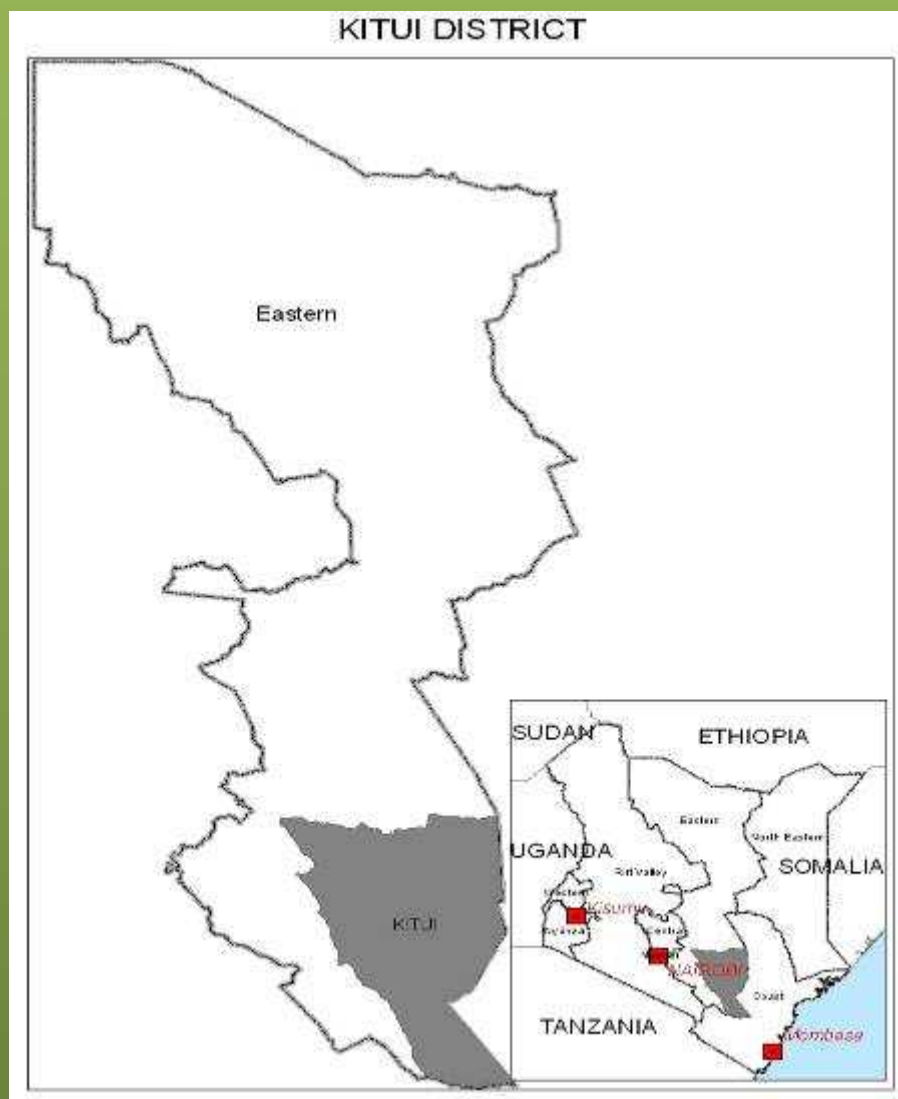




REPUBLIC OF KENYA
MINISTRY OF ENVIRONMENT AND MINERAL
RESOURCES
NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY



KITUI 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 Kitui District. The preparation of the DEAP was undertaken through a participatory process both in the public, private and civil sectors. Further, this document has incorporated salient issues from the Divisions.

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

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

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

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

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

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

FOREWORD

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

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

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

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

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

The preparation of the DEAPs for Eastern Province 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 costs, is gratefully acknowledged.

I wish to underscore that the 2008-2012 DEAP report is a broad-based strategy that will enable the District attain sustainable development as envisaged in Vision 2030.

Dr. Ayub Macharia (PhD)

DIRECTOR GENERAL (Ag),

NATIONAL ENVIRONMENT MANAGEMENT

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

I acknowledge the insights and dedication to this process by the Provincial Director of Environment (Eastern) and the District Environment Officer.

Last but not least, I extend my gratitude to all those who contributed towards the finalization of this District Environmental Action Plan in one-way or another.

Dr. Kennedy I. Ondimu

**DIRECTOR, DEPARTMENT OF ENVIRONMENTAL
PLANNING & RESEARCH CO-ORDINATION**

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LIST OF ACRONYMS

| | |
|-----------|---|
| ASAL | Arid and Semi Arid Lands |
| CBOs | Community Based Organizations |
| CDM | Clean Development Mechanism |
| CDTF | Community Development Trust Fund |
| DDPs | District Development Plans |
| DEAP | District environmental Action Plans |
| DEC | District Environment Committee |
| DEOs | District Environment Officers |
| DIDC | District Information and Documentation center |
| EMCA | Environmental Management and Coordination Act |
| EMS | Environmental Management system |
| ERSW & EC | Economic Recovery Strategy for Wealth and employment creation |
| F.F.S | Farmers Field School |
| GDP | Gross Domestic Product |
| GIS | Geographical Information system |
| HA | Hectares |
| IK | Indigenous Knowledge |
| Km | Kilometers |
| MDGs | Millennium Developmental Goals |
| M.E.A | Multilateral environmental Agreements |
| MENR | Ministry of environment and Natural Resources |
| MOH | Ministry of Health |
| NDPS | National Development plans |
| NEAP | National Environment Action Plan |
| NEAPC | National Environmental Action Plan Committee |
| NEMA | National Environmental Management Authority |
| NEPAD | New Partnership for Africa Development |
| NGOS | Non-Governmental Organizations |
| PDEs | Provincial Directors of Environment |
| PEAPs | Provincial Environment Action Plans |

| | |
|-------|--|
| PEC | Provincial Environment Committee |
| PPO | Provincial Planning Officer |
| PRSP | Poverty Reduction Strategy Paper |
| SKNP | South Kitui National Reserve Park |
| TENP | Tsavo East National Park |
| UNCED | United Nations Conference on Environment and Development |
| UNDP | United Nations Development Programme |
| WC | Water Closet |
| WHO | World Health Organization |
| WSSD | World Summit on Sustainable Development |

CHAPTER ONE

1.0 INTRODUCTION

1.1 Preamble

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

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

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

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

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

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

1.2 Challenges of sustainable development

Kitui District economy primarily depends on natural resources where over 95% of the population live in rural areas and derive their livelihoods mainly from these resources. Economy activities derived from the natural resources include agriculture, small-scale industry, energy, water, trade and mining. The environment and natural resources have in the recent years been under threat due to increased dependence on natural resources to meet basic needs. The situation is aggravated by the rising poverty levels from 53% in 1994 to 59% in 2002 and is currently estimated to be over 65% the situation is even worse within the rural population. The population growth rate has over time become higher than the economic growth rate hence pressure on these resources. This has also led to increase in – migration in urban center and over utilization of fragile ecosystem.

The immigration into marginal areas from high potential area has contributed to unsuitable land use practices often resulting to resource use conflicts especially water and pasture. Poverty often leads to over –use and destruction of the environment where short-term development goals and practices are passed at the expense of long-term environmental sustainability. Once the resource base is degraded, poverty is aggravated because the capacity of the resource base to support the same population even with unchanged demand will have diminished. Therefore there is a close link between poverty and environm

Rapid urbanization coupled with increased unplanned settlements due to population increased and persistence drought have resulted to loss of environmental quality and health deterioration, water pollution, loss of biodiversity, Encroachment of fragile ecosystems and urban decay. In both rural and urban areas access to safe drinking water and basic sanitation is a critical environmental and health concern. The widespread accumulation of solid wastes and liquid wastes in urban areas is also an environmental hazard culminating in air and water pollution and increased incidences of respiratory and water borne diseases.

The climate of the district is generally hot and dry for the most of the year and characteristic of arid and semi-arid land with very unreliable and erratic rainfall. While subsistence agriculture is the main economic stay and source of income for 80% of the population. Only 2% of the district is high potential and can support meaningful agriculture, while 32% is medium potential.

Livestock keeping constitute the major economic activities given the arid climate of the district. However the district is a food deficit area due to the recurrent drought. Due to this the ecosystems are fragile and susceptible to degradation. Climatic vulnerability further reduces the capacity of land to support existing and emerging livelihoods thus further aggravating environmental degradation. This is evidenced by increased reduction in pasture and vegetation cover, soil erosion, food insecurity, increased conflicts and insecurity – all contributing to increased poverty.

1.3. EMCA, 1999 provision on environmental planning

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

1.3.1 DEAP Methodology

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

The District Environment Action Planning Committee spearheaded the preparation of the Kitui DEAP. The committee requested for sectoral environment reports from the lead agencies and compiled the DEAP.

1.3.2 Objectives of District Environment Action Plans

- To determine the major environmental issues and challenges facing the district
- To identify environmental management opportunities.
- To create synergy and harmony in environmental planning
- To integrate environmental concerns into social economic and development planning.
- To formulate appropriate environmental management strategies.

1.3.3 Kitui DEAP Scope

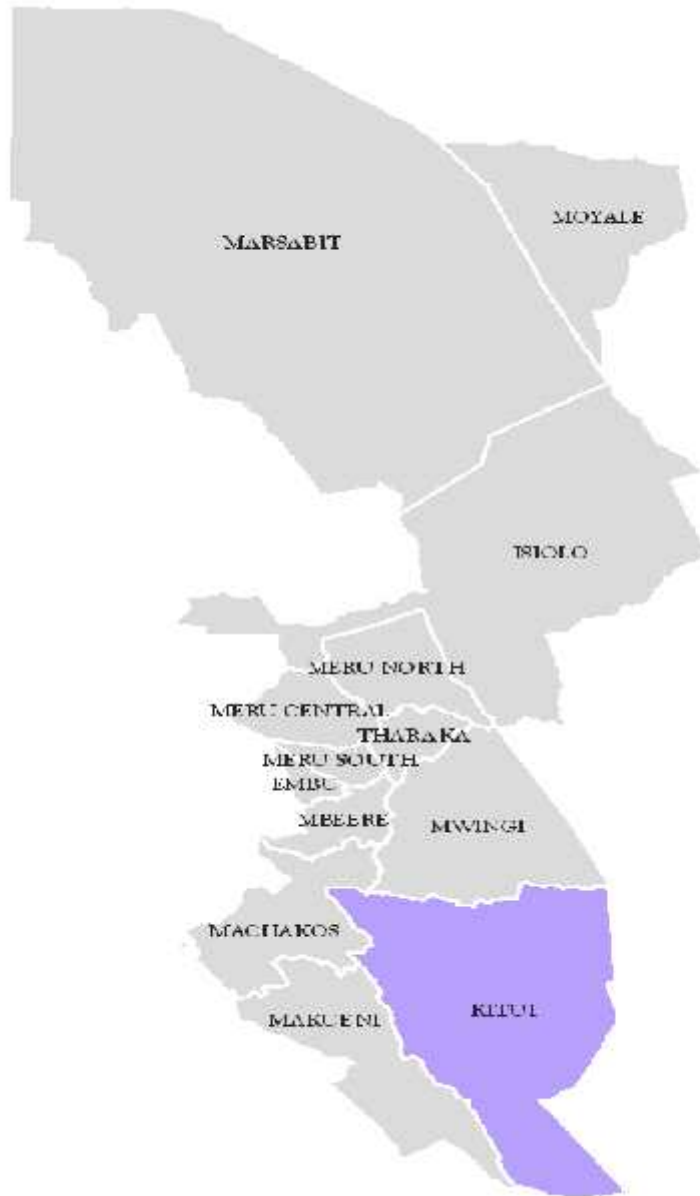
The preparation of the Kitui DEAP has been realigned with Vision 2030, Midterm Plan 2008-2012 as directed by the government. The current DEAP covers the period of 2008-2012 and as per EMCA shall be revised after every five years. The DEAP will be monitored by the annual preparation of the State of Environment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

1.4 District profile

This section gives the physical description of Kitui district in terms of its location area of administrative divisions and main physical features.

1.4.1 Geographical Location Size and Administrative Units

This section provide information on the administrative set up of the district, geographic and physical description of the district in terms of climate, rainfall, soil and natural resource endowment.



Geographical location

Kitui District is one of 13 districts of Eastern Province. It is located in the southern part of Kenya. It borders Machakos and Makueni districts to the west, Mwingi district to the north, Tana River district to the east and Taita Taveta district to the south. The district is located between Longitudes 37° 45" and 39° 00" east and latitudes 0° 37" and 3° 00" south. The district covers an area of approximately 20,402km² including 6290.3km² occupied by the uninhabited Tsavo National Park. The district is divided into 10 administrative divisions, namely: - Central, Chuluni, Matinyani,

Mwitika, Mutitu, Ikutha, Yatta, Mutonguni, Mutomo and Mutha. The divisions are further divided into 57 locations and 187 sub-locations, as shown in table 1

Table 1: Administrative units by Division

| <i>Division</i> | <i>Area Km2</i> | <i>Location</i> | <i>Sub-Location</i> |
|------------------------|------------------------|------------------------|----------------------------|
| Central | 808.6 | 8 | 30 |
| Chuluni | 521.5 | 6 | 16 |
| Matinyani | 308.6 | 7 | 19 |
| Mutonguni | 359.2 | 8 | 20 |
| Yatta | 1175.0 | 6 | 14 |
| Mutomo | 803.9 | 4 | 17 |
| Yatta | 1417.5 | 5 | 18 |
| Mutomo | 837.2 | 3 | 12 |
| Mwitika | 3426.1 | 4 | 16 |
| Mutha | 4454 | 6 | 25 |
| Tsavo East N/Park | 6290.3 | - | - |
| Total | | 57 | 187 |

Source: Kitui District Development Plan 2002-2008

Mutha division is the largest while Matinyani and Mutonguni divisions are the smallest. Central division which hosts the district Headquarters has the largest number of locations and sub-locations while Mutitu division has the lowest; this is as per table 1 given above.

There are 4 parliamentary constituencies in the district. These are Central, Kitui West, Mutitu and Kitui South. Kitui Central constituency comprises of Central and Chuluni Divisions; Kitui West constituency comprises of Yatta and Mutonguni divisions, Kitui south constituency comprises of Mutomo, Ikutha and Mutha division; and Mutitu Constituency comprises of Mutitu and Mwitika Divisions.

Kitui district has two local Authorities namely Kitui County Council and Kitui Municipal Council. The County Council has 44 wards while Kitui Municipal Council has 16 wards all represented by elected Councilors.

Kitui south and west constituencies have the largest number of county council wards with 15 and 14 respectively. Central constituency has the least number of wards. The Municipal Council wards are

only in Kitui Central and Kitui west constituencies with the former having the largest number of wards

1.5 Climate and physical features

1.5.1 Altitude

The altitude of the district ranges between 400m and 1800m above the sea level. The central part of the district is characterized by hilly ridges separated by wide low lying areas and has slightly low elevation of between 600m and 900m above the sea level to the eastern side of the district, the main relief feature is the Yatta plateau, which stretches from the North to the South between rivers Athi and Tana. The plateau is almost plain with wide shallow spaced valleys. The highest areas in the district are Kitui Central, Mutitu hills and Yatta plateau. Due to their high altitudes they receive more rainfall than other parts in the district and are the most productive areas.

1.5.2 Climate

The climate of the district is arid and semi-arid with very erratic and unreliable rainfall. Most of the areas are generally hot to dry leading to high rate of evaporation. This combined with unreliable rainfall; limits intensive and meaningful land use and related development activities. The annual rainfall ranges between 500 -1050mm with 40 percent reliability. The long rains come in April/May and short rains in November/December. The short rains are more reliable while long rains are usually unreliable. The periods falling between June to September and January to March are usually dry. The topography of the landscape influences the amount of rainfall received. The high- land areas of Central hills in Kitui and Mutitu in the Eastern parts of the district receive between 500-760mm of rainfall per year. The Endau hills receive 500-1050mm per year while the drier eastern and southern areas receive less than 500mm.

The district experiences high temperatures throughout the year, which ranges from 16⁰c to 34⁰c. The hot months are between June and September and January and February. The minimum mean annual temperatures are 28⁰c in the western part and 22⁰c in the eastern parts. Maximum mean annual temperatures on other hand are 28°C in the western part and 32° C in the eastern part.

1.6 Ecological zone

66% of the district falls under AEZ IL₅ and IL₆ that is classified as range lands. This is mainly in Ikutha, Mutha, Mwitika and lower Yatta. 32% of the district falls under AEZ LM₄ and LM₅- which is Agri-marginal areas. This covers the area of Mutomo Chuluni (Lower), upper Yatta and Mutitu

division. Meanwhile 2% of the district falls under AEZ UM₄ and LM₃ which is regarded as suitable for agricultural production and include Central Upper Chuluni, Matinyani and Mutonguni Divisions.

Although according to land suitability classification UM₃ UM₄, LM₅ millet and cotton zone a mixture of all the above crops and livestock have been pushed in these areas including the rangeland. In this zone various crops (Maize, Sorghum, Millet Beans, Cowpeas, Pigeons peas, green grams and cotton) are mixed on the same place of land, mostly with no defined rotational pattern.

1.7 Population size and distribution

Kitui District has had a relatively high population growth since independence. Population size increased from 216,547 persons in 1969 to 303,960 in 1979, 412528 in 1989 and 515,422 in 1999. It was projected that by year 2002 the figure should have exceeded 550678 persons. These projections are based on the 1999 population census and assume a growth rate of 2.23 per cent. This trend is likely to create a negative impact on the environment and economic welfare, with over 60 per cent of the people who are currently living below the poverty line.

1.7.1 Population Growth

High population growth rate implies stress in potential arable land. This leads to inadequate environmental goods and service worsening the fragile environmental resource. The end result is depletion of Natural resource. 96 percent of district population lives in the rural areas with only 4 % per cent in urban areas.

1.7.2 Population Distribution

The Population of the district is youthful with 59.4 percent being 21 years and below.

Table 2 : Population projection by division

| <i>Division</i> | <i>1999</i> | <i>2002</i> | <i>2004</i> | <i>2006</i> |
|------------------|-------------|-------------|-------------|-------------|
| Central | 123742 | 132205 | 138169 | 144401 |
| Chuluni | 72341 | 77289 | 80774 | 84417 |
| Matinyani | 40898 | 43632 | 45600 | 47656 |
| Mutonguni | 58898 | 62927 | 65764 | 68729 |
| Yatta | 41646 | 44494 | 46501 | 48599 |
| Mutitu | 23860 | 25494 | 26644 | 27845 |
| Mutomo | 45787 | 48918 | 51123 | 53429 |

| | | | | |
|----------------|---------------|---------------|---------------|---------------|
| Mwitika | 25701 | 27459 | 28697 | 29991 |
| Mutha | 39139 | 41817 | 43704 | 45673 |
| Ikutha | 43470 | 46443 | 48537 | 50726 |
| Total | 515422 | 550678 | 575512 | 628591 |

Source: District planning unit-Kitui (2005)

Table 2 above implies that Central Division has the highest population of 138,169 while Mutitu and Mwitika Divisions had the lowest population of 26,644 and 28 697 respectively as per projection of 1999 population census. Other demographic features are given in tables 3, 4 and 5 below.

Table.3: POPULATION SIZE AND DISTRIBUTION (DENSITY)

| NO | YEAR | POPULATION | DENSITY |
|-----------|-------------|-------------------|----------------|
| 1 | 1962 | 177,677 | 9 |
| 2 | 1969 | 217,573 | 11 |
| 3 | 1979 | 296,362 | 11 |
| 4 | 1989 | 412,528 | 20 |
| 5 | 1999 | 512,422 | 25 |
| 6 | 2000 | 526,916 | 26 |
| 7 | 2001 | 538,666 | 26 |
| 8 | 2002 | 550,678 | 27 |
| 9 | 2003 | 562,958 | 28 |
| 10 | 2004 | 575,512 | 28 |
| 11 | 2005 | 588,346 | 29 |
| 12 | 2006 | 601,466 | 29 |
| 13 | 2007 | 614,879 | 30 |
| 14 | 2008 | 628,591 | 31 |
| 15 | 2009 | 642,609 | 31 |
| 16 | 2010 | 656,939 | 32 |
| 17 | 2011 | 671,589 | 33 |

Source: District Statistics Office 2006.

Table 4: POPULATION DISTRIBUTIONS BY GENDER

| Division /location | Years | | | | | | | | | |
|-----------------------|-------|--------|---------|---------|---------|---------|---------|---------|-----------------|---------|
| | 1962 | | 1979 | | 1989 | | 1999 | | Projection 2011 | |
| Kitui District | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female |
| Kitui District | | - | 215,336 | 348,947 | 341,313 | 394,580 | 243,045 | 272,377 | 305,227 | 494,037 |
| Total | | | | | | | | | | |

Source: District Statistic Office 2006

NB: Population distribution by Gender within Kitui District is between 1979 and 1989 both include Mwingi District, which was curved from Kitui District in 1992

Table.5: MORTALITY TRENDS (INFANT. UNDER 5 YEARS, OTHERS)

| Division Location | Years | | | | | | | | | | |
|----------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|---------------------|
| | 1962 | | 1969 | | 1979 | | 1989 | | 1999 | | Projections 2011 |
| Kitui District | Infants | Under 5 years | Infants | Under 5 years | Infants | Under 5 years | Infants | Under 5 years | Infants | Under 5 years | |
| | - | - | - | - | 11,696 | 41590 | 15890 | 61531 | 21781 | 65477 | 111,216 |
| | 173 | 139 | 126 | 144 | 133 | 103 | 91 | 110 | 127 | 139 | |

Source: District Statistic Office -2006

NB: Mortality is one of the contributing factors to population. Apart from decreasing the size of a population, it also influences the shape of the age and sex structure of a population.

1.8 Economic social and cultural characteristics

1.8.1 Economical Characteristics

Agricultural development in Kitui just as in other marginal lands is problematic due to low rainfall and the menace of wildlife and pests. In the District crop production has been made quite unreliable and unevenly distributed in the recent years the district has been experiencing crop failure of almost 90% thus rendering the majority of people in the district destitute and in dear need of food.

The people of Kitui are engaged in various economic activities for their livelihoods. Whereas the majority is engaged in agriculture, livestock keeping still remains the income earner in the district and especially in the drier area. People practice mixed farming because livestock acts as a buffer during poor rain seasons. Most of what is harvested is consumed domestically, and there is hardly any net surplus. The District is famine-prone; whatever is produced has to be supplemented with external food aid to avert starvation.

Major commercial activities like wholesale, retail shop keeping process of food products, honey farming harvesting and refining are other economic activities taking place in urban centers and market places. Not to be underrated in their capacity to absorb the labor force are the Jua-kali workshops spread out in all towns and markets centers. Cotton ginning, formerly a major commercial activity has greatly declined due to worsening climatic conditions, while charcoal burning and sales has gone up considerably.

There are several financial institutions in the District, most of these Micro-enterprises make acquisition of credit to small-scale business people and farmers possible and has been a great boost to the people in the district as they strive to fight and alleviate poverty. Self-help groups have also increased in number in the district and have become a great source of income for the members. The groups, which are registered at the department of Social Services and the department of culture, are involved in many income generating activities which include Bee-keeping, poultry keeping water – kiosks, basketry, merry go round and small loans to members among other activities.

1.8.2 Social Characteristics

As indicated above poverty level in the district is very high. Several factors have contributed to this trend; the most dominant ones are poor and unreliable rainfall, persisted drought and famine, illiteracy and lack of employment opportunities. Generally the overall welfare of the people of Kitui is not good and this can be gauged by use of several indicators including mortality rate, child

mobility and malnutrition, occurrence of common Diseases like Malaria, Diarrhea, Tuberculosis, HIV/Aids, School enrolment to mention but a few.

Food availability and nutrition per capita calories and protein intake are other measures of the welfare of a given society. The climatic conditions in Kitui are such that the District is always deficient in food supply. It has been estimated that the District faces serious crop failure five out of every eight seasons. The incidence of destitute and families on famine relief are social welfare indicators. The District relies on famine relief almost on a yearly basis. Education in the District is also affected by the recurrent famine and quite a number of them have to be assisted through bursaries and food –for fees programs that are sometimes have to be used to keep students in school. Several organizations and children homes set up by churches and other organizations also help destitute children. The catholic Diocese of Kitui is a good example that maintains quite a number of destitute institutions.

Due to the climatic condition of District, the greatest potential is for livestock keeping, and indeed there are large numbers of livestock. The livestock include goats, cows, donkey, sheep, bees and poultry. These are kept in large numbers with the resultant destruction of vegetation of the land. This encourages soil erosion and desertification in lands that are already arid. These animals die of starvation and lack of water when drought strikes; this is a waste that should be curbed through rearing of manageable herds and provision of water. Charcoal burning has also greatly contributed to the destruction of the environment and should be curbed.

The government departments have being in the forefront in trying to better the lives of the people. It has been networking with various local NGOs, bilateral and multilateral organizations to promote the welfare of the people of Kitui. Such organizations include the Danida (Kitui agricultural Project which completed its projects in June 2005), JICA, ADRA, USA Peace Corps among others.

The activities include projects in water harvesting and venturing, into poultry keeping, tree seedling, bee keeping, merry go-round and social welfare, loans to members, small scale business, and small scale farming among others. The Department gives grants to groups to boost their activities for increased production and profit. Groups are encouraged to write proposals for funding on their activities and these are used while disbursing the fund.

The Kitui Agricultural Project was especially active and helpful in identifying the needs of the people and funded many projects especially in helping the small –scale farmers and groups through FFS (Farmers field school) a number of between 30 to 40 FFS were formed and aided in the District.

It also helped the community in accessing water, capacity building of groups in leadership, marketing and selling of products.

Table 6No. of groups in the district by year 2003 -2004

| Year | Number of registered groups | Membership |
|-------------|------------------------------------|-------------------|
| 2000 | 253 | 1,227 |
| 2001 | 214 | 1018 |
| 2003 | 310 | 1952 |
| 2004 | 291 | 1890 |
| 2005 | 321 | 2215 |

Source: District Social Development Officer - 2006

Table.7:No. of groups given grants and amount by year 2003-2004

| Year | No | KSH |
|-------------|-----------|------------|
| 2003 | 10 | 200,00 |
| 2004 | 12 | 300,000 |

Source District Social Development Office 2006

1.8.3 Cultural Characteristics

Culturally, the people of Kitui are mainly Kamba, and the language mostly spoken is Kikamba. There are also other communities like Swahili, Kikuyu, Asians, Embu and Meru. Other languages also spoken include Kiswahili, Kikuyu Ki-mbeere and other Swahili is the main language especially in town centers that have a variety of tribes. The major religion in Kitui is Christianity, followed by Muslim.

The Kamba people in Kitui are mostly farmers although due to adverse weather conditions this brings very little if any products. Crops mainly grown in Kitui include Maize , beans cowpeas , pigeon peas , sorghum , millet finger , sweet potatoes , cassava , fruits include mangoes , oranges, lemons, passion fruit ,avocadoes , among others vegetable are also grown along the river backs and these include lettuce, cabbages , tomatoes, green peas , capsicum and onions.

Due to these poor weather conditions most plants do not do so well except the traditional foods plants that is drought resistant. These include sorghum, millet, finger millet, cassava and sweet potatoes. The department of culture tries to encourage the planting and consumption of these foods for food security, but these are only for domestic consumption. If adapted this trend could reverse the drastic effects of famine. Several food security groups have been established and they are encouraged to plant and use traditional food plants. Traditional food festivals have also been held where the public is sensitized on the need to plant and consume these traditional foods.

Shifting cultivation – The local community are known to practice cultivation, which has adverse



effect on environment. They use fire to clear the vegetation, which is followed by land tillage without proper soil conservation structure. After first two seasons, the land productivity is affected thus cause environmental degradation. This is mostly happening within hilltops, sloppy areas and natural protected areas, as shown in the in photograph.

Bee Keeping – practicing traditional bee keeping using long hives knows The Kambas people. The bee keeping is done in areas where natural vegetation is intact. The most preferred tree species are of acacia type. In areas where bee keeping is done the beekeepers discourage human activities, which threatened the vegetation, thus enhance bi-diversity conservation.

Hunting and Wood Curving – Among other major activities that, the local community uses to supplement income-generating activity are hunting and wood curving. Currently hunting and wood curving is major contributor to loss of bio-diversity due to commercialization. The most affected wild life species are *Dalbegia melanoxydon*, *Terminalia brwonii* and *combretum schumanii*, small animals e.g. Antelopes and birds. The most affected areas are protected forest and natural reserves.

CHAPTER TWO

2.0 ENVIRONMENT AND NATURAL RESOURCES

2.1 Soils and land use

2.1.1 Soils

Soil is an important non-renewable natural resource that supports life, and is especially significant because of their importance of agriculture. Soil patterns are influence by geology, land forms altitude and climate. The Map below shows soil type and distribution within Kitui and Mwingi districts.

There are four (4) major soil types in the central part of the district. Two (2) of which are found in the central part of the District The distribution of soil types in different ACZS provide information that may facilitate planning of that use and management. Soils vary in their physical and chemical characteristic, being either saline or sordic or both.

2.1.2 Soil Type Land use

Main soil types are alfisols (Acrisols, luvisols and ferralsols with some pockets of vertisols. These soils are generally friable clay, sandy clay, loams and loamy sandy. The soils have a high tendency to cap under the raindrop impacts, thus resulting/vulnerable to soil erosion. These soils are relatively coarse, low in organic matter and generally shallow in depth.

Apart from the Yatta Plateau, and the range of hills in the central part of the district, the topography is undulating And gives way to plains toward the east. Various gneisses of the Basement System are the bedrock and are exposed in the hills east of Kitui and Mutomo, and northeast of Endau.

The soils of the hills are usually shallow and stony. Occasionally they may be somewhat more fertile. On the associated foothills, the soils are of moderately low to high fertility.

The uplands in the western part of the district carry soils characterized by an increase of clay with depth of low fertility and low to moderate fertility. South of Kangondi there is some areas with soils of moderate to high fertility.

The major part of the central district is non-dissected sedimentary plain. These soils have natural fertility. Soils having hardpan and of low natural fertility occur near the eastern district boundary. These soils are often found with soils of low to moderate fertility. Along the major water courses on the flat river terraces, soil of moderate, to high fertility occur Most of the soils in the plains are of

low to moderately low fertility and show a sodic / salinity hazard. In some areas in the east of the district “badlands” are found with poor soils rich in sodium.

2.1.3 Land and land use changes

The central part of Kitui District consists of an undulating plateau about 1100 m in altitude, surmounted by ridges and hills, which rise to 1700 m. There are only two short rainy seasons with 60 % rainfall reliability during the growing period of 250-390 mm and 280-490 mm, divided by two distinct arid seasons. The total annual average is between 750 and 1150 mm. In view of the evaporation and the water requirement curves of the leading crops, the rainfall is just enough for the agro-ecological zones class 4, UM_4 = Sunflower-Maize Zone in the Upper Midland and LM_4 = Marginal Cotton Zone in the Lower Midlands. Due to a localized, unfavorable anomaly of temperature, cotton can only be grown up to 1080 m here, compared to 1250-1500 m further west. On the other hand, Zone UM_4 starts at such a low altitude that pigeon peas still grow and are widely planted, more so than sunflower, so that the name “Maize-Pigeon Pea Zone” would actually be more suitable.

The highest hills catch some clouds from the southeast trade winds after the first rains, enabling coffee trees to survive on certain favorable locations. This is therefore a mixed Zone, $UM_{3.4}$.

Downhill towards the lower Midlands, the climate is too dry for a cotton zone and even the Marginal Cotton Zone (LM_4), which is also the driest for successful maize cultivation, is fairly restricted. Therefore, the main areas of the District, the pen plain around the central Upper Midlands, belong to the Livestock-Millet Zone (LM_5) where early maturing bulrush millet, proso and foxtail millets should be the leading grain varieties. Very early maturing sorghum is also possible there. At present, maize is still widely planted, with subsequent crop failures and the risk of famine. For especially dry years in which the rains are insufficient even for sorghum and millet, new perennial crops like buffalo gourds (from Arizona) and marama beans (from Kalahari) may be advisable. They have edible seeds rich in protein and form nutritious tubers after a few rainy seasons. As a cash crop, jojoba, the wax plant, looks promising.

In the Ranching Zone (IL_6), the annual rainfall is between 350 and 550 mm; the 60 % rainfall reliability during the first rains is only 80-100 mm, during the second rains 130-150 mm.

Land tenure

Kitui district has total area of about 20402 Km² and annual populations grow of about 4.6%. This has led to population increase resulting to change of land use and increase demand for land. Only 40% of the land has been demarcated and registered under free hold system while the rest is held under clan ownership or trust land. This inhibits investments on the land such as soil and water conservation, tree planting and conservation of grazing land and water harvesting for crop production.

Land tenure categories

Category area Ha

| | |
|----------------------------------|------------------|
| Urban land | 9600 |
| <i>Settlement schemes</i> | |
| Adjudicated trust land | 129,402 |
| Un-adjudicated trust land | 1,192,969 |
| Gazetted forest | 17,703 |
| Parks /reserves | 705,400 |
| Other water bodies | 500 |
| Totals | 2,055,574 |

Source Kitui District Forest Master Plan

Land use in Kitui district is arbitrary dished out with no regard environment considerations. Human settlement and population increase has led to high rate of land sub division in some parts of the district. This mode of cultivation has lead to increased soil erosion and land degradation. Most of the households whenever they want to open new land for cultivation use fire since they claim that it saves on time, money and energy. But fire destroys both fauna and flora thus degrading the environment further.

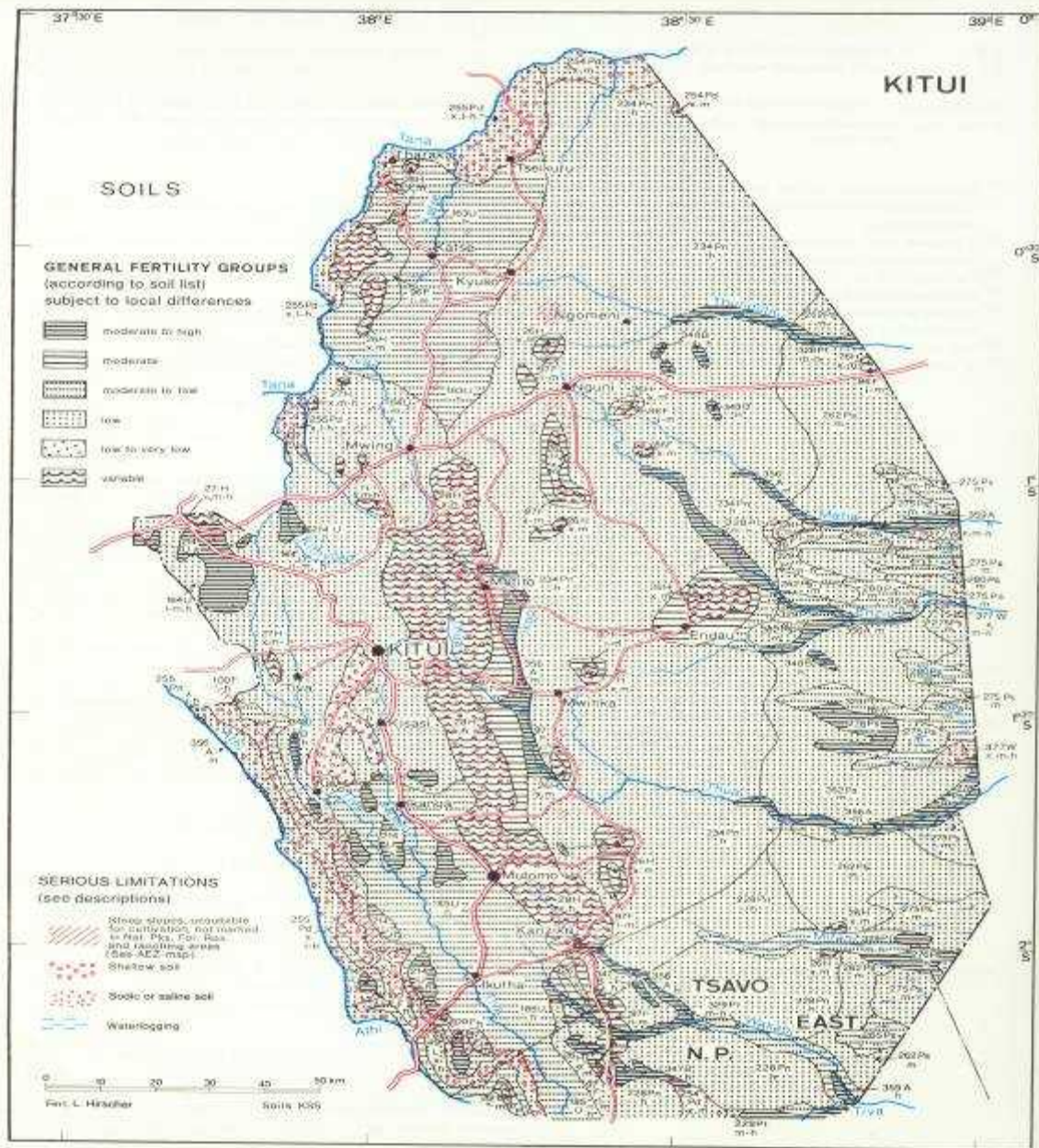


Fig.1: Soil Map of Kitui and Mwingi Districts

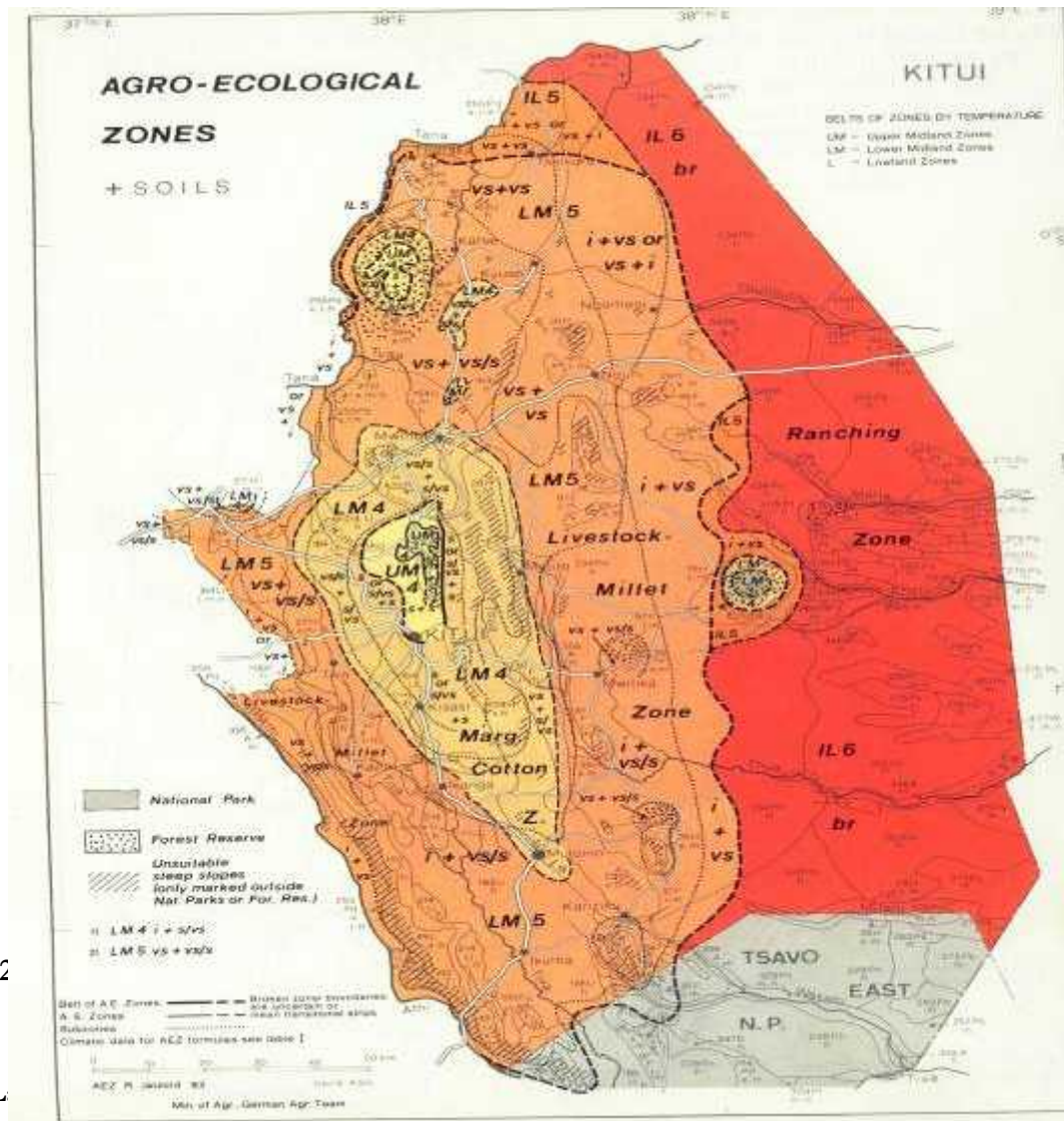


Fig.2

2.2 L

Agro-ecological Zone (AEZIV –AEZV) which is Marginal to medium dry land the Potential land uses are crop production, Forest Ranching and wildlife conservation the area covers over 79,700 (ha) extending all divisions district wide (Central division Chuluni division, Mutonguni Division part of Mutitu and Yatta Division). The figure 2 above indicates the agro-ecological zones of Kitui district.

Key Environmental Issues

- -Soil erosion
- -Declining soil fertility
- -Loss of biodiversity
- -Land subdivision into small uneconomic size
- -Pests and diseases out break
- -River bank erosion
- -Limited credit given to agriculture
- -Poor infrastructure development
- -Commodity price fluctuation
- -Inadequate policy legal and institutional frame work leading to unsustainable production patterns

Proposed interventions

- -More training of farmers on better farming skills
- -More training farmers on poor harvest
- -Empower gender to access credit facilities for agricultural production
- -Ensuring that an early warning system
- -Access market information to farmers more efficiently.

Table 8: Land Use Potential

| | | | | | | |
|----------------|---|---|---|---|--|--|
| EZ IV-V | Dry zone forest intensified social forestry | Forest development -Indigenous forest conservation -Wood lot establishment -Communal forestry development and management | Gazetted hills Trust land hills individual wood lot District wide | 18816.9 | Deforestation due to change of land use Destruction of water catchment areas Loss of bio diversity | -Promote use of alternative source at energy -Soil and water conservation programs to be intensified -Promote use of energy saving jikos -Establishment of village tree nursery |
| AEZV | Ranching potential for tourism Breeding ground for improved livestock breed | Charcoal production livestock charcoal Dormant Dormant | Mwakini yatta Ukai yatta GASP Enziu athoni Nguu nyumu kilawa | 5,000 55,960 5,000 2,000 72,600 120 142 150,201 | -Poor roads net work within the ranches -Poor management of the ranches resulting to soil erosion -Persistence drought leading to loss of animals -Loss of biodiversity due to over stoking | -Provide good and all wealth roads within he ranches. -Build capacity of management team on ranches -Establish and maintain stocking capacity -Improve range management practices |
| AEZV | -National park and reserve -Honey gathering -Biodiversity conservation area -Tourists attraction areas -Grazing areas during drought time | -Protect and reserved area for wildlife conservation -Grazing areas -Source of cultural social materials by the local communities e.g. thatching grass razing / pasture honey gathering | Tsavo east national park & Kitui south game reserve | 630,901 113,300 | Biodiversity loss due to human activities wood poaching meat poaching human wildlife conflict to resource competition e.g. water pasture -Expansion of land for agriculture toward game reserve | -Formation of grazing committee -Provision and development f more water source both in and outside game reserve -Encourage afforestation activities within house holds |

Source: District Forest Master Plan – 2000

2.3. Drylands

Land Classification according to ecological zones

The district falls between moisture availability zones, 11 and V1 with the following distribution (r is average annual rainfall in mm and EO is average potential evaporation, so r/EO gives the degree of aridity as %).

| Zone | Classification | r | r/EO |
|------|-------------------------|-----------|--------|
| 11 | Sub-humid | 1000-1600 | 65-80 |
| 111 | Semi-humid | 800-1400 | 55-65 |
| 1V | Semi-humid to Semi-arid | 600-1100 | 40-50 |
| V | Semi-arid | 450-900 | 25-40 |
| V1 | Arid | 300-550 | 15-25 |

Land Tenure Systems

Land tenure systems in Kitui district is classified into the following:-

Trust Land

This land is held under trusteeship by County Council of Kitui e.g. of this kind of ownership are ranches and Forest hilltops.

Free Hold

This is the greatest interest in land – a person can have and gives the person (landowner) absolute ownership of the land. Most of the land in Kitui district falls under this category.

Lease hold

Land given for define term of years and may be granted to free holders usually subject to the payment of a fee or rent, and subject with attached define conditions which should be observed. Most of the land in Kitui town falls under this category.

Reservation

This included land set for either Government use or trust land to government Ministries/department/local/authority

Regulatory and Institutional Arrangements

Land in the district falls under trust land vested in trust of Kitui County Council, Private and

Freehold and group ranches land, land policy and including land adjudication Act Cap 284 are applied in order to ascertain rights and interest on landowners.

Status and Land use Systems

The climate of district is hot and in most part of the year, characterized by unreliable and erratic rainfall pattern. This hinders intensive land use and other related development activities.

The total area of land under Agricultural production is 79,700 ha of which is intensified within Central, Chuluni, Matinyani and some parts of Mutonguni divisions.

Grazing /pasture area - cover about 522,116 ha which is mostly spread within Eastern and Southern parts of the district. Forest woodland covers about 758,507 ha and located within the hilly parts of the district.

Major Causes of Land Degradation

Basically the main human activities which cause land degradation are change of land use due to increase of human population which leads to encroachment of forests and nature reserve for cultivation, human settlement, grazing, shifting cultivation and poor farming methods accelerates these valuable ecosystems. The major causes of degradation are as flows:

- Low incomes among the residents of the district cause the over reliance on charcoal as a source of income thus degrading the environment.
- Failure of the community to plant drought of plant/crops.
- Lack of clear land ownership (title deeds) decreases extent of tree planting, as this is a long-term activity.
- The area under dry land biodiversity is slowly declining as a result of increasing demand of Land use from the increasing population.

Key Environmental issues

- Protected areas – These include forested hills and national Reserves whereby loss of biodiversity species and genetic level is on the increase in the district due to continued loss and alternation of the natural tropical habitat.
- Grazing field ranches – livestock being major economic activity in the district, pastures and water for animals last only a few months leaving the animals with virtually no grazing fields.

Proposed Intervention

- Among the poverty reduction strategies there is the introduction of high value tree species, *Mukau*, *Mpingo* and quick maturing grafted Mangoes on the farm.
- Increase the uptake of farmer's innovations and new technology options combating desertification and encouraging income generation activities.
- Increase planting materials to increase on-farm forage production.
- Increase tree coverage and protection of environment.
- To ensure promotion of Biodiversity conservation.

Table 9: Land use systems

| Ecological Zone | Land Tenure | Land Use Type | Percentage of District area | Challenges /Constraints | Proposed Interventions |
|-----------------|--------------------|---------------|-----------------------------|---|--|
| AEZV | Private individual | Agriculture | 34.2 | Loss of soil fertility, soil erosion, adverse climatic condition | Soil & water conservation measure to be intensified. Ensuring that early warning systems are functional |
| EAZVI | Private/individual | Pasture | 26.2 | Overgrazing, loss of biodiversity change of land use, increase land degradation | Improve Capacity building amongst the community on how to deal with issues related to animal health, fodder. Challenges /Constraints encountered in pasture establishment & improve tree planting, conservation & range rehabilitation, Challenges /Constraints water pan construction |

| | | | | | |
|------|---------------------------|---------------------|------|---|--|
| EAZV | Trust land public land | Forest Wood land | 39.3 | Encroachment, loss of biodiversity, increase land degradation | Gazettement of conservation areas. Promote use of alternative source of energy. Increase tree base in district. Improve level of tree management skills in the district |
| EAZV | | Other | 0.3 | Change of land use, loss of vegetation cover | Review by-laws, review housing legislation, construction of decent houses, promote recreation amenities, and promote investment in middle & low cost housing in towns where slum development is in increase. |

Source: District Development Plan 2004-008 (Abstract)

Land degradation and desertification is the net result of natural and human induced processes. It amounts to reduction of land capacity to satisfy a particular use. It manifests itself in loss or degradation of soil fauna, flora, water and biological productivity in area under ecological stress (table 9 above).

The Government's initiatives that relate to soil conservation and management include the establishment of the Kenya soil survey project, the arid lands resource management project, the National agricultural and livestock extension programme, seasonal paper No 6 of 1999 on environment and development, national action programme to combat desertification 2002, the national environment action plan (NEAP) of 1994, the enactment of environmental management and co-ordination Act 1999, the 8th National development plan (NDP) 2002-2008, the agricultural Act CAP 318) the water act 2002 and the Revised Forest Act.

2.4 Agriculture, livestock and fisheries

Agriculture and livestock are the main source of livelihoods for the rural populations three board production systems are crop cultivation livestock rearing and fisheries. Each of the production system has the potential to significantly affect human and environmental health.

2.4.1 Agriculture

Over 80% of the population in this district depends on subsistence agriculture. Two percent of the district is high potential whereas 32 percent is medium potential for crop production basically 70, percent of the farm families depend on livestock economies. Because of this narrow and uncertain socio-economic livelihood coupled with unreliable rainfall patterns, the district has remained a food deficit one

Crop production trend

Table 10: Annual crop production

| Crop | Total hectares | Total production Tones |
|--------------|----------------|------------------------|
| Maize | 70,000 | 12420 |
| Sorghum | 6,700 | 2070.0 |
| Millet | 4,750 | 1508.0 |
| Beans | 23,640 | 5400.0 |
| Cowpeas | 18,200 | 6859.0 |
| Green grams | 53,900 | 17400 |
| Pigeon peas | 22,750 | 4095.0 |
| Cassava | 200 | 2000 |
| Sweet potato | 50 | 500 |
| Cotton | 2,000 | 1120 |
| Sunflower | 35 | 105 |
| Tobacco | 100 | 200 |

Status and Trends of Agricultural Development

Livestock is a major economic activity in the district, pastures and water for animals last only a few months leaving the animals with virtually no grazing fields. The vagaries of the climatic condition are further compounded by poor farming implement in adequate supply of drought resistant seeds and lack of alternative sources of income as well as dependence on subsistence farming.

The district is hot and dry for the most part of the year, characterized by unreliable and erratic rainfall pattern. This hinders intensive land use and related development activities. There is evident low agricultural production due to unproductive traditional farming method ,low soil fertility poor extension services , high cost of inputs and in adequate seeds this has made the district to be perpetual net importer of food and reliant on famine relief .

Table 3: Fertilizers and Pesticides

| Crop | Fertilizer | Pesticides |
|-------------------------------|------------|---|
| Legumes | -Do- | Folimat , dimethoate bestox |
| Maize sorghum and millet | -Do- | Bull dock granules |
| Cotton and tomatoes | -Do- | Synthetic Pyrethoids |
| Kales | -Do- | Xentan sherpa |
| Maize | -Do- | Actellic supper sumi combi mortein doom |
| Agro forestry trees and maize | -Do- | Furadan ,confidor |
| Citrus | -Do- | White oil |
| Pawpaw's and cotton | -Do- | Miticides |

NB: The amount and type of fertilizer used in the district remain minimal due to the nature of soil

The cereal-grain-legume system

Some areas farmlands in Kitui consist of cereal-grain-legume systems. Production is mainly for subsistence. However, surplus food crops are sold for cash. Cotton, sunflower, and sisal have potential as cash crops, but marketing is still poor. The main constraints are low crop yields due to poor management and crop failure due to unreliable rainfall. Grazing lands are degraded due to overgrazing and poor management, and soil erosion is a problem on sloping land.

Trees along soil conservation structures to make them more permanent, trees on boundaries and scattered trees in cropland are potential technologies for increased wood production and as a support to agricultural production. Hedgerows of leguminous shrubs may be less feasible due to the risk of moisture competition with crops. Woodlots have a role to play in wood production, and young stock and draught animals need fodder trees as a supplement. More fruit trees of improved varieties could also be grown, both for domestic consumption and for sale.

2.4.2 Livestock production

The livestock-cereal system

While others farmlands in Kitui consist of livestock-cereal systems. Ideally, only drought tolerant crops should be grown in this system, but due to subsistence requirements, the main food crops are

still maize and beans. Other crops are pigeon peas, cowpeas, sorghum and millet. Livestock are an important component.

Constraints to crop production are moisture limitation and little use of manure or fertilizers, which results in poor soil fertility. Serious degradation of grazing land due to overstocking and poor land management is common throughout these areas. There is also a shortage of poles and timber.

Improvement of soil fertility is much needed, and trees and shrubs could play a role if combined with water harvesting. However, consideration must be given to the risk of moisture competition with crops. Planting of more fodder trees, the establishment of fodder lots and better management of grazing areas would increase fodder availability, which would benefit both livestock and crop production (through draught animals being in better condition).

Types of Livestock Production Systems

The following types of production systems are in practice in the district:

- Free range system
- Intensive system,
- Extensive system (mostly in the ranches)
- Semi-intensive system

However, the first three are the most commonly practiced production systems.

Table 4 Types and status of livestock production systems bond.

| Type | Extent (Ha) | % Total district area | Location | Livestock Products | Status | Challenges | Proposed Interventions |
|-------------------------------------|-------------|-----------------------|---|---|----------|--|--|
| Free range Production System | 648,984.00 | 32% | Yatta Mutomo Mutitu Mwitika Ikutha Mutha | Meat (Beef, Chevron, Mutton) Milk Hides and Skins Manure | Moderate | Over-stocking, Poor Marketing of livestock and livestock products. | Formation of farmer groups and associations, Community Capacity building, Pasture and fodder Establishment |
| Intensive Production System | 70.4612 | 0.0000 35% | Central Chuluni Matinyani Mutonguni | Meat (Beef, Chevron, Mutton) Milk Hides and Skins Manure | Moderate | This has been on the increase due overstocking and desegregation (Charcoal Burning and | Formation of farmer groups and associations, Community Capacity building, Pasture and fodder Establishment |

| | | | | | | | |
|------------------------------------|------------|--------|---|---|----------|---|--|
| | | | | | | opening up of land for arable farming) | |
| Extensive Production System | 648,984.00 | 32% | Yatta Mutomo Mutitu Mwitika Ikutha Mutha | Meat (Beef, Chevron, Mutton) Milk Hides and Skins Manure | Low | Over-stocking, Poor Marketing of livestock and livestock products | Formation of farmer groups and associations, Community Capacity building, Pasture and fodder Establishment |
| Semi-Intensive | 8,308.9 | 0.004% | Central Chuluni Matinyani Mutonguni | Meat(Beef, Chevron, Mutton) Milk Hides and Skins Manure | Moderate | Over-stocking, Poor Marketing of livestock and livestock products | Formation of farmer groups and associations, Community Capacity building, Pasture and fodder Establishment |

Source: District Range Office Annual Report 2006

NB: All the production systems are in practice throughout the district

2.4.3 Fisheries Resources

Types of fisheries production systems

- Earth dam fisheries
- Riverine fisheries – Athi River
- Fish pond culture
- Ornamental fisheries

Status and trends of fisheries development

Concerted effort was done to stock with fish most of the permanent earth dams dotting the district in various divisions. Most of the dams were stocked with Tilapia species while others with mixed stock of tilapia and catfish. This is referred to as monoculture and poly-culture systems respectively.

Frequent occurrences of drought have negatively affected fish production especially where some of the dams have dried up wiping out fish stocks.

Athi River Fisheries: The River is one of the richest fish resource base in the district. It provides food supplements to communities bordering the river from Yatta to Ikutha Divisions. Also fish from the river reaches markets as far as Kitui and other towns. It has Tilapia species and other indigenous fish like the cells, catfish barbar and labeo

Pond Culture: This is a system, which depends solely on permanent sources of water.

Most of the springs, rivers, streams and wells in the district are seasonal. However there are few farmers who have reliable springs and wells and have initiated small fish projects.

The extension of the Masinga water project has made it possible for anybody interested in culturing fish for domestic use in a small scale with minimal costs. We have fish demonstration ponds towards that cause in our office.

Ornamental fisheries: This is a system where some fish species special for decorative or ornamental use are cultured in Aquariums (glass walled containers) that use generators. They can be kept in living rooms or business premises. Several business people have adopted this concept in the town.

Some fish is imported from outside the district and the main sources are Lake Victoria, Naivasha and the Tana River dams. The types of fish are mainly Nile Perch, Omena and Tilapia species.

Fish Production

Earth dams / ponds produce about 4,220 kg while river fisheries produce 6,000kg per annum.

This figure fluctuates due to accessibility of some of the areas hampers the collections of production. Not all areas are well covered due to shortage of manpower and scarcity financial resource.

Alien Species and Threats to Habitants

There are no species that have been introduced in the district or that has been recorded in our waters. The catfish introduced in the dams has a population control effect of the fast breeding Tilapia species.

Regulatory and institutional arrangements

Fishing industry is controlled by the Fisheries Act 1989 and fisheries (general) regulations of 1999. This regulates all fisheries activities in the district namely: Fishing, trade in fisheries products, movement of fish and products, processing, fishing period and all aspects involving fisheries.

The fisheries department has the mandate to enforce the Act and regulate, manage and develop the fisheries resources.

Table 5: Types and Status of Fisheries Production Systems

| Type of production system | Location | Status | | | |
|---------------------------|--|--------------------------|----------------------------|---|--|
| | | Current production level | Potential production level | Challenges | Proposed interventions |
| Earth dams /Fish ponds | Central, Kyuluni , Mutonguni , Kabati , Yatta Mutito | 4,220kg per annum | 12,960kg per year | . -Proper fish gears -Negative attitude towards fish diet -Poor brood stock -Poor fish husbandry due to conflict of interests water consumers. | - Purchase and accessibility of fishing years -Sensitization of the communities -Introduction of new brood stock -Stocking of more dams |
| River line fisheries | Athi river | 6,000kg per annum | 12,000kg per year | -Proper monitoring and patrol of the river -Proper fishing gears | Availability of funds fuel and transport and purchases of gears -Additional man power |

Source: *Fisheries Officer - 2005 Annual Report.*

Key Environmental issues

It should be noted that fish is part of the environmental heritage, which should be preserved and guarded, and especially the river line fisheries. The Athi is home to some of the rare indigenous fish species.

Aquaculture especially dam fisheries enhances healthy environment in the water resources fish in the earth dams has an added advantage consuming spawning in the dams are consumed by fish therefore checking the spread of Malaria.

It has observed that there is an increase of toxic materials from industrial wastes and chemicals released from flower farms and industries Nairobi and Machakos unchecked release of toxic the materials into waters habitants affects fish stocks.

However there are no hazardous activities in the district warranting attention except the lack of sewage system in Kitui town that has seen most of the sewage wastes being released in Kalundu River and other streams.

Proposed intervention

- Monitoring of the fisheries habitats
- Control of water pollution
- Monitor of fishing activities

2.5 Water sources

Water sustainability resolves around quality and quantity issues. Increasing demand place an increasing strain on natural water bodies. Water resources depletion and pollution is a threat to environmental degradation and thus social –economic conflicts deterioration and hence poverty propagation.

Due to limited rainfall received surface water sources are very scarce. The major sources of surface water are seasonal rivers that form during the rainy seasons and dry up immediately after the rains. River Athi is the only perennial river in the district and flows along the border with Machakos and Makueni Districts. The district has no lake but has several dams and pans that play a significant role in providing water. Most of the dams dry up during the dry season due to the high evaporation rates of between 1800 -2000mm/year. Spring water is generally found in the hilly areas of the district namely Mutitu hills, Endau hills and Mutha hills. The springs vary in their flow regimes and some dry up during extended drought period. Underground water sources supplement the scarce surface water sources through drilling boreholes.

2.5.1 Main Catchment and Drainage

Kitui district is mainly formed of two distinct catchment areas defined by the ridges which forms part of great Mozambique belts. The upper catchments area with altitude of 1200m a.s.l forms the main water catchments to the lower area whose altitude is averagely 500m a.s.l.

Table 6: Water Catchment and Drainage

| Main Water Catchment | Major Drainage |
|---|----------------|
| Mutitu ,Ndau ,Mutha ,Mutulani ,Kiongwe,Miambani and Ikoo valley | Thua |
| Mutonguni ,Kavonge,Kiima,Musengo and Museve | Tiva |

2.5.2 Identified Status / Trend of Water Resources

The major water sources could be classified into surface water and ground water.

The status and trends of the water resources are analyzed below:-

Table 14: Status of Water Quality and Quantity

| Water Resource | Status | Trends |
|----------------|----------|--|
| Boreholes | Fair | Decrease in yield |
| Dams | Poor | Increase in siltation |
| Rivers | Moderate | Increase in pollution/decrease in quantity |
| Springs | Fair | Decrease in yield |

2.5.3 Regulations and Management Arrangement

The Water Act provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water. The Act is provided by the following responsibilities:

- Development principles, guidelines and procedures for the allocation of water resources;
- Monitor, and reassess the national water management strategy;
- Receive and determine applications for permits for water use, and monitor and enforce conditions attached to water permits for use;
- Regulate and protect water resources and quality for adverse impacts;
- Management and protect water catchment and liaise with other bodies for better regulation and management of water resources;
- To gather and maintain information on water resources and regularly publish forecasts, projections and information on water resources.

Table 15: Identified main water uses

| USE | UTILIZATION | REMARKS |
|------------|-------------|--|
| Domestic | 75% | Utilization is limited to domestic due to scarce |
| Industrial | 1% | No major industries |
| Irrigation | 10% | Irrigation accessible along river lines |
| Livestock | 14% | High number of livestock though use is limited to availability |

Table 16: Impacts of water use and demand on environment and natural resource

| USE | IMPACTS | REMARKS |
|---------------------|------------------|---|
| Domestic | Increased demand | Development of more sources |
| Irrigation | Depletion | Over utilization |
| Livestock | Pollution | Uncontrolled watering |
| General Agriculture | Siltation | -Serious erosion -River bank cultivation |

Source: District Water and Irrigation Officer – 2006

Table 7: Sources and Status of Water Resources

| Source | Status | | Usage | Management | Challenges threats | Proposed interventions |
|--------------------------------------|----------|---------|---------------------|-------------------|--|--------------------------------|
| Piped water Systems: - | Quantity | Quality | | | | |
| 1. Borehole | Average | Good | Domestic | Committee | Running costs | Increase boreholes |
| 2. Springs | Low | Good | Domestic | Committee | Catchment destruction Running cost & low distribution | Gazettement of catchments |
| 3. Masinga P/L | High | Good | Domestic | Gazetted supply | Network | Increased distribution network |
| Ground water sources:- 1. S/wells | Average | Fair | Domestic/irrigation | Individual/supply | Low yield | Development of more wells |
| Surface water sources | | | | | | |
| 1. Dams | Low | Poor | Domestic/irrigation | Groups | Drought , siltation | Catchment protection |

| Source | Status | | Usage | Management | Challenges | Proposed |
|--|--------|------|---------------------------------|-------------------|--|--|
| 2 rivers | Low | Poor | Domestic/Irrigation & livestock | Non | Drying river beds | -Formation of catchment committees & regulation gathering river line activities -Construction of harvesting structures along river beds |
| 3. Rocks | Low | Fair | Domestic | Groups committees | Changing weather condition/cost involvement | -Construction of viable sites. |
| Rain water harvesting 1. Roof / C tanks | Low | Good | Domestic | Individual | -Changing weather condition , cost involvement | -Construction of more tanks |

Table 18: Priority environmental issues and interventions

| No. | Prioritized issues /challenges | Proposed intervention |
|-----|--|---|
| 1 | -Conservation of catchment areas -Construction of conservation structures -Capacity building -Resource mobilization | -Sensitization -Agro-forests/re-afforestation /afforestation -Identification and selection of viable sites for conservation structures -Conservation of reservoirs at catchment base |
| 2 | River banks protection -Flooding /flow control | -Sensitization -Defining of river line -Capacity building -Construction of harvesting structures Defining |

Source: District water officer Kitui -2006

2.6 Forestry

2.6.1 Vegetation types

The Gazetted and non-gazetted forest land in the district covers 18,816 ha. Total gazetted forestland is 16,691km² and 95% is composed of natural forest while the remaining 5% consists of mainly Cypress, Pines and Eucalyptus among others

Forests in the district mainly serve as water catchment areas and most of the rivers originate from the forest areas. There are about 400 (ha) of forest land planted with exotic trees plantations to provide timber and wood fuel. The trees are also used as fodder for livestock, herbal medicine, beekeeping, birds and animal sanctuary.

Table 19: Shows the distribution of forests and their status.

| Forest Name | Area (Ha) | Ownership | Status |
|-------------|------------|------------|-------------|
| Mutitu | 1958.7 | GoK | Gazetted |
| Engamba | 3,222.3 | GoK | Gazetted |
| Makongo | 3431.8 | Trust land | Gazetted |
| Endau | 6717.8 | GoK | Gazetted |
| Kavonge | 31.0 | Trust land | Un -Gazeted |

| Forest Name | Area (Ha) | Ownership | Status |
|--------------|-----------------|------------|-------------|
| Kyawea | 63.0 | Trust land | Un Gazetted |
| Museve | 48.2 | Trust land | Un Gazetted |
| Mutuluni | 596.1 | Trust land | Un Gazetted |
| Mutha | 1361 | Trust land | Gazetted |
| Nzoani | 1387 | Trust land | Un Gazetted |
| Total | 18,816.9 | | |

Source: Kitui District Forest Master Plan- 2000

2.6.2 Regulatory and Management Arrangements

Issuance of Forest products movement permits was introduced in the year 2005 as a measure of control to the wanton cutting of indigenous trees for charcoal. The process of getting a movement permit has to be ascertained by various departments represented in the environment committee, a long process that would only leave the very genuine cases of tree cutting. This mechanism also enables forestry department to monitor areas where cutting is taking place and ensure the same is replanted.

Environment committees have been launched in every division and have the responsibility of inspecting and authorizing the cutting of trees in their respective divisions before any person is issued with a movement permit. The committees authorize cutting of trees only cases where the owners of land are clearing land for agricultural expansion purposes.

The communities are being empowered through training and seedlings production at the farm level to ensure sustainability of afforestation efforts by the departments Forest extension services.

The new approach by the department to involve the adjacent communities neighboring forests in the management of state forests through Participatory forest management will not only ensure protection but also sustainable management.

2.6.3 Exploitation of Forest Resources both For Timber and Non Timber Products

Exploitation of mainly *Melia volkensii* and eucalyptus for timber and poles is ongoing within the district and especially in Central, mutitu, mwitika mutha and Mutomo division. All the local conversion of timber is done using chainsaws to shape frames. This is very wasteful as chainsaws can only yield about 25% of the original wood.

According to results of the survey carried out in 2001 on charcoal trade, an average of 255,229 bags of charcoal leaves the district, each year, mostly to Nairobi. At 35 kg a bag, this makes 8933T. Converted into solid wood, it makes $8933 / 0.10 * 1.4 = 125065\text{m}^3$ per year. However, there is currently an upsurge in exploitation of wood for charcoal production in the district now estimated at 400,000 bags per year.

Kitui district is endowed with a vast resource of essential non-wood forest and tree products e.g. *aloes*, medicinal plants, resins, oils and gums, honey production and other insects e.g. silkworms, butterflies etc all which can be harnessed, improved and commercialized to industrial levels. The exploitation of these products is however very minimal.

There is need for certain tree species for special income generating activities in the district. These include woodcarving and processing of herbal products. Species like *Dalbergia melanoxylon* for carving are on the verge of extinction and alternatives need be identified and propagated to meet the needs of this industry. Neem (*Azadrachta indica*), *Moringa Oleifera*, *Prunus african* and olea species are on demand for herbal medicine production

Key Environmental issues

Loss of biodiversity through expansion of agricultural land is common everywhere, and in Kitui the area under agriculture is expected to increase, at the expense of areas under bush land used for pasture and wood production. In the year 2000, about 65% of the district area was still under pasture, forest & woodland, with agriculture taking the remainder of 35% or some 670,000 ha. In twenty-five years' time, it is projected that it will have changed to 60% and 40%, respectively or a decrease of 140,000 ha of land under pasture and wood production (an average of 5,600 ha loss per year).

Uncontrolled charcoal burning and wanton destruction trees within trust land and private land is a major threat to environment conservation in Kitui District. There is also a lot of encroachment by the neighboring communities for farming; overgrazing and cutting of vegetation cover hence soil erosion and degradation.

Exploitation of wetlands both for agricultural farming and as water sources without conserving their catchments is threatening the sources of the very scarce water resource in the district.

Proposed Interventions

The forestry sector's contribution to Kitui district overall development will be effected by the following strategies:

- ***Promotion of on-farm tree planting*** by introduction and strengthening the existing on-farm tree nurseries for increased tree products like poles, fuel wood, timber and improved agricultural yields and fodder for livestock.
- ***Awareness creation*** through training, barazas, and exchange tours, demonstration plots, schools, adult education classes. The community will be sensitized on issues of environmental concerns like deforestation, soil erosion, species selection, need to increase wood biomass on farms, fodder availability and management of common resources e.g. dams, riversides and hills.
- ***Establishment and management of exotic and indigenous plantations on the hills*** by involving the communities and other stakeholders. These will aim at eliminating the existing timber, poles and fuel wood deficit, improve soil and water conservation, leading to increase food and fodder production, and raise living standards through job creation.
- ***Promotion of public utility conservation and management programs*** like riverbanks and dam and water catchment protection, and encouragement of eco-tourism to benefit the communities. Promotion of amenity tree planting to improve the aesthetic aspects of the urban centers.
- ***Improvement of existing charcoal production technology*** by replacing the traditional earth mound by improved casamance mound will ensure efficiency in wood biomass conversion. These coupled with improved collection of chess money by the County Council and eventually bring back some of the money through Forest Department for afforestation programs will ensure sustainability in charcoal production.
- ***Promotion of production, processing and marketing of non-wood forest products and support sources of income generation.*** The dry lands are endowed with a vast resource of essential non-wood forest and tree products erg aloes, medicinal plants, resins, oils and gums, honey production and other insects e.g. silkworms, butterflies etc all which can be harnessed, improved and commercialized to industrial levels. The planners should therefore put into account strategies that will go towards exploiting these resources

Table 8: Forest Type and Coverage

| Division | Total Area (ha) | Agriculture | Pasture & woodlands | Forests & Hills | National Parks & Reserves | Other |
|-------------------------|----------------------------|--------------------|------------------------------------|--------------------------------|--|--------------|
| Central | 76,548 | 62,000 | 6,026 | 7,400 | - | 1,122 |
| Chuluni | 53,920 | 29,000 | 10,150 | 14,364 | - | 406 |
| Ikutha | 611,302 | 89,370 | 52,890 | 39,180 | 428,401 | 1,461 |
| Mutha | 653,342 | 297,830 | 115,257 | 37,605 | 202,500 | 150 |
| Mutitu | 61,445 | 24,676 | 14,186 | 22,533 | - | 50 |
| Mutomo | 77,900 | 49,000 | 16,460 | 9,900 | - | 2,540 |
| Mutonguni/ Matinyani | 79,569 | 57,300 | 6,400 | 15,300 | - | 569 |
| Mwitika | 324,935 | 32,000 | 256,000 | 36,600 | - | 335 |
| Yatta | 116,614 | 45,600 | 65,400 | 5,214 | - | 400 |
| TOTAL (ha) | 2,055,575 | 686,776 | 542,769 | 188,096 | 630,901 | 7,033 |
| TOTAL (%) | 100 | 33 | 26 | 9 | 31 | 0.34 |

Table 9: Types and Status of forests

| Type of forest | Extent (ha) | Dist. (% of total) | Loc. | Forest uses | Status | | | | Proposed intervention |
|-------------------|-------------|--------------------|-------------------------|---------------------------|----------|---------|---|-----|---|
| Pasture woodlands | 542,769.0 | 26% | District wide | Pasture | | | | 40% | Introduction and promotion of high value tree species and quick maturing grafted fruits trees geared toward farming programme to provide a source of income as well as ensure proper natural resource utilization |
| Game reserves | 705,400.0 | 31% | Mutha Ikutha & division | Biodiversity conservation | 630,901 | 113,300 | | 10% | Formation of partnership with appropriate stakeholders and build their capacity and knowledge on wildlife /human conflict resolution Development mean full incentives which will encourage the community / stakeholders/partners to support biodiversity conservation effort |
| Forests & Hills | 188,096.0 | 9% | District wide | Water conservation | 17,088.7 | | 1 | 5% | To improve sustainable forestry resources management, tree planting of indigenous high value tree species, promote utilization of indigenous trees for both domestic consumption and income generation as well as commercialization of activities such as tree planting -Community involvement in forest management as a communal resource |
| Others | 7,033.0 | 0.34% | | | | | | | Integrated approach – afforestation and conservation of forest is linked to increased water supply. Sustainable agricultural production |

2.7 Wildlife resources

2.7.1 Types of wildlife and area under wildlife

The area is 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.

2.7.2 Trends and status of wildlife resources

The status of wildlife in Kitui district has been relatively stable unless in cases when there is wild fires and the animals migrate.

2.7.3 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.

2.7.4 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.

Types and status of Wildlife

The National reserve which has an area of 1833 Km² and is located in South Kitui support ecotourism activities in the district. The main threats to wildlife are poaching, charcoal burning, encroachment and hunting as well as logging (table 20 below).

Table 10: Priority Issues and Interventions

| Challenges | Proposed intervention | Remarks |
|--------------------------------------|--|---|
| Security in the reserve | Patrols by KWS. Council to recruit and train rangers | Proposal is underway for the support of this recruitment and training |
| Encroachment into the reserve | Flushing out those already in the reserve Establish an outpost out at Enyai | Integrated management plan is under way detailing this intervention |
| Poaching of small game meat | Community management Committee already training organized Continue empowering the management committee through training and educational tours | Training has been organized and tours |
| Logging for timber | Patrols in and outside the reserve Initiate group tree nurseries to reduce competition for timber | Police Administration Needs to wake up |
| Charcoal burning | Awareness through barazas Initiate group tree nurseries to reduce comp. for indigenous | Police Administration /Personnel needs to wake up |
| Encroachment into the Sanctuary | Beaconing of the sanctuary Development of dilapidated infrastructure | Beaconing has been done. |
| Over harvesting of some tree species | -Regulate and control harvesting of forest products Capacity build the community in afforestation | Afforestation and diversification tree planting |

| Challenges | Proposed intervention | Remarks |
|---|--|--|
| | programme Regulate and control harvesting of forest products Capacity build the community in afforestation programme | |
| Inadequate energy source | Encourage community involvement in seedling production and afforestation programs Promote tree planting as income generating activity -Enhance use other source of energy -Promote use of energy saving devices | Intensive afforestation and re-forestation of Trust land |
| Highly degraded land due to over stocking, Livestock and opening up new land for crop production. | Promote use of alternative source of energy and encourage use of energy saving devices -Continue promoting Communal forest management system. Promote planting of indigenous trees for environmental conservation | Encourage and support farmers Field Schools |

2.8 Biodiversity conservation

2.8.1 Biodiversity Data and Information

Type, extent, status, trends of biodiversity and environmentally significant areas

Forest type

This type of vegetation is found in the high altitude areas of Kitui town and its surrounding. It is characterized by species such as *Croton macrostachyus*, *Croton megalocarpus*, *Dombeya spp.*, *Combretum collinum*, *Combretum molle melia volkensii*. Other species are *Vitex doniana*, *Euphorbia spp.*, *Sclerocarya birrea* among others. In this type of vegetation exotic species such as Eucalyptus species, *Grevillea robusta*, *Mangifera indica* and occasionally bananas are seen on valley bottoms.

Woodlands

This type of vegetation comprises of species such as *Commiphora baluensis*, *Terminalia brownii*, *T. spinosa*, *T. orbicularis*, *T. prunoides*, *Delonix elata*, *Balanites aegyptiaca* and *Acacia spp.* A number of the species shed leaves in the dry season as a survival mechanism.

Bush land and Shrub land

This can be seen as vegetation of a height between 2 and 10 m combining trees and shrubs with a woody cover of 10 – 30%. Species include *Commiphora africana*, *C. schumanii*, *Combretum molle*, *Acacia mellifera*, *A. brevispica*, *A. horrida*, *A. bussei*, *Boscia coriacea*, *Steganotaenia* spp, *Bridelia microcantha*, *Indigofera* spp., *Terminalia prunoides*, *Combretum exaltatum* and *Osyris lanceolata*. This vegetation type is mainly within the plains where some massive hills are standing out e.g. Mutitu, Makongo, Endau, Egamba, Mutha, Nzoani. On the higher elevations of those hills, species such as *Albizia*, *Newtonia*, *Tamarindus*, *Croton*, *Olea*, *Vitex* are observed.

Dwarf Shrub grasslands

This type of vegetation has grass and shrubs covering more than 80% and with shrubs of up to 7 m, mainly found in the Eastern and Southern Lowlands. Species found in this vegetation type are: *Croton dichogamus*, *Bauhinia* spp, *Muevia* spp, *Acacia mellifera*, *Adansonia digitata*, *Combretum* shrubs, and *Acacia nilotica* among others.

Table 11: Type extent, status, trends of biodiversity

| Type | Extent (Ha) | Status | Trends |
|-------------------------------------|-----------------|---|---|
| Game Reserve | 705,400 | Trust Land | Encroachment by human activities |
| Forested hills and water catchments | 7,703 1111.9 | Gazetted & Protected Un Protected Trust land | Threatened ecology due to invasion by farmers for charcoal burning, cultivation & grazing |
| Ranch | 150,021 | Privately Own | Invaded by squatters & over stocking leading to environmental degradation |
| Sanctuary | 50 | Trust land | Proposed for development to enhance eco-tourism |

Key Environmental Issues

- Land use change –conversion of grazing lands to cultivate land and sub sequent human invasion to ranches.
- Deforestation and biodiversity loss is due to forest fire, charcoal burning, shift cultivation or over grazing.
- Degradation of the habitant – Encroachment by livestock, wood poachers in nature reserve and conservation areas. Changing land use practices whereby people are moving to drier areas to cultivate has exacerbated degradation of the habitant.

Table 12 Types of Utilization and Major Beneficiaries

| SPECIES | | |
|--------------|--|---------------------|
| Timber poles | Mellia Volkensii, Eucalyptus | Timber |
| Post | Grevellia robusta, Commiphora baluensis, Accacia's spp | Marchants & bulders |
| Fire wood | | Land Owners, Forest |
| Charcoal | Acacia spp | Traders |
| | Commiphora spp | Farmers |
| Non wood | Tamarindus, guavas | Farmers |
| Produce | Baobab seeds | Wood carvers |
| Carvings | Dalbergia combretum, Lelanoxylon vitex doniana | Agriculture |

The main human activities that threaten environmental significant areas and bio-diversity conservation are cultivation grazing and poverty, which is due to frequent drought occurrence. This is due to lack of pasture to sustain the livestock and more so, shift cultivation and poor farming method which lead to soil erosion resulting to degradation of those valuable ecosystem.

Major Threats to Biodiversity:

Encroachment/human settlement: Settlement in the reserve occurs on the lower parts of the south Kitui national reserve mainly to the north at Maliluni and Enyali and Northwest at Kyeni. This is attributed to the availability of water from Thua river which transverses East to West of the reserve. Clearing along river banks have been made to create land for subsistence farming A primary school at Kyeni had been constructed inside the reserve but abandoned after frequent raids from bandits.

Over grazing and the advancement of deserts conditions: The depletion of ground cover in the north and north East region is so high that the drastic changes in biodiversity is evidenced of progressive arid and desert situation. The Ormans who have lived inside the reserve and some time they keep on moving, further and further into the reserve due to the pressure of banditry attacks.

Subsistence and commercial poaching: There is both small scale (subsistence) and commercial poaching in the area .Commercialization of traditional subsistence hunting has dealt a crippling blow to traditional Kamba wildlife management system. Traditional taboos that enhance wildlife conservation through sustenance use by regulating small scale hunting (species type and age and level of off take) are currently loosely adhered to. In Kitui District 25.1% bush meat consumed is purchased

and a substantial illegal trade industry occurs. Of bush meat hunter in Kitui, commercial trade motivates 32% while the remaining 68% of hunting is motivated for subsistence consumption. The trade of bush meat in Kitui is a well developed informal industry that affects many inhabitants with 172 traders reporting sale of 82.2 metric tons of dressed bush meat from 24 species during 1997 (Barnett, 2000).

2.9 Unsustainable natural resource use practices

With absolute and food poverty at 64.9% and 63.2% respectively, Kitui District ranks high in the national rankings of districts with lowest per capital income. The harsh climatic conditions in the district sometimes translate to prolonged drought and thereby famine. The reserve has as such reserved as a source of food, timber, fuel and other non-timber forest products such as honey. This has created an open access regime in the reserve where the extraction of resource is highly unsustainable with the resultant being destruction of wildlife habitat, loss of biodiversity and desertification (table 24 below).

Key Environmental Issues

- Land use change –conservation of pastoral lands to cultivate land and sub sequent human invasion to ranches.
- Deforestation and biodiversity loss due to forest fire charcoal burning, shift cultivation or over grazing.
- Degradation of the habitant – Encroachment by livestock, wood poachers in nature reserve conservation area. This has been exacerbated by changing land use practices whereby people are moving to drier area to cultivate
- Overstocking of wildlife, which might be more than the carrying capacity of the national park or reserve

Proposed Interventions

- Control of wildlife to prevent human/wildlife conflict
- Involve the neighboring communities and create awareness to control poaching and destruction of wildlife
- Construction of more and close protection camps both for KWS and FD guards
- Facilitation of the guards (plants and equipment)

Table 24: Status of Species and ecosystems in the district*Source: Agriculture Department -2006*

| Name of invasive species scientific/ English local name | Ecosystem affected | Environmental impact | Proposed interventions |
|--|---------------------------|-----------------------------|--|
| <i>Ipomea balatas</i> | dry land | Loss of soil fertility | Manual uprooting and introduction of desirable species (plants and grass) |
| Water weed | Swamp area | Loss of water | Manual uprooting and introduction of desirable species (plants and grass |
| <i>Lantana camara</i> | Dry lands | Loss of pasture | Manual uprooting and introduction of desirable species (plants and grass |
| <i>Acanthospemon hispidum</i> (large grain borer) | (Stores grains) | Threats to food security | Application of the pesticides and training of post-harvest management |
| <i>Prosopis juliflora</i> | Range land | Pasture | Manual uprooting and introduction of desirable species (plants and grass |
| <i>Leuceana Leucocephala</i> | Range land | Pasture | Manual uprooting and introduction of desirable species (plants and grass |
| <i>Datura stramonium</i> | Dry lands | Pasture | Manual uprooting and introduction of desirable species (plants and grass |

The Common plant invasion species invent the land due to execrated soil erosion and introduction of some plants which require specialized management procedure to control but the community is not capable of applying the techniques. While insect invasion species are manifested due to lack of proper post harvesting methods and importation of food due to food insecurity.

TOURISM

The district also has a high potential in tourist attraction though not adequately exploited. The expansive Tsavo East National Park, which occupies an area of 6,290.3km ² has a large population of

wildlife, which attracts tourists in the Country. Generally the National Park has no economic gain in the district because the revenue collected is not ploughed back to the district. Also tourist infrastructural facilities such as lodges, water and other tourist's related amenities need to be developed in south and north reserves as well as National Parks

MINING

The district is endowed with some minerals and materials that are exploited on commercial basis. Building sand found in abundance and is exploited on commercial basis. At the moment, there are several sand harvesting sites namely, river Nzeeu, Tiva, Mutendea Mwitasyano and Kauwi near Kitui town. Other small sand harvesting sites are spread throughout the district. Due to absence of consolidated volcanic ash and other forms of buildings rocks, bricks are locally made of clay materials found in the district.

CHAPTER THREE

3.0 HUMAN SETTLEMENT AND INFRASTRUCTURE

Human settlements and infrastructure Influence the location of investment, which provides employment, generate revenue for and creates demand for materials and services. This includes education, commercial, industrial, recreational residential , agriculture public utility (services include supply of water ,waste disposal ,sanitation telephone ,power services include supply of water, sewers) public purpose will include (religious institutions) and protected land (public parks, national parks and reserves, forests) transport (roads railways ,airways lake/sea ports) These activities can have negative or positive impacts on the environment.

Factors Influencing Settlement Patterns

Land potential largely determines the population density between divisions, climatic conditions also influence the settlement patterns and also infrastructure and security also determine population density of any division central, Matinyani and Mutonguni divisions have the highest densities of 153,151, and 148 person per km² respectively while Ikutha, Mwitika and Mutha division have the lowest population densities of 6.0 8.0 and 9.0 person per km² respectively. Tables 24, 25 and 26 show some social indicators related to land tenure, urban planning and access to water.

Table 13 Land tenure systems and area (ha) in the district

| Tenure type | Area (ha) | | | | | | Remarks |
|---|-------------|-------------|-------------|-------------|-------------|-------------|---|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2005 | |
| Leasehold | 20 | 40 | 150 | 180 | 210 | 260 | Most of the trust land has been allocated |
| Freehold | 9000 | 8960 | 8900 | 8870 | 8850 | 8800 | Agriculture land has been subdivided |
| Trust land | 90 | 77 | 50 | 40 | 94 | 35 | |
| Others (gazetted forest parks & reserve | | | | | | | Threaten by human activities |
| Total | 9110 | 9077 | 9100 | 9090 | 9154 | 9099 | |

Source: Municipal Council of Kitui – 2006

Table 14: Planned urban areas

| City/Municipality | Local plan | | | | | | Regional Plans | | | | | | |
|-------------------|------------|------|------|------|------|------|----------------|------|------|------|------|------|------|
| Municipality | 1960 | 1970 | 1980 | 1990 | 2000 | 2005 | 1960 | 1970 | 1980 | 1980 | 1990 | 2000 | 2005 |
| Kitui town ship | 1 | 1 | 1 | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- |
| Matinyani market | -- | -- | -- | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- |
| Katulani market | -- | -- | -- | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- |

Source: Municipal Council of Kitui 2006

Table 15 Percentage of households with access to water and sanitation services

| Location | Water Dams | | Sanitation | | | | | | | | | Remarks |
|----------------|--------------|-------|------------|--------|-------|--------|--------------------|-------|-------------|----------------|--------|-----------------------------|
| | Piped B/hole | Well | Bore Hole | River | Dams | Others | Connected to sewer | WC | Pit latrine | Flying toilets | Other | |
| Kitui | 10,000 | 8,000 | | 20,000 | 5,000 | 1,000 | Nil | 1,000 | 30,000 | Nil | 13,000 | |
| Kitui District | 40% | 5.8% | 2% | 80% | | 8.2% | NIL | 4% | 56% | 1% | 39% | Low Coverage for both items |

Source: District Public Health Office -2006

Key Environmental Issues

- Increased land demand lead to encroachment of human to protected area (parks, reserved and gazetted forests)
- Loss of biodiversity cover
- Overgrazing lead to soil erosion and desertification.
- Destructions of water catchment areas
- Reduce soil fertility and destructions of aesthetic value of land.
- Loss of wildlife habitat.
- About sixty per cent (60%) of the district area is range land (grazing are) most of this land has been degraded mainly through overgrazing thus leading to low vegetation cover with approximately 10% ground cover and 15% canopy cover.

Proposed interventions

- Accelerated land adjudication to ascertain existing rights and interests of individuals overland.
- Sub division of group ranches and co-operatives farms to facilitate insurance of individual titles to their respective members
- Promote afforestation programs within public, private trust land and individual farms.
- To sensitive the community on importance of preserving conserving and protecting environmental significant areas (Forested hills, water catchment and river bank areas) to enhance environmental goods and services.
- Improve animal breeding to increasing livestock products thus reducing the number of livestock.

3.1 Human and Environmental Health

The district experiences a number of diseases which affect the people. Some of the diseases are influenced by environmental factors which range from poor waste management to use of polluted water. The table 30 below shows trend in disease manifestation in the district over a number of years.

Common diseases influenced by environmental factors

- Malaria
- Intestinal worms
- Skin infection
- Diarrhea
- URTI
- T.B
- Eye infection
- Amoebiosis
- Bilharziasis
- Typhoid fever

Status and Trend of Common Environmental Diseases

- Malaria is on the increase due to new strains of malaria parasites resistant to common anti-malarial drugs.
- T.B is on the increase but is related to HIV/AIDS.
- Typhoid fever is on the decrease due to effective treatment and increased awareness on preventive measures.

- Amoeba is on the decrease due to improved environmental sanitation and increased awareness
- URTI –fluctuates with season. It is more during dry period and cold season.
- Eye infection is on the decrease due to high awareness leading to the sick seeking medical attention and improved health care system
- Skin infection is on the increase due to HIV/AIDS.
- Bilharzia cases are decreasing due to improved water and sanitation and improved awareness.
- Intestinal worm decreasing due to improved sanitation.

Table 16: Disease Trends 1993 - 2004

| Year Type Of Disease | 1993 | 1994 | 1995 | 1996 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|-------------------------------|-------|-------|------|-------|--------|-------|--------|--------|--------|--------|--------|
| Malaria | | 38612 | 4416 | 99539 | 105980 | 85747 | 114018 | 101263 | 137359 | 197836 | 211199 |
| Intestinal Worms | 5401 | 2720 | 1392 | 13772 | 792 | 10787 | 12618 | 10803 | 13785 | 20756 | 26935 |
| Skin Infection | 16864 | 1887 | 6060 | 17484 | 839 | 14571 | 11025 | 14068 | 18809 | 20769 | 33424 |
| Diarrhoeal Diseases | 19922 | 10479 | 3729 | 18591 | 10012 | 12384 | 10580 | 10664 | 12533 | 20713 | 26901 |
| Urti | 33932 | 8438 | | 7973 | 141 | 40394 | 45610 | 6991 | 61179 | 95870 | 11842 |
| Pneumonia | | | | | | | | 2406 | | 7276 | |
| Eye Infection | 4130 | 293 | 94 | 3712 | 443 | 3865 | 3979 | 3864 | 3957 | 4919 | 6640 |
| Dental Carrier | -- | -- | -- | -- | -- | -- | -- | -- | -- | 3701 | -- |
| T.B | | | | | 97 | 158 | 179 | 190 | 343 | 1786 | 2094 |

Intervention Measures

- Increased awareness level and training of groups on hygiene's and environmental health.
- Increased inter-sectoral collaboration
- Improved water and sanitation measures
- Increased Donor funds to the communities

- Capacity building of the trained personnel
- Increase health facilities and medical equipment
- Improved infrastructure

Pollution and Waste Generated From Human Settlement

The solid wastes generated by household and business (agricultural and products) are mainly disposed of through burning about 40% is dumped in the neighborhood and 20% is dumped in the drains

Therefore is need to address the issue of solid waste management since improved drains mean creation of dumping site which will improve discharge of effluent. Solid waste generated from the neighborhood is only a fraction that is managed in all the areas in KITUI Town thus creating dump sites within residential areas. This caused a lot of pollution and the dump files are an eye sore and danger to the people.

Major Sources of Pollution on land, water and air

- Solid waste –residential, commercial and market areas.
- Liquid waste – from residential, eating) places, car wash, lodgings, commercial places, schools.
- Chemical waste /Agriculture waste – generated from Agricultural areas, schools, hospitals.
- Industrial waste – from Jua Kali garages and petroleum on-lets.
- Special hospital waste – Pharmaceutical and Agro-vet shops, health facilities.
- Air pollution – caused by emission into air of gas from burning waste and moving vehicles.

Air Pollution

- Smoke
- Toxic/ hazardous gases
- Industrial fumes

Key Environmental Issues

- Blockage of drains
- Littered neighborhood
- Loss of aesthetic value
- Diseases out break

Proposed Interventions

- Proper solid and liquid management
- Use of biodegradable chemical in farms.

- Provision of adequate solid waste infrastructures and facilities
- Proper design of sewerage systems
- Public participation in solid and liquid waste management
- Enforcement of laws and regulations.

3.2 Communication networks

Roads

The present road transport network in Kitui ranges from feeder roads to highway. The system is divided into classified and unclassified roads with a total network of 1854km.

Out of the 361.8 km classified road network 75.8 km are of bitumen standard, 286 km gravel standard and the rest are earth stand.

Telephone line/postal services

The land line telephone service are accessible to all major towns and 8 divisional headquarters that is Central, Matinyani, Mutonguni, Chuluni, Mutomo, Ikutha, Mutitu, Mutha except Yatta and Mutonguni. Mobile telephony has been introduced and is growing very fast all over the district.

Key Environmental Issues

- Clearing of vegetation and prime agricultural land to make room for road
- Increase air/noise pollution
- Increase the rate of soil erosion
- Emission of gaseous pollutants

Proposed Interventions

- Routine maintenance of feeder roads opening up new feeder road.
- Build bridges, drifts or culverts at strategic river crossing points.
- Community programmes on development and maintenance of feeder roads.

3.3 Water supplies

Water sources in the settled areas are rivers, springs, dams and wetlands as shown in the table 28 below. The quality of the water varies from source to source as shown in table 29 below.

Table 28: Identified Key Water Resources

| Water Resource | SURFACE WATER | | | | | | |
|----------------|--------------------------------|--------------------------------|------------------|---|-------|---------------------------------------|---|
| | RIVERS | | | Springs | Lakes | Dams /reservoir | Wetlands Hill C/ment |
| | Permanent (1) Athi river | Seasonal 1. Tiva 2. Thua | Streams 50 No | 1.Mutitu 2. Kiima 3. Endau 4.Mutha 5. Kitho 6. Musengo | N/A | 150NO. Along rivers and streams | 1. Mutitu 2. Kiia 3.Mutitu 4. Mutonguni 5. Mutonguni 6. Along rivers |
| | GROUND WATER | | | | | | |
| | Shallow Wells | Borehole | | | | | |
| | 200No. | 100No | | | | | |
| | | | | | | | |

Table 29: Access to Safe Drinking Water

| SOURCE | PERCENTAGE | REMARKS |
|-------------------------|------------|--|
| Piped water/borehole | 50% | From borehole/ Masinga pipeline safest source |
| Springs | 2% | Piped and un piped sources. Threat to catchment destruction. Irrigation accessible along river lines |
| River bed scooped wells | 40% | Pollution ,siltation |
| Dams | 8% | Prone to pollution |

Key Environmental issues

- Loss of vegetation cover around the water draw points
- Spread of water borne diseases.
- Pollution of the land
- Loss of biodiversity near the water source (environmental degradation).

Proposed Interventions

- Ensure that environmental impact Assessment/ Audit is done to assist in conserving and protecting the area
- Control pollution
- Enforcement of relevant legislations and regulation

3.4 Sanitation

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

- The urban centers in the District do not have sewerage facilities. Planning of these facilities is considered to be important as population continues to increase and waste disposal is increasingly becoming a challenge
- Proportion of people with sanitation facilities 58%
- Density Population of Kitui – 80 persons /Km²
- Land area 20402sq km
- Number of market with sewage system –none

Key Environmental Issues

- Intestinal worms
- Diarrhoea diseases
- Skin infection
- Eye infection
- Malaria

Proposed intervention

- improvement of sanitation
- improved provision of water quality

3.5 Energy

3.5.1 Source of Energy Supply in the District

Firewood provide energy which is used by 90% of the rural households in Kitui for cooking, heating, warming, lighting and is mainly sources from Agro forestry plots, trust land and gazetted forests.

Charcoal is a semi-refined wood fuel which is used by 34% of house hold in the district. However charcoal is mainly used in urban center of which over 90% of the house hold use charcoal for cooking, heating, ironing and come business. Source charcoal is private land, trust land, gazetted forest.

L.P.G (Liquid Petroleum Gas). There is low use of L.P.G in rural areas. However, L.P.G is used in hotel industry in urban center and few individuals in town center for cooking and lighting. Kerosene- widely used in urban population than in rural house hold for lighting and cooking about 95% of population use Kerosene.

Electricity – locally produced from hydro-power Geo-thermal and oil source. Only 3.8% of households in the district are connected electricity.

Key Environmental Impacts

- loss of biodiversity,
- soil erosion,
- depletion of water catchment areas and the resultant
- Increase in suspended particulate matters, they constitutes the indoors air pollutants affecting particularly women and children.

The combustion of fossil fuels gives out large quantities of sulphur and nitrogen oxides, heavy metals hydrocarbons, particulates and carbon monoxide.

3.5.2 Energy sector

Energy Sector

The district has immense potential for renewable energy sources while almost. The figures below show energy situation in the district.

Biomass Energy Situation

(a) Kitui District accessible Biomass Yield (Tons / Yr.)

| Energy source | | Yield/Year |
|-------------------|---|------------|
| Closed forest | - | 342 |
| Wood kind | - | 32,375 |
| Bush land | - | 219,530 |
| Wooded artisan | - | 3940 |
| Grassland | - | 7 |
| Farm land | - | 1,098,985 |
| Plantation | - | Nil |
| Total wood (m3) | - | 1,365,178 |
| Total wood (Tons) | - | 948,625 |
| Wood waste | - | Nil |
| Total supply | - | 974,258 |

(b) Biomass Energy Balances (Tons / yrs)

| | | |
|----------------------|---|-----------|
| District demand | - | 1,011,745 |
| Total Biomass supply | - | 974,528 |
| Deficit | - | 37,488 |
| % Deficit | - | 3.71% |

Specific Biomass demand

The total fuel wood demand is over 421,115 tons, charcoal over 39,244 tons i.e. over 594,960 tons wood fuels for charcoal per year. The rest are by farm residue of wood waste.

Key environmental issues in the energy sector

Firewood

Firewood widely used as a source of energy by many Kitui households. Over 90% of Kitui households use firewood for various purposes including of cooking, heating, warming, lighting and house business.

The firewood mainly comes from three areas.

- Agro forestry – includes boundary/ fences, crops lands, woodlots, roadside and neighbors.
- Trust land – rangelands or common lands.
- Gazetted forest – state owned lands forests

Charcoal

Charcoal is a semi-refined wood fuel made by carbonization of wood in limited air. Recovery efficiency in charcoal making for the best kilns is about 30% while in the traditional earth, kilns commonly used in Kenya, recovery ranges from 10% to 20% indicating that considerable amount of energy is wasted. However because charcoal does not smoke and it has twice calorific value per unit of wood, it is convenient to use indoors and is thus preferred by many town dwellers. Use of charcoal as a source of energy supply for cooking, heating, ironing etc constitutes 34% of households in Kitui district.

Farm Residue:

The most common crop residue being used in Kitui is maize cobs, stalks and sorghum stalks, millet, cassava, beans and cotton. Despite the low calorific value, farm residue comprises an important fuel in areas suffering fuel wood scarcity especially in poor households. Statistically 29% of rural households use farm residue for cooking, water heating, ironing, lighting and home business.

Wood waste:

This energy source includes timber off-cuts and rejects, wood shavings and saw dust from wood used in construction and other industrial purposes. If not used on site the wood by product may be collected by households for free or purchase at a small fee. The consumption in low it potential agro-ecological zones e.g. Kitui is possibly a reflection of availability i.e. more tree plantations and saw mills occur in better environment.

Kerosene:

Kerosene is widely used by the urban population than in the rural households for lighting and cooking. Presently 95% of rural households use kerosene. As with other petroleum – based fuels kerosene is marketed by the multi-national oil companies and by smaller private companies. Unlike other petroleum fuels however, there are numerous kerosene retailers who buy the kerosene for re-sell and consequently it is available in most urban and rural areas.

L.P.G Liquid Petroleum Gas:

There is a general low use of LPG in rural areas and therefore Kitui due to the low income per capita of families. This is attributed to the high cost of LGP appliances (cylinders & cookers).

Electricity:

Electricity is a versatile energy source locally produced from hydro-power, Geo-thermal and oil sources. Nationally only 3.8% of households in rural areas have electricity. The limited access mainly due to the high upfront costs of expanding the national grid and where accessible, the relatively high wiring costs retail prices. In Kitui only paltry- or of the population have access to this energy source.

Solar:

The solar energy use in Kitui is minimal though quite attractive. This potential has been impeded by financial constraints and un-affordability and by lack of personnel to give maintenance and advice.

Biogas:

The uptake of biogas has remained low in Kitui due to the high capital cost for not only the plant but also the maintenance and management. Lack of adequate water supplies which is normally added in a value between one and three parts water to one feedstock has been an impediment.

Batteries:

Dry cell and vehicle batteries are also used at the household levels as sources of energy in Kitui. Mainly they are used for flash lights, radio –cassette, players and clocks. The use of batteries is growing as households in the low income brackets and generally in rural areas acquire electronic equipment.

Wind Energy:

The wind energy tried out is mainly for communal water supply. This source of energy is Under-developed in Kitui. While infrastructure costs are high technical advances are expected to open new areas to development.

Coal:

Coal in Kitui is a non-renewable energy source being mined for exploration to ascertain the quantity and quality and in effect the economic benefits. The resource has been found to exist in a belt running from Mui- Zombe to Mutito.

Mini/micro hydro systems:

The potential to use mini/micro hydro system of energy exist to especially pump water from dams and rivers for irrigation purposes. This is a source which is not in use due to lack of perennial rivers in Kitui.

Factors Influencing Trend

The energy consumption pattern, demand and supply are determined by the needs of the various groups, and individuals. It is therefore important to identify the energy needs which could be categorized into:-

- **End use** – domestic end uses, agriculture post-harvest transport etc.
- **End user group** – economic class, gender age etc. i.e. beneficiary
- **End user requirements** – i.e. knowledge in operations of the different energy sources/equipment.

Factors influencing generation

The main issues affecting availability, access and use of energy would therefore be:-

- Fuel availability and constraints.
- Alternative or competing uses of fuel.
- Socio-economic status of end user.

The trends in energy distribution, spatial distribution and supply types are determined by:-

- End user importance.
- End user group – different priority for different groups.
- End user requirement – technical requirements etc.
- Availability.
- Alternative competing fuels and
- Institutional capabilities i.e. Dissemination, extension, credit, supports materials.

Regulatory and Institutional Arrangement

The efforts for sustainable energy supply and use may be exemplified by the establishment of Kitui Energy center charged with the role of assisting community in mitigating measures, information and training including dissemination of new and renewable sources of energy.

Management Challenge

Due to the increasing population the land use patterns have changed such that areas that were previously left as trust lands i.e. range lands or common lands have been invaded by the communities in pursuit of energy sources especially firewood and charcoal, most of these lands have now been grazed and trees harvested leading to bare around which is very susceptible to environmental degradation.

The fact-that many regions of Kitui have not been demarcated also contributes negatively to the establishment of agro forestry, tree nurseries and even wood-lots.

The commercialization of energy supply e.g. the use of *Eucalypt* is progressing well but mainly the tree is being planted for poles and timber production with only off-cuts and saw-dust being used as a source of wood fuel.

The unexploited and underutilized energy resources in Kitui include of solar, biogas, wind & coal. The main reason for under development is the initial capital costs followed by the maintenance requirements. Efforts in place to tap utilized energy sources include the ongoing coal exploration by the ministry of energy in the Mui- Zombe, Mutito belt

Key environmental Issues

- Soil erosion Greenhouse effect
- Soil infertility increased
- Indoor air pollution
- Greenhouse effect
- Low energy conversion which affects its use

Proposed Interventions

- Proper management of indigenous trees to yield increased fuel wood products.
- Promotion of commercial fuel wood plantations on large scale farms by private sector.
- Strengths forestry on small scale farms throughout the district.
- Improve the percentage of house hold using improved jikos (to 80%)
- Increase the number of people using improved kuni mbili and other stores (49, to 15%)
- Support exhibitions, seminar on improved cook stoves & jikos.
- Efficiency of earth kiln to improve from 15% to 20% through intensive training of charcoal producers.

CHAPTER FOUR

4.0 INDUSTRY, TRADE AND SERVICES

4.1 Industrial sector

Industries, Trade and services can benefit a lot by adapting environmental management systems that not only address production process but also promote waste minimization.

The sector, particularly trade contributes significantly to the income generated in the district. The growth of industries in the district will provide employment opportunities to the local people thus leading to increased incomes. The agro based industries will provide ready markets for locally available raw materials. The district has mineral deposits such as coal, which are not exploited. Once exploited, they will be a source of the income to the district and hence sustain economic growth.

The Jua Kali sub-sector will provide employment and cheap agricultural inputs. The major stakeholders in the sector include the government, private sector NGOS and CBO's. The government will continue to provide enabling environment, especially for the private sector to conduct business both in industry and trade, NGO's CBO other stakeholders will provide entrepreneurial skills. Other stakeholders will facilitate in providing infrastructure and financial services

Table 17 Type and Trends in Industrial Development

| No | Type of industry | 1991-1995 | 1996-2000 | 2001-2005 | Projections for 2010 | Remarks |
|----|------------------|-----------|-----------|-----------|----------------------|---|
| 1 | Kitui Ginnery | 1 | 1 | 1 | 1 | Fluctuation of raw material and market is the hindering factor. Poor infrastructures development |

Source: District Trade Office -2006

4.2 Trade sector

The sector particularly trade contributes significantly to the income generated in the district. The growth in the district provides employment opportunities to the local people thus leading to increased incomes. The trading patterns in the district revolve around trading in agro-based goods and other products from the informal sector which includes activities such as carpentry, masonry, mat making, tailoring, shoe shining and bicycle repairs

4.2.1 Types of trade in the district

Retail , whole sale butcheries, bar/restaurants hair salon, carpentry, posh mill , blacksmith dealers hide /skin private health providers agro-vet services pharmaceutical services, Jua kali, mineral exploration and exploitation ,provision of credit facilities telecommunication services hotels and lodging services

4.2.2 Trends and trading patterns

The trade in agro-based products will continue to provide ready markets for locally available raw-materials, while jua-kali sub sector will continue to provide employment and cheap agricultural inputs lack of proper marketing strategies coped by lack of credit facilities and high interest rates, poor infrastructure will hinder manful development of small scale industries and trade.

Key Environmental Impact

- Improper disposal of garbage resulting pollution of land and water
- Transportation services lead to air pollution or land and water
- Destruction of ecosystem due to logging of valuable and endangered species(*Mellia volkensii* and *Osyris lanceolata*.)
- Deforestation ,soil erosion, air, noise and water pollution
- Dumping of substandard goods.

Table 18: Type and Impact of Trade on Environment

| No | Type of trade | Raw materials | Product | No. of people employed | Wastes (solid, liquid and gaseous) | Key environmental impacts | Mitigation measures |
|----|------------------|----------------------------------|---------|------------------------|------------------------------------|---------------------------|---------------------------------------|
| | Food preparation | Farm products Charcoal Gas | Food | Many | All | Air pollution Land | Proper disposal and proper management |

Source: District Public Health Office 2006

Table 19 Type of Trade and Impact on Environment

| Type of trade | Linkages (impacts) to environmental degradation | Proposed interventions |
|-------------------------------------|---|---|
| Retail wholesale | Production of solid waste e.g. polythene bags & waste papers | Provide container to keep waste generated |
| Patrol filling station | Spillage of oil, water and a mission of bad smell production of used containers tins and plastic bags etc | Ensure that these facilities are subjected to environmental impact assessment/Audit |
| Hotels , butcherries lodging | Bones , waste water ash , food remains, waste papers , smell, etc | Ensure that they have proper soak pit & septic tanks as per Public Health Act & building code |
| Groceries & farm produces | Agricultural waste e.g. rotten cabbage, kales and banana leafs spoil farm produce | Encourage recycling of waste to generate organic fertilizer manure |
| Transport posh mill jua kali sector | Emission of gas, oil spillage, noise pollution production of non-bio-degradable metallic materials. | Proper compliance of safety & hygiene & Environmental regulations |
| Wood curving charcoal business | Threaten extinction of tree species Loss of biodiversity Deforestation | Enforcement of forest law, afforestation to be enhanced, alternative source of IGA |

Source: Public Health -2006

4.3 Services sector

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

Major Service Sectors in the District

Energy

- House hold with electricity connection - 0.4%
- Town (trading centers) with electricity Connection - 24%

Transport facilities

- Total kilometer of roads - 1867km

- Bitumen standard roads - 62.2km
- Gravel - 1137.5km
- Number of airstrips - 2

Education facilities

- Pre-primary school - 789
- Primary school - 627
- Secondary school - 90

Main training institution

- Polytechnic - 36
- Medical training school – 1
- Health facilities

They are 182 in total

Communications

- Mobile coverage (safaricom & Zain) - 2
- Posts /sub post 16

Trade Commerce and Industry

- Registered hotels restaurants - 433
- Petrol filling station - 5

Banking & Financial services

- Banks - 3
- Micro-finance institution - 4
- Insurance broker – 3

Table 20: Services Sector Linkages to Environmental Degradation

| Services | Linkages (impacts) to environmental degradation | Proposed interventions | Remarks |
|---|---|--|--|
| Transport and communication | Emissions of hydrocarbons carbon monoxide oxides of nitrogen and particulate matter radioactive rays e-pollutants Disposal of rechargeable batteries Disposal of the mobile phone scratch cards | Research to come up with proper disposal method /encourage adaptation of cleaner production technology | Disposal of mobile scratch cards & used batteries is causing major concern in the district |
| Hospitality services (lodges & hotels) | Production of waste water in the environment polythene bags condoms, noise pollution generation of waste both solid and effluent in the environment | Proper design of building and provision of adequate facilities to handle the waste generated | Generally the developers don't follow the development plan thus result failure to |

| | | | |
|-------------------|---|---|--|
| | | | provide essential facilities like soak pit or idea septic tank |
| Health facilities | Presence of sharps used linen expired drugs laboratory wasted detergent & soap packaging material , smudge Chemical plastics Radioactive waste discharge emission of air pollutant in an appropriate ground disposal of waste | Construction of waste disposal. Use of clean production technology. | Management of the hazardous waste is very important |

Source: District Environment Office – 2005 State of Environment

Key Environmental issues

- Solid waste management
- Lack of capital to start industries such as honey, processing capacity building small scale trade

Proposed intervention

- Collection & disposal of waste
- Provision of appropriate infrastructures,
- establishment of Agro-based industries,
- Create enabling environment,
- Provision of credit facilities
- Establishment of district loan bond

4.4 Tourism

4.4.1 Type of Tourism, Attraction and Potential

Unlike the other districts in the republic of Kenya, Kitui district is very potential in Wildlife conservation for tourism. Kitui South National Reserve is not fully utilized though very potential full of all wild species needed by tourists. The south Kitui National Reserve (SKNR) borders Tsavo East National Park (TENP) and acts as its dispersal area in the dry season seasonal migrations from T.E.N.P into the SKNR in the dry season are said to have reduced in volume largely due to insecurity over years. It is therefore an important ecosystem to the conservation effort of the Tsavo.

The Biodiversity conservation impact in the larger ecosystem likely to be achieved is high. This is so owing to the large size of the reserve i.e. 1833km² Kitui district is among the poorest district in the

country and any interaction of its people with environment has resulted to massive environmental degradation due to unsustainable resource use practices either for subsistence or commercial reasons. Sustainable resource use practice and the need to introduce poverty alleviation strategies dictate that such a resource be utilized to improve the livelihoods of the community through employment, benefits sharing and introduction of sustainable income generating activities.

The reserve also unique scenery such as rock outcrops planar topography and unique river line vegetation amidst dry land shrubs.

4.4.2 Types of Tourism attraction and potential

Kitui District has 6 potential conservation sites covering almost of the district land area with large variety of animals, plants and unique land forms. However the potential of these sites is not fully achieved due to lack of development and implementation of integrated management plan and this has over the year's resulted to rampant wildlife habitat degradation, poaching, logging, overgrazing and encroachment. Types of tourism attractions are elaborated in the table 40 below.

Table 21: Types of Tourism

| No | Type of tourism | No. of facilities | Geographical location |
|----|-------------------------|--|--|
| 1 | Forest nature walking | Mutomo plant sanctuary, Kyawea Museve, Endau Kabonge, Mululina Mutha hills | Mutitu, Mutha and central divisions |
| 2 | Wildlife safari | South Kitui national reserve not fully developed | Ikutha division |
| 3 | Cultural tourism | Nzambani, ikutha, Mutomo Mutha and Mutitu | Chuluni Division Mutomo division |
| 4 | Hiking, camping trails | Nzambani Rock, Thatha hills, Endau hills, Mutitu | Central division Mutha division, Mutitu |
| 5 | Private ranches tourism | Kanyonyo, Nziu Kilawa | Yatta division Mutitu Division |

Source: County Council of Kitui -2006

4.4.3 Trends in Tourism Attraction

Kitui South National Reserve (KSNR) the site is not well development and very few visitors come to the area. The sites are as follows:

Mutomo Plant Sanctuary: This is very strategically positioned for cultural center activities. It can be the center for all curving of K.S.N.R traditional dancer if opening and development of tourism infrastructure with K.S.N.R for tourism is done.

Nzambani Rock: Can be turned camp site, rock climbing, and tourists if the Kitui south National reserves is developed.

Kanyonyoo Ranching area: This place has high potential for tourists and visitors as well as for game drive for visitors from Thika, Embu, Nairobi, Isiolo, Meru Mwingi and Garissa. The ranch has very many species of wildlife and more can be Tran located to the area if need be slighting that if road from Kangonde to Kibwezi is tarmac many people will be using this road and might stop for wildlife (Game drive).

Thatha hill camping site: This can be viable for visitors and tourists on transit to Mt Kenya region.

Other ranches: Kanyonyoo, Nziu in Mutitu, Kilawa Ngali Kanziku, Ngunyumu many of these ranches boulder the reserve beside kilawa and kanyonyoo. These can be turned to private sanctuaries some act as dispersal areas of wildlife species.

Key Environmental Issues

- **Encroachment by human settlement.** Settlements in the reserve occur on the lower parts of the reserve to the north at Mililani and Enyali and North West at Kyeni. This is attributed to availability of water from Thua river which traverses east to west of the reserve.
- **Over grazing and the advancement of desert conditions** The depletion of ground cover in the northern and north east regions is so high that the drastic changes in biodiversity is evidence of progressive and desert situation. Also vegetation clearing along the river banks has been made to create land for subsistence farming.
- **Unsustainable natural resources use practices:** Kitui district with absolute poverty and food scarcity at 64.9% and 63.3% gives it the lowest per capital income. The harsh climatic conditions in the district sometimes translate to prolonged drought and there by famine.
- The reserve has such served as a source of food timber, fuel and other non-timber forests by products such as honey .This created an open access regime in the reserve where the extraction of resource is highly unsustainable with the resultant heightened destruction of wildlife habitat loss of biodiversity and desertification.
- **Subsistence and Commercial Poaching** There exists both small scale (subsistence and commercial poaching in the area commercialization of the traditional subsistence hunting has dealt a crippling blow to traditional Kamba wildlife management system.

Proposed intervention

- Preparation of an integrated management plan
- Undertake resource mapping of the reserve
- Enrichment planting of both grass & fodder trees
- Intensify introduction of reliable grass and tree spp also to improve animal breed

4.5. Mining and quarrying

4.5.1 Types of Minerals and Method of Extraction

Mining is an activity that involves excavation of the earth's surface and subsurface for the purpose of exploiting and processing minerals for economic and industrial development. Types of mining include underground and cast methods. Informer, vertical, inclined or horizontal methods of excavation and extraction are involved. The open cast method involves open quarries pits and trenches. Some of the minerals currently being mined in Kitui district are vermiculite, gypsum, limestone magnetite and various gemstones including green garnet, sapphire and ruby. Exploration for coal in the Mui basin has been in progress. Several companies are involved in quarrying and sand harvesting. Quarrying materials are used for ballast aggregate and building stones. Minerals being exploited include sand and limestone.

4.5.2 Sand harvesting and quarrying

Sand harvesting is carried out under the authority and permission of municipal council of Kitui and Kitui county council. It pays very little respect to environmental aspects. The activity continuous to expand due to increased demand for construction raw materials discussed quarries and mines are often left un-rehabilitated and thus unsafe to inhabitants and animals living around (Timboni case).

Table 22: Types of minerals and methods of extraction

| No | Type of mineral | Method of mining | Land tenure own ship | Geographical location/Name of mine | Size of quantity mine ha | Waste product |
|----|-----------------|------------------------|----------------------|------------------------------------|--------------------------|------------------|
| 1 | Lime stone | Open cast | Lease | Kenze | - | Dust soil |
| 2 | Gemstone | Open cast method | Individual | Kavovoni | - | -do- |
| 3 | Iron ore | Underground horizontal | Lease | Kenze Timboni | - | Dust stone soil. |

Source: District Environment Office- 2004

Table 23: Trends in Extent of Mines

| Type of mineral | 1991 -1995 | 1996-2000 | 2001-2005 | Projection for 2010 | Mitigation measure |
|-----------------|---|---|--|---|--|
| Iron ore | A trench of more than 1 km not rehabilitate | A trench of more than one kilometer not rehabilitated | A trench of more than 1 km remain un rehabilitated | Remain the same | Restoration order is required |
| Limestone | | 4 acres remain un rehabilitated | Same size | More size due to mining is still going on | Enforce compliant with EMCA through EIA&EA |
| Gemstone | | | Done by individual and hard to quantify the extend | More size due to mining is still going on | Consult Mine geology Department to ensure compliant. |

Source: District Environment Office – 2004 State of Environment Report

Key environmental issues in mining sector

- Losses of biodiversity
- Noise and airborne dust emission
- Dust pollution land scars soil and water contamination from mined area
- Increased soil erosion
- Damage to wildlife habitat
- Remove of vegetation

4.5.3 Regulatory and institutional arrangement

Mining activities are regulated by the mining Act (1987) the forest Act (385) the wildlife Conservation and management Act and EMCA. The mining Act is silent on what should be done with abandoned mines. But EMCA emphasizes that all new mining projects should be subjected to environmental impact assessment (EIA'S) while ongoing projects should undergo environmental audit local authority and municipal council should be involved in enforcing safe sand harvesting quarrying and all minerals or materials covered by their licenses .

4.5.4 Sand Harvesting

Sand harvesting is carried out under authority and permission of various local government authorities. It pays little respect to environmental aspects.

Sand harvesting along the rivers has degraded the environment by lowering the riverbed, steepening and destabilizing riverbanks thereby causing erosion and river channel wandering. Besides, it is expected that the environmental degradation in form of bed load. Some of the impacts of sand harvesting are noted in the table 43 below.

Table 24: Methods of Sand Extraction

| Source of sand | Method of sand harvesting | Geographical location/name of site | Size of site | Quantity extracted annual | Regulatory agency | Environmental impacts |
|----------------|--|------------------------------------|-------------------------|---------------------------|-------------------|--|
| River | Manual scooping | River Kalundu | 2.5-3.km ² | 5,000 tones | Municipal council | River bank erosion Loss of water |
| River | Manual scooping | River Nzeeu | 0.1-0.6km ² | 7560 | Municipal council | Water pollution by soil Drying of swallow wells River bank erosion |
| River | Manual scooping mechanical scooping | River Tiva | 0.01-0.1km ² | 7560 | Municipal council | Drying of water source Bank erosion soil erosion |
| River | Manual scooping | River Mutendea | -- | 7560 | -- | Drying of water source Soil erosion River bank erosion |
| River | Manual scooping | River Mwitasyano | -- | 7560 | County Council | -do- |
| River | Scooping | River Kauwi | -- | 7560 | | -do- |

Source: Kitui County Council – 2006

4.5.5 Trends in sand harvesting

Building sand is the major material found in abundance and is exploited on commercial basis.

The major sand harvesting sites are Nzeeu , Kalundu, Tiva , Mwitasyano, Mutendea, Kaayo and Kauwi rivers within and surrounding municipal council of Kitui . Many other smaller sites are widespread throughout the district.

Generally the trend of sand harvesting within Kitui district is carried out under the authority and permission of local councils and they do not have any environmental management plan,

This business of commercialized sand harvesting has degraded the environment and threatening the existing infrastructures within our major roads.

Environmental Issues

- Land degradation
- reduced water supply,
- river bank erosion
- soil erosion

Proposed intervention

- Develop regulations to ensure no over harvesting
- Regulate harvesting of sand
- Determine sand harvesting sites

CHAPTER FIVE

5.0 ENVIRONMENTAL HAZARDS AND DISASTERS

5.1 Introduction

Most environmental disasters are climate weather and tectonic movements related disasters can be natural or manmade which may lead to destruction of environment (land degradation) life (epidemics and property). The causes are invader species, droughts, accidents, fire, diseases outbreaks, technological, disaster and other disasters. Disasters have a tendency to retard and erode gains made in building meaningful livelihood and economic development. Kitui district is very vulnerable to various hazards and these have had far-reaching application to development. The major hazards faced in the district include the following-

Drought

Kitui District being semi-arid is prone to frequent and prolonged droughts. The end results are crop failure and lack of pasture for livestock thus threatening food security efforts. Water catchment areas and sources dry up meaning people have to spend longer man hours looking for water. Water borne diseases outbreaks are quite common during such times because of use of contaminated water. Land degradation is usually made worse due to lack vegetative cover.

Floods

A greater part of the district particularly the eastern and central parts are low lying making them vulnerable to flooding during heavy rains. These results in earth roads becoming impassable and outbreak of diseases both human and livestock and soil erosion.

Forest fires

These are either accidental or caused by farmers while clearing the farms and trust lands. The problem is compounded by uncontrolled charcoal burning and overgrazing in private farms and country council forests. The effects of these hazards have compounded the problem of destruction of indigenous forests particularly on hilltops loss of water catchments are and serious soil erosion in deforested areas.

HIV/AIDS

The government of Kenya has declared the HIV/AIDS pandemic as a national disaster. The prevalence of HIV/AIDS has increased rapidly in the district. Urban centers have in the past reported the highest infection rates as compared to rural. Currently the number of HIV/AIDS orphans is over 3000 while the number of people who have tested positive for HIV is daily increasing. The disease has weakened the economically productive population. The most affected age group is between 15 and 49 who constitute the majority of the work force.

The scourge has contributed significantly to high incidences of poverty.

5.2 Extend and trends of environmental hazards and disasters

The common environmental hazards and disasters are as follows:

- Drought
- Land degradation and denudation as a result of de-vegetation and overstocking
- Loss of pasture on grazing lands
- Disease epidemics e.g. New Castle Disease (NCD) in poultry, Foot and Mouth Disease, Contagious Bovine Pleural-pneumonia (CBPP) in Bovines and Contagious Caprine Pleuro-pneumonia (CCPP) in Goat

The tables 44, 45 and 46 show some aspects of hazards in the district.

Table 25 : Type of Hazards and Occurrence trends 1960 to 2005

| Year | 1960s | 1970s | 1980s | 1990s | 2000s | 2005 | Remarks |
|---|-------------------------------|-------|-------|-------|-------|------|---|
| Disaster type | | | | | | | |
| Drought | 1961 | 1974 | 1984 | 1994 | N/A | 2005 | The trend has shown an occurrence of drought after every five years |
| Land Degradation | This has been on the increase | - | - | - | - | | This has been on the increase due overstocking and de-vegetation (Charcoal Burning and opening up of land for arable farming) |
| Land denudation HIV/AIDS loss of Pasture | The impact is on the increase | - | - | - | - | - | This has been on the increase due overstocking and de-vegetation (Charcoal Burning and opening up of land for arable farming) |

Table 26 Type of Disasters and their Impacts

| Year | 1960s | 1970s | 1980s | 1990s | 2000s | 2005 | Remarks |
|---------------------------|---|---------------|--------------------|---------------|-------|------|---|
| Drought | 1961 (severe) | 1974 (severe) | 1984 (very severe) | 1990 Moderate | - | 2005 | The 2000s droughts have not had a big impact on livestock |
| Land degradation | Poor quality pasture and fodder. | - | - | - | - | - | The impact of land degradation will continue being felt not unless corrective measures are put in place |
| HIV/AID & land denudation | The impact is on the increase due to overstocking | - | - | - | - | - | There is need for Soil and Water conservation programmes |

Table 27 Sector Specific Disaster Occurrence and Severity

| Type of disaster | Number of deaths/ injured | Environmental Damage | Severity | Interventions | Remarks |
|------------------|---|---|--|---|--|
| Drought | No records are available on the number of animals that died | Deforestation gully format. Loss of biodiversity | The 1974 and 1984 droughts were very severe to both livestock and humans in the district | Promotion of drought tolerant pasture and fodder species, Water harvesting technologies, range rehabilitation practices | There is need to introduce drought monitoring systems and build the capacity of the technical staff on the ground as well as the community |
| Land Degradation | No records are available on the number of animals that died | Loss of pasture, Siltation of dams, Gully formation, denuded land | The severity of land degradation has been on increase | Range rehabilitation programmes, Soil and water conservation programmes and de-stocking of livestock | There is need for initiating income generating activities so as to divert people from charcoal burning which |

| Type of disaster | Number of deaths/ injured | Environmental Damage | Severity | Interventions | Remarks |
|----------------------------------|---|----------------------|---|--|---|
| | | | | | has turned out to be a way of life for the majority of people in the lower area of the district |
| Land denudation /desertification | No records are available on the number of animals that died | Loss of biodiversity | The severity of soil erosion has been on increase | Range rehabilitation programmes, Soil and water conservation programmes and de-stocking of livestock | Reinforcement of policies related farming methods and indiscriminate felling of trees needs to be enhanced. |

Source: Participatory Appraisal Reports for Itoleka and Katulani Sub-locations

Status of Early Warning Systems

Details of the early warning systems in the district are shown in the table 47 below.

Table 28 Sector Capacities for Disaster Preparedness and Response

| Type of Disaster | Human Resource | Technical Equipment | Financial | Coordinating Mechanism (Logistics) | Lead Agency |
|------------------|----------------|---------------------|------------|---|--|
| Drought | Inadequate | None | Inadequate | Stakeholder Forums, Field Monitors and Questionnaires | Office of the President (Arid Lands Resource Management Project) |
| Land Degradation | Inadequate | Inadequate | Inadequate | Community Sensitization through training of farmers and community resource persons, Public barazas, field demonstrations. | Ministry of Agriculture and Ministry of Livestock and Fisheries Development and other Development agencies operating within the district |

| | | | | | |
|--------------|------------|------------|------------|--|--|
| Soil Erosion | Inadequate | Inadequate | Inadequate | Community Sensitization through training of farmers and community resource persons, Public barazas, field demonstrations | Ministry of Agriculture and Ministry of Livestock and Fisheries Development and other Development agencies operating within the district |
|--------------|------------|------------|------------|--|--|

Source: District Development Office -HIV/Aid sections 2006

Environmental Issues

- Drought
- Land Degradation
- Land denudation (desertification)
- Enhanced poverty

Proposed Interventions

- Relief food and livestock feed (hay) Distribution.
- Restocking
- Sensitization on sustainable utilization of environmental resources e.g. proper stocking rates
Development of water points,, and Sustainable tree harvesting
- Range rehabilitation Practices, Fodder tree planting and Community sensitization
- Sensitization on sustainable utilization of environmental resources e.g. proper stocking rates and Sustainable tree harvesting
- Training of community and community Resource persons and Laying of Soil Conservation Structures ,Reseeding, Campaign on proper stocking rates
- Enhancing Policy Reinforcement and Sensitizing Community on proper utilization of environmental resources

CHAPTER SIX

6.0 ENVIRONMENTAL EDUCATION, INFORMATION AND TECHNOLOGY

6.1 Status of Environmental Education

There is both formal and non-formal environmental education in the district. Formal education is mostly done in schools and through NGOs mainly engaged in agro-forestry activities with the communities under their training. Non formal type is mostly cultural and relates to flood control and activities that affect their livelihood such as food production and fishing – the need to protect breeding grounds

The types of environmental programmes in the district include;

- Eco -Schools
- Wildlife Clubs
- 4K Clubs
- Environmental Awareness and Management Project for Schools

Types of environmental education

There exists different form of environmental education in the District. These include tree planting afforestation) tree labeling, beekeeping tree nursery establishment and management, soil & water conservation (Horticulture & animal husbandry) flower garden and rabbit keeping, fish rearing, and drama and arts. Exchange visit and ecotourism are another form of this aspect of environmental education.

Challenges schools face in implementing environment projects

Schools face various problems in implementing environmental projects in schools (table 48 below). Such problems are as follows:-

- **Lack of water:** Kitui is a semi-arid district where water is a major problem. Most schools do not have boreholes and water harvesting facilities. So to establish a tree planting projects is a challenge to many schools. Pupils are forced to carry water from their homes.
- **Lack of tools:** Working tools is also another challenge because schools do not have the tools to implement some of the conservation activities
- **Lack of enough time:** School programmes are so tight such that time allocated to clubs is very little.

- **Lack of funds:** Some projects require funds to be implemented e.g. *bee keeping project* .So to undertake such projects is a challenge to students because they do not have money.
- **Lack of support from institutions:** In same schools the head teachers do not support the efforts of students hence kill their morale. Students need to be supported financially and materially.
- **Guiding materials:** Other projects require guiding materials to be implemented more effectively. Lacks of these materials have resulted to poor implementation and management of the projects.
- **Lack of incentives:** Student's morale needs to be boosted, this will encourage them to work harder Stakeholder should come with prize giving programme for the clubs.

Proposed Interventions

- Support its members (Environmental clubs) with technical expertise on how to carry out the projects in schools
- Encouraging them to start water harvesting techniques by building gabions, roof catchments and water tanks
- Provide them with guiding materials, (guide books) on environmental projects organize educational tours

Table 29: Status of Environmental Programmes in Schools

| No | No. schools Primary | Secondary | Tertiary | Types of environmental programmes | Remarks |
|----|------------------------|-----------|----------|---|--|
| | 66 | | - | 4k club fruit tree nurseries vegetable growing rearing of small stock Tree planting | 4k clubs have become dormant and other dropped out due to lack of funds and limited transport -Water problems in most schools |
| | | 28 | 8 | Young farmers club most of institution take agriculture as a course offered in their curriculum These project improve soil fertility and conserve water and soil management | Inadequate security of the project under taken by the clubs Funds and transport are the major limitation for rural youth |
| | | | | Young farmers clubs | |

Source: District Education Office 2006

The environmental topics taught in schools and tertiary institutions enhance awareness on the importance of sustainability of the environmental and USE OF natural resources to the learners, and enlisting public support toward environmental management and prevention or abatement of environmental degradation. This is mainly achieved through undertaken practical work on forestation programme, agriculture, participation of learners in environmental commemoration day's barazas

sensitization and public holidays. The knowledge acquired during school and College (training time) is also applied practically by the students and pupil when they complete their studies.

Tree nursery started in their institution also produces tree seedlings which are planted in their institutional compound and the rest given to pupils / student to plant at their home. These enhance afforestation in the district.

6.1.1 The non- formal education programmes

The non- normal education programmes in the district are registered with the department of culture and social service. They are also known as farmers field school (FFS) depending on objective of the groups. Both FFS and SHG) are formed in order to reach large crowd at minimal cost while the subjects taught are done in a systematic manner. The key players in no-formal environmental programmes in the district include the government of Kenya bilateral organization (JICA, Belgium, Danida and KAP) and also some NGO'S and CBO'S are involved in non-formal environmental programme together with community.

Various environmental issues have being integrated in non-formal programmes and basically includes agro forestry and agro-pastoralist also Beekeeping environmental health (sanitation & hygiene) groups dynamics which will assist the community to manage resource effectively and efficiently (Management Committees e.g. water source and supplies)

Benefits of non-formal programmes

- Improving the capacity of people to address environment and development issues.
- Promote sustainable development
- Educate and enhance public awareness
- Assist the people to meet their basic needs as well as alleviate poverty.

Main Conservation Activities

- Afforestation Programmes within government, trust land and private and individual farms
- Training of farmers on better farming skills and organize gender awareness campaigns
- Train farmers on improved water harvesting techniques and improved farm water harvesting techniques
- Training of more health workers as TBA& family planning HIV AID home cares thus improving health services delivery mechanism to rural areas
- Initiative income generating activities to cater for the needs of disadvantages group or gender. (Aged, HIV/AIDS victims and Aids orphans

Table 30: Status of Environmental Programmes in the District

| Environmental Programmes | Key players | Challenges | Proposed interventions |
|--|---|--|--|
| Soil conservation, fertility management and run-off harvesting conservation, through farmers Field Schools (FFS) | Agriculture dept Kitui development center ,Adra Kenya KARI Catholic diocese of Kitui | Acute staff shortage , the unreliable rainfall and occasional drought The level of funding affect facilitation of planned activities Low literacy level among the community Poverty level | Promote private sector service provider e.g. terrace markers, grafters, A.H.C.A Promote effective use of ox-plough Promote agro forestry Use of farmers field schools (FFS) as extension method |
| Energy efficient technologies | Forest dept Renewable energy centre, Kenya forestry research centre agriculture department | The adaptation rate is very low The cost to acquire the material Poverty level Cultural value of the tradition fire place Limitation of extension staff & funds | Demonstration on use of fuel economy stove fireless cookers , charcoal coolers Training of local artisan to produce the stove and fireless cookers Encourage use of other energy source |
| Health and sanitation | Amref , public health department water department , agriculture | Limitation of human resources and finance Ignorance High poverty level | Training farmers on how to make dish racks, rubbish and VIP Latrine |
| Community capacity building | Ukambani Christian community based services NEMA provincial administration other stakeholders | Low level of awareness on environmental issues, Low literacy level, poverty | |
| Farmer Associations (Kitui Dairy Goat Farmers Association and Kitui Beekeepers Association) | Community, GoK, FARM Africa, Kitui Agricultural Project (KAP), Kitui Development Centre and Agri-business Development (ABD) | Funding, Infrastructure, Transport and Personnel | Encouraging Group approach in Technology Dissemination |

Source: District Development Office -2006

6.2 Technologies

6.2.1 Traditional Water Filter

To improve the quality of the drinking water a simple bucket water filter that utilizes stones, gravel charcoal and sand to eliminate most impurities is used. This combined with boiling of the filtered water renders water safe for drink.

6.2.2 Improved Cooking Stove

Fuel conservation in the dry area remains an important strategy of preserving ever decreasing natural wood resources. An improved cooking stove” Enzaro Jiko” has been promoted among homesteads in Kitui.

One disadvantage of Enzaro Jiko does not promote the Social aspect of story telling in the evening, which was an important past time activity of passing information from one generation to the other as people warm themselves.

6.2.3 Water Micro-Catchment

Water harvesting structures such as Micro-catchment enhance the performance of trees by collecting surface run-off and concentrating it around the roof zone of planted trees. There are different types of Micro-catchments V. shaped, W-shape, Circular shaped catchment and bottle watering basically used during drought when it is necessary to water some young trees to ensure survival.

Evaporative charcoal cooler

High temperature leads to reduce shelf life of perishable food staff in the dry land. A simple charcoal cooler has been used effectively to reduce the temperature considerably thus increasing the self-life of perishable commodities.

Tumbukiza

This is a system of fodder establishment especially, Napier grass where several splits of cane are planted in round pits measuring 2* 2 feet or rectangular pits of 2*2*2 feet or furrows 2-3 feet wide and 2 feet deep. It is most suitable in low to medium attitude areas where moisture stress often limits Napier growth.

Introduction of improved breeds of livestock

This refers to the introduction of improved breeds of livestock such as the dairy cows and goats that are more productive and require more intensive management in terms of housing, feeding and diseases control aspects. Such animals are kept under Zero grazing units and under cut and carry method of feeding thus limiting their movement into the field where they would otherwise cause gullies along the trucks to the watering points and also loosen the soil encouraging soil erosion.

Range rehabilitation techniques

This is an integration of several activities in rehabilitation of denude lands. It involves bush clearing, construction of soil and water conservation structures and reseedling.

Water harvesting techniques

Example of this is the Semi-circular bunds which are diamond shaped Micro-catchments enclosed by small earth bunds, with infiltration pit at the lower corner. They are most preferred as they trap runoff water that would be lost and increase moisture storage in the soil.

Terraces

The normal Fanya Juu terraces that are meant for soil and water conservation on both farm and range lands they are meant for soil and water conservation.

Zai Pit (planting holes)

These are the planting holes commonly practiced in fruit tree and fodder tree production. They are Micro-catchments for runoff harvesting and conservation.

Modern Langstroth beehives

These are box kind of hives that can be utilized in migratory beekeeping systems to assist in crop pollination process, hence increase in crop yields. Bees in Langstroth are more docile due to the increased frequency of farmer visits. The management aspects i.e. watering and supplementation feeding are easily executed, hence making them more docile to the surrounding. Planting of drought resistant pasture and fodder that would do perform better in the district and enhance soil and water conservation within grazing lands.

Table 31: Priority Issues and Interventions

| Prioritized issues/ challenges | Proposed intervention | Responsible institution | Remarks | Estimate coast |
|---|--|--|---|---|
| An awareness creation | Hold awareness Baraza workshops to sensitize community on environmental conservation | District environment office, culture and social services and adult education offices | this will ensure people at grass root level are involved in environ metal managements | 10 workshop at a cost 50,00/=total 500,000 /= |

| Prioritized issues/ challenges | Proposed intervention | Responsible institution | Remarks | Estimate coast |
|---|---|--|--|---|
| Capacity building of field officer e.g. CDAS Adult education teachers officials of C.B.Os groups herbalists and botanist organizations | Enhance Capacity building workshops on environmental conservation and management | Environment, culture, social services, adult education | This will enhance the performance of the staff on the ground on the issues of environment | 5 capacity building workshop at a cost 50,000/= total 250,000 |
| Documentation of indigenous knowledge available in the district for dissemination to the public to enhance environmental management | Data collection on IK Data analysis and storage Data dissemination | D.E.O and the district cultural officer | This will provide the much needed indigenous information on environmental conservation | 250,000/= |
| Promotion of indigenous food plans for food security | Sensitize the public on production preservation and consumption of indigenous food plants and herbs for food security | D.E.O & department of culture, Agriculture and Livestock | This will alleviate the constant food shortage situation in the district through the increased use of drought resistant food crops | Yearly sensitization at a cost 50,000/= per year. |

Source: Culture Department - 2006

6.3 Environmental information systems

6.3.1 Types and sources of environmental information

The table 51 below gives details of the types and forms of environmental information in the district and its accessibility.

Table 51: Information and Data types in District

| Sector | Type information/ types | Form GIS/ maps/ reports/ electronically, book) | Institutions | Access conditions / policy | Users | System of up dating |
|---|---|--|---|----------------------------|--|---|
| Livestock & Vet | Livestock statistics range trend and conditions livestock marketing | Reports prints | Livestock office | Free of charge | G.O.K staff community and other development agency | Monthly Quarterly and annual |
| Agr | Crop statistics arable land trend and condition | Reports | Agriculture Office KARI | Free of charge | G.O.K Staff Community and other development agency | Monthly Quarterly and annual |
| D.P.U | Projects programmes & plans | Maps Books Magazines Newsletter, pamphlets | District Documentation And information Centre D.D.O | Free of charge | G.O.K Staff, Community development partners | Projects Reports Quarterly Annual Magazine/New letter |
| Natural resources statistics trends & condition | Natural resource statistics trends & conditions | Reports Videos Print CDS Electronic Pamphlets | District forest office ALRMP II Office KEFRI-Kitui | Free of charge | G.O.K Staff Community development agencies | Review report Quarterly Monthly Annual |

Source: District Plan Unit – 2006

6.3.2 Status of Environmental Information Management Systems

Information sharing and communication mechanism is an important aspect of information management. In the district after some evaluation carried out late 1990's it was realized that the district technology transfer and information mechanism was inadequate especially among the G.O.K, NGO'S, C.B.OS and

other development agencies in the district. Therefore though dept of planning, Danida embark on establishing District information and documentation centre (DIDC) . This office is manage by a staff from planning department although it is not adequate stocked due to lack of find to acquire necessary materials

The objectives of the DIDC

- Develop and implement information flow /communication systems plan
- Enhance corporate communications and public relations
- Enhance information management for research and extension at district level.
- Institutional skills in information management
- No adequate staff that is versed information management
- The information is not frequently updated

Constraints in data collection and dissemination

- In adequate funding
- In adequate co-ordination in information by the various stakeholder agencies at district level
- Inability to access information from other source (electronic)

Proposed interventions

- Increase funding for information management and data collection systems
- Joint data collection and management ventures
- Frequent information exchange at the district level.
- Improve access systems telephone infrastructure and efficiency.

6.4 Indigenous knowledge (IK)

Kitui district is very rich in indigenous knowledge especially on traditional herbs and medicine. `

Traditional carving and wood work, traditional weaving and basketry and knowledge on plant and tree names, rivers, shrines and languages in general. The department has been promoting this knowledge and preserving it for posterity because those who are old and knowledgeable are passing on and die with knowledge. A committee on this has been established where old people act as a reservoir of this knowledge and pass it on to younger generation.

Herbal medicine is also an area where Kitui district is very rich. Promotion of herbal medicine is in the forefront for the department and an association is formed for the same. Many indigenous tree species are

endangered through improper harvesting and the department encourages tree species are endangered through improper harvesting and the department encourages establishment of botanical gardens and preservation and conservation of the same. Hills like the Endau are a catchment area for the district and it is also very rich in indigenous and endangered tree species. The communities around these hills are encouraged to protect and preserve these trees.

6.4.1 Types of IK, Key Players and Challenges

The Indigenous Knowledge in livestock production revolves around use of herbs i.e. herbal medicine in treatment of some livestock diseases. The main challenge in herbal medicine is that the knowledge is with a few individuals within the community and they are the key players.

CHAPTER SEVEN

7.0 ENVIRONMENTAL GOVERNANCE AND INSTITUTIONAL FRAMEWORKS

Environmental Governance entails the formulation of comprehensive environmental policies, and the enactment of supportive legislative regimes. These should be complemented by strong and well-coordinated environmental institutions. The institutions would then draw up and enforce environmental regulations and standards, to ensure sound environmental management. The public and civil society organizations should be facilitated to access and use information on environmental policies and legislations. An informed society will have an enhanced ability to make decisions and fully participate in sustainable development issues. The achievement of sustainable development in semi-arid areas will mainly depend on the empowerment and capacity of the public and civil society to complement the government efforts in environmental management. And this can only be achieved, if everyone will have capacity to localize / domesticate and take advantage of the technical and financial facilities provided for in various MEA'S

The increasing human population and associated consumption patterns have threatened the environment and natural resources. Population has also impacted on the quality of environment especially in aspects related to settlement and urbanization.

The environmental governance consists of the legislation, standards regulations and institutions to control activities damaging the environment. The enactment of EMCA (1999) and the current national policies on the environment have been influenced by a series of developments both at the national and international level,

Environmental management in the district should have a bottom up approach if it is to be realized. The trend in the past has been that NGOs and other bilateral and multilateral organizations come with the projects and try to impose them to the group. This approach has failed because the people's needs and aspirations are not incorporated fully during planning stage of the project. So the role of local communities in decision-making and implementation of environmental programmes is of utmost importance. Organized groups and CBOs can be used in these programmes. This will ensure good implementation and sustainability of these programmes. The community if involved will also benefit and feel to be part of the process so they will support the efforts. Traditionally, the environment was managed through communal responsibility and it was the responsibility of every member of the community to ensure a clean environment and safeguard trees and plants from destruction. Through IK

systems like stories , songs proverbs and riddles information on the environment was passed including names and plants with nutritional and medicinal value so that these trees would not be destroyed.

7.1 Status of environmental governance and institutional arrangements

Collaborating Government Departments. Office of the President, Forest Department, Agriculture and Livestock departments, Vet. department, Culture and Social Services and Ministry of Health guide on policy uses, and provide technical back-up

Environmental, NGO's CBO's/Private sector active in the district.

Environmental, NGO's operating in the district includes the follow AMREF .SASOL ADRA-KENYA .K.D.C TARDA . SASOL. Their main activities include supplement government effort in development activities.

C.B.O's

CBOs mobilize the community to provide free labour to address common environmental problems within their locality. They also create awareness and sensitize the community, become entry point to a given community and Capacity to build the community (empowerment).

Examples of some of the CBOs in the district include the following:

- Mathima integrated development – Mutha Division
- Mwendaandu CBO-Central Division
- YARD C.B.O-Yatta Division
- Kwaka C.B.O Kabati division
- Yike wikwe C.B.O –Central
- Kyamatu wazee C.B.O Mwitika Division
- Rudi CBO –Mutomo Division
- Kilaa C.B.O –Mwitika Division
- Yiuku C.B.O Mwitika Division
- Kavumbuni C.B.O –Kyuluni Division
- Itambya C.B.O Central Division
- Many takwa tuthi C.B.O –Mutomo Division
- Smile rotary club C.B.O –Ikutha Division
- K.U.D.P –District wide
- Rumatao C.B.O –Central
- Kasuma C.B.O Mutitu Division
- Makongo C.B.O –Mwitika Division
- Friends of Nature – Central division

7.2 Types of Regulatory and Management Tools

Environmental management and co-ordination Act (EMCA) 1999

To ensure implementation of NEAP, the environmental policy of 1999 was formulated. This was followed by enactment of environmental management and co-ordination Act (EMCA) of 1999. EMCA provides an appropriate legal and institutional frame work for the management of the environment. It is also an umbrella legislation that provides the guidance, Co-ordination and harmonization of all environmental laws in the country.

EMCA (1999) institutions

National environment council (NEC): responsible for policy formation, setting goals and objectives and determining priorities for the protection of the environment.

National Environment management authority (NEMA): principal instrument of government in supervision, co-ordination and implementation of all policies relating to the environment.

NEMA management board: Mandated to control supervise and administer the asset of the authority.

Provincial and District environment committee (PECS and DEC: Responsible for the proper management of the environment

Environmental action plan (NEAP) committee: NEAP Committees facilitates the integration of environmental consideration into policies plans Programmes and projects.

EIA Technical advisory committee (TAC): reviews / assess and advises on EIA document reports / requests comments received by the authority.

Public complaints committee (PCC); to investigate any allegation against any person or against the authority in relation to the condition of the environment EMCA does not replace hitherto existing laws, which deal with specific sectors or components of the environment. It is applied alongside the existing legislation governing the different sectors or components of the environment. It is applied alongside the existing legislation governing the different sectors of the environment.

Legislative reforms continue to be undertaken alongside institutional reforms in order to facilitate implementation of policies environmental conservation and management will be better coordinated under this enabling environment.

7.2.1 Multilateral Environmental agreements MEA'S

MEA'S are legal instruments to enhance the global responsibility in management of the environment and natural resources. In Kitui multilateral Environmental Agreement that is being implemented in the district includes the following.

Activities to combat desertification under the United Nations convention (UNCCD), implemented through different CBO'S in Zombe. These were adopted at the 2000 millennium declaration that committed all countries represented to do all they can to eradicate poverty, promote human dignity and equity and achieve peace, democracy and environmental sustainability. Kenya as a country has taken the necessary measures to enable the country to achieve the MDG'S in health and sanitary issues and environmental sustainability.

Constraints in Implementation of MEA'S & MDGS

- In adequate capacity to implement the MEA'S & MDGS
- In adequate institutional and legal frame works to implement.
- Inadequate financial resources
- Lack of Intersect oral co-operation
- Lack of linkage of activities gears towards MDC'S & MEA'S

Recommendations

- Develop register of on activities target all MEA'S and MDG'S
- Sources for adequate financial resources
- Develop adequate Institutional and legal frame work
- Build human resource capacity to implement MEA'S & MDG'S

Table 32: MEAs supported Programmes in the District

| Programmes/ Project/ Activities | Start date | Duration | Source of Funding | Actors | Remarks |
|--|------------|---------------------------|---|--------------------------------|---|
| GoK/ Asal Based Rural Livelihood Support Project | July 2005 | 6 years | GoK/ African Developmen t Bank | GoK Staff, ILRI and KARI | There is need for enhanced collaboration among stakeholders |
| Arid Lands Resource Management Project | 2003 | 6 years | GoK/ World Bank | GoK Staff | There is need for enhanced collaboration among stakeholders |
| Kitui Development Centre(KDC) | 2003 | 2 years(But Renewable) | Various | KDC Staff and GoK staff | There is need for enhanced collaboration among stakeholders |

| | | | | | |
|---|-----------|-------------------------|----------------|---------------------------------|---|
| Agribusiness Development (ABD) | July 2005 | 15 years | DANIDA | GoK and Private Sector | There is need for enhanced collaboration among stakeholders |
| ASP (DASS) | July 2005 | 15 years | DANIDA | GoK Staff | There is need for enhanced collaboration among stakeholders |
| FARM Africa | July 2005 | 2 years (But renewable) | European Union | GoK Staff and FARM Africa Staff | There is need for enhanced collaboration among stakeholders |
| Adventist Development and Relief Agency | 2002 | 5 years (But renewable) | USAID | ADRA Staff and GoK | There is need for enhanced collaboration among stakeholders |

Source: District Livestock & Production Office 2006

Key Environmental Issues

- Land use planning increased pressure for land cultivation
- Improve pasture Mgt & feed conservation
- Environmental degradation around water points & catchment area
- Poor Mgt of water resources

Proposed Interventions

- Increase tree coverage & protection of environment
- Gazette hills, plant sanctuary, forests watershed
- sensitization/awareness creation on change on land use
- Increase planting material to increase on farm forage production
- Discourage human settlement in catchment's areas
- Rehabilitation of degraded catchment indigenous vegetation.
- Create awareness on need to conserve indigenous vegetation
- Capacity building of the water resource Mgt
- Construct & protect water resource

CHAPTER EIGHT

8.0 IMPLEMENTATION STRATEGY

The District Environment Action Plan (D.E.A.P) Provincial Environment Action Plan (P.E.A.P) and National Action (N.E.A.P) preparation and implementation is guided by National priorities as contained in major policy documents including the ERSWEC, the National Development Plans, Vision 2030 and the District Development Plans. The objective of this Environmental Action Plans is to integrate environmental concerns in the development planning and implementation as outlined in chapter one of this document.

Environmental concerns are cross cutting in nature and their impacts are felt at the village, location, divisional and district level. Their integration in development process at all levels is essential hence the preparation of the District Environment Action Plans (DEAPS). The preparation and implementation is a statutory requirement under Section 38 of EMCA 1999.

8.1. Stake holders' involvement

The Implementation strategy of Environment Action Plan should involve many stake holders as possible. These include all government departments, agencies, state cooperation and any other organ of government as well as civil society organizations, private sector and individuals.

8.2 Identification of Stake holders

At the village, location and sub-location levels, environment management committees in conjunction with project management committees will carry out the programmes and also monitoring and evaluation. Project management committees will oversee the day-to day implementation of the projects and the exercise will be continuous. At the divisional level, the divisional implementation team will be composed of the District Officer, divisional departmental heads and the relevant NGOs representatives. The implementation will be owned by the project management committee through the communities.

8.3 Monitoring and evaluation

In order to ensure that implementation of the plan is undertaken by all stake holders. It is important to ensure monitoring and evaluation of district Environment Action Plan is developed from village level to the district level.

The monitoring and evaluation of the implementation of D.E.A.P will be carried out using the participatory approaches where project committee together with technical team will be

Involved.

Monitoring will mainly be undertaken on continues basis through meetings and field visits. Reports will be prepared and reviewed. Evaluation will be undertaken periodically after the end of every financial year.

The purpose of monitoring and evaluation of D.E.A.P is to ensure there are efficient and effective implementation as well as ensuring that environmental concerns have been addressed and integrated in development process. It will involve documentation of cross cutting issues.

There are a number of cross cutting issues which if documented would help to halt and reverse environmental degradation and reduce human vulnerability to the environmental excesses. These issues may result to action which includes:-

Table 52; Kitui DEAP Implementation Matrix

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|----------------|------------------------|------------|--|---|---------------------|
| District Wide | District Wide | Air | Air pollution | 1 | Control burning garbage | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 2 | Promote recycling of waste | Local Authorities | |
| | | | | 3 | Apply and enforce Public Health and Sanitation Act on disposal of dead animals | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 4 | Sensitize communities on waste management | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 5 | Afforestation and Reforestation | KFS | |
| | | | High prevalence of T.B | 6 | Improve housing ventilation | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 7 | Conduct air pollution monitoring | Min. of Public Health and Sanitation, Local Authorities | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|---|--------------------------|------------|---|---------------------|---------------------|
| | | Climate & related environmental hazards | Frequent Drought /Famine | 8 | Irrigate crops where possible | WRMA | |
| | | | | 9 | Plant drought tolerant crops | Min. of Agriculture | |
| | | | | 10 | Plant early maturing crops | Min. of Agriculture | |
| | | | Frequent Drought /Famine | 11 | Afforestation and Reforestation | KFS | |
| | | | | 12 | Promote storm water harvesting e.g. construct water pans | WRMA | |
| | | | | 13 | Enhance introduction of income generating activities(IGS) | Min. of Fisheries | |
| District Wide | District Wide | Climate & related environmental hazards | Flooding | 14 | Enforce water harvesting in Athi river | WRMA | |
| | | | | 15 | Afforestation and reforestation | KFS | |
| | | | | 16 | Initiate appropriate soil conservation measures | Min. of Agriculture | |
| | | | | 17 | Improve farming methods | Min. of Agriculture | |
| | | | | 18 | Peg river banks | Min. of Agriculture | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|-------------------------|---------------------------|------------|---|---------------------|---------------------|
| | | | | 19 | Regulate sand harvesting in the district | Min. of Agriculture | |
| | | | | 20 | Introduce cash crops such as cotton | Min. of Agriculture | |
| | | Crop Production & Soils | High rate of soil erosion | 21 | Initiate appropriate soil conservation measures | Min. of Agriculture | |
| | | | | 22 | Afforestation and Reforestation | KFS | |
| | | | | 23 | Construct Check dams and sand dams | WRMA | |
| | | | | 24 | Construct proper drainage on roads | Min. of Roads | |
| | | | | 25 | Build gabions | Min. of Agriculture | |
| | | | | 26 | Plant cover crops | Min. of Agriculture | |
| | | | | 27 | Promote roof water catchment | Min. of Agriculture | |
| | | | | 28 | Promote use of mulching | Min. of Agriculture | |
| | | | Poor crop yields | 29 | Promote use of certified seeds | Min. of Agriculture | |
| | | | | 30 | promote timely land preparation and planting | Min. of Agriculture | |
| | | | | 31 | Initiate appropriate soil conservation measures | Min. of Agriculture | |
| | | | | 32 | Plant early maturing crops | Min. of Agriculture | |
| District Wide | District Wide | Crop Production & Soils | Poor crop yields | 33 | Enhance farmers Field schools for extension purpose | Min. of Agriculture | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|----------|----------|----------------|-----------------------|------------|---|-------------------------------------|---------------------|
| | | | | 34 | Practice crop rotation | Min. of Agriculture | |
| | | | | 35 | Plant drought tolerant crops | Min. of Agriculture | |
| | | | | 36 | Promote use of farm yard manures | Min. of Agriculture | |
| | | | | 37 | Promote irrigation along developed water sources | Min. of Agriculture, WRMA | |
| | | | | 38 | Promote Agro-forestry | Min. of Agriculture | |
| | | | | 39 | Promote indigenous crops | Min. of Agriculture | |
| | | | | 40 | Sensitize communities to use certified seeds | Min. of Culture and social Services | |
| | | | | 41 | Conduct frequent soil sampling | Min. of Agriculture | |
| | | | | 42 | Encourage use of machine to prepare farmland /dry planting. | Min. of Agriculture | |
| | | | | 43 | Diversify crops | Min. of Agriculture | |
| | | Energy | Shortage of wood fuel | 44 | Promote planting of quick maturing trees | KFS | |
| | | | | 45 | Promote use of energy saving devices | Min. of Energy | |
| | | | | 46 | Promote use of alternative sources of energy e.g. biogas, solar | Min. of Energy | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|-------------------------------------|---|------------|---|---|---------------------|
| | | Environmental Education & Awareness | Low level of awareness on environmental education | 47 | Educate the public through electronic and print media, drama and songs | Min. of Information | |
| District Wide | District Wide | Environmental Education & Awareness | Low level of awareness on environmental education | 48 | Promote public participation in environmental plans, programmes and activities | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 49 | Sensitize communities/opinion leads to abandon cultural beliefs that inhibit environmental conservation | Min. of Culture and social Services | |
| | | | | 50 | Disseminate environmental information | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 51 | Integrate environmental issues in Schools & Adult/Public Institutions and literacy Centres | Min. Education | |
| | | | | 52 | Increased awareness on environmental laws through <i>Barazas</i> , seminars, workshops | Min. of Public Health and Sanitation, Local Authorities | |
| District Wide | | Fish & Fisheries | Shortage of fish | 53 | Promote on farm fish farming | Min. of Fisheries | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|-----------------|-------------------|------------|---|-------------------------------------|---------------------|
| | | | | 54 | Afforestation and reforestation | KFS | |
| | | | | 55 | Rehabilitate and restore water catchment areas | WRMA, Min. Agriculture | |
| District Wide | District Wide | Forests & Trees | Deforestation | 56 | Promote on farm and off forestry /afforestation | KFS | |
| | | | | 57 | Promote agro forestry | KFS | |
| | | | | 58 | Conserve herbal medicinal plants | KFS | |
| | | | | 59 | Promote use of energy saving devices | Min. of Energy, Min. of Agriculture | |
| District Wide | District Wide | Forests & Trees | Deforestation | 60 | Regulate charcoal burning | KFS&, Local Authorities | |
| | | | | 61 | Promote community education and awareness on good forestry practices | KFS | |
| | | | | 62 | Plant drought tolerant crops | Min. of Agriculture | |
| | | | | 63 | Gazette existing forests | | |
| | | | | 64 | Enforce the Forest Act | KFS | |
| | | | | 65 | Promote public awareness on the need to conserve and protect forests and catchments | KFS | |
| | | | | 66 | Establish tree nurseries | KFS | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|----------------|-----------------------------------|------------|---|---|---------------------|
| | | | | 67 | Identify hilltops prone to soil erosion and rehabilitate them | KFS, Min. of Agriculture | |
| | | Health | Prevalence of waterborne diseases | 68 | Apply and enforce Public Health and Sanitation Act | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 69 | Promote treatment of drinking water | WRMA | |
| | | | | 70 | Protect water sources | WRMA, Min. Agriculture | |
| | | | | 71 | Apply and enforce waste management regulations | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 72 | Construct a proper drainage and sanitation facilities | Min. of Public Health and Sanitation, Local Authorities | |
| District Wide | District Wide | Health | Prevalence of waterborne diseases | 73 | Construct latrines | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 74 | Create awareness on proper hygiene | Min. of Public Health and Sanitation, | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|----------|----------|--------------------------------------|-------------------|------------|--|---|---------------------|
| | | | | | | Local Authorities | |
| | | | | 75 | Develop and Protect water sources | Min. of Public Health and Sanitation, Local Authorities | |
| | | | Aflatoxicosis | 76 | Create awareness on proper food storage | | |
| | | Industry & Other Business Activities | | 77 | Apply and enforce Water quality and Waste management regulations | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 78 | Enforce air control regulations | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 79 | Promote use of environmentally friendly sources of energy | Min. of Energy | |
| | | | | 80 | Promote use of cleaner production technologies | Min of Industry | |
| | | | | 81 | Recycle polythene materials | Local Authorities, Min of Industry | |
| | | | | 82 | Promote use of EFB | Min of | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|---------------------|--------------------------------------|------------|--|---|---------------------|
| | | | | | | Industry | |
| | | | | 83 | Protect springs | WRMA, Min. Agriculture | |
| District Wide | District Wide | Livestock & Grazing | Low livestock productivity | 84 | Control animal diseases | Min of Livestock | |
| | | Livestock & Grazing | Low livestock productivity | 85 | Upgrading of indigenous cattle breeds/crossbreeding | Min. of Livestock | |
| | | | | 86 | Undertake research on Ticks control | Min. of Livestock | |
| | | | | 87 | Train the communities diagnosis of animal disease and prevention methods | Min. of Livestock | |
| | | | | 88 | Train farmers on good animal husbandry | Min. of Livestock | |
| | | | | 89 | Plant fodder crops/trees | Min. of Livestock | |
| | | | | 90 | Construct water points | Min. of Livestock | |
| | | | | 91 | Make hay for use during the dry season | Min. of Livestock | |
| | | | | 92 | Reduce the stocking rate | Min. of Livestock | |
| | | | | 93 | Promote zero grazing | Min. of Livestock | |
| | | Mining & Quarrying | High incidences accident occurrences | 94 | Rehabilitate and restore mined areas | Mines and Geology Dept. Local Authorities | |
| | | | Open mining pits | 95 | Fence mining areas and pits | Mines and Geology Dept. Local | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|------------------------------|-----------------------|------------|--|---|---------------------|
| | | | | | | Authorities | |
| | | Settlements & Infrastructure | Diseases | 96 | Construct latrines | Local Authorities | |
| | | | | 97 | Apply and enforce waste management regulations | Min. of Public Health and Sanitation, Local Authorities | |
| District Wide | District Wide | Settlements & Infrastructure | Diseases | 98 | Promote community education on good hygiene and sanitation | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 99 | Apply and enforce Public Health and Sanitation Act | Min. of Public Health and Sanitation, Local Authorities | |
| | | | Unplanned settlements | 100 | Improve existing roads | Local Authorities | |
| | | | | 101 | Promote land use planning | Min of lands | |
| | | | | 102 | Prepare urban development plans | Min of Lands, local Authorities | |
| | | | | 103 | Apply and enforce Physical Planning Act and Council Bylaws | Min. of Public Health and Sanitation, Local Authorities | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|-----------------|---------------------------------|------------|---|---|---------------------|
| | | | | 104 | Construction of sewerage system | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 105 | Construct pit latrines | Min. of Public Health and Sanitation, Local Authorities | |
| | | | Poor sanitation | 106 | Apply and enforce waste management regulations | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 107 | Designate waste disposal sites | Min. of Public Health and Sanitation, Local Authorities | |
| | | | | 108 | Apply and enforce Physical Planning Act and Council byelaws | Min. of Lands | |
| District Wide | District Wide | Water Resources | Inadequate clean drinking water | 109 | Afforestation & Reafforestation of water catchments including hill tops | WRMA, KFS | |
| | | | | 110 | Treat drinking water | WRMA | |
| | | | | 111 | Dig boreholes/shallow wells | WRMA | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|-----------------|-------------------|------------|--|--|---------------------|
| | | | | 112 | Protect and conserve water sources | WRMA | |
| | | | | 113 | Promote roof water catchments | WRMA | |
| | | | | 114 | Regulate river water abstractions | WRMA | |
| | | | | 115 | Construct pit latrines | Local Authorities, Min of Public Health and Sanitation | |
| | | | Water pollution | 116 | Undertake Public education on good hygiene | Local Authorities, Min of Public Health and Sanitation | |
| | | | | 117 | Promote proper waste management | Local Authorities, Min of Public Health and Sanitation | |
| | | | | 118 | Promote proper application of agrochemicals | Min. of Agriculture | |
| District Wide | District Wide | Water Resources | Water pollution | 119 | Undertake appropriate soil conservation measures | Min. of Agriculture | |
| | | | | 120 | Divert run offs far from the boreholes | Min. of Public Works, WRMA | |
| | | | | 121 | Construct sewage systems | Local Authorities, | |
| | | | | 122 | Designate waste disposal sites | Local Authorities, | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|---------------|---------------|----------------------------------|---------------------------|------------|--|--|---------------------|
| | | | | | | Min of Public Health and Sanitation | |
| | | | | 123 | Protect water sources | WRMA | |
| | | | Drying of water sources | 124 | Plant trees on the water catchment areas | KFS/WRMA | |
| | | | | 125 | Provide piped water | WSB | |
| | | | | 126 | Regulate sand harvesting activities | | |
| | | Wetlands | Degradation of wetlands | 127 | Regulate the usage of wetlands resources | WRMA, Min. Agriculture | |
| | | | | 128 | Educate communities on the importance of conserving wetlands | WRMA, Min. Agriculture | |
| | | | | 129 | Draw management plans for wetlands | WRMA, Min. Agriculture, Min of Lands | |
| | | | | | | | |
| | | | | 130 | Map and protect wetlands | WRMA, Min. Agriculture, Min of Lands, Min of Fisheries | |
| | | Wildlife, Biodiversity & Tourism | Human – wildlife conflict | 131 | Develop roads within game reserve | KWS | |
| | | | | 132 | Establish wildlife buffer zones | KWS | |
| District Wide | District Wide | Wildlife, Biodiversity & Tourism | Human – wildlife conflict | 133 | Strengthen District Compensation Committee | KWS | |
| | | | | 134 | Sensitize communities to appreciate the | KWS | |

| Division | Location | Issue Category | Problem Statement | Action No. | Actions Needed | Stakeholders | Timeframe 2009-2013 |
|----------|----------|----------------|--------------------------------|------------|--|-------------------------------------|---------------------|
| | | | | | importance of conserving wildlife | | |
| | | | | 135 | Involve the communities in wildlife management | KWS | |
| | | | Loss of biodiversity | 136 | Plant indigenous trees | KFS | |
| | | | | 137 | Preserve indigenous tree species | KFS | |
| | | | | 138 | Protect natural ecosystems | KFS, KWS | |
| | | | Untapped eco-tourism potential | 139 | Carry out an inventory of existing/potential tourism sites | Min. of Tourism | |
| | | | | 140 | Apply and enforce EMCA | Min. of Tourism | |
| | | | | 141 | Promote and market existing eco-tourism activities | Min. of Tourism | |
| | | | | 142 | Use media to promote local tourism | Min. of Tourism, Min of Information | |

APPENDIX 1

PART IV OF THE ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT (1999) ENVIRONMENTAL PLANNING

(Extract from EMCA)

37. National Environment Action Plan Committee

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

2. The National Environment Action Plan Committee shall, after every five years, prepare a national environment action plan for consideration and adoption by the National Assembly.

38. Provisions of the National Environment Action Plan

The national environment action plan shall:

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

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

39. Provincial Environment Action Plans

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

40. District Environment Action Plans

Every District Environmental Committee shall, every five years, prepare a district environment action plan in respect of the district for which it is appointed. and shall submit such plan to the chairman of the Provincial Environment Action Plan committee for incorporation into the provincial environment action plan proposed under section 39

41. Contents of Provincial and District Environmental action Plans.

Every provincial environment action plan and every district environment action plan prepared under section 30 and 40 respectively shall contain provisions dealing with matters contained in section 38 (a), (b), (c), (d), (e), (f), (g), (h), (i), and (j) in relation to their respective province or district.

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