14: Comparisons of Water Demand vis. Available Water*

DIVISION	TOTAL WATER DEMAND			AVAILABLE WATER RESOURCE			DIFFERENCES			COMMENTS	
	2006	2010	2015	2006	2010	2015	2006	2010	2015		
<b>SIAKA GO</b>										5	-Most of water available is surface water. -The surface water source is from outside the District. -Water remaining by 2015 will be less than a third.
	278.84	9313.769	24093.338	35198.9	35198.9	35198.9	32416.06	25885.131	11,105.562		
<b>EVURORI</b>	4072.503	23854.489	38609.083	452,809	452,809	452,809	44,877	42895	414,199.917	-Very little water use -The river boundaries Evurore and Meru South	
<b>MWEA</b>	5806.043	31302.503	46149.793	55,339.2	55,339.2	55,339.2	49533.157	24,036.697	9189.407	By 2015 the water in the river will be less than one fifth. -Most of water available is surface water.	
<b>GACHOKA</b>	9835.67	17521.535	32358.866	188,797.1	188,797.1	188,797.1	17896.143	171,275.565	156,438.234	-a lot of surface water available not used. -Most of available water is surface water.	

*Source District water office, Mbeere*

### **Water quality**

Only about 53% of the people have access to water. The district is served by two water supplies, Ena - Siakago and Ishiara. However, only 30% of the population has access to safe drinking water. The other part of the population consumes untreated water. Water demand is very high and the supply is low at 3:10 ratio. Due to low accessibility to safe water, water borne diseases are common. Prevalence of water borne/related diseases is in the incidences of Typhoid, Malaria, Diarrhea, Amoebiasis and Skin diseases: Seepage from soak pits, pit latrines and runoff from urban areas pollute the water sources affecting the quality. Pesticides and herbicides used in the farms especially near water sources lower the water quality. These farms are termed as highly productive and therefore are farmed intensively: Nitrate levels have also been increasing. Tebere Quarry water analysis indicated a level of 21.92 Nitrate parts per liter.

Sources of pollution in the district include run off, faecal matter, pesticides, fungicides, washing of linen in rivers, car wash in rivers, as well as open river bathing. If water resources are fully developed, the vulnerability of people to waterborne diseases could be reduced. Borehole water in the district is of high quality except for the salty boreholes. Spring water, treated water is also of high quality. Direct river water, earth dam water and sand dam water are of Low quality, while rock catchment's and roof catchment's water is of medium quality.

### **Water harvesting**

The national supply of piped safe drinking water is very low, with 40% coverage. This makes rain water an important and reliable alternative to conventional water circulation systems. This is because Kenya received 360 billion cubic meters, a good percentage of which could be harvested.

Water in the district is used for, domestic, irrigation, livestock and for power generation. Water harvesting is done by rock catchment's (2 main ones); roof catchments and sand dams. The water harvesting facilities being used are masonry tanks, plastic tanks, Ferro-cement and gutter constructed on rocks. Sand dams have been affected by sand scooping which has been unsustainable. Earth dams serve both livestock and human population. Rarely are they used for agriculture. Power generating dams include Kindaruma, Gitaru, Masinga, Kamburu and Kiambeere. These dams are also used for agricultural purposes,

though this is limited. However, fishing activities are prominent. Siltation has become a major problem resulting from unsustainable land use practices mostly on the upper zones and in neighbouring districts of Embu, Kirinyaga and Maragua. Dam levels are low during drought periods and fluctuations have become frequent.

### **Key environmental issues**

- Siltation of water dams
- Fluctuation of water levels in the dams
- Drought
- Over exploitation of the water resources
- Pollution
- Waterborne diseases
- Soil erosion

### **Proposed interventions**

- De-siltation of dams
- Conservation of water catchment areas
- Enforcement of water quality regulations
- Awareness creation and empowerment of local communities
- Use of appropriate agricultural practices
- Promote rain water harvesting technologies

## **2.4 Forestry and wildlife resources**

### **2.4.1 Forestry**

The District has no gazetted forests, but 3,751 hectares of natural forest reserve are found. These are held under trust, by the Mbeere County Council, which has entrusted the Kenya Forestry Service (KFS) to manage them on their behalf. These include: -

- Kiang’ombe hill forest in Evurori & Siakago division - 2,104 ha.
- Kiambeere hill forest in Gachoka division - 643 ha.
- Kianjiru hill forest in Gachoka division - 1,004 ha.

Twanyoni, Muthuri and Ndune hills in Mwea settlement scheme, Mwea division have been proposed for conservation. There are other many hills in the District that have been deforested. These include Natha and Kamarandi among others.

Kiang'ombe hill forest consists of both exotic plantations and natural forests. However natural forest is dominant, with *cordia abyssinica*, *ficus thoningii*, *croton megalocarpus*, *Warbugia ugadensis* and *vitex keniensis* as some of the trees found there. Encroachment in all the hills by the neighboring community has been significant. The community also burns the hills annually as a cultural practice in order to improve the grade and to increase the sand harvest.

The Kenya power generating company, is undertaking Eucalyptus tree plantations establishment in Kiambeere area and about 1,500 ha is proposed to be put under plantations. The total forest cover for Mbeere District is approximately 62.71Km<sup>2</sup> or 6271 ha. This is only 2.9% of the total District area. Most farms having indigenous woodlands like in Evurore however complement. In Siakago division irrespective of existing forest extension service, there is need for increased effort to raise the coverage to 10%. Since, one year ago, 2005, *Osyris compressa* (East African sandalwood) is being heavily exploited for medicinal purposes. Its exploitation has been noted to be unsustainable and measures to curb these needs to be put into high gear.

### **Key environmental issues**

- Deforestation
- Loss of biodiversity
- Encroachment on forest reserves
- Inadequate awareness on environmental management and conservation

### **Proposed interventions**

- Enforcement of relevant legislations
- Awareness creation
- Establishment of botanical gardens for threatened species
- Involvement of the community in conservation
- Sharing of benefits accruing from controlled areas
- Re-forestation and afforestation

## **2.4.2 Wildlife**

Mwea National reserve serves as the main conservation area in the District. It covers 42Km<sup>2</sup>, and is situated in Makima location of Mwea Division. Among the animals found in the reserve are elephants, buffaloes, hippopotamus, crocodiles, giraffes and various types of antelopes. Most of the district was covered by wildlife in the 1960s and 1970s. But as the need for more land increased most of the animals were decimated and others migrated to the Mwea reserve.

The issue of Human-wildlife conflict exists and increases during the dry period, especially when the dam water level decreases. This to some extent has been addressed by the installation of the solar electric fence in the West and North of the reserve. The degradation of Mwea ranch/scheme forced the animals once leaving in the area to migrate (monkeys) to the surrounding communities farm like Gachuriri location. These have become a menace to crops during drought periods.

The Kenya wildlife service manages, the National Reserve in conjunction with the Mbeere County Council and has put measures to improve relationship between them and the local community.

### **Key environmental issues**

- Human-wildlife conflicts
- Destruction of wildlife habitats
- Inadequate mechanisms for benefit sharing from wildlife resources
- Inadequate awareness

### **Proposed interventions**

- Creation of awareness of the park and its importance to the local Community.
- Enhance governance on wildlife management
- Tarda/Kengen/KWS/County Council to regulate the fluctuation of water in the Kamburu reservoir that is affecting the movement of wild animals.
- Bee-keeping within and outside the park need to be encouraged much more. This will create direct benefits to the surrounding community.

- Crocodile population should be controlled or alternatively license crocodile farming to interested entrepreneurs.

## **2.5 Biodiversity conservation**

### **2.5.1 Biodiversity data and information**

Environmentally significant areas in the district are hills, Kiang'ombe, Kianjiru, Kiambeere, Kamarandi, Twanyoni, Ndune, and Natha among many others. With the exception of Kiango'mbe, Kiambeere and Kianjiru most of the other hills are private land.

Wetlands are found along the rivers, Tana, Thiba, Rupingazi, Ena and Thuci, as well as the hydropower generating dams of Kindaruma, Masinga, Gitaru, Kaburu and Kiambeere.

People farm on the hills because it's more fertile, due to shortage of land for agriculture linked to increased population. This has led to loss of biodiversity and loss of water catchment's capacity. Various soil conservation measures are carried out by farmers, these are however not adequate because only a few are involved. Tree planting has not also been adequately incorporated in these soil conservation measures.

Virtually all rivers are in danger from encroachment by agricultural activities. Other threats include, over abstraction of water, intensification of fertilizer and biocide inputs, river line tree destruction and Alien and invasive species. Louisiana crayfish (*procambarus clarkii*) has invaded the power generating dams.

Flood plains and river line ecosystems (wetlands) have been reclaimed for farming, sand scooping and brick making activities in the District. This is encouraged by market availability for sand, and vegetables. Brick making and curing is taken as an off-season activity (July-September) and, since water and fuel wood is limiting resources, this activity is located near water bodies where fuel wood can be sourced easily. This has led to water quality decline, loss of biodiversity and increased soil erosion. Important habitats for fish breeding and other forms of life have being encroached by human beings.

The main driving force on access and benefit sharing of biodiversity is sustainable utilization, commercialization of genetic resources and sustainable strategies for ownership, transfer of property rights and growth of biodiversity prospecting enterprises. Despite the money generated from biodiversity, little goes back to conservation. *Aloe* species are found in

Mbeere, but their commercial exploitation is not known. However the people exploit them for various ailments. Other species locally exploited are *Carisa edulis*, *Rbus natalensis*, *Pistacia aethiopica*, *Osyris compressa* (East African sandal wood) and *Toddalia asiatica*. Herbalists also exploit these medicinal plants and others, and have become popular to the community.

Cultural practices that offered some regulatory framework have broken down leading to loss of biodiversity and indigenous knowledge.

#### **Key environmental issues**

- Loss of indigenous knowledge
- Loss of biodiversity
- Inadequate benefit sharing mechanisms
- Inadequate awareness and information sharing

#### **Proposed interventions**

- Constant policing of forest resources is necessary to ensure minimum destruction.
- Apply indigenous knowledge in biodiversity conservation alongside other approaches.
- Develop a strategy on benefit sharing to address major concerns on biodiversity utilization.
- Regulate utilization of aquatic resources. Punitive measures should be taken against those who degrade the resource base in all ecosystems.
- Implementation of soil and water conservation measures.
- Enforcement of environmental impact assessment (EIA) regulations, procedures and standards.

## **2.6 Energy sector**

### **Types and status of Energy Sources**

In the District the main energy sources are wood fuel. This accounts for over 80% of energy used. Others include, use of Kerosene, Solar, Electricity, Cooking gas, Petrol and Diesel. Though the district has major electricity generating plants, the electricity distribution grid has been extended to a very limited area. The rural electrification programme is yet to benefit the district. Electricity services are mainly in major town centers. The most disadvantaged division with respect to electric power supply is Mwea.

### **2.6.1 Trends in Energy production, consumption, costs and projections**

There have been tree-planting activities at various sites in the districts such as Kiariri, Makunguru, and Kianamu and Kianyangwa hills and at Katuanyaga earth dam. Due to the high population growth, and unmatched rates of reforestation, the demand for wood fuel could make forest resources exploitation unsustainable. It is therefore necessary to use this resource sustainably and at the same time adopt and promote energy conservation measures. Solar energy can be used as an alternative for electricity .However, the cost and installation of the panels is prohibitive.

The Kenya Electricity Generating Company (Kengen) has proposed to set up 1,500 hectares of *Eucalyptus camadulensis* tree clones in Kiambeere location of Gachoka Division; this is targeting the Kenya tea development Authority (KTDA) tea factories that have of recent times been sourcing wood fuel in the district. KTDA's factories have shifted from using furnace oil to fuel wood.

The demand for electric energy is high especially in urban centers in the District. This is however limited by high installation costs. Tea factories from the neighboring Embu district are sourcing their wood fuel materials in the District for tea drying.

#### **Other Sources of Energy**

Solar energy exploitation in the district is quite low and has a great potential for development. Wind energy has not been exploited significantly, but the district is not prone to strong winds except on hilltops. The lower part of the Tana River around Ishiara (Evurore Division) has a great potential for further development of hydropower stations (proposed Mutonga dam). This would exploit the Meru catchments for power generation. Small hydro power stations have also not been fully exploited, in the district and have a great potential.

#### **Key environmental issues**

Unsustainable farming methods in the catchment's areas have resulted to increased sediment load that has continued to reduce volume of water in the hydropower generating dams. There are significant gender constraints in fuel wood access and ownership in the District and use of agricultural residue for energy is also not significant. The forestry department,

Agriculture, Provincial Administration, Water Department, is making increased efforts; Community based groups, and NGO's, to promote sustainable resource use by adoption of Agro forestry technologies, energy saving devices and use of indigenous knowledge. The harnessing of hydropower on large and medium scale involves the creation of artificial water reservoirs by denuding, dredging and flooding thousands of hectares of land. The creation of reservoirs modifies many environmental components. As these reservoirs have already been developed in the district, environmental audits as stipulated in EMCA (1999) must be undertaken in order to mitigate negative environmental impacts that might be resulting. This should also be extended to petrol stations and paraffin depots in the district. Use of other energy sources should be encouraged in order to avoid relying on only one source of energy.

### **Proposed interventions**

- Increase access to affordable electricity.
- Incorporate energy conservation and efficiency.
- Explore alternative sources of energy.

## CHAPTER THREE

### 3.0 Human settlements and infrastructure

Land in the District is mostly freehold, with the exception of trust lands (Mwea National reserve, Kiang'ombe, Kianjiru and Kiambeere hill forests). There are proposals of setting aside some hills in Mwea division for conservation purposes. These are Twanyoni, Muthuri and Ndune hills. A lot of land sub-division is taking place in the district, leading to poor farming practices, soil erosion and degradation.

There has been some illegal settlement in Mwea ranching scheme, a communal/trust land. The illegal settlers have introduced inappropriate farming systems or methods which are not sustainable. The woodlands that once existed have been destroyed due to charcoal burning and opening up of new land for farming activities.

The physical planning department is now integrating land use planning with environmental considerations. Much more, however needs to be done in urban areas. Mushrooming of unplanned settlements and creation of more space for infrastructure and environmental aesthetics need to be considered. During land adjudication hills in the district were demarcated and issued as freehold. These areas are not suitable for cultivation and most of them are now eroded and degraded. The riparian areas have been encroached upon which has led to adverse effect on biodiversity. Encroachment is in form of sand harvesting, brick making and cultivation.

The planning and management of human settlements is the function of the physical planning Department and respective local authorities, which are mandated by the physical planning Act (Cap 286) and the local Government Act (Cap 265). However, the physical process has not kept pace with development requirements, thus resulting in uncontrolled human settlements. Urbanization is therefore taking place in a planning vacuum. To be effective in reversing the environmental crisis resulting from lack of planning interventions, there is need to strengthen institutional frameworks. Conflicting interests and inadequate capacities to plan is affecting development of urban centers in Mbeere more so in Siakago, Kiritiri, and Ishiara and Makutano which requires agent attention though Siakago town is less affect.

Physical development plans prepared by the Physical planning Department are usually left at the whims of the local authorities to implement. But the local authority has inadequate capacity to implement these plans. In the planning processes there is need to consider the

majority of the population and reach a consensus so that, environmental assessment is made easier, as issues will have been tackled at the planning stage. Programmes that need to be subjected to strategic environmental assessment (SEA) include waste disposal, road construction, land subdivision and allocation, settlements, and buildings plans. There is need to embark on the preparation of Environmental Development Plan, (EDP) for Siakago and other major towns in the District.

### **3.1 Land use and Human Settlement.**

#### **3.1.1 Land use**

Out of the District's total area of 2,097 Km<sup>2</sup>, Land suitable for agriculture is 1,690Km<sup>2</sup>(81%); 2,055 ha. is taken up by the large farms, 3,751 ha is forestland, while Mwea National reserve covers a total of 4,200 ha.

The land potential in Mbeere District can be classified in to Medium potential land covering about 840 Km<sup>2</sup> and lower potential land constitute about 1260km<sup>2</sup>. Land under irrigated land area is approximated to be 19.5Km<sup>2</sup> while cultivated land is about 400 Km<sup>2</sup>

Forestland is about 37.7 Km<sup>2</sup> (un-gazetted forests) which include Kiang'ombe 21.04 Km<sup>2</sup>, Kianjiru 10.04 Km<sup>2</sup> and Kiambeere, 6.34 Km<sup>2</sup>. Land considered to be occupied by wildlife and referred as Game reserve takes about 42 Km<sup>2</sup> (Mwea National Reserve) and large Scale farms occupies about 20.55 Km<sup>2</sup> while Small scale farms constitute about 1,980Km<sup>2</sup> of the available Land in Mbeere District.

#### **3.1.2 Human Settlement**

Lack of land policy is a major cause of environmental degradation: A good example is Mwea settlement scheme that offers quite a challenge. Land in Siakago and Evurore divisions is registered and people have title deeds. At the time of land adjudication, there was no proper policy and hence the demarcation was done by the local community who had no knowledge that some fragile areas needed to be set aside. This resulted to demarcation of hills and hence an adverse effect on the environment. Table 15 shows the number of households by main type of roofing materials for the main dwelling unit.

**Table 15:** Number of Households by Main Type of Roofing Materials for the main Dwelling Unit

Iron sheets	Tiles	Concrete	Asbestos	Grass	Makuti	Tin	Other	Total
25580	252	65	480	10210	84	253	112	37036
69.07%	0.68%	0.18%	1.30%	27.57%	0.23%	0.68%	0.30%	100.00%

Source, Central Bureau of Statistics

Table 16 show the number of households by main source of water

**Table 16:** Number of Households by main source of water

Pond	Dam	Lake	Stream/River	Spring	Well	Borehole	Piped	Jabias/tanks	Total
1500	3565	44	12432	1555	5891	8340	3554	155	37036
4.05%	9.63%	0.12%	33.57%	4.20%	15.91%	22.52%	9.60%	0.42%	100.00%

Source, Central Bureau of Statistics

### Key environmental issues

- Deforestation
- Encroachment on agricultural land for settlement
- Land fragmentation

### Proposed Interventions

- Enforcement of the physical planning Act, EIA and EA regulations.
- Afforestation and reafforestation

## 3.2 Human and Environmental health

### Water - borne diseases

Water borne and water related diseases are among the top causes of outpatient morbidity in the district. Malaria alone resulted to 282 deaths in 2004. Other diseases include diarrhea, skin and intestinal worms' related diseases and eye infections. Factors giving rise to these diseases include poor sanitation, inadequate coverage of safe and clean water supplies in the district, poor hygiene practices, poor food handling practices and poverty.

These disease occurrences have resulted to mortality, and reduced economic productivity.

## Vector -borne diseases

Malaria is endemic in the district and is a leading cause of mortality, as well as leading in outpatient numbers. Poor sanitation and drainage, poor management of solid waste, climatic and other conditions that favor the breeding of mosquitoes and a high incidence of poverty, give rise to this situation. Other water related diseases and vector borne diseases include typhoid, amoebiasis and bilharzias.

## Respiratory Diseases

Mortality from tuberculosis is approximately 61%. HIV/AIDS is responsible for about 40% of reported TB cases. Increased levels of poverty are some of the pressures for this situation. Table 17 shows the disease prevalence rate in the district.

*Table 17: Disease Prevalence Rate*

Month	Malaria	Diarrhea	Worms	Eye Infection	RT1
January	7771	511	1572	213	3624
February	11278	719	2016	187	5131
March	10827	1061	1981	222	5099
April	7180	661	1491	208	3551
May	9490	506	1775	265	5477
June	10344	687	1643	247	5527
July	13127	582	2140	263	5678
August	9607	656	1933	342	5512
September	7171	465	1669	238	3566
October	DATA	NOT	AVAILABLE		
November	7372	611	1345	172	3265
December	8498	689	1560	196	3661
<b>Total</b>	102665	7148	19125	2553	50091
<b>Prv%. Rate</b>	53.4%	3.7%	9.96%	1.33%	26.09%

*Source: MOH: Data from health facilities in the district report 2007*

## Pollution and waste generated from human settlement

The rapid population growth has increased demand for urban, agricultural and industrial activities, thus leading to generation of vast amounts of waste into the environment. In the district major pollution sources are - markets, over filled septic tanks, Hotels, bars, Abattoirs

sand scooping areas, quarries, rivers where intensive agriculture is being undertaken such as in Gachoka and Mwea, and hawking zones such as in Makutano along Nyeri - Nairobi road.

Types of waste generated include both solid and liquid. Polythene bags and market waste are prominent. The county council does not have a specified dumping site for wastes. Liquid wastes offer a serious problem due to lack of sewerage system in all urban centers' in the District. This liquid waste eventually ends up in river systems.

The district Hospital at Siakago and Ishiara has incinerators and pits for disposing their waste. Private clinics and other health facilities do not have waste disposal facilities, and are a big concern. It is suggested that any clinic that does not meet the requirements for waste management should be closed. Other sources of waste include, posho mills, wood workshops, washing of vehicles in rivers, misuse of rivers by adjacent communities, by open river bathing and linen washing.

Disposal of liquid waste is hindered by lack of facilities and unplanned settlement. Sock, septic tanks and open drains emanate foal smell in town centers. Settlement in swampy areas like in Siakago town is an environmental problem as it hinders proper liquid waste disposal and also serves as mosquito breeding ground. Tebere quarry chips factory at Makutano produces a lot of dust that covers vegetation in the surrounding area and also affects the air quality. The decommissioned old quarry is yet to be rehabilitated.

### **Key environmental issues**

- Water borne diseases
- Pollution
- Poor waste management
- Inadequate waste facilities

### **Proposed interventions**

- Proper sanitation facilities
- Proper waste management
- Awareness creation
- Provision of health facilities

### **3.3 Communication networks**

The District has a total length of 800 km of roads, out of this 40 km is tarmac, and 486 km is minor roads, while 236 km constitute rural access roads. The road network and road maintenance are poor. The Department of public works and Mbeere County council undertakes the road maintenance. There is need therefore, for the allocation of more resources in order to improve the status of these roads. The 40 km, Bitumen standard road in the district, is a trans-district road, connecting Mbeere with Machakos and Embu districts, through Machanga, Kiritiri and Gachoka market centers. Other notable roads are Embu town to Siakago, Siakago to Kiritiri, and Embu to Ishiara market and then connect into Tharaka district. Another connects Siakago to Ugweri market.

During land surveying and demarcation some roads between pieces of land were located down or uphill instead of across the hill. The hilly terrains in this area parts cause formation of deep gullies due to run-off water; during heavy rains. The access roads on the lower part of the District (Mwea division) become impassable during heavy rains, as a result of the nature of the soil. This is because of the black cotton soils. Most of the drifts are in bad condition resulting from sand harvesting underneath them. This calls for sustainable sand scooping measures to be put in place.

About 10-20% of the silt load in the rivers is estimated to come from roadside erosion. Water diversions to neighboring farms from the roadsides is not supported by any soil conservation measures, while, roof catchment's in town centers play havoc, by creating gullies.

#### **Key environmental issues**

- Gully erosion
- Inadequate communication network
- Poor roads
- Inaccessibility of remote areas

#### **Proposed interventions**

- Improve roads networks
- Soil conservation programmes

### **3.4 Social, economic services and infrastructure**

#### **Water**

In the district, some of the ground water (boreholes and shallow wells) yields saline water, while the quality of water in the shallow wells cannot be ascertained. Some are close to pit latrines that serve as source of water pollution. Others are unused quarries where run off collects and have high contamination levels. Ground water potential in the district is low, hence most boreholes dry up. Kiang'ombe Forest (hill) serves as an import catchment's area and is a source of several springs.

There are five perennial rivers, in the district namely: Tana (south boundary), Thuci, Thiba in the western boundary, Ruingazi (tributary of Thiba) and Ena to the north south and east flow, drain the District. Springs near the urban areas are highly polluted, especially those close to urban centers.

Water sources include: Rivers, Boreholes, wells, springs, Roof catchments, Earth dams, Sand dams, Rock catchments, and Surface runoff.

Despite the above situation, water availability for domestic and livestock consumption is a major problem to the community. Large capital expenditure is required to harness it, and the quality of the water is poor, hence most of the people consume untreated water. Pesticides especially in irrigated areas and tobacco nurseries located near water sources pollute water. Overall water flow has been on decline due to increased abstraction and poor land management.

#### **Water availability and access**

Rivers Tana, Thuci, Thiba, Ruingaci and Ena are permanent rivers. The district has about 37,036 households of which 8548 households has piped water, 9,972 households has access to potable water. The number of dams in the district is 122 and the average distance to nearest potable water point is 4km. The degradation of Kiang'ombe, Kianjiru, Kiambeere, other hills and the reclamation of the wetlands in the district is having an effect on infiltration and surface run off, leading to an effect on ground water recharge rates. Tana River is brown in color due to erosion. This is having a direct impact on the quality of the water and on the life of the reservoirs for hydroelectric generation and irrigation channels downstream.

Current water development programmes focus on water delivery, with little concern for demand management and conservation. Some spring sources such as Gatituri in Riandu Sub-location, Siakago division have been set-aside as a conservation site. Agro forestry practices, spring source conservation, land use planning is being advocated.

The following are the operational water projects in the district and the proposed ones;

### **Ena– Siakago Water Project**

#### **Present Status:**

- Design population was 40,000 people.
- Currently serving 5, 500 people.
- Present population in the project areas 60,000 people and expected to increase to 80,635 by the year 2015 by an increase of 3% per annum.
- Only 500 people connected.

### **Kune Water Supply**

#### **Present Status:**

- Design was to serve 1,205 people.
- The present population is 2,389
- Designed to serve, Kariru sub Location and part of Riandu.

### **Kirie Water Supply:**

#### **Present Status**

- The source is presently serving 600 people. However work was done by Plan International though no design data was available.
- Present population 1,685
- year 2015 population will be 2,264 by increase of 3% per annum.

### **Gangara/Kiringa Water Project:**

This is a community water project drawing water from Kiringa stream and other springs in Kiang'ombe hill. The project was funded by Plan International and was to serve an approximate population 1,000 people. The present population is estimated to be 5,282 and by the year 2015 it is estimated to be 7,100.

**Gatituri Water Project:**

This is a community water project that was originally developed by county council of Mbeere. Recently the Drought Management Office laid a pipeline and constructed a storage tank of 25m<sup>3</sup> and 2 water kiosks. Currently it is serving about 350 people. The water project has the capacity to serve more people.

**Boreholes****Present Status:**

Currently there are about 30 boreholes. About 17 are operational, while 13 are not operational.

**Recommendations**

There is a proposal to drill about 20 boreholes and rehabilitate about 13 in the next 10 years.

**Dams/ Pans/Rock and Roof Catchment:****Present Status:**

Currently there are about 3 Dams, which are all operational.

**Recommendations**

There is need to construct 20 dams, 20 rock and 30 roof catchments for more storage of water. This will be done on the sites that will be identified as suitable.

**Mwea Division****Gategi Water Project:**

This is a private water supply that is serving an area of about 15km<sup>2</sup>. It draws its water from Thiba River. Currently the water supply is serving a population of about 1,000 people. The current population is estimated to be 6,771 and by the year 2015 it is estimated to be 9,100.

**Ndia/Karaba Water Scheme:**

This is a non-operational project. The pipeline and tanks are in place. The project was to cover over 75Km<sup>2</sup> and serve a population of 20,000 people.

### **Makima Water Project**

The project is non – operational. It is a pumping project. Pipeline is in place although it needs rehabilitation. The current population in Makima sub – location is 4,333 and by the year 2015 it is estimated to be 5,823.

### **Boreholes**

#### **Present Status:**

Currently there are about 70 boreholes. There are about 30 Operational, 40 are not operational.

#### **Recommendations**

There is a proposal to drill about 20 boreholes and rehabilitate about 40 boreholes in the next 10 years. Five boreholes will be equipped with solar power systems.

### **Dams/Pans/Roof Catchments**

#### **Present Situation:**

Currently there are about 10 dams. There are 3 Operational, and 7 are not operational.

#### **Recommendations**

There is need to construct 40 Dams/ Pans and 30 roof catchments for storage of flood flow. This will be done in the sites that will be found suitable.

### **Evurore Division**

#### **Ishiara Water Supply:**

#### **Present Status:**

- Design population 30,000 people.
- Currently serving 6,000 people.
- Present population in the project area is 30,000 people and expected to increase to 40, 317 by the year 2015.

**Kanyuambora Water Project:****Present Status**

The project is presently, serving about 2,600 people. The current population on the project area is 11,840 and is projected to grow to 15,912 by the year 2015. Thuci River is the main water resource in the project area. The project has been funded by Water service Trust Fund and a new intake is being constructed and storage tanks and pipelines will be laid. The project design is expected to meet the water demand for 6, 000 people.

**Kathiga Gacheru Water Project:****Present Status:**

The project's fifty 4"inch G.I pipes from the intake to a distance of about 250 meters downstream were washed away by floods some years ago, and have not been replaced therefore; the project is not in use.

**Ngunyumu Water Project:**

Catholic Diocese of Embu funds the project. It is currently serving a population of about 550 people. Water is abstracted from a spring in Kiang'ombe hill. The current population is 2,788 and is projected to grow to 3,329 by the year 2015.

**Mkepp Projects:**

The MKEPP has earmarked some projects in Kiang'ombe FDA that is in Evurore Division.

The projects are: -

- Marivue sand dam
- Rock catchment
- Earth dam
- Roof catchment – 2 Tanks in schools.

**Boreholes:****Present Status:**

Currently there are 11 boreholes. 4 are operational, and 7 are not operational.

**Recommendations**

There is need to drill about 10 boreholes and rehabilitate about 7 boreholes in the next 10 years

## **Dams/Pans/Roof Catchments**

### **Present Status:**

Currently there are about 17 Dams. There are about 8 Operational and 9 are not operational.

### **Recommendations**

There is need to construct 30 Dams/ Pans and 20 roof catchments for storage of flood flow. This will be done in the sites that will be found suitable.

### **Gachoka Division:**

Gachoka Division seems to have very little community water projects. The projects in this Division are mainly private and are mostly concentrated along Rupingazi River. However there are two projects proposed these propose projects include:-

### **Kiambere Integrated Spring Project.**

Christian Community Service sponsored the project but it has stalled. There is need to fund this project which when complete is supposed to supply water to the current population of about 5,832

### **Rwika (Rianjeru) Water Project**

#### **Present Status:**

The survey and design have been done.

#### **Recommendations:**

There is need to have a turbine system as a method of abstraction from Rupingazi River.

## **Dams/Pans/Roof Catchments**

### **Present Situation:**

Currently there are about 47 Dams. 21 are operational, and 26 are not operational.

### **Recommendations**

There is need to construct 40 Dams/ Pans and 30 roof catchments for storage of flood flow. This will be done in the sites that will be suitable.

**Boreholes:****Present Status:**

Currently there are about 110 boreholes. 50 are operational and 60 are not operational.

**Recommendations**

There is need to drill about 30 boreholes and rehabilitate about 60 in the next 10 years

**3.4 Energy supply**

The District's main energy sources are firewood and charcoal. This accounts for 80% and 11.4% respectively of energy used. Others include, use of Kerosene, Solar, Electricity, Cooking gas, Petrol and Diesel.

The harvesting of wood fuel leads to deforestation. Charcoal production has continued to increase over the years due to its increased demand in the urban centres within and without. Use of efficient production of charcoal through adoption of energy efficient technologies such as improved kilns is not significant. Tobacco companies have designed a venture Jiko that uses half the quantity of fuel wood as compared to the traditional one for tobacco curing. The use of fireless cookers and efficient stoves is limited to a few groups, hotels and schools. The District has major electricity generating plants, but electricity distribution grid has been extended to a very limited area. The rural electrification programme is yet to benefit the District.

Electricity services are mainly in major centers of Siakago, Karaba, Kiritiri, Makutano and Ishiara. The most disadvantaged division with respect to electric power supply is Mwea.

There are few Petrol Stations in the district and storage of petroleum fuels in drums is common in shopping centers. This is a risky scenario, as set standards have not being followed.

In Mwea division, lack of land adjudication and policy guidelines has resulted in a free for all harvesting of trees for charcoal production fuel wood and clearing for agriculture.

An intensified Social Forestry Project for semi-arid areas is on going in the district. Its main objective is to increase household income and enhance environmental conservation through facilitation of social forestry extension activities through farmer initiative and institutional strengthening.

A forestation and Agro-forestry activities are taking place, mainly on individual farms. The farmers grow their own seedlings and are also supplemented by the forestry department, agriculture department, water department, British American tobacco, (BAT) Mastermind, Tana and Athi River Development Authority (TARDA), Kamurugu Agricultural Development initiative (KADI) and NGOs. There is however low tree seedling survival due to termite attack, drought and destruction by livestock.

Due to the high population growth, and unmatched rates of reforestation, the demand for wood fuel could make tree based resources exploitation unsustainable. It is therefore necessary to use this resource sustainably, and at the same time adopt and promote energy conservation measures.

Use of solar energy is on the increase, in areas not served by the electricity grid. However purchase and installment of the panels is inhibitive to the poor majority. The Kenya Power Generating Company KENGEN has proposed to set up 1,500 hectares of *Eucalyptus camadulensis* tree clones in Kiambeere location of Gachoka Division; this is targeting the Kenya tea development Authority (KTDA) tea factory, which has of recent times been sourcing wood fuel in the district. KTDA's factories have shifted from using furnace oil to fuel wood.

Wind energy as a source of energy has not been explored, but the district is not prone to strong winds, except atop hills like Kianjiru where Safaricom is using wind energy to run its base transmission station. The lower part of the Tana River around Ishiara (Evurore Division) has a great potential for further development of hydropower stations. This would exploit the Meru catchments for power generation. Small hydro power stations have also not been significantly exploited, in the district and have a great potential.

Unsustainable farming methods in the catchment's areas have resulted to breeding rivers. This increased sediment load has continued to reduce volume of water in the hydropower generating dams.

There are significant gender constraints in fuel wood access and ownership in the District and use of agricultural residue for energy is also not significant. The forestry department, Agriculture, Provincial Administration, Water Department, is making increased efforts;

Community based groups, and NGO's, to promote sustainable resource use by adoption of Agro forestry technologies, energy saving devices and use of indigenous knowledge.

**Key Environmental issues**

- Deforestation
- Siltation of dams
- Soil erosion
- Water pollution

**Proposed intervention**

- Initiate afforestation and reforestation programmes
- Regular de-siltation of dams
- Initiate soil conservation measures
- Awareness creation on water pollution

**3.5 Sanitation**

Safe sanitation includes the use of flush toilets (to sewer/septic tank), covered pit latrine and ventilated improved pit (VIP) latrine for waste disposal. Unsafe sanitation includes the use of pan/bucket, uncovered pit latrine and other “other” means of waste disposal. Unsafe sanitation also includes households having no toilet since, in principle; the category includes use of the bush as a means of waste disposal.

The urban centers in the District do not have sewerage facilities. Planning of these facilities is considered to be important as population continues to increase and waste disposal is increasingly becoming a challenge.

**Key Environmental issues**

- Inadequate pit latrines
- Inadequate sewerage systems
- Inadequate availability of safe drinking water

**Proposed interventions**

- Constructions of latrines in homesteads
- Provision of sewerage facilities
- Provision of safe drinking water

**3.6 Health facilities**

Water borne and water related diseases are among the top causes of outpatient morbidity in the district. Malaria alone resulted to 282 deaths in 2004. Other diseases include diarrhoea,

skin and intestinal worms' related diseases and eye infections. Factors giving rise to these diseases include poor sanitation, inadequate coverage of safe and clean water supplies in the district, poor hygiene practices, poor food handling practices and poverty. Only 54% of the households have access to unsafe water.

These disease occurrences have resulted to mortality, and reduced economic productivity.

Health facilities in the district are as tabulated below.(table18)

**Table 18: Health facilities**

Government hospitals	2
Government health centers	2
Government dispensaries	21
Private dispensaries	3
Religious organizations dispensaries.	4
Doctor patient ratio	1:57,000

### Health facility issues

- Insufficient number of doctors
- Insufficient environmental health knowledge
- Inadequate strategies of health education, disease control and prevention

### Proposed intervention

- Dispatch more doctors to the district
- Improvement of the quality of health care
- Reduction of the cost of health services

### 3.7 Educational facilities

The education facilities in the district are as tabulated below in regards to enrollment and teacher pupil ratio.

<b>Number of pre-primary schools</b>	234
Total enrolment rates (boys 4,040 and girls	3,869)
Teacher/pupil ratio	1:35
<b>Number of Primary schools</b>	219
Total enrolment rates (1999)	boys (22,471) and girls (23,014)
Teacher/pupil ratio	1:26
<b>Number of Secondary schools</b>	39

Total enrolment rates

boys (2,988) and girls (2,839)

Teacher/pupil ratio

1:20

## **CHAPTER FOUR**

### **4.0 Industry, trade and services**

#### **4.1 Industrial sector**

The industries in the District are mainly flour milling, timber and timber processing small Industries, Ballast processing, and power generation by KENGEN. Cut flower and vegetables processing for export is also undertaken in Gachoka division. In most cases the small Industries are located in urban centers within the District. Wood shavings, noise, dust; unfilled quarry pits are some of the major effects of the Industries. While Small-scale fish processing has potential with the improvement of fishing activities in the KENGEN dams.

Ballast processing has a lot of potential as extensive patches of volcanic Flows and falls that weather easily are found in the District. These includes, phonolites and Basalt which are currently being exploited for aggregates in areas around Rwika and tuffs that are exploited for building stones in Nganduri Munyori, Kamutungu, and Ngiori in Gachoka division and in Siakago division at Kwamuguku quarries.

Use of efficiently produced charcoal has potential but a lot of sensitization for effective sustainable productions is yet to be undertaken. In areas where electricity is easily accessible, there has been a shift from using diesel power to electrical, especially in flour milling. In Charcoal production, the old production methods are still in use. Timber exploitation on the farms is motorized and processing is done by use of electricity. This is going to increase as demand for products increases with increase in population. Safety measures are being followed in the industries but regular inspections are necessary. Training on standards and regulations is seen as a necessity as some are not being followed.

#### **4.2 Trade sector**

The cumulative and collective environmental impact of the several trade enterprises in the District is quiet large. Some of the notable trading activities with an impact on the environment includes, motor vehicle garages, hawking, timber processing, agricultural produce markets, hotels and bars and general trade. Motor vehicle garages oil based, scrap metal, and other garage wastes are not biodegradable. These wastes contaminate the soil, water and at times blocks drains. The perception, that these enterprises support the very poor in the Society, makes it difficult for authorities to monitor and properly regulate them.

### **4.2.1 Hawking**

Hawking has increased significantly in the urban centers. The increase has been contributed by the high rate of unemployment. Although the contribution to the economy is quite big, it impacts negatively on the environment. The hawkers do not clean the mess they create when undertaking the hawking activity. The local authority should control and regulate this trade within Makutano centre. Over the years, wholesale and retail trade has continued to grow both in rural and urban areas. However, there has been poor planning, which has led to mushrooming of shops and kiosks. This has generated enormous amounts of Waste which constitute polythene bags. The solid waste at time is eaten by livestock, blocking drains as well as being an eye sore and poor aesthetics.

The demand for business premises has resulted to unplanned towns, as development cannot meet the high demand. The end result is that the local authorities are unable to collect waste generated.

The District has ideal climate for flower and horticultural farming and is endowed with water resources. However these have not been fully exploited. Market for fish, bee products and beef is available but not fully developed. However the District road network is in pathetic condition and new markets need to be explored. Capital needs to be availed for enterprises development.

### **4.3 Services sector**

The services sector plays an important role in creating and supporting an enabling environment that facilitates private sector investment, growth and job creation. The provision of adequate services, coupled with macroeconomic stability and long-term development strategy, are essential preconditions for sustainable economic and social development. The sector also greatly contributes to the degradation of the district's environment. Though the roads are in moderate to poor condition, they serve as a channel for transporting natural resources from the district, both legally acquired and contraband. Runoff water from the roads causes erosion as it finds the natural course to watercourses. Servicing of vehicles that ply these roads result into oils and grease polluting soils and water resources.

## **4.4 Tourism**

### **Type of tourism attraction and potential**

The type of tourism in the district is wildlife and leisure. This is basically to watch wildlife at the Mwea National Reserve. Facilities are however lacking in terms of hotels at the reserve. In the other urban centers in the district, like Ishiara market, reasonable hotel facilities exist. Impacts on the environment are not substantial at the moment due to low turnout of visitors. However this is not expected to remain as infrastructure and facilities are developed.

## **4.5 Mining and quarrying**

### **4.5.1 Mining**

Mining: of Amazonite sapphire and other precious stones is done mined in Kirii area of Siakago division and abandoned mining holes (open cast) have not been reclaimed though being on private land. Iron area mining was done in the past in Kiangombe location, Evurore division.

### **4.5.2 Quarrying**

Ballast processing has a lot of potential as extensive patches of volcanic Flows and falls that weather easily are found in the District. These include phonolites and Basalt which are currently being exploited for aggregates in areas around Rwika. Tuffs are found in Nganduri Munyori, Kamutungu, and Ngiori in Gachoka division and in Siakago division at Kwamuguku quarries and are being exploited for building stones.

Several quarries are found in Gachoka and Siakago divisions. The main quarries sites are, Nganduri, Munyori, Kamutungu, Ngiori in Gachoka division and Kwamuguku in Siakago division. Stone chips processing (Ballast) is done at Makutano area in Mwea division. However these sites are left open without any measures for reclamation being undertaken.

Several privately owned quarry pits (about 30) are found in Kianjiru location of Gachoka division and are operational. Their status range from near surface level, to several meters deep. About 11 pits have been decommissioned at the same location and rehabilitation

recommended. The big quarries at Wachoro in Mwea division (near Makutano town) have been fenced off and Environmental impact assessment conducted.

Water accumulates in these quarry pits and over time become polluted. The members of the community use the sites as alternative water sources and are also breeding grounds for mosquitoes and other disease vectors, as well as being risky sites to both human and animals. Quarry rehabilitation committee's needs to be formed in order to effectively address this issue.

#### **4.5.3 Sand harvesting**

Sand is manually scooped in Gachoka and Siakago divisions because these areas are easily accessible to the market. It is scooped along the dry riverbeds, particularly on the seasonal Thura River on the border of Gachoka and Siakago divisions. Sand harvesting affects sand water dams and therefore denies the residents nearby water resources, destroys the soil structure and infrastructures such as drifts. Big pits are dug when the sand is scooped, whose sides cannot hold. These areas are risky to the community as they can fall/slip over and are buried by loose soil. Sand harvesting should therefore be done in a more sustainable manner, and should only be carried out in areas where the community is not affected.

Other sites where manual sand scooping is done are Githagana seasonal stream, on the BAT side, Nguu stream around Mecca and Kwamiti area along Kiritiri Gachoka road. Also near, Kanyariri and on roadsides especially on drifts along Siakago-Kiritiri road and other drifts in the district.

Sand scooping increases during the dry period as a coping mechanism by the community. It is also prominent due to lack of employment opportunities

#### **Key environmental issues**

- Loss of biodiversity
- Pollution by waste from industries
- Open quarries act as breeding grounds for mosquitoes and other environmental hazards
- Inadequate enforcement of relevant legislations

**Proposed interventions**

- Pollution control measures
- Conservation of biodiversity
- Enforce relevant legislation

## CHAPTER FIVE

### 5.0 Environmental hazards and disasters

**Hazard:** A potentially damaging physical event, human activity or phenomenon with a potential to cause loss of life or injury, property damage, social and economic disruption of life, environmental degradation among other effects.

**Disaster:** A disaster can be defined as a serious disruption of the functioning of the society causing widespread human, material or environmental damage and losses which exceed the ability of the affected community to cope using their own resources.

### 5.1 Extent and trends of environmental hazards and disasters

Flash flooding has intensified in the district due to increased environmental degradation. The floods and droughts have adverse impacts on the social, economic, public health and environment sectors. Being an ASAL district, severe droughts are experienced. Recorded droughts were experience in 1930, 1943,1964,1974,1983,1984,1994,2002 and 2004.

The duration between droughts continues to shorten, while droughts persist longer. As the majority of the people in the district are poor, drought results to increased charcoal production as a coping mechanism. Poverty has thus accelerated environmental degradation especially on land. Most areas adversely affected by drought include the following locations of, Kiambeere, Mumiji, Mutitu, Ishiara, Ndurumori, Mutuovare, Mavuria, Gichiche, Kiria, and Iria-itune. Flooding is not a frequent occurrence in the district. Nevertheless when it occurs especially during rainy periods the results are erosion on steep hillsides, silting of earth dams, roadside erosion, farm siltation and blockage of road culverts. El-nino rains had the highest effect.

#### Key environmental issuers

- Deforestation
- Soil erosion
- Poor infrastructure
- Disease outbreaks
- Pollution
- Loss of biodiversity
- Inadequate early warning systems

### **Proposed intervention**

- Re-afforestation, afforestation,
- Soil conservation measures
- Provision of adequate infrastructure
- Enhance early warning systems
- Pollution control
- Conserve biodiversity
- Awareness creation.

Disaster risk reduction (DRR) strategies should also include early warning systems and preparedness, monitoring, response, recovery and post recovery. Dependency on relief measures should come after other measures of DRR have been applied.

Quarrying and mining activities are also both hazardous and disastrous and measures need to be put into place to avoid this. Acts governing these activities need to be enforced. It is envisaged that the district should identify institutions/agencies that will be involved in the processes on disaster on a day today basis as well as outline the working protocol and information sharing mechanisms.

## **CHAPTER SIX**

### **6.0 Environmental education and technologies**

#### **6.1 Status of environmental education**

As we aspire to achieve sustainable development, there is need to educate the public on the importance to participate in environmental conservation and application of appropriate technology while addressing their socio-economic development concerns.

The types of environmental educational programmes in the district include eco-schools, 4k clubs, geography clubs and wildlife clubs. These are in primary, secondary and tertiary institutions. Basically all these programs focus on tree planting and on a clean environment. Focus in these institutions is also on cooking to conserve especially at secondary and tertiary levels.

At the non-formal level, there is education on the establishment of group tree nurseries, soil and water conservation, afforestation and catchment's conservation. The key players are the government departments, CBOs, NGOs and NEMA. Funding has been a challenge on the part of DEO as well as lack of curricula for environmental education.

#### **6.2 Public awareness and participation**

When information on the environment is made available to the public, it enhances internalization of values that support sustainable environmental management. Results done in three locations in the district, found out that, the status of public awareness and participation in environmental conservation programmes is about 50%-60% in Kiango'mbe, Kianjiru and Gachuriri. However, some extremists in disregard to conservation is either habitual, cultural, a coping mechanism or opportunistic.

Key players in environmental awareness are CBOs, NGOs, Government department, and NEMA. Linkages between these key players are a challenge, as the DEO is not well facilitated. Although sharing of information and collaboration is ongoing.

### **6.3 Environmental information systems**

#### **Types and sources of environmental information**

The broad challenge in harnessing environmental information and communication technology include inadequate resources and capacity for information collection, analysis, storage and dissemination; inadequate awareness among environmental managers and the public, and lack of knowledge sharing networks at grass root level. The data types available in the district are;

Information on land that can be accessed from the land adjudication office, District Surveyor, District Physical Planning Officer, County Council, Forestry department, the Agricultural department and the Public administration: There is need for District Lands Office where all matters on Land could be readily accessed, from one roof. This is important, as it will make environmental Planning and Management easier. Other information can be accessed from the District statistics office, Livestock office, Public health office, the District development office and the Provincial geologist office. The information is however not readily available to the community, and it is actually made for the consumption of the particular department.

#### **Environmental Information Systems**

Sharing of information between departments and institutions is mainly during meetings, committees and task forces. There is lack of skills and documentation centers in the district, for handling information and management. The NEMA quarterly magazine is normally circulated to departments and the Samaki news from Fisheries department. Few other magazines are in circulation.

There is need for funding to produce brochures to inform the public on environmental issues and environmental development. Table 19 shows Data and Information Management by Main Sectors

**Table 19: Data and Information Management by Main Sectors**

Sector	Data and information Aspects
Wildlife	A major gap in wildlife information is little or inadequate data on population dynamics-sex ratios and population growth potential. Equally data collection suffers from infrequent surveys due to inadequate human and financial resources as well as appropriate technology
Tourism	Tourism is rapidly expanding economic industry in Kenya. As industry tourism is based mainly on wildlife and its natural habitat in addition to the natural attractions like beaches and landscapes. The growth of tourism will depend on good public relations, marketing efforts, political stability and world economy and politics. Financial base is a major constraint to the tourism industry. The budget provision is severely inadequate.
Forestry	A major gap in forestry data includes characteristics , biodiversity, dynamism and economic value
Livestock	Information relating to livestock is far from adequate particularly on population dynamics, biodiversity policy/legislation, human resources/technology, networking/marketing, quantity and socio-cultural aspects.
Marine and Fisheries	There is general inconsistency and lack of periodicity in data collection. Main contributing factors is inadequate funding for human resource capacity building, and for purchase of equipment, and for surveys, analyses and storage
Soils	Soil surveys are expensive to carry out due to intensive and demanding field checks. This has resulted to having only limited areas (30 % of the country covered to a scale of 1:100,000 in a span of 20 years) The only soil map covering the whole country to a scale of 1:1,000,000, which is now in resolution and inappropriate for projects implementation. Inadequate funds have been major constraints to these efforts. Most soil surveys reports lack illustrations for the general public, particularly maps on the distribution of soil erosion hazards and soil loss amounts.
Water resources	The water master plan comprise interrelated databases including the following: socio-economic conditions; potential water resources and

	<p>demands, development plan for domestic and industrial water supply and livestock water supply, wildlife and fisheries, development plan for agriculture, hydropower development and flood protection and drainage. It also contains a total of 151 various thematic maps and other illustrations on vegetation and land use, landforms, hydrology, groundwater quality, surface water, water resources, this information has been digitized.</p> <p>Other government ministries also do collect data on water. E.g. Health, Agriculture and Local government. Universities, research centers, parastatals NGos. Development authorities also collect water and wastewater samples for analyses by government and private laboratories. Public and private universities and researchers have data in the form of research reports. There is need to fill data /information gaps on aquatic environment; location and extent of acquirers in different areas and their potentials; cause of declining water levels in Rift Valley lakes; effects of pesticides, heavy metals and other substances on water quality.</p>
Land use	<p>Available information is of varying types, formats and scale and is held by various organizations. Collection analysis and management is expensive as it is multi-sectoral in nature requiring the participation of various institutions. Besides, funding has been inadequate, while technologies used have been largely inappropriate.</p>
Geology and Mining	<p>Geological information collected can be used to assess and locate ground water resources, rock formations, hydrocarbons, geological hazards and mineral potential.</p> <p>Existing data bases are available in forms of; geological reports and maps; well information which includes well logs and cores; geo-chemical and petrol-physical samples; and geophysical data and accompanying reports but only for a part of the country.</p> <p>The National Oil Corporation of Kenya (NOCK) is digitizing existing databases. Data in the mines and Geology Department are still in form of reports and maps. Enormous information exists in universities.</p>

Energy	Four main sources of energy are wood-fuel, fossil fuel, hydro and geothermal electricity. Information is available but scattered in different institutions e.g. NOCK, Ministry of energy, Public works, private and NGOs.
Metrological	<p>Meteorological data is observed at 28 ground surface stations, 15 agro-met stations, 3 radio sound, 18 pilot balloon and about 2000 rainfall stations. In collecting and disseminating met Data, use is made of schools, hospitals, government offices, farmers and interested individuals for observation of rainfall data. KMD provides them with rain gauges and maintain them.</p> <p>Missing data gaps are insufficient network of observation stations due to inadequate funding. Type of data collected; Rainfall, clouds, wind, temperature, visibility, pressure, evaporation, sunshine, radiation etc. some data-back to 1890. Most data are kept on magnetic tapes and observation registers. Processed data are microfilmed and stored. Other constraints that face quality of data radiation measurement is imprecise-type and intensity, which denies the scientist the chance of involvement in research of ozone depletion and global, warming.</p>
Agriculture	<p>Information relating to agricultural activities and services are at the moment held by various organizations and government departments. Information is stored in various forms ranging from monographs to digital information. The Ministry of agriculture publishes bulletins on agriculture and related services. It also has several information systems ranging from a library service to a documentation unit and computed databases. Currently, uncoordinated institutions manage agricultural information services. Besides, the institutions lack clear, consistent guidelines for data collection, standardization and reporting. The public lack information on the availability and dissemination of information in the sector. There is inadequate funds to support information acquisition and management; absence of adequately trained personnel to undertake the tasks of information management and dissemination. Information collection, management and dissemination have not been accorded appropriate priority and funding. As a consequence, presentation of some information from agricultural research is sometimes difficult for the end users to understand.</p>

*Source: State of Environment Report 2004*

## 6.4 Technologies

Technologies can contribute to economic development and environmental conservation when used appropriately. Not much has been done in the district as regards this. However, cloned Eucalyptus tree seedlings have increasingly been planted in the district. These are fast growing and could help avert an energy crisis in the foreseeable future. Areas where planting has been done are Rwika area in Kiamuringa location, Kithembe and Riandu in Siakago and Kiambeere area. Use of improved honey harvesting methods, reversion to indigenous foods farming and storage are being advocated as a renewed technology. Traditional herbal medicine use have increased in importance due to the benefits of indigenous plants and hence to their sustainable use.

## 6.5 indigenous knowledge (IK)

National and International laws have ignored the right of indigenous and local people on biodiversity. Intellectual property rights do not include protection of traditional knowledge, innovations and rights of indigenous and local people. Indigenous knowledge offers potential information that can be exploited to contribute positively to develop the environment sustainably.

*Aloe* species are found in Mbeere, but their commercial exploitation is not known. However the people exploit it for various ailments. Other species locally exploited are *Carisa edulis*, *Rhus natalensis*, *Pistacia aethiopica* and *Toddalia asiatica*. Herbalists also exploit these medicinal plants and others, and have become popular to the community.

Cultural practices, which offered some regulatory framework, have broken up leading to loss of biodiversity and indigenous knowledge. There is therefore the need to do the following;

Apply indigenous knowledge in biodiversity conservation alongside other approaches.

Develop a strategy on benefit sharing to address major concerns on biodiversity utilization.

Encourage the use of culture in environmental conservation.

## Key environmental issues

- Inadequate environmental materials for distribution and reference
- Inadequate facilities and equipment
- Inadequate documentation of indigenous knowledge

### **Proposed interventions**

- Develop and improve circulation of environmental materials
- Develop information infrastructure and equipments
- Document indigenous knowledge

## CHAPTER SEVEN

### 7.0. Environmental governance and institutional frameworks

#### 7.1 Overview

There are several institutions involved in the management of environment in the district. They range from government ministries and departments; state corporations; private sector; associations; NGOs; CBOs and individuals. This wide ranging interest in environmental management is bound to encounter operational conflicts and duplication of roles and responsibilities. This is compounded by poor co-ordination, inappropriate and incoherent legislation, lack of adequate institutional frameworks on governance issues and a lack of understanding of the importance of these ecosystems for human well-being and prosperity<sup>1</sup>.

Promotion of awareness among the public and policy-makers of the importance of proper management of resources and the integration of environmental issues in the development agenda remains a key priority. Other priorities include promoting legislation to take up and implement relevant Multilateral Environmental Agreements (MEAs), harmonizing legal frameworks that address these issues, developing appropriate guidelines, standards and procedures for Strategic Environmental Assessments (SEAs) and Environmental Impact Assessments (EIAs), developing model legislation for sectors such as local councils, tourism, agriculture and engaging with relevant organizations to promote sustainable business practices.

#### 7.2. Status of environmental governance & institutional arrangements

Key issues on governance, legal framework and institutional arrangements and policies are: inadequate capacity to interpret and enforce environmental legislations; conflict of environmental legislations and institutional mandates; undefined pre-existing ownership rights and utilization of natural resources; use of incentives to strengthen compliance for environmental management; introduction and acceptance to pay for ecosystem services and goods; over reliance on elaborate and lengthy court systems and formal institution in deliberating environmental cases. Government ministries and departments, and state corporations that collaborate with NEMA through the District Environment Office include; Agriculture, Fisheries, Livestock, Health, Education, Planning, Development and Vision

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<sup>1</sup>*This upholds the Principle of Sustainable development; the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

2030, Local Authorities, Kenya Forest Service, Water Resources and Management Authority, NGOs and Community Based Organizations

The European Union is also funding proposals from CBOs through Community Development Trust Fund (CDEMP) and Community Environment Facility. The Swedish International Development Agency (SIDA) is funding the National Agriculture and Livestock Extension Programme (NALEP), a programme that has embraced environmental issues and the District Environment Officer is a member of the District Coordinating Team (DCT).

### 7.3. Regulatory and management tools

*Table 20: Regulations and by-laws for managing environmental and human health in the district.*

Title of Regulations and Gazette Notice Number	Year of Gazettement	Aspects of environment regulated	Implementing Agency	Coordinating mechanisms	Areas on overlaps and conflicts with EMCA, 1999
The Local government (Adoptive-by laws) (Building (Amendment) order 1995 L./Notice No. 257 of 7/7/95)	1995	Provision of drainage& waste water Sanitary provisions	Local Authority		<i>Overlap</i> Enforcement
Statute Law (Miscellaneous Amendments) Act (No. 2 of 2002) in respect of Cap 242 and Cap 254 penalties	2002	Enhancing environmental cleanliness	Public health dept	Supervision Prosecution	<i>Overlaps</i> Supervisions Prosecution

*Source: District Environment Office, Mbeere 2006*

*Table 21: Policies that Impact on Environment*

Policy	Formulation date	Aspects of environment addressed	Implementing agency	Coordinating mechanisms	Challenges in enforcement	Overlaps and conflicts with EMCA, 1999
Forest policy	2005	Tree planting, poverty reduction, soil, water and biodiversity conservation, conservation of catchment areas, forest research, training	KFS	Participatory community forest protection, participatory tree planting, reporting forest pest & diseases to KEFRI, research and dissemination of findings by KEFRI,	-Inadequate funds. -Poor coordination-political interferences-inadequate law enforcement	<i>Overlaps</i> -Research -Training -Public participation
Diagnosis, treatment and prevention of malaria	2003	Prevention/control of vectors	Ministry of Public Health and Sanitation	Seasonal calendar data compiled at Medical Dept	Inadequate funds	

*Source; District Forest Office, 2006 & District Public Health Office,*

**Table 22: Legislation that impact on human health and environmental quality**

Title of legislation	Year of enactment	Aspects of environment addressed by Act	Implementing Agency	Coordinating mechanisms
Forest Act	2005	-Management of: All state forests and provisional forests in collaboration with the owners -Protection of forests -Promotion of forestry education and training -Community participation -Prohibited activities in the forest -Presidential protection of trees	KFS	Formation of PFM Formation of user groups Education through barazas
Water Act	2002	-Management and conservation water resources Protection of water catchments	WRMA	Formation of water users associations and river user associations
Public Health Act		-Sanitation and hygiene	Public Health Department	
Fisheries Act	1989	-Pollution prevention zones -Ecological zones where fishing is prohibited	Ministry of Fisheries Development	
Agriculture Act		Soil conservation River bank protection	Ministry of Agriculture	
Pest Control Product Act	1984	Safe use of chemicals Disposal of containers & obsolete chemicals Quality control/persistence	PCPB	
The Local Government Act	1978 and revised in 1998	-Control factories/industries/which by smoke, chemical fumes, gases, noise, vibration to neighbours -Control planning of specific areas	Local Authority	

*Source, District Forest, Agriculture, Public Health, Fisheries & Water Offices, 2006*

### **Environmental Impact Assessment (EIA) and Environmental Audit (EA)**

These are the regulatory tools applied in the district for activities listed in the First Schedule of EMCA, 1999. . Other facilities such as the agro - based processing industry and filling stations also undertake annual environmental audits (EA) to ensure compliance with EIA/EA regulations. Due to the complicated nature of land use activities as well as sensitivity of wetland management, the District Environment Committee through the District Environment Officer keeps itself informed of the on going activities.

Various mechanisms are in place in the district to ensure the environment is conserved. EMCA, 1999 provides for the establishment of the District Environment Committees (DEC). This Committee has been constituted and gazetted. The Local Authority (Town Council) has an environment division to ensure that the environment's integrity is maintained. The level of domestication of MEAs is low. There is an urgent need for the public to be informed on the contents of these MEAs.

### **Key Environmental Issues**

- Overlaps in enforcement
- Inadequate research on local Environmental issues
- Inadequate capacity for enforcement
- Inadequate public participation
- Low level of domestication and implementation of MEAs

### **Proposed Interventions**

- Harmonization of regulations
- Enhanced research on environmental issues
- Enforcement of EMCA, 1999 and other relevant legislations
- Enhance public participation thorough *Barazas* and field days
- Domesticate and create awareness on MEAs locally

## **CHAPTER EIGHT**

### **8.0 Implementation and monitoring strategy**

#### **8.1 Stakeholder involvement**

The implementation strategy of the Environment Action Plan should involve as many stakeholders as possible. These include all Government departments, agencies, state corporations and any other organ of Government, civil society organizations, private sector and individuals.

#### **8.2 Resource requirements**

Implementation of the Environmental action plan requires a deliberate and targeted allocation of resources. -Financial, human and technology. The impacts from various interventions in the integration of environmental concerns often take time to be realized hence the need for prioritizing as resources for allocation are usually scarce.

Resources could come from community-based resources; local Authorities transfer fund, constituent development fund, government budgetary allocations, and support from NGOs, CBOs, religious organizations, and private sector and from development partners.

#### **8.3 Monitoring and evaluation**

The Monitoring and Evaluation of the implementation of the Environmental Action Plan will be carried out using participatory approaches where stakeholders are involved at all stages. Monitoring will mainly be undertaken on continuous basis through meetings and field visits. Reports will be discussed at all stages but quarterly reports will be prepared and reviewed. Table 24 shows the Implementation Matrix.

Table 23: Implementation Matrix

Division	Location	Issue Category	Problem Statement	Action No.	Actions Needed	Stakeholders	Timeframe 2009-2013
District Wide	District Wide	Air	Air pollution	1.	Control burning garbage	Min. of Public Health and Sanitation, Local Authorities	
				2.	Promote recycling of waste	Local Authorities	
				3.	Apply and enforce Public Health and Sanitation Act on disposal of dead animals	Min. of Public Health and Sanitation, Local Authorities	
				4.	Sensitize communities on waste management	Min. of Public Health and Sanitation, Local Authorities	
				5.	Afforestation and Re-afforestation	KFS	
			High prevalence of T.B	6.	Improve housing ventilation	Min. of Public Health and Sanitation, Local Authorities	
				7.	Conduct air pollution monitoring	Min. of Public Health and Sanitation, Local Authorities	
		Climate related environmental hazards	Frequent Drought /Famine	8.	Irrigate crops where possible	WRMA	
				9.	Plant drought tolerant crops	Min. of Agriculture	
				10.	Plant early maturing crops	Min. of Agriculture	
			Frequent Drought	11.	Afforestation and Re-afforestation	KFS	

			/Famine				
				12.	Promote storm water harvesting	WRMA	
				13.	Promote fish farming	Min. of Fisheries	
District Wide	District Wide	Climate related environmental hazards	Flooding	14.	promote water harvesting in the Tana river catchment	WRMA	
				15.	Afforestation and Re-afforestation	KFS	
				16.	Initiate appropriate soil conservation measures	Min. of Agriculture	
				17.	Improve farming methods	Min. of Agriculture	
				18.	Peg river banks	Min. of Agriculture	
				19.	Regulate sand harvesting in the district	Min. of Agriculture	
				20.	Introduce new crops such as cotton	Min. of Agriculture	
		Crop Production & Soils	High rate of soil erosion	21.	Initiate appropriate soil conservation measures	Min. of Agriculture	
				22.	Afforestation and Re-afforestation	KFS	
				23.	Construct Check dams and sand dams	WRMA	
				24.	Construct proper drainage on roads	Min. of Roads	
				25.	Build gabions	Min. of Agriculture	
				26.	Plant cover crops	Min. of Agriculture	
				27.	Promote roof water catchment	Min. of Agriculture	
				28.	Promote use of mulching	Min. of Agriculture	
			Poor crop yields	29.	Promote use of certified seeds	Min. of Agriculture	
				30.	promote timely land preparation and planting	Min. of Agriculture	

				31.	Initiate appropriate soil conservation measures	Min. of Agriculture	
				32.	Plant early maturing crops	Min. of Agriculture	
District Wide	District Wide	Crop Production & Soils	Poor crop yields	33.	Enhance farmers Field schools for extension purpose	Min. of Agriculture	
				34.	Practice crop rotation	Min. of Agriculture	
				35.	Plant drought tolerant crops	Min. of Agriculture	
				36.	Promote use of farm yard manures	Min. of Agriculture	
				37.	Promote irrigation along developed water sources	Min. of Agriculture, WRMA	
				38.	Promote Agro forestry	Min. of Agriculture	
				39.	Promote indigenous crops	Min. of Agriculture	
				40.	Sensitize communities to use certified seeds	Min. of Culture and social Services	
				41.	Conduct frequent soil sampling	Min. of Agriculture	
				42.	Encourage use of machine to prepare farmland /dry planting.	Min. of Agriculture	
				43.	Diversify crops	Min. of Agriculture	
		Energy	Shortage of wood fuel	44.	Promote planting of quick maturing trees	KFS	
				45.	Promote use of energy saving devices	Min. of Energy	
				46.	Promote use of alternative sources of energy eg biogas, solar	Min. of Energy	
		Environmental Education & Awareness	Low level of awareness on environmental education	47.	Educate the public through electronic and print media, drama and songs	Min. of Information	

District Wide	District Wide	Environmental Education & Awareness	Low level of awareness on environmental education	48.	Promote public participation in environmental plans, programmes and activities	Min. of Public Health and Sanitation, Local Authorities	
				49.	Sensitize communities/opinion leads to abandon cultural beliefs that inhibit environmental conservation	Min. of Culture and social Services	
				50.	Disseminate environmental information	Min. of Public Health and Sanitation, Local Authorities	
				51.	Integrate environmental issues in Schools & Adult/Public Institutions and literacy Centers	Min. Education	
				52.	Increased awareness on environmental laws through Barazas, seminars, workshops	Min. of Public Health and Sanitation, Local Authorities	
Masinga Division		Fish & Fisheries	Shortage of fish	53.	Apply and enforce fisheries Act	Min. of Fisheries	
				54.	Promote manual removal of water hyacinth and put it into economical use	WRMA	
				55.	Promote fish farming	Min. Fisheries	
				56.	Afforestation and Re-afforestation	KFS	
				57.	Monitor and ban use of chemicals for fishing	Min. of Fisheries	
				58.	Rehabilitate and restore water catchment areas	WRMA, Min. Agriculture	
				59.	Apply and enforce Public Health and Sanitation Act to	Min. of Public Health and	

					control pollution	Sanitation, Local Authorities	
				60.	Promote use of recommended fishing gears and methods	Min. of Fisheries	
				61.	Construct ice plants/preservation	Min. Fisheries, min of Cooperatives	
			Resource use conflict between Machakos and Mbeere fishermen	62.	Protect fish breeding grounds	Min. of Fisheries	
				63.	Promote use of solar to substitute the oil lamps for fishing	Min. of Fisheries	
				64.	Establish an Masinga fishermen organization to address the conflicts	Min. of Fisheries	
District Wide	District Wide	Forests & Trees	Deforestation	65.	Afforestation and Re-afforestation	KFS	
				66.	Promote agro forestry	KFS	
				67.	Conserve herbal medicinal plants	KFS	
				68.	Promote use of energy saving devices	Min. of Energy, Min. of Agriculture	
District Wide	District Wide	Forests & Trees	Deforestation	69.	Sensitize communities against traditional beliefs that hinder environmental conservation	Min. of Public Health and Sanitation, Local Authorities	
				70.	Promote community education and awareness on good forestry practices	KFS	
				71.	Plant drought tolerant crops	Min. of Agriculture	
				72.	Gazette existing forests		
				73.	Enforce the Forest Act	KFS	

				74.	Promote public awareness on the need to conserve and protect forests and catchments	KFS	
				75.	Establish tree nurseries	KFS	
				76.	Identify hilltops prone to soil erosion and rehabilitate them	KFS, Min. of Agriculture	
		Health	Prevalence of waterborne diseases	77.	Apply and enforce Public Health and Sanitation Act	Min. of Public Health and Sanitation, Local Authorities	
				78.	Promote treatment of drinking water	WRMA	
				79.	Protect water sources	WRMA, Min. Agriculture	
				80.	Apply and enforce waste management regulations	Min. of Public Health and Sanitation, Local Authorities	
				81.	Construct a proper drainage and sanitation facilities	Min. of Public Health and Sanitation, Local Authorities	
District Wide	District Wide	Health	Prevalence of waterborne diseases	82.	Construct latrines	Min. of Public Health and Sanitation, Local Authorities	
				83.	Create awareness on proper hygiene	Min. of Public Health and Sanitation, Local Authorities	
				84.	Promote use of treated mosquito nets	Min. of Public Health and Sanitation, Local	

						Authorities	
		Industry & Other Business Activities		85.	Apply and enforce Water quality and Waste management regulations	Min. of Public Health and Sanitation, Local Authorities	
				86.	Enforce air control regulations	Min. of Public Health and Sanitation, Local Authorities	
				87.	Promote use of environmentally friendly sources of energy	Min. of Energy	
				88.	Promote use of cleaner production technologies	Min of Industry	
				89.	Recycle polythene materials	Local Authorities, Min of Industry	
				90.	Protect springs	WRMA, Min. Agriculture	
District Wide	District Wide	Livestock & Grazing	Low livestock productivity	91.	Control animal diseases	Min of Livestock	
		Livestock & Grazing	Low livestock productivity	92.	Upgrading of indigenous cattle breeds/crossbreeding	Min. of Livestock	
				93.	Undertake research on Ticks control	Min. of Livestock	
				94.	Train the communities diagnosis of animal disease and prevention methods	Min. of Livestock	
				95.	Train farmers on good animal husbandry	Min. of Livestock	
				96.	Plant fodder crops/trees	Min. of Livestock	
				97.	Construct water points	Min. of Livestock	

				98.	Make hay for use during the dry season	Min. of Livestock	
				99.	Reduce the stocking rate	Min. of Livestock	
				100.	Promote zero grazing	Min. of Livestock	
		Mining & Quarrying	High incidences of malaria	101.	Rehabilitate and restore mined areas	Mines and Geology Dept. Local Authorities	
			Open mining pits	102.	Fence mining areas and pits	Mines and Geology Dept. Local Authorities	
		Settlements & Infrastructure	Diseases	103.	Construct latrines	Local Authorities	
				104.	Apply and enforce waste management regulations	Min. of Public Health and Sanitation, Local Authorities	
District Wide	District Wide	Settlements & Infrastructure	Diseases	105.	Promote community education on good hygiene and sanitation	Min. of Public Health and Sanitation, Local Authorities	
				106.	Apply and enforce Public Health and Sanitation Act	Min. of Public Health and Sanitation, Local Authorities	
			Unplanned settlements	107.	Improve existing roads	Local Authorities	
				108.	Promote land use planning	Min of lands	
				109.	Prepare urban development plans	Min of Lands, local Authorities	
				110.	Apply and enforce Physical Planning Act and Council By-laws	Min. of Public Health and Sanitation, Local Authorities	

				111.	Construction of sewerage system	Min. of Public Health and Sanitation, Local Authorities	
				112.	Construct pit latrines	Min. of Public Health and Sanitation, Local Authorities	
			Poor sanitation	113.	Apply and enforce waste management regulations	Min. of Public Health and Sanitation, Local Authorities	
				114.	Designate waste disposal sites	Min. of Public Health and Sanitation, Local Authorities	
				115.	Apply and enforce Physical Planning Act and Council By-laws	Min. of Lands	
District Wide	District Wide	Water Resources	Inadequate clean drinking water	116.	Afforestation & Re-afforestation of water catchments including hill tops	WRMA, KFS	
				117.	Treat drinking water	WRMA	
				118.	Dig boreholes/shallow wells	WRMA	
				119.	Protect and conserve water sources	WRMA	
				120.	Promote roof water catchments	WRMA	
				121.	Regulate river water abstractions	WRMA	
				122.	Construct pit latrines	Local Authorities, Min of Public Health and Sanitation	

			Water pollution	123.	Undertake Public education on good hygiene	Local Authorities, Min of Public Health and Sanitation	
District Wide	District Wide	Water Resources	Water pollution	124.	Construct latrines	Local Authorities, Min of Public Health and Sanitation	
				125.	Promote proper waste management	Local Authorities, Min of Public Health and Sanitation	
				126.	Treat drinking water eg. Using chlorine	WRMA	
				127.	Promote proper application of agrochemicals	Min. of Agriculture	
				128.	Undertake appropriate soil conservation measures	Min. of Agriculture	
				129.	Divert run offs far from the boreholes	Min. of Public Works, WRMA	
				130.	Construct sewage systems	Local Authorities,	
				131.	Designate waste disposal sites	Local Authorities, Min of Public Health and Sanitation	
				132.	Protect water sources	WRMA	
			Drying of water sources	133.	Plant trees on the water catchment areas		
				134.	Provide piped water	WRMA	
		Wetlands	Degradation of wetlands	135.	Regulate the usage of wetlands resources	WRMA, Min. Agriculture	
				136.	Educate communities on the importance of conserving wetlands	WRMA, Min. Agriculture	
				137.	Draw management	WRMA, Min.	

					plans for wetlands	Agriculture, Min of Lands	
				138.	Map and protect wetlands and other fish spawning areas	WRMA, Min. Agriculture, Min of Lands, Min of Fisheries	
		Wildlife, Biodiversity & Tourism	Human wildlife conflict	–	139.	Erect an electric fence around Masinga Dam	KWS
					140.	Establish wildlife buffer zones	KWS
District Wide	District Wide	Wildlife, Biodiversity & Tourism	Human wildlife conflict	–	141.	Strengthen District Compensation Committee	KWS
					142.	Sensitize communities to appreciate the importance of conserving wildlife	KWS
					143.	Involve the communities in wildlife management	KWS
			Loss of biodiversity		144.	Plant indigenous trees	KFS
					145.	Preserve indigenous tree species	KFS
					146.	Protect natural ecosystems	KFS, KWS
			Untapped eco-tourism potential		147.	Carry out an inventory of existing/potential tourism sites	Min. of Tourism
					148.	Enforce EMCA	Min. of Tourism
					149.	Promote and market existing tourism activities	Min. of Tourism
					150.	Use media to promote local tourism	Min. of Tourism, Min of Information

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## **APPENDIX**

### **PART IV OF THE ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT (1999-ENVIRONMENTAL PLANNING (EXTRACT FROM EMCA)**

#### **37. National Environmental Action Plan Committee.**

1. There is established a committee of the authority to be known as the National Environmental Action Plan Committee and which shall consist of;
  - a) The permanent secretary in the ministry for the time being responsible for national economic planning and development who shall be the chairman;
  - b) The permanent secretaries in the ministries responsible for the matters specified in the first schedule or their duly nominated representatives;
  - c) Four representatives of the business community to be appointed by the minister;
  - d) Representative of each of the institutions specified in the Third schedule;
  - e) Five representatives of non-governmental organizations nominated by the National Council of Non-Governmental Organizations;
  - f) Representatives of specialized research institutions that are engaged in environmental matters as may be determined by the minister; and
  - g) A Director of the Authority who shall be the secretary.

2. The National Environmental Action Plan Committee shall, after every five years, prepare a National Environmental Action Plan for consideration and adoption by the National Assembly

#### **38. Provision of the National Environmental Action Plan**

The National Environmental Action Plan Shall:-

- a) Contain an analysis of the natural resources of Kenya with an indication as to any pattern of change in their distribution and quality over time;
- b) Contain an analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational equity;
- c) Recommend appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes;

- d) Recommend methods for building national awareness through environmental education on the importance of sustainable use of the environment and natural resources for national development;
- e) Set out operational guidelines for the planning and management of the environment and natural resources;
- f) Identify actual or likely problems as may affect the natural resources and the broader environment context in which they exist;
- g) Identify and appraise trends in the development of urban and rural settlements, their impacts on the environment, and strategies for the amelioration of their negative impacts;
- h) Propose guidelines for the integration of standards of environmental protection into development planning and management;
- i) Identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general adverse effects on the environment;
- j) Prioritize areas of environmental research and outline methods of using such research findings;
- k) Without prejudice to the foregoing, be reviewed and modified from time to time to incorporate emerging knowledge and realities; and
- l) Be binding on all persons and all government departments, agencies, state corporations or other organs of Government upon adoption by the National Assembly.

### **39. Provincial Environmental Action Plans**

Every provincial environmental committee shall, every five years, prepare a provincial environment action plan in respect of the district for which it is appointed, incorporating the elements of the relevant district environmental action plans prepared under section 40 and shall submit such plan to the chairman of the National Environment Action Plan Committee for incorporation into the National Environment Action Plan

### **40. District Environmental Action Plan**

Every District Environmental Committee shall, every five years prepare a district environment action plan in respect of the district for which it is appointed and shall appointed and shall submit such plan to the chairman of the Provincial Environment Action

Plan Committee for incorporation into the provincial environment action plan proposed under section 39.

#### **41. Contents of Provincial and District Environmental Action Plans**

Every provincial environment action plan and every district environment action plan prepared under section 39 and 40 respectively shall contain provisions dealing with matters contained in section 38 (a), (b), (c), (d), (e), (f), (g), (h), (I), and (j) in relation to their respective province or district.