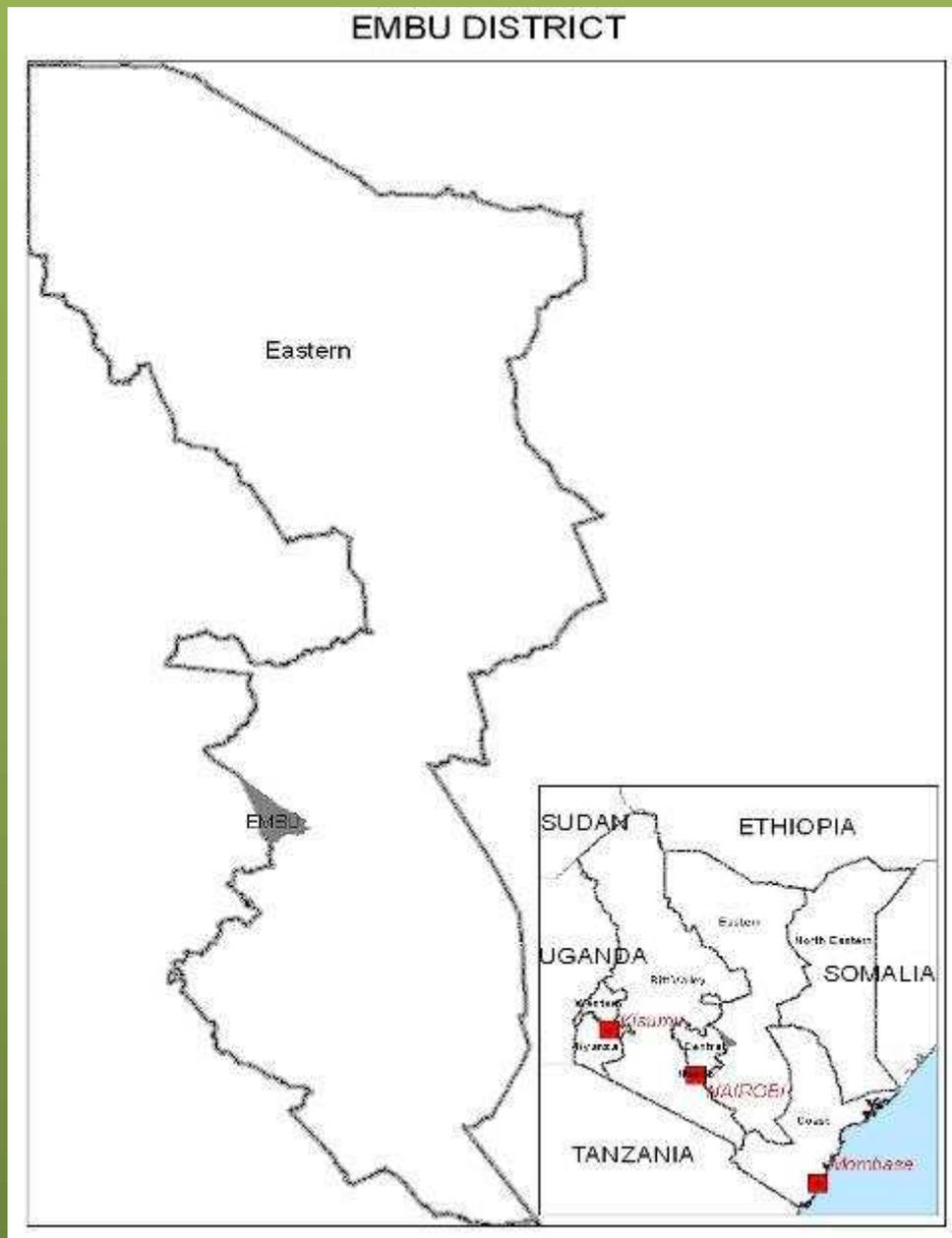**REPUBLIC OF KENYA**
MINISTRY OF ENVIRONMENT AND MINERAL RESOURCES
NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

EMBU DISTRICT

EMBU DISTRICT
ENVIRONMENT ACTION PLAN
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 Embu District. The preparation of this DEAP was done through a participatory process involving the public, private and civil sectors. Further, this document has incorporated salient issues from all administrative units in the District.

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 1 gives the challenges of sustainable development and 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 2 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 3 entails the human settlements and infrastructure in Kitui 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 4 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 5 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 8 brings out 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, NGOs and local communities at District and Divisional levels. These consultative meetings provided the basis also for formulation of the PEAP and finally the National Environment Action Plan.

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 2008-2012). 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 DEC and will be reflected in the State of the Environment Reports.

The preparation of the DEAPs for Embu owes much to the technical and financial assistance provided by the NEMA. This support, which included innovative community and civil society consultations, facilitation of DEC meetings as well as final publication cost is hereby 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),

Ag, DIRECTOR GENERAL

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

ACKNOWLEDGEMENT

On behalf of the National Environment Management Authority (NEMA) ,I would like to thank the Embu 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 members and the District Environmental Action Plan Technical Committee members for their invaluable inputs and approval of this environmental action plan.

I also acknowledge the contribution of the members of the local communities through NGOs, CBOs 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) and District Environment Officer (Embu), for their insights and dedication to this process. Lastly, I extend my gratitude in one way or another to all those who contributed towards the finalization of this District Environmental Action Plan.

Dr. Kennedy I. Ondimu

DIRECTOR, ENVIRONMENTAL PLANNING

& RESEARCH CO-ORDINATION

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ABBREVIATIONS AND ACRONYMS

ASALs   -Arid and Semi Arid Lands

UNCED   -United Nations Conference on Environment and Development

EMCA   -Environment Management and   Coordination Act

NGO   -Non-Governmental Organization

CBO   -Community Based Organization

NEMA   National Environment Management Authority

NEAP   -National Environment Action Plan

PRSP   -Poverty Reduction Strategy Paper

ERSW&EC   -Economic Recovery Strategy for Wealth and Employment   Creation

PDPS   - Physical Development Plans

NDP   -National Development Plan

UNFCCC   -United Nations Framework Convention on Climate Change

UNCBD   -United Nations Convention on Biological Diversity

UNCCD   -United Nations Convention to Combat Desertification

PIC   -Rotterdam Convention on Prior Informed Consent

NEPAD   New Partnership for African Development

MDGs   -Millennium Development Goals

WSSD   -World Summit Sustainable Development

PEP   - Poverty Eradication Programme

MEAs   -Multilateral Environmental Agreements

EAC   -East African Community

UN   -United Nations

IGAD   -Intergovernmental Authority on Drought and Development

SACCO   -Saving and Credit Cooperative Society

HIV/AIDS   -Human Immunodeficiency Virus/ Acquired Immune deficiency Syndrome

FYM   -Financial Yield Management

GM   -Guarantee Minimums

GMR   -Guarantee Minimum Returns

LH   -Lower Highland

LH1   -Lower Highland 1

UM   -Upper Midland

UM2   - Upper Midland 2

UM3   -Upper Midland 3

UM4   -Upper Midland 4

LM   -Lower Midland

MENR   Ministry of Environment and Natural Resources

KEWI   -Kenya Water Institute

DFEO   - District Forestry Extension Officer

NRM   -Natural Resources Management

KWS   -Kenya Wildlife Services

FD   -Forest Department

GOK   -Government of Kenya

DEO   -District Environment Officer

DALEO   -District Agriculture and Livestock Extension Officer

IUCN   International Union for Conservation of Nature

SOE   State of Environment

NRC   Non-esident Cultivation

NHC   National Housing Corporation

URTI   Upper Respiratory Tract Infection

GDP   Gross Domestic Product

KCC   Kenya Creameries Cooperatives

SMES   Small and Medium Enterprises

BOD   Biological Oxygen Demand

ICT   Information and Communication Technology

EIA   Environmental Impact Assessment

EA   Environmental Audit

KARI   Kenya Agricultural Research Institute

MOA   Ministry of Agriculture

MOW&I   Ministry of Water and Irrigation

MKEPP   Mt. Kenya East Pilot Project

IK   Indigenous Knowledge

NEC   National Environment Council

PEC   Provincial Environment Committee

DEC   District Environment Committee

SERC   Standards, Enforcement and Review Committee

NEAP   National Environment Action Plan

TAC   Technical Advisory Committee

NET   National Environment Tribunal

PCC   Public Complaints Committee

IFAD   International Fund for Agricultural Development

USAID   United States Agent for International Development

GTZ   Germany International Cooperation Agent

FINIDA   Finland International Development Agent

GEF   Global Environment Facility

SGP   Small Grants Programme of UNDP

COMPACT   Community Management of Protected Areas Conservation

KTDA   Kenya Tea Development Authority

CHAPTER ONE
1.0 INTRODUCTION

1.1 PREAMBLE

The United Nations Conference on Environment and Development (UNCED) commonly known as the Earth Summit held in Rio de Janeiro in 1992 aimed at improving the global environment, while ensuring that economic and social concerns are integrated into development planning. The Conference underscored the need to plan for sustainable socio-economic development by integrating environmental concerns into development through adopting and preparing appropriate policies, plans, programmes and projects. The Conference agreed on the guiding principles and a global plan of action *(Global Environmental Action Plan)* for sustainable development commonly called Agenda 21.

Sustainable development is 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 said to be sustainable if it meets ecological, economic and equity needs. The process of attaining sustainable development calls for the integration of environmental considerations at all levels of decision making in development planning and implementation of programmes and projects. The theme of the Summit was on how nations could attain the sustainable development objective. The Government of Kenya embraced this noble idea when it developed the first National Environment Action Plan (NEAP) in 1994.

The country also prepared the National Development Plan (1994-97) that ensured that there was not only a chapter on Environment and Natural Resources but also that environmental concerns were integrated in all the chapters of the Development Plan. Environmental planning was anchored in EMCA, 1999, which provides for the integration of environmental concerns into national policies, plans, programmes and projects. In this regard, EMCA provides for the formulation of National, Provincial and District Environment Action Plans every five years.

1.1.1 EMCA, 1999 Provision On Environmental Planning

The Act, requires that every District Environment Committee (DEC) shall every five years prepare a District Environment Action Plan in respect of the district for which it is appointed and shall submit such plan to the chairman of the Provincial Environment

Action Plan Committee for incorporation into the Provincial Environment Action Plan as provided for under Section 39 of EMCA, 1999.

1.1.2 Environmental Action Planning Process

DEAP Methodology

District environmental action planning began with the capacity building of the DEAP Secretariat comprising of District Water Officer, District Development Officer (DDO) and District Environment Officer (DEO) on DEAP methodology. Subsequently, the District Environment Committee gazetted in 2003 constituted the District Environment Action Planning Committee comprising lead agencies and representatives from other stakeholders, chaired by the DDO and the DEO as the Secretary. Once the DEAP draft was ready it was tabled before the DEC who approved it for submission to the Provincial Environment Committee for inclusion in the Provincial Environment Action Plan (PEAP).

Objectives of District Environment Action Plans

The objectives of District Environment Action Planning are to:

- Determine major environmental issues and challenges facing the district
- Identify environmental management opportunities
- Create synergy and harmony in environmental planning
- Integrate environmental concerns into social, economic planning and development of the district
- Formulate appropriate environmental management strategies specific to the district

1.2 CHALLENGES OF SUSTAINABLE DEVELOPMENT

The economy of the district depend on natural resources where majority of the population live in the rural areas and subsequently deriving their livelihoods from natural resources. Economic activities undertaken in the district from natural resources include agriculture, industry, water, energy, trade and quarrying. These resources are faced with threat due to over reliance on them. The increasing population makes the situation worse.

Poverty is a major issue in the district. It leads to over use and destruction of the environment as poor people struggle to get daily livelihood as opposed to long-term environmental sustainability. This phenomenon is counteractive in the sense that as the

resources so destroyed is diminished; the population will still require resources. There exists a close link between poverty and environment such that fighting poverty leads to improved environmental conditions.

Rapid urbanization has led to the development of slums in most urban areas. This has been worsened by rural urban migration resulting in; health deterioration, loss of biodiversity, water pollution and encroachment of fragile areas. Sanitation has also deteriorated coupled with widespread accumulation of wastes and poor disposal of effluents resulting in increased respiratory and waterborne diseases.

Poor management of plantation forests led to the imposition of the ban on shamba system and subsequent loss of livelihood of communities. This has led to increased poverty and creation of slums/squatter villages in the tea/coffee zones. The displaced communities in turn are now encroaching on the forest natural resources or migrating to the drier areas.

Intensification of agricultural production in the tea and coffee zones, with subsequent increase in use of fertilizers and pesticides has increased eutrophication and pollution of water bodies.

The pollution of rivers has health implications on the people with subsequent increase in water borne diseases and morbidity.

An increase in migration of people from the coffee zone to the lower zones has increased pressure on the marginal areas leading to environmental degradation.

There is also widespread encroachment to ecologically sensitive areas, including cultivating of river frontage, reclamation of wetlands, and cultivation of trust lands hills, overgrazing and charcoal burning.

1.3 EMBU DEAP SCOPE

The preparation of the Embu DEAP was aligned with Vision 2030 and the Midterm Plan 2008-2012. It covers the period 2009-2013 and will be revised after five years as directed by EMCA (1999). 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 Reports. 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.

1.4 EMBU DISTRICT PROFILE

1.4.1 Geographical Location

Embu district is one of the thirteen districts in Eastern Province (Figure1) covering an area of 708 km² (with Mt. Kenya Forest Reserve and Mt. Kenya National Park occupying 210.2 km² which is about 30% and uninhabited) It borders Mbeere District to the east and south east, Kirinyaga District to the West and Meru South District to the North. The District lies approximately between latitudes 0°8' and 0° 35' south and longitudes 37°19' and 37°42' east.

Figure 1: Location of Embu district

Embu district is divided into five administrative divisions, namely; Central, Manyatta, Nembure, Runyenjes, and Kyeni. There are 15 locations and 52 sub-locations.

Manyatta Division is the largest occupying 208 km², followed by Runyenjes occupying 186 km², Kyeni occupying 139 km² and Nembure occupying 111km². Central Division is the smallest of all, occupying 64km². The District Headquarters is located in Embu town, which is in Central Division.

There are two parliamentary electoral constituencies namely; Manyatta (covering central and Manyatta divisions, and Kithimu location in Nembure division) and Runyenjes constituency (covering Kyeni and Runyenjes division, Makengi location in Nembure Division and Gaturi North location in Manyatta Division). The district has three local authorities namely: Embu Municipal council, Runyenjes municipal council and Embu county council

1.4.2 Climate and Physical Features

Highlands, midlands and other topographical features like hills and valleys, typical of Kenya's Eastern Highlands, characterize the landscape of the District. Altitude varies between 910 and 4500metres above sea level. The upper parts of the district (parts of Kyeni, Manyatta and Runyenjes Divisions) fall between 1500 to 4500metres. The middle parts covering Nembure and Central Divisions fall between 1200 to 1500metres.

The district is drained by four major rivers, namely Thuchi, Kii, Rupingazi (with Kapingazi as a tributary) and Ena, all of which flow in a South East direction. The Kapingazi and Rupingazi are intensely used for domestic water and for irrigation.

The highlands are found in areas whose altitude range from about 1500 to 4500 meters. The only hills n the district are Karwe and Maranga

1.4.3 Rainfall

The annual rainfall ranges from 2200-2500mm to less than 800mm in the lower zones down at the eastern end of Kyeni and Runyenje's Divisions. Rainfall and altitudes largely determine land use. The wide range of altitude gives the District distinct agro-ecological zones. The South Eastern part receives 1,250 to 2,500mm of rainfall while the lowlands on the leeward side to the north and to the East receive unreliable rains of between 400-1,000mm. Annual average rainfall is 700mm. The rainfall in the District is bimodal, with long rains occurring from mid-March to May, and short rains from October to December.

1.4.4 Temperatures and Agro-Ecological Zones

The District displays a characteristic sequence of belts of vegetation associated with altitude generally found on tropical high mountains. Extending from the high to low altitudes, the belts are:

(i)   The Nival zone, topped by the mountain peak above 4500m above sea level;

(ii)   The Afro-alpine zone, between 4000m and 4500m above sea level

(iii)   The moorland zone, between 3300m and 4000m above sea level;

(iv)   The forest zone, between approximately 2000m and 3300m above sea level and containing areas of indigenous forest and areas of forest plantations merging into bamboo zones with increasing altitude; and

(v)   The agricultural zone below the forest zone (below 2000m above sea level) but in some places extending up to 2800m above sea level)

Jaetzold and Schidt (1983) have described the natural potential of the land around the district. The district falls under four major Agro-ecological zones including tropical alpine (TA), Upper Highlands (UH), Lower Highlands (LH), Upper Midland (UM), Lower Midland (LM), and Inland Lowland (IL). The salient features of the various agro-ecological zones and the associated sub-zones are outlined in the table 1. Temperatures in the district range from 12°C in July to a maximum of 27°C in March.

Table 1: Agro-ecological Zones in Embu district

Agro-ecological Zones	Altitude m above sea level	Annual Mean Temperature (C)	Annual Average Rainfall (mm)	Land Use Potential
Tropical alpine	--	--	--	National park
Upper Highlands (UH)				
UH0	--	--	--	Forest reserve
UH1	--	--	--	Sheep and dairy zone
UH2	2440-2740	13.7-11.7	950-1600	Pyrethrum-wheat zone
UH3	2230-2900	14.9-10.5	700-1000	Upper wheat-barley zone
UH4	--	--	--	Upper highland ranching zone
Lower Highlands (LH)				
LH1	1830-2200	17.4-14.9	1700-2600	Tea-dairy zone
LH2	1890-2130	17.0-15.4	1200-1800	Wheat, maize, pyrethrum zone
LH3	2070-2220	15.8-15.0	700-1400	Wheat/maize/barley zone
LH4	2070-2210	15.8-15.1	600-850	Cattle, sheep, barley zone
LH5				Lower highland ranching zone

Agro-ecological Zones	Altitude m above sea level	Annual Mean Temperature (C)	Annual Average Rainfall (mm)	Land Use Potential
Upper Midlands (UM)				
UM1	1520-1800	19.2-17.6	1500-2400	Coffee/tea zone
UM2	1280-1680	20.6-18.2	1500-2400	Coffee zone
UM3	1280-1520	20.6-19.2	1400-2200	Marginal coffee zone
UM4	1520-1770	19.3-18.0	750-1600	Sunflower/maize zone
UM5	1520-1770	19.3-18.0	500-900	Livestock/sorghum zone
UM6				Upper midland ranching zone
Lower Midlands (LM)				
LM3	910-1280	22.9-20.6	1000-1600	Cotton zone
LM4	760-1220	23.7-221.0	800-1200	Marginal cotton zone
LM5	700-910	24.0-22.9	600-900	Livestock/millet zone
LM6				Lower midland ranching zone
Inlands Lowlands (IL)				
IL5	610-700	24.7-24.1	500-850	Lower livestock/millet zone
IL6				Lowland ranching zone

Source: Jaetzold and Schidt (1983)

1.5 POPULATION SIZE AND DISTRIBUTION

The Embu district population densities are relatively high with central Division registering 783 persons per km² in 2002 and expected to grow to 869 by 2008(this is mainly due to its urban characteristics which covers Embu Municipality). Runyenjes Division has the lowest density at 454 in 2002 and projected to grow to 504 in 2008. The projected population densities for Nembure, Manyatta and Kyeni Divisions by 2008 are 552,779,540 respectively. Table shows the district demographic statistics.

Table 2: *District demographic statistics*

Demographic and population profiles	Number
Population size(2004 projections)	300561
Population structures(2004 projections)	
Total No. of males	147,419
Total No. of females	153,142
Female/Male sex ratio	100:96
Total No. of youth population(15-25)	75,843
Total population of primary school going age(6-13yrs)	60,855
Total population of secondary school going age (14-17yrs)	31,585

Demographic and population profiles	Number
Total labour force(15-64yrs)	172,543
Dependency ratio	100.73
Population growth rate	1.7% p.a
Population Density (excluding Mt. Kenya forest) (2004 projections).	
Highest density Central division	800
Lowest density Runyenjes division	465
Average density(excluding Mt. Kenya forest)	577
Other demographic information	
Urban population	11.5%
Crude birth rate(2003)	32.8
Crude death rate	8.8/1000
Life expectancy	Male: 60.7 female: 71.9
Infant mortality rate	41.1/1000
Child mortality rate	69/1000
Total fertility rate	3.7
Social economic indicators	
Total number of households	68,p16
Average household size	4.35
Number of female headed households	21,368(31.7)
Poverty index	56%
Urban population living in absolute poverty	47%
Rural population living in absolute poverty	57%

Source: District Statistics office, Embu 2001

1.6 SOCIAL, CULTURAL, AND ECONOMIC CHARACTERISTICS

1.6.1 Social

Social-economic vulnerability in the district increases from the upper tea zone (with an average monthly income of Ksh 6000) to the lower cotton and tobacco zones (with an average monthly income of Ksh 1000). These incomes influence a household's ability to provide food, education and health care. Overall, the district population is vulnerable since it is subject to decreasing farm size and declining land productivity. The collapse of the coffee sector stemming not only from the depressed world coffee prices, but also from local and national problems in the industry, has made small-scale coffee production uneconomic and has significantly contributed to accelerating poverty in the district.

Religion

The major religion in the District is Christianity, although in the urban centers there are few Muslims.

Languages

The main language spoken in the District is Kiembu, Chuka and Kimbeere although due to immigration, there are languages like Kirinyaga and Kimeru

1.6. 2 Cultural

Traditionally, land is owned through inheritance and subdivided between sons each successive generation, leading to small agriculturally unviable holdings. Women do not inherit land from their parents. As a result, there are inequalities in land ownership and accessibility between men and women. Any unmarried woman is allocated a plot for building a dwelling but she may not have access to the rest of the land. Some widows become household head, but they can still not inherit the land or hold a title to it as land may be inherited only by men and from the husband's family. Women own land only when they purchase their own.

Economic Characteristics

Social-economic vulnerability in the district increases from the upper tea zone (with an average monthly income of ksh 6000) to the lower cotton and tobacco zones (with an average monthly income of ksh 1000). These incomes influence a household's ability to provide food, education and health care. Overall, the district population is vulnerable since it is subject to decreasing farm size and declining land productivity.

The collapse of the coffee sector stemming not only from the depressed world coffee prices, but also from local and national problems in the industry, has made small-scale coffee production uneconomical and has significantly contributed to accelerating poverty in the district.

Embu district economic mainstay is coffee and tea production. The production levels of the two crops have been declining over the last few years thus perpetuating poverty situation in the district. This has had trigger effects to the other sectors of the economy, affecting the social-economic well being of the people. This is reflected for instance in the increasing drop out rates at both primary and secondary Schools levels. Other crops include Macadamia, Tobacco and cereals such as maize, beans and horticultural crops

such as French beans, cabbages, kales, tomatoes, avocados, mangoes, pawpaw, bananas and other fruits.

District Poverty Level

Using food indices as the determining factoring assessing poverty levels, 45% of the people in the district may be classified as poor. This is as per the Welfare Monitoring Surveys of 1994 and 1997. This proportion translates to about 124,000 people in the district and of these about 25% people are very poor.

The poor in the district are mainly the landless, unemployed, slum dwellers, female-headed households and the physically handicapped. Programmes to reduce poverty in the district will have to target these groups.

There are many causes of poverty in Embu district. These include low agricultural productivity and poor marketing, drought and lack of water for irrigation, lack of employment opportunities and low wages, high cost of education, gender imbalance, land sub-division, landlessness and poor infrastructure including roads. These causes are linked to environmental and economic factors as demonstrated by the wide income disparity with the poorest 20% of the rural population receiving only 3.5% of rural income. The life expectance at birth has decreased, partly attributed to HIV/AIDS; the major cause of death among the youth and middle aged and the declining enrollment rates both in primary and Secondary Schools. The health sector is under increasing pressure from the rapidly increasing population, the emergence for new diseases and re-emergence of old ones, increased infant mortality rate. HIV/AIDS poses as one of the greatest challenges in all the sectors of the economy. It has negative macroeconomic consequences including reduction in savings, decline in labor productivity and loss of skilled and experienced staff. It is estimated that 18% of urban and 13% of rural populations are positive.

Poverty and Environmental Degradation

There is strong relationship between poverty and environmental degradation. Poverty is associated with low education and limited knowledge of sustainable agricultural methods, so that current practices are extractive and unsustainable. Despite the high potential of the area, poverty is widespread and worsening. Few coping strategies are available to the poor. Some of the main problems include:

- shortage of land for agriculture linked to high population and land fragmentation, which has lead to the cultivation of steep slopes, riverbanks, and wetlands – with environmental consequences in terms of soil erosion (loss of top soil, declining soil fertility, loss of water catchments capacity leading to lower dry season flows and flooding during wet season),
- loss of coffee and dairy farming incomes linked to the loss of services provided by parastatals in these industries, with the result that the farmers have opted for other activities such as illegal harvesting of trees in the forest for sale and growing marijuana in the forest,
- Lengthy procedures for obtaining water abstraction permits results in many people simply extracting water without permits;
- Unregulated water use for irrigation in the middle catchment areas has deprived the communities in the lower areas of water which they need for their livestock and which could be used for intensifying agricultural production. In response the farmers resort to opportunistic activities such as charcoal burning which destroys the vegetation cover and causes accelerated soil erosion which further reduces land productivity;
- Sale of subsistence crops at harvest time leaves many families vulnerable for several months before the next harvest;
- Lack of markets for farm produce in general, so that farmers are not earning income which could be invested in their farms,
- Inadequate soil conservation structures on slopes of the lowest gradient leads to soil erosion and concomitant siltation in the rivers.

While high population density leads to pressure on the land and subdivision of farms, it need not have a negative effect on environmental conservation. It can even be a stimulant to agricultural intensification provided there is awareness creation on better crop husbandry and soil and water conservation. High population density also means that labor will not be a limiting factor, allowing the cultivation of labor intensive, high value crops and the construction of soil and water conservation structures.

Natural Resource Base

The district is well endowed with big rivers and therefore relies heavily on surface water resources. The other natural resources are the forests, which occupy an area of 2,264 hectares representing 3.5 % of the district's total area. The district has also an enormous potential for fisheries activities.

1.6.3 Agriculture and Rural Development
Land use types and ownership

The most common farming systems in the district are small-scale cash crop and subsistence farming. The cropping patterns are determined by the district agro-ecological zones. The intensity of land use changes decreases as one goes downstream of the various river catchments. In the tea zones, family land size varies from less than ½ acre to 4 acres. In the coffee zone, farm sizes vary from 0.2 ha to 2.0 ha. In the lower zone, family land size is variable and ranges from less than 0.1 ha to over 16 ha. The farm sizes have been declining for over 30 years.

CHAPTER TWO

2.0 ENVIRONMENT AND NATURAL RESOURCES

2.1 SOILS AND LAND

2.1.1 Soil

Most of the soils in the district are developed on parent materials derived from Mount Kenya. The soils pattern follows the Mount Kenya top-sequence found in Meru South District. The higher parts contain soils of variable fertility and depth (Histosols and Leptosols) but it is too cold for agriculture. At slightly lower altitude, humid top soils of moderate high fertility (Andosols) are found. These soils are leached and acidic. The major part of the district, forming the volcanic ridges, has soils with top soil often rich in organic matter and of moderate to high fertility (mainly Nitisols and Andosols). Parts of the district bordering Mbeere District have deeply weathered red clay soils (Ferralsols) of low fertility.

2.1.2 Land Use Changes

Land under freehold tenure is used mainly for agricultural purposes. Crops grown include beans, maize, potatoes, vegetables such as French beans, cabbage and *sukuma wiki*, etc. Tea, coffee and dairy cattle keeping are mainly practiced in the upper parts of the District. The lower parts are experiencing intensive land subdivision. People have encroached into riparian reserves where they introduce inappropriate land use practices.

A part from agricultural use and Urban Centers, the rest of the District is covered by Mt. Kenya Forest.

2.1.3 Regulatory and Institutional Arrangements

The Ministry of Lands through the District Lands Officer, in collaboration with Ministry of Agriculture, Municipal and County Councils control the allocation and development of land in the district.

Key environmental issues

- Inadequate environmental conservation
- Soil erosion
- Excessive use of fertilizers
- Inadequate farming technologies
- Subdivision of land into uneconomical units

Proposed interventions

- Promote soil and water conservation and management;
- Awareness creation among the land users
- Promote appropriate technologies
- Encourage organic farming
- Enforcement of legislations governing land

2.2 AGRICULTURE, LIVESTOCK AND FISHERIES

2.2.1 Agriculture

Agriculture is the main economic activity. The physical features, soils and climate create a very favorable environment for growing high value crops like tea, coffee and macadamia. Other crops include maize, beans and horticultural crops (French, beans, tomatoes, avocados, cabbages, and kales). The average farm size is about 1.2 hectares. The area under maize, beans, Irish potatoes and cowpeas has fluctuated over time depending on the price structure and the cost of inputs. In general, there is potential for increasing crop productivity with improved management and use of inputs.

Agriculture accounts for 60% of the total national employment. Its contribution to gross domestic product (GDP) was 37% just after independence but it has declined to 25% in the year 2000. The relative decline in agriculture is attributable in part to rapid rates of growth in other sectors and to underperformances in relation to its potential for creating employment and income. This under performance is linked to a number of factors, which include; barriers to the management of biophysical, socio-economic, and institutional environments. The evolution of and implementation of micro and macroeconomics policies has constrained development.

The collapse of a number of parastatals such as Kenya meat commission and KCC among others also had a negative impact on farmers and livestock keepers. While past intensive efforts to train farmers through extension services and technical advice, have certainly contributed to the current level of development particularly of the cash crop sector, the adoption of sustainable agricultural techniques remains a challenge. Poor flows in agricultural information that leads to high transaction costs have lowered the pace of agricultural development. One current practical dilemma is how to improve the performance of agricultural extension services that are currently facing logistical and methodological constraints.

Key environmental issues

- Soil erosion
- Pollution of rivers from agrochemicals
- Inadequate soil and water conservation structures
- Water pollution due to effluent discharge from tea industries

Proposed interventions

- Promote soil and water conservation measures
- Promote proper use of agrochemicals
- Enforce relevant regulations
- Create awareness on environmental conservation

2.2. 2 Livestock

Livestock production mainly consists of both local and exotic cattle, sheep, goats local and exotic poultry, pigs, and rabbits. There is emerging livestock in the district that mainly include Bee keeping, Silkworm farming and Quails. The main products of livestock in the district include: Milk, Beef, Eggs, Poultry meat and Pork.

The livestock population has been on the increase over time. The increase in dairy cattle and goats could be attributed to the Integrated Small Livestock and National Dairy Development Programmes in the district. Most areas of the District produce enough food to feed its population apart from the dry area which covers less than 5% of the district, in the lower areas of Runyenje's, Kyeni, Nembure and Central Divisions.

Key Environmental issues

- Livestock diseases
- Soil erosion
- overstocking
- Poor animal husbandry
- Poor waste management.
- Inadequate extension officers

Proposed interventions

- Community sensitization on proper farming methods
- Integrate indigenous and modern farming methods
- Control livestock diseases
- Encourage zero grazing

- Encourage good husbandry practices
- Enforcement of relevant legislation

2.3. FISHERIES RESOURCES

Fish farming is practiced on a small scale largely for domestic consumption, while the surplus 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 because of increased water turbidity. Subsistence fishing is also done on rivers like Rupingazi, Thambana, Nyanjara, Thuci, Ena, and Kii. Table 3 shows status of fisheries resources.

Table 3: Status of Fisheries Resources

Fisheries	Status
Warm water aquaculture(year 2001)	
Potential(area)	1,062 units(1.5% of Embu District)
Potential (production)	300,000kg
Potential (value)	30 million
Population of fish farmers	77
No. of fish ponds	144
Area covered by fish ponds	20,831m²
Main species of fish catch	Tilapia, cat fish, common carp
Cold water Aquaculture (year 2001)	
Suitable trout farming areas	River Rupingazi, Thambana, Nyanjara, Thuci, Ena, and Kii
Potential for trout production	200,000kg
Value of potential production	Ksh 80m p.a current prize at 400/= per kg
Current production(11000 rainbow trout)	One farmer with six ponds and One Group with two ponds
Main species of trout	Rainbow trout, Brown Trout

Source: District Agricultural Office 2001

Key Environmental Issues

- Use of small size nets which catch young fish
- Unexploited potential for fish farming
- Sedimentation and siltation of fish ponds

Proposed Interventions

- Use of appropriate fishing nets

- Desiltation of ponds
- Promote fish farming

2.4 WATER RESOURCES

2.4.1 Key Water Sources

Main sources of water in the district include rivers, streams, springs, rainfall and boreholes. Major uses of water in the district include Domestic, Agricultural, Industrial and Recreational. The water supply systems do not meet the demand mainly due to population increase and poor management of the resource. This challenge is being addressed through capacity building programmes for Project Management Committees to improve on service delivery through efficient distribution of available water resource, formation of Water and River Users Associations for equitable sharing of the water resource and conservation and management of the water catchments areas and the river basin itself.

The irrigated areas in the district include Nthambo, Njukiri, Manyatta and Mbuvori.

Wetlands

Reclamation of the wetlands and cultivation of river frontage is now a major source of degradation in the district. Although the actual area is not known, a large percentage of wetlands in the area have already been drained and converted to agricultural use mainly for the growing of maize, beans, tomatoes, cabbages and tree species such as *Newtonia buchananii*, *Albizia gummifera* and *Croton macrostachyus* among other important tree species in both tea and coffee zones. In addition, cultivation of river frontage has been found to interfere with water quality through increase in siltation and eutrophication.

Key Environmental Issues

- Change in water quality
- Water borne diseases
- Loss of soil fertility
- Soil erosion
- Siltation of water works
- Flooding
- Water borne and water related diseases
- Breeding grounds for mosquitoes
- Encroachments into wetlands

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Proposed interventions

- Monitoring of water quality
- Promote proper farming practices
- Catchments protection
- Sound management of wetlands
- Community involvement in relevant projects and programmes
- Enforcement of relevant legislations

2.5 FORESTRY AND WILDLIFE RESOURCES

2.5.1 Forestry

The district forests, occupy an area of 2,264 hectares representing 3.5 % of the district's total area. The Mount Kenya ecosystem, especially the National park is home to biodiversity of national and global significance. In 1994, a list of 882 plant species belonging to 479 genera in the 146 families was published for the forest zone of Mt. Kenya. There are at least 11 strict endemic species of higher plants and more than 150 near endemic, i.e. species that also occur in at least one of the following; Aberdares Mountains, Mt. Kilimanjaro, Mt. Elgon, Mt. Meru and Ruwenzori mountain. Below the afro-alpine zone, the bamboo (*Arundinaria alpina*) forest, which occurs between 2,400m above sea level and 3000m above sea level, dominates the upper reaches of the forest. In the lower mountain region, between 1500 and 2400m above sea level, broad-leaved evergreen hardwoods and conifers dominate the forest. Within this range, the species of *Ocotea usambarensis, Juniperus procera* and *Podocarpus latifolius* dominate at high elevations whilst at the lower altitude forested areas, *Croton macrostachyus*, *Newtonia buchanii, Prunus Africana, Olea europea, Ficus thoningii* are common forest trees.

The total area of forest in Embu is 19,067.7 hectares, which include:

- Mt. Kenya Forest   18393.0 ha.
- Kirimiri Hill Forest   101.0 ha.
- Maranga Hill Forest   219 ha.
- Njukiri East Forest   383.7 ha.

Farm Forests cover about 1/3 of the District.

2.5.2 Trends and Status of Forest Resources

There are constant threats to forest products from the neighbouring communities. Table 4 shows the types and status of forest resources.

Table 4: Types and Status of forests

Type of forest	Extent (ha)	Distribution (%of total) or Name	location	Forest uses	Status			
					gazzeted	Under Trust land	Private land	% degradation
Natural	18,393.0	Mt .Kenya	Mt. Kenya	Conservation	gazzeted			20%
Natural	101.0 ha.	Kirimiri	Runyenjes Division	Conservation		Trust land		Intact
Man made	219.0 ha	Maranga	Runyenjes Division	Conservation & Exploitation		Trust land		50%
Natural and Man made	383.7 ha.	Njukiri East	Central Division	Conservation & Exploitation		Trust land		50%
Man made	N/A	Farm lands	Through out District	Domestic			Private land	N/A

Source Embu District Forest Office 2001

2.5.3 Regulatory and Management Arrangements

The forest department, Kenya forestry research institute and the ministry of agriculture are the main government service deliverer in the district. The district forestry extension officers attached to the forest station help in the establishment of community tree nurseries by providing technical advice. The nearest forest station to the nurseries also facilitates the management of soil materials and seedlings.. The local communities are empowered with the relevant skills to manage the established tree nurseries through training courses in tree nursery management, water harvesting techniques, compost making and agro-forestry.

The Forest Department is also responsible for community activities dealing with planting of trees in the national reserves and outside the forest reserve. It also plays essential role as regard to environmental issues at the district level.

Key environmental issues

- Deforestation
- Illegal logging

- Encroachment of the forest for cultivation

- Poor methods of extracting medicinal plants

- Loss of biodiversity

- charcoal burning and extraction of fire wood

- inadequate environmental /forest management

- Unsustainable methods in natural resource utilization

Proposed interventions

- Initiating afforestation and reafforestation programmes

- Awareness creation and sensitization of people living around the forest areas.

- Introduction of alternative livelihoods other than charcoal burning

- Encourage community participation in forest management

- Develop forest management plans

- Enforcing the relevant environmental legislation

2.6 WILDLIFE

2.6.1 Types of Wildlife and Area Under Wildlife

The forested parts of Embu district are a suitable habitat for a wide diversity of fauna some of which attract tremendous conservation interest. According to the International Union for the Conservation of Nature (IUCN) Red Data Book, threatened large mammals found in the Mt. Kenya forest include*; leopard, Eastern bongo, Giant forest hog, Black rhino, Africa elephant and Black fronted duiker.* Other wildlife that is commonly encountered in the area include *Cape buffalo, black and white colobus, Skye's monkey, olive baboon, eland, Zebra, reedbuck, spotted hyena, serval, genet,* and mongoose. Notable smaller and rare mammals reportedly include the Mt. Kenya *mole shrew, mole rat, thicket rat, highland musk shrew and East African rock hyrax.* Mt. Kenya is an important bird area and home to the threatened and little-known *Abbot's starling.* Fifty-three out of Kenya's 67 African Highland biome bird species are found here. At least 35 forest specialist species and six of the eight species from Kenya Mountains Endemic Bird Area reportedly occur on Mt Kenya.

2.6.2 Trends and Status of Wildlife Resources

The status of wildlife in Embu has been relatively stable. However, there are occurrences of wild fires that causes animals migration.

2.6.3 Regulatory and Management Arrangements

The wildlife management is carried on under the provisions of the wildlife (Management and Conservation) Act Cap. 376. In 1989, the act was amended to create the KWS to replace the Department of Wildlife management that was in charge of implementing the provisions of the act. The act prohibits a range of activities within a national park or reserve. These include hunting; residing; cutting or setting fire to vegetation; knowingly introducing animal or vegetation; clearing; cultivating or breaking up land for cultivation; and fishing.

2.6.4 Exploitation of Wildlife Resources both Consumptive and Non-consumptive

Exploitation of wildlife in Mt. Kenya region is strictly prohibited as it has been declared as one of the world's conservatory sites. However, there are reported cases of game meat harvesting.

Key environmental issues

- Human/wildlife conflict
- Habitat destruction
- Loss of biodiversity
- Wildlife poaching

Proposed interventions

- Promote community participation in wildlife conservation
- Enforce existing legislations
- Create awareness on the importance of wildlife
- Control human/wildlife conflicts

2.6.5 Biodiversity Data and Information

Population pressure is pushing the Embu people to farm on the hills. This has led to loss of biodiversity and general degradation of the water catchment's areas. 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 also been encroached on.

Key environmental issues

- Loss of biodiversity

- Deforestation

- destruction of water catchment areas

- Inadequate information on environmental conservation measures

- Habitat destruction

- Inadequate information /data on biodiversity status

Proposed Interventions

- Enforcement of legislations to protect the endangered species

- Initiating afforestation and re-afforestation programmes

- Undertake inventory on biodiversity

- Create awareness on the importance of environment conservation

- Promote community participation in environmental conservation

2.7 ENERGY SECTOR

The main types of energy in the district are, firewood, charcoal, solar, electricity, biogas/gas, LPG kerosene and wind. Energy usage depends on household economic status. The energy types are categorized as traditional and convectional. The traditional type include wood, charcoal and other biomass while conventional include petroleum products, solar and electricity. Both rural and urban households consume a mixture of both traditional and conventional energy types.

Firewood

Most of the households use this energy for cooking purposes. Firewood from the district mainly comes from on farm sources

Charcoal

Most of the urban households rely on charcoal for cooking and heating. Charcoal is considered relatively cheap compared with firewood. Per capita use stands at 156kg in urban and 152 in rural areas.

Farm Residue and Wood Waste

There is rampant household use of farm residues like maize, millet, sorghum, sugarcane remnants after harvesting. Sawdust has also been used as a source of energy

Petroleum products

Kerosene is widely used by households both in rural and urban areas mainly for lighting.

Electricity

This is the most modern and convenient source of energy. However, it is expensive for the majority of the households in the district. There is a need for rural electrification programme to be enhanced so that the rural folks can access this energy even if it is only for lighting.

Solar Energy

There is limited use of solar energy for both lighting and heating

Biogas

This form of energy is not well spread in the district. However, the district has a lot of potential.

Unexploited and Potential Energy Sources

Wind energy is an unexploited source in the district there are also underutilized energy sources that include biomass, solar and liquefied petroleum Gas (LPG).

Key environmental issues

- Deforestation
- Air and indoor pollution
- Soil erosion
- Loss of biodiversity
- Loss of habitats
- High initial cost of accessing energy

Proposed interventions

- Encourage afforestation and reafforestation programmes
- Introduction of efficient and affordable energy technology
- Promote soil conservation initiatives
- Enforcement of environmental legislations and regulations
- Design houses with adequate ventilations
- Awareness creation to the community on the importance of environmental conservation

CHAPTER THREE

3.0 HUMAN SETTLEMENTS AND INFRASTRUCTURE

3.1 Human Settlements

Over the years, Human settlement issues have continued to cause degradation on the environment. Although a number of policies and legislations have been put in place to address some of the emerging concerns, environmental degradation continues unabated due to weak enforcement mechanisms. The district's inhabitants are predominantly a rural society with majority of them living in dispersed rural settlements.

3.2. Rural and Urban Housing Types

Embu town, as an administrative centre has enjoyed positive trends in the development of housing. Most of the houses are permanent except in the slum area where you find temporary, mud, timber and brick houses. In the rural areas, 90% of the houses are temporary mud houses, few timber, brick and stone houses. The housing providers include:

- Government
- Local authorities
- National housing corporation (NHC)
- Private developer
- Individuals

From the 1999 census, report 12,039 households were found to reside in the real urban area of Embu municipality against a population of 40747. Consequently, the average size was held at 4 persons per household. The emerging scenario in housing depicted a situation of non- crowding and low housing demand. A survey conducted to authenticate the above revealed that there was a number of housing units, which were unoccupied.

3.2.1 Rural Settlement Schemes

Human settlements are the built up areas where human beings live and provide themselves with basic human development needs. Such needs include shelter, food, health, education services and the other socio-economic systems that sustain human systems. It is in human settlements that human beings seek to satisfy their material, social and spiritual needs. There are three major types of settlements in the district namely:

- The nucleated

- The scatter
- Ribbon

Due to its physical extents, Embu district reflects both the concentrated and scattered settlements. Pockets of concentrated settlements are however noticeable in some small satellite markets i.e. Kibugu, Manyatta, Kithimu and Runyenjes, while the scattered settlements take up the other parts of the district.

3.2.2 Squatter Settlements

The squatter settlements are distributed within the trust land and in the out skirts of the local rural markets where development has not taken ground due to some constraints. The council has however embarked on the slum and squatter upgrading programmes.

Key environmental issues

- Inadequate land use planning
- Pollution
- Deforestation
- Overstretching the existing infrastructure

Proposed interventions

- Initiating coordinated urban planning
- Enforcing relevant legislation and regulations
- Initiating afforestation and reafforestation programs

3.2.3 Human and Environmental Health

Man and other creatures depend on environmental ecosystem for their day-to-day survival. Environmental concerns should be addressed during development of all infrastructure projects. The challenge is to sensitize all stakeholders to mainstream environmental issues in all development initiatives.

Malaria account for over 30% of morbidity making it the leading cause of death in the district. HIV/ Aids scourge is the second leading killer after malaria, largely affecting the working age bracket, while the respiratory tracts and water borne diseases especially tuberculosis are major human and environmental health challenges. Other health challenges are water borne and water related diseases.

Common diseases influenced by environmental factors

The major diseases in the district include;

- Malaria

- HIV and AIDs

- Intestinal worms

- Diseases of the skin

- Pneumonia

- Accidents

- Diarrhea diseases

- Rheumatism

- Eye infections

- Urethra tract infections

- Immunization coverage is 86%

- Latrine coverage 92%

- U.R.T.I (Diseases of Respiratory System)

- Skin

- Eye infections

- Typhoid

Other water borne diseases found in the district include *typhoid, cholera dysentery, amoebiasis, bilhazia, and filariasis.*

These diseases are generally caused by poor sanitation, inadequate coverage of safe and clean water supplies in the district, poor hygiene practices, poor food handling practices, poverty, and social-cultural practice Poor sanitation and drainage, poor management of solid waste, climatic and other conditions that favorable to breeding of mosquitoes as well as poverty also play a significant role. Typhoid and other respiratory diseases have been on the increase for the last few years in Embu district.

Key Environmental Issues

- Poor environmental sanitation

- Low level of awareness of safe and hygienic use of water

- Spread of diseases

- Poor refuse disposal

Proposed Intervention

- Promotion of sanitation and hygiene standards

- Prevention and control of disease outbreaks

- Awareness campaigns for diseases prevention and control,

- Control of disease vectors,
- Supervision and advise on safe and proper disposal of both solid and liquid wastes,

3.2.4 Pollution and Waste Generated from Human Settlement

Major sources of pollution

The major sources of pollution are industrial, municipal, agriculture, institutional, domestic, construction debris and waste from mining operations. Rapid urbanization has led to high consumption of natural resources and generation of waste.

3.2.5 Types and Amounts of Waste and Pollution

The Embu district waste falls into three categories namely: Solid, liquid, and gaseous. There is also noise pollution from motor vehicles, nightclubs, discos and religious organizations. Indiscriminate disposal of solid, liquid and human waste pollutes the district environment. This is in form of sewerage, food waste, plastic bags and other households' wastes as is the case in Shauri and Kathita estates. In low-income areas, the collection services are very poor. Uncollected waste is found thrown along the streets, play fields and between houses. The collection of garbage from communal sites is not frequent. Usually, priority is given to the central district, industrial area and high income residential areas. Less effort are put in the middle and low-income areas and slum settlements. The accumulated and scattered waste emits awful smell and is breeding grounds for rodents, flies and mosquitoes.

The main types of solid wastes found in both Embu and Runyenjes municipalities are, Food waste, paper, plastics, textiles, bones, metals, glass, wood shavings, rubber and leather. Most of this waste is disposed off in open dumpsites, burned or composted. There is a scarcity of disposal sites within the municipalities, because the available areas are converted to residential. This due to lack of proper planning and zoning. Composting and burning is generally practiced in estates that have large compounds and within the rural areas. Generally, most urban waste is collected in bins at the household level and in bulk containers at the institutional level and large super markets.

Only Embu District Hospital incinerates their hospital waste, but nearly all clinics in the towns dispose off their medical waste at the dumpsites. Incineration is expensive and not affordable by many medical practitioners although their services are highly required.

There is a lot of noise from upcoming churches, which are constructed within residential areas and offices.

3.2.6 Sanitation

Pit latrines are the common onsite sanitation systems in the District, covering most of the rural settlements, urban slums, peri-urban settlements and small towns. Latrine coverage in the rural areas is generally high; 100% in the tea zone, approximately 80% in the coffee zone and 60%-80% in the cotton/livestock zone. However, use of proper hygiene practices like washing hands after visiting the latrine is rarely practiced. The situation is most critical in the market centers. None of the rural market centers has adequate sanitation facilities. Large amounts of organic waste are being generated and are often thrown in the nearby depressions and are eventually washed into streams. There are limited environmental sanitation facilities such as garbage pits and dish racks in the district.

Sewage system in Embu town covers, only 4.7km². The system coverage includes Isaac Walton, Spring Valley, Majengo, town centre and Government institutions. A large part of the municipality is not covered taking into account that the main trunk covers about 54.4km of the major road reserves. For areas not served by the sewage system, use of septic tanks and pit latrines is predominant.

Key environmental Issues

- Poor Sewerage system in urban areas
- Poor solid waste management
- Pollution of water systems
- Environmental Diseases
- Slum developments
- Noise pollution

Proposed Interventions

- Enforcement of relevant legislations and regulations
- Control slum developments
- Provide clean water
- Awareness creation

3.3 COMMUNICATION NETWORKS

3.3 1 Roads

Embu district has no tarmac road other than the Nairobi-Meru road that traverse the district at the middle and Embu Muthatari on the way to Mbeere. Most of the rural access roads are impassable during the rainy season, which adversely affects access to the market for agricultural produce and ease of access to farm inputs, and extension services .The cost of road maintenance per unit is comparatively high in most areas due to the hilly terrain characterizing the district.

3.3.2 Telecommunications

The district is well covered by the mobile telephone services and expects to further benefit from service quality improvement currently being undertaken by the service providers. The landline service has also experienced increase in the number of telephone lines availability and enhancement of quality through upgrading of the technology. However, there is need to further roll out the services to cover all rural areas through quality and quantity improvement particularly for the fixed line services offered by Telkom. Over 1000 lines were available for leasing out by June 2005. Improving telephone access to rural areas will increase access to ICT particularly to learning institutions.

The main problems facing telecommunication are high cost of installation and maintenance and poor/inadequate road maintenance

Key environmental issues
- Pollution from transportation, use and storage of petroleum products, has been reported in the district and molasses leaking from the tankers.
- Destruction of roads by heavy commercial vehicles.
- Inadequate infrastructure in the district

Proposed interventions
- Control of pollution by Phasing out the use of leaded petrol
- Enforcement of Environmental legislations
- Enforcement of Municipal and Town Councils by-laws to reduce pollution from petroleum outlets and establishment of the same.
- Awareness creation among the public on danger of poor storage and use of petroleum products.

- Encourage the use of cleaner technologies
- Develop and improve the existing infrastructure

3.3.3 Social Economics Services and Infrastructure

Education

Sustainability of the benefits of free primary education (FPE) is a major challenge in relation to ensuring the enrolment is maintained and that transition rates increase to take care of the high enrolments. The quality of education is threatened by the sheer numbers enrolled more so as regards the availability of the physical facilities. There is need to continue on enhancing the management skills of school heads and school communities to deliver on the primary education. High poverty levels are contributing negatively on the transition rates. The district is addressing this through improving the capacity of local day secondary schools to admit more students by supporting the construction of additional facilities like classrooms and laboratories. Table 5 summarizes the educational facilities in the District.

Educational facilities in the District

Table 5: Educational facilities in the District

Pre- Primary	Number
Number of pre-primary schools	261
Gross Enrolment by sex	
Male	4.506
Female	4,686
Total No. of teachers	371
Teacher/pupil ratio	1:26
Primary	
No. of primary schools	201
Gross enrolment rates by sex	
Male	118.7%
PRE- PRIMARY	
Female	119.6%
Dropout rates (10-14yrs)	9.5%
Total No. of teachers	2130
Teacher/pupil ratio	1:31
Secondary	
No. of secondary schools	77
Total enrolment by sex	13270
Male	6450 48.61%

Female	6820 51.39%
Total No. of teachers	850
Tertiary	
No. of training institutions	
Teachers colleges	1
Medical training	2(Embu Medical Training, Kyeni Mission Hosp. Nursing School)
Youth polytechnics	13
Theological	Mt. Kenya Theological College
Commercial private colleges	4

Key environmental issues

- High dropout rates
- High prevalence of HIV/AIDS
- High cost of education
- Frequent changes in recommended text books and course books
- Poor transition rate from one level of education to another
- Inadequate physical infrastructure

Proposed Interventions

- Expand school bursaries to cater for needy children
- Offer loans and scholarships
- Promote education at all levels

Health

The health sector needs to be enhanced for health services delivery through physical facility development, supply of drugs and equipment. Various health provision facilities were upgraded in 2004/2005 but physical facilities and equipment availability to meet services commensurate with their new status is a challenge.

CHAPTER FOUR

4.0 INDUSTRIAL, TRADE AND SERVICES

4.1. TRADE

The Kenya's general trade policy objectives are articulated in Sessional paper No. 1 of 1986 and elaborated in the 8th National Development plan. The district's general policy objectives include moving towards a more open regime, strengthening and increasing the districts market access and integrating it in the Kenyan economy. However, a number of factors have adversely affected the achievements of these objectives. This include; influx of imports in the domestic market, non-competitiveness of local products, limited negotiation capacity of private and public sectors, poor infrastructure, high cost of utilities, finance, and high cost of inputs of locally manufactured goods.

Over the years, the district wholesale and retail trade has continued to grow both in rural and urban areas. However, there have been poor planning, which has led to mushrooming of shops and kiosks, which have generated enormous amounts of waste. These wastes include polythene bags, which end up clogging the sewerage system and littering the environment.

Garages

The wastes generated by the garages are mostly oil based; scrap metal and others that are non-biodegradable. Those wastes contaminate the air, soil, water and at times block the sewage systems. The perception that these enterprises support the very poor in the society makes it difficult for authorities to monitor and properly regulate them

Agriculture and produce market

This sector's contribution to the GDP has progressively declined from 37% in the early 1970s to about 25% in 2000.Growth in agriculture and improved rural incomes has a significant and direct impact in reducing poverty. The sector also provides raw materials to the manufacturing sector. In the district, the sector covers all the crops including horticultural crop, which is currently the third most important foreign exchange earner.

4.1.1 Challenges and Environmental Impacts of Trade Liberalization

The major problem is dumping of counter fait goods. When these products do not function, they are just dumped. Most of them are non-biodegradable and therefore result into another source of pollution.

4.2 INDUSTRY

The Kenya's industrial sector is one of the largest in Sub-Sahara Africa but Embu district is lagging behind in terms of industries. Some of the main recognizable industries in the district are the tea and coffee industries. This sector performs less than its optimal capacity due to the high costs of energy, poor infrastructure and increased dynamism of the customer needs and demands.

4.2.1 The Charcoal Burning Industry

Approximately 80% of the total quantity of energy consumed in the district is provided by the woody biomass. The amount is expected to double by the year 2020. Carbon monoxide is widely generated indoors by heating and cooking appliances in poorly ventilated rooms.

Over reliance on both charcoal and firewood is mainly responsible for the deforestation of most of the forests with serious consequences on flooding and soil erosion. Whereas charcoal burning is illegal, its sale is done openly and it is legal. There is need therefore for the government to remove the apparent conflict between the two activities, while at the same time finding an alternative and affordable energy sources for the rural and urban poor.

4.2.2 The Tea Industry

Environmental pressures of the tea sector include; smallholder factories use fossil fuel, which is expensive and produce environmentally unfriendly carbon gases as opposed to large estates and wood fuel, which causes deforestation. This has resulted into destruction of forest ecosystems, destruction of catchments areas and increased land degradation.

4.2.3 The Coffee Industry

Smallholder farmers under the cooperatives societies produce most of the coffee in the district with only a small percentage being produced by the large estates. The coffee co-operative factories are organized into a series of societies serving small-scale growers (1-5 acre plots) and privately owned estates.

Wastewater from coffee factories is normally discharged into watercourses after pre-treatment, or directly through seepage pits; and in some cases, it is used for irrigation.

Coffee wastewater has high biological oxygen demand (BOD) that interferes with aquatic life. Solid wastes from coffee factories are used as mulch for grass, coffee and soil conditioning. The use of pesticides and fungicides for coffee also raises environmental concerns.

4.2.4 Slaughter Houses

The district has slaughterhouses that have serious environmental problems with respect to the management of their solid waste, effluents and gaseous emissions. Based on existing practices, the following environmental liability should be addressed;

- Hygiene standards for treating , handling and storage of animals and meat on all stages of the production process
- Regular hygiene and animal health checks should be carried out before slaughter
- Collection of residues arising from the slaughter of animals
- Burning of waste and recovering fats and oils

Effluent produced during the slaughtering process may generate pollution problems due to the high content of animal fat, waste, blood and cleaning agents. The main sources of atmospheric odor are animal wastes (skin, hides, and hooves), unprocessed materials and other solid waste.

4.2.5 Transport

The district's transport system generally comprises of roads. It integrates the various productions, population centre and facilitates mobility in both rural and urban centre. Vehicular pollution has become a significant environmental problem in the district with the main pollutants being lead and by-products of fuel combustion, which include both visible smoke and invisible emissions. The main emissions are hydrocarbons, carbon monoxide, oxides of nitrogen and particulate matters.

4.2.6 Telephone

Telecommunication is important in facilitating the integration of the domestic economy and contributes to promotion of trade and economic development. The number of telephone exchange connection has been increasing steadily. The mobile phones industry has been growing very fast in the district. However, there is need to manage the disposal of the mobile phone scratch cards and enhance safe disposal of rechargeable batteries.

4.2.7 Information and Communication Technologies (ICT)

Although information and communication technologies are one of the fastest growing and dynamic sub-sectors in Kenya, Embu district has lagged behind in the sector. The demands for basic ICT services remains unmet and the disparity in the distribution of communications facilities between the rural and urban areas continue to widen.

4.3 TOURISM

Kenya is a mega diverse country with high quality tourism products. It has remained one of the most popular tourist destinations in the world. The Embu district stunning topography ranges from the snow capped peaks on Mt. Kenya (5199m), to the diverse flora and fauna in the whole region. The Kenya tourism board has in the recent past implemented some mitigation measures recommended at the global level, including minimizing resource use and treating wastes, recycling wastewater and rehabilitating degraded sites. However, the mushrooming of unclassified hotels and restaurants in the major urban centers has negatively impacted on the environment due to improper disposal of wastes generated from these facilities. Some of the facilities have also become health hazards due to unavailability of running water.

4.3.1 Type of Tourism, Attraction and Potential

The tourism industry is growing slowly in Embu. The only hotel meeting international standards in the district is the Isaac Walton. The tourism potential is very high in the district but is to be fully exploited.

Positive impacts of tourism on the environment

Ecotourism promotes environmental health by providing environmental education to the local people and by building consumer demand for environment-friendly products and services. It contributes to environmental conservation through improved environmental management and planning for example through control of tourism activities and use of environment-friendly technology. The suppliers of hotels and restaurants such as farmers, vegetable growers, breweries, banks and foreign exchange dealers, motor and fuel suppliers, builders, furniture makers and airport staff all benefit from the tourism industry.

Negative impacts of tourism to the environment
- Deforestation, cutting down trees or shrubs for firewood, particularly while hiking and camping

- Soil erosion; air, noise and water pollution , littering ; decreased diversity of flora and fauna ; and aesthetic degradation
- Pollution as a result of improper disposal of solid waste from tourist facilities

4.4 MINING

This activity involves excavation of the earth's surface and sub-surface for the purpose of exploiting and processing minerals for economic and industrial development. The district does not have many mining activities apart from the sand harvesting and quarrying.

4.4.1 Sand Harvesting and Quarrying

This activity is carried out under the authority and permission of the local authorities. It pays little respect to the environmental aspects. Although the activity is not wide spread in the district for the last few years, it is currently expanding at a high rate due to the increased demands for construction raw materials.

Key environmental Issues

- Open quarries act as breeding grounds for mosquitoes and other environmental hazards.
- Inadequate enforcement of relevant legislations governing the sector
- Inadequate awareness

Proposed Interventions

- Rehabilitation of quarries and disused mines
- Creating awareness on sustainable quarrying and mining activities
- Enforcement of relevant legislations
- Create awareness

4.4.2 Trends in Industrial Development in the District

The real industrial growth in Embu has somehow stagnated. There is no major industrial growth. The Jua Kali has been growing but without proper planning. The Agro-based Industries have not been expanding at a good rate. For example, Coffee & tea expansion has stagnated while fruit canning and milk processing has experienced some expansion in recent years. The wood industry was affected by the ban on forest exploitation of Mt. Kenya forest.

The industries in the district include:

- Tea factories
- Coffee Industries
- Wood based industry
- Jua Kali
- Processing industries (canning & Milk)
- Service industry (shops & supermarkets)
- Transport industry
- Tourism (minimal)

4.5 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 results to oils and grease polluting soils and water

Key Environmental Issues

- Pollution by waste from industries
- Inadequate Ecotourism development in the forest reserve
- Inadequate Infrastructure development

Proposed Interventions

- Enforce regulations governing waste disposal
- Develop ecotourism ventures
- Infrastructure development

CHAPTER FIVE
5.0 ENVIRONMENTAL HAZARDS AND DISASTERS
5.1 Extent and Trends of Environmental Hazards and Disasters

Hazard: A hazard is 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.

Most disasters are climate/weather and tectonic movements related. They can both be natural or manmade and in most cases lead to destruction of the environment, life and property. They have the tendency to retard gains made in building meaningful livelihood and economic development. In the district, there are several forms of disasters.

Some of most frequent disasters in the district include drought, fires and disease outbreak.

Key Environmental Issues
- Droughts
- Fires
- Landslides occurrence
- Disease out breaks
- Floods

Interventions Measures
- Early warning mechanisms have been put in place to enhance prediction of various weather conditions.
- Dissemination of timely and accurate metrological data has to be recognized as key to mitigate drought occurrences
- Enhancement of the coping mechanism of the district's population, with regard to adverse environmental change and reduction of environmental insecurity
- Mobilization of domestic financial resources for environmental management
- Enhancement of institutional capacity to coordinate, monitor and supervise environmental management
- Improvement of environmental information systems

- Setting targets and monitoring performances

CHAPTER SIX

6.0. ENVIRONMENTAL EDUCATION AND TECHNOLOGIES

6.1. STATUS OF ENVIRONMENTAL EDUCATION

The Formal education system has integrated environmental education into the school and tertiary level curriculum. This is done through biological, social and physical sciences. Types of environmental programs in the district include wildlife clubs, environmental clubs, eco-school programmes, tree planting programmes and school gardens.

Information on environmental issues that have been integrated in the subjects taught in schools and tertiary colleges include:

- Soil and water conservation
- Pollution problems
- Climate studies
- Natural resources studies
- Health and hygiene
- Pests management

The informal education systems encompasses adult education and outreach programmes, public barazas and village meetings

Key players in non-formal environmental programs

- Department of Adult Education
- Ministry of Agriculture
- National Environment Management Authority
- NGOs
- Civil Society Organizations

Environmental issues integrated into non- formal programs

The environmental issues that have been integrated into the non- formal programs in the district are:

- Energy conservation methods through upesi jikos, solar cooker and sawdust jikos.
- Tree nursery, agro- forestry, poultry keeping, zero grazing
- Soil and water conservation

- Land pollution

- Health education programmes

- Agriculture

- Waste management

Challenges of non-formal environmental education

The non-formal environmental education is challenged:

- Inadequate qualified staff.

- In adequate teaching materials.

- Lack of policy guidelines.

6.2. PUBLIC AWARENESS AND PARTICIPATION

Status of public awareness and participation

Lead Agencies and some CSOs and NGOs undertake public awareness on environment and community participation. The channels of information dissemination and awareness creation include; public *barazas*, demonstration and field days, CBOs, Environmental clubs in schools, Electronic and the print media.

Key players in environmental awareness and public participation include:

- National Environment Management Authority

- Agriculture and Environmental Programme

- Office of the President (Provincial Administration)

- Ministry of agriculture

- Forest department

- Ministry of Information

- Ministry of health

There is inadequate integration of environmental awareness into development planning in the district. NEMA initiated award schemes for best practices in environmental management. However, the programme has encountered challenges due to financial constrains. Kenya Forest Service occasionally provides free seedlings for planting as an incentive.

6.3. TECHNOLOGIES

The following are some of the technologies being applied to manage natural resources and environment in the district.

- Grafting in tree planting

- Plastic and scrap metal recycling

- Use of oil receptacles at petrol stations

6.4. ENVIRONMENTAL INFORMATION SYSTEMS

Types and sources of environmental information

Data types available in the district include:

- Climate

- Natural resources

- Pollution

- Infrastructure

- Demography

- Diseases

Sources of environmental information

Environmental information in the district is found in the following forms.

- Annual reports

- Research studies and journals

- Projects progress reports

- Population censuses

- Registers and files

- District state of environment reports

Data/information in the district is available in the following Institutions

- Government departments and local authorities

- Non government Organizations

- Special government projects and programs

Data Formats and Accessibility

The available data formats in the district are purpose specific and vary from one source to another. Most of the available information is in narrative form while a few are in quantitative formats. Maps and electronic formats of presentation of information are very rare. Some institutions charge a fee for information access.

Status of Environmental Information Management Systems

The available information is scattered in various institutions in form of reports. Some of the challenges include:

- Inadequate information sharing between various institutions

- Inadequate institutional capacity in information management

- Some information is obsolete and inaccurate

- Limited number of newsletters and magazines in the district

- Limited local publications

6.5. INDIGENOUS KNOWLEDGE

There are various types of indigenous knowledge, innovations, and practices in the district. The level of their applications in environmental management is low. The indigenous knowledge is not well documented.

Key environmental issues

- In adequate environmental reading materials

- In adequate clear guidelines on environmental education

- Low priority on environmental education within the curriculum

- Low funding for environmental education

- In adequate documentation of indigenous knowledge

- Low levels of networking

- Non-formal education programmes are facing difficulties in translating environmental terminologies into local languages

- Inadequate capacity for environmental education

- Inadequate environmental awareness materials

- High costs of technologies

- Lack of policy framework on IK and data sharing

Proposed interventions

- Develop environmental awareness materials

- Dissemination of environmental awareness materials

- Undertake documentation of indigenous knowledge

- Mobilization of resources for environmental education

- Introduction of rewards and sanctions and recognition

- Translation of scientific information into simple format for the general public

- Enhance the ICT infrastructure in environmental education

- Provide policy guidelines

- Integrate environmental awareness into development planning

- Establish environment information centers

- Baseline survey on the existence of environmental technologies and indigenous knowledge

CHAPTER SEVEN
7.0 ENVIRONMENT GOVERNANCE AND INSTITUTIONAL FRAMEWORKS

7.1 OVERVIEW

Environmental governance in Kenya is through various legislations, standards and regulations together with institutions that implement them. Before the enactment of EMCA in 1999 as on overarching framework law, environmental management was scattered in various sectoral legislations and some were conflicting. Environmental Management and Coordination Act (EMCA 1999) devolve administration of a number of environmental and natural resources management issues to communities. It recognizes community rights, benefit sharing, pastoral land tenure and equitable and sustainable access to land. The Environmental Management and Coordination Act addresses land use management issues including sustainable land use, land use planning, and ecosystems protection and management. The law identifies   structures that oversee the equitable distribution of benefits and devolution of decision making on natural resources. Further EMCA empowers organised communities to formulate environmental actions and conservation and management plans, through NEAPC, PECs and DECs.

7.2. STATUS OF ENVIRONMENTAL GOVERNANCE AND INSTITUTIONAL ARRANGEMENT

Environmental governance in Kenya involves major players who are coordinated by National Environment Management Authority. There are also sectors of the government who have aspects of environmental management in their programmes and are referred to as lead agencies in the EMCA. Environmental Impact Assessment and Environmental Audit are tools used for planning for upcoming and existing projects respectively

Some of the Lead Agencies in the district

- Ministry of Water and Irrigation
- The Kenya Forest Service

- Water Resources Management Authority and related Companies and Boards
- Ministry of Works
- Ministry of Housing
- Ministry of Labour and Human Development
- Mines and Geology Department
- Ministry of Education, Science and Technology Development
- Ministry of Medical Services
- Ministry of Public Health and Sanitation
- Ministry of Energy
- Ministry of Agriculture
- Ministry of Local Government
- Kenya Wildlife Services
- Ministry of Livestock Development
- Ministry of Fisheries development

The Committees under EMCA 1999 are:

- Public Complaints Committee
- National Environment Tribunal
- District and Provincial Environment Committees

7.4. REGULATORY INSTRUMENTS

Some environmental tools being employed in the district include

- EMCA 1999 and its regulations
- Public Health Act,
- Forest Act 2004,
- Wildlife Act,
- Water Act 2002,
- Mining Act,
- Occupational, Health and Safety Act 2007,
- Factories Act

7.5. MULTILATERAL ENVIRONMENTAL AGREEMENTS (MEAS)

Kenya has signed and ratified a number of MEAs and thereof is bound by the requirement of the agreements. Development partners have supported environmental management activities through these instruments.

Key areas where communities are involved in domestication of MEAs include:

- Poverty eradication programmes.
- Natural resource conservations and gender issues.
- Environmental health.
- Capacity building
- Access to clean drinking water
- Reduced child mortality
- Environmental sustainability

However, there is needed to scale up the programmes to include more partners in order to enhance the community involvement in the domestication of MEAs in the entire district.

International Agreements

Some of the international agreements include:

- Convention on Biological Diversity (CBD)
- Cartegena Protocol on Biosafety
- United Nations Framework Convention on Climate Change (UNFCC)
- The Vienna Convention on the Ozone Layer Protection
- The Montreal Protocol of the Vienna Convention on Ozone Layer Protection
- Kyoto Protocol to the UNFCC
- United Nations Convention to Combat Desertification (UNCCD)
- Convention on International Trade in Endangered Species (CITES)
- Convention for the Protection of the World Cultural and Natural Heritage
- Convention on the Wetlands of International Importance especially as Waterfowl Habitats (Ramsar Convention)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- United Nations Convention on the Law of the Sea (UNCLOS)

- Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (Basel Convention)

Regional Agreements

The regional agreements include

- Bamako Convention on the hazardous Wastes in Africa

- African Convention on the Conservation of Nature and natural Resources

- Tripartite Environmental Management Program for Lake Victoria

- The Nile Basin Treaty of 1929

Millennium Development Goals

The MDGs being implemented in district are:
- Eradicate extreme poverty
- Improve maternal health
- Improve access to clean drinking water.
- Universal education
- Net working and partnership
- Reduce child mortality
- Combat HIV/AIDS, malaria and other diseases
- Environmental sustainability

Key environmental issues
- Low level of domestication and implementation of MEAs
- Inadequate public participation
- Misconception on EIA and EA requirements and long term benefits

Proposed interventions
- Enhanced MEAs implementation
- Enforcement set legislations and regulations
- Create awareness on EIA and EA requirements and long term benefits

CHAPTER EIGHT
8.0 IMPLEMENTATION STRATEGY

8.1 Overview

This chapter focuses on the implementation strategy, monitoring and evaluation systems that will be used in the management process during the plan period. It also presents implementation, monitoring and evaluation matrix, that the Embu district will put in place to ensure that the implementation of the plan is carried out to achieve the objectives. The District Implementation and Monitoring Action Plans were developed from intensive consultation workshops at District level.

Implementation of the Action Plan will not be a preserve of NEMA but all Kenyans and non-Kenyans. It is everybody's duty to identify any environmental intervention activity or activities in this report and implement. This will involve resource mobilization from within the district, Province, nationally and even internationally.

The donor community through registered NGOs and CBOs can support some of the intervention strategies identified for addressing the challenges in the District. The Kenya Government through various programmes in other ministries may also play an active role in addressing the many challenges. Sectors like water, energy, forest, Mining, fisheries, roads, housing, local authority, education, research and disaster management, agriculture and livestock may individually or collectively through allocation of funds implement environmental remedial measures.

8.2 MONITORING AND EVALUATION

Monitoring and evaluation will be carried out using participatory approaches where stakeholders are involved at all stages. It will 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. Evaluation will be undertaken periodically preferably on annual basis in the line with the performance-contracting period in the public service. The purpose of evaluation is to ensure efficient and effective implementation as well as ensuring that environmental concerns have been addressed and integrated in development process. It will involve documentation of best practices for the purpose of replication. The implementation strategy will be evaluated using the matrix as shown in table 6.

Table 6 : Implementation Matrix

PRIORITY ISSUES	OBJECTIVES	OUTPUT	ACTIVITIES	STAKE HOLDERS	RESPONSIBLE INSTITUTION
Deforestation and loss of biodiversity	Raise level of tree cover in the district	Increase tree seedlings production	Establishment of tree nurseries -Carry out survey on Status of biodiversity	Forest department of Agriculture -NEMA -NGOs /CBOs -KARI	Forest Department
		Increase number of trees planted on farms and trust lands	-On-farm tree planting -Hilltops reforestation	-Forest department -Agriculture --NGOs/CBOs	Forest Department
Water Pollution	-Reduce water borne diseases' incidences	-clean water in rivers and other reservoirs	-River bank protection -Training on river bank protection -Formation and training of River Users Associations (RUAs)	Water office Agriculture Forest Dept. MKEPP ALRMP II NEMA	Water Office

PRIORITY ISSUES	OBJECTIVES	OUTPUT	ACTIVITIES	STAKE HOLDERS	RESPONSIBLE INSTITUTION
Degradation of water catchment areas/Hilltops cultivation	Stop encroachment of water catchment areas	-Increased river flow -Reduced pollution of water sources	-Hill top forestation -Delineation and marking of hilltop boundaries	Forest Dept. Agriculture ALRMP II NEMA Local Community	Forest Department
Land degradation due to mining, quarrying and sand harvesting	Reduce environmental degradation	Clean and healthy environment	-Inventorize all mining /quarrying/sand harvesting -Regulation of sand harvesting -follow up visits on mining companies to ensure they implement EMP in their EIA/EA reports	-County council -NEMA -Sand harvesters	County Council

PRIORITY ISSUES	OBJECTIVES	OUTPUT	ACTIVITIES	STAKE HOLDERS	RESPONSIBLE INSTITUTION
Poor waste (solid/liquid) management	Improve management of waste in the district	Clean and healthy environment. -Reduced disease incidences	Development of dumpsites in the main urban centers Acquisition of litterbins by business community Sensitization meetings Garbage collection Construction of sewerage system	County council Public health CDF NEMA Chamber of commerce	County Council
Land degradation from road run off	Reduce Pollution of water sources	-Clean water in rivers -Reduction in gully formation	-Stabilization of road embankment -Roadside forestation	-Roads and Public works -Forest Dpt. -County council -NEMA	Roads and Public Works

PRIORITY ISSUES	OBJECTIVES	OUTPUT	ACTIVITIES	STAKE HOLDERS	RESPONSIBLE INSTITUTION
Low awareness on environmental issues	Raise public awareness on environmental conservation	Improved management of the environment	-Sensitization Barazas -Establishment and training of environmental clubs in schools and tertiary institutions -Establishment of environment and safety committees in institutions/companies -Establishment of District Environmental Information and Documentation Center	-NEMA -Education -Office of the president -All GOK departments -NGOs/ CBOs -CDF	-NEMA -Office of the president

Table 7: Monitoring and evaluation matrix

Activity	Ovis(Objectively Verifiable Indicators)	Movs(Means Of Verification)	Reporting Schedule	Implementers	Responsible Institution For M&E	Remarks
Establishment of tree nurseries	-No. of nurseries -No. of seedlings	-Field visits -Reports	-quarterly, bi-annual, annual	-KFS., farmers, stakeholders	-KFS.	
Carry out survey on Status of biodiversity	-Survey report	-Survey report	-	NEMA,KFS, KARI,KWS	NEMA	
On-farm tree planting	-No. of seedlings planted -Ha planted	-Field visits -Reports	-quarterly, bi-annual, annual	-KFS Dept., farmers, stakeholders	-KFS	
Hilltops reforestation	-No. of seedlings planted -No. of hills forested	-field visits -Reports	-quarterly, bi-annual, annual	-forest Dept., farmers, stakeholders	Forest Dept.	
On-farm soil conservation	-No. of farms conserved -Meters of terracing done	-field visits -Reports	-quarterly,bi-annual,annual	Agriculture, farmers, stakeholders	Agriculture	
Farmers training on soil conservation.	-No. of farmers trained -No. of trainings carried out	-List of farmers -Invitation letters -training program	Annual	Agriculture, farmers, stakeholders	Agriculture	

Activity	Ovis(Objectively Verifiable Indicators)	Movs(Means Of Verification)	Reporting Schedule	Implementers	Responsible Institution For M&E	Remarks
Sensitization on negative impacts of slash and burn method of land preparation	-No. of Barazas	-Reports -Field visits	Annual	Agriculture, farmers, stakeholders	Agriculture,	
Rehabilitation of badly eroded areas	No. of sites rehabilitated	-Reports -Field visits	Annual	Agriculture, MOLDF farmers, stakeholders	Agriculture, Livestock	
River bank protection	-Meters of river bank protected	-Field visits -Reports	Annual	Forest, water, agriculture, NEMA, Farmers	Agriculture	
Development of dumpsites in the main urban centers	No. of dumpsites developed	-Reports -Field visits	Annual	County council, Public health, NEMA, stakeholders	County council	
Inventorize all mining /quarrying/sand harvesting	No. and type	-Inventory developed -Field visits	Annual	NEMA, County council, OP, Stakeholders	NEMA	
Sensitization Barazas on environmental conservation	-No of Barazas	Report Field visits	Annual	NEMA, OP, Stakeholders	NEMA, OP	
Establishment of District Environmental Information and Documentation Center(DEIDC)	DEIDC established	-Reports -Site visit	-	NEMA, Stakeholders	NEMA	

REFERENCES

GOK (2004) -Economic Recovery Strategy for Wealth and Employment Creation

GOK (2001) -Poverty Reduction Strategy Paper (PRSP) 2001 - 2004

GOK (2002) -District Development Plans 2002-2008

NEMA 2004 & 2005 -NEMA State of Environment Reports for the years 2003 and 2004

GOK (2002) -Economic survey

GOK (2000) -Statistical Abstract

GOK (2004 & 2005) Government District Departments Annual Plans

GOK (1999) Population and Housing Census