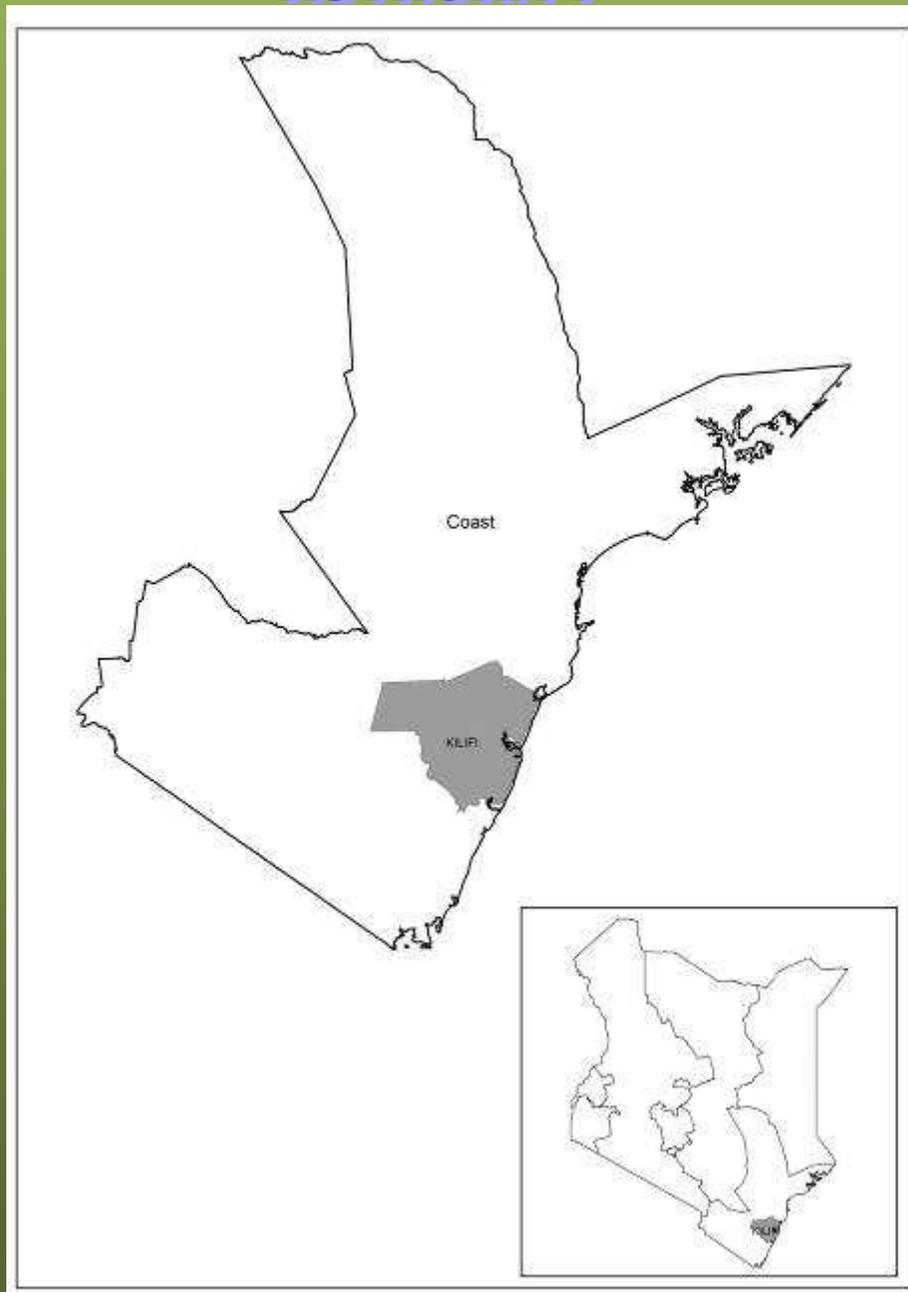




REPUBLIC OF KENYA
MINISTRY OF ENVIRONMENT AND MINERAL RESOURCES
NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY



KILIFI
DISTRICT ENVIRONMENT ACTION PLAN
2009-2013

EXECUTIVE SUMMARY

Economic growth and environment are closely intertwined in Kenya's development process. Environmental Action Planning is a tool that aims at enhancing the integration of environment into development planning.

Poverty has led to the over-use and destruction of the environment. Continued reliance on trees for fuel and wetlands for farming and its resources has led to deforestation and wetland encroachment. The utilization of marine resources needs to be monitored to ensure sustainability.

The DEAP highlights key environmental issues and actions to be undertaken so as to achieve sustainable development in the District. The report consists of eight chapters. Chapter one gives the challenges of sustainable development and also describes the rationale for the preparatory process of the DEAP. The chapter also outlines the district's profile covering the physical features, demographic and agro-ecological zones.

Chapter two describes the District's Environment and Natural resources of soils, land, Water, Biodiversity, wetlands and agriculture, livestock and fisheries. For each resource, major environmental issues, challenges and proposed interventions are identified.

Chapter three details the human settlements and infrastructure in Kilifi 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, biodiversity loss, depletion of fisheries resource and energy.

Chapter four addresses environmental aspects in trade, industry, services and tourism sectors. The key issues under this chapter are high pollution levels from industrial activities poor management of solid waste and abandoned unrehabilitated quarries. Chapter five discusses environmental hazards and disasters. The major hazards covered include; floods, drought and famine and HIV/AIDS.

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 in environmental conservation.

Governance, Policy and Legal Framework as well as Institutional arrangements are set in chapter Seven. The key issues addressed include; harmonization of environmental legislations and institutional mandates, incorporation of indigenous knowledge in environmental management. 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. This EAP process was participatory, involving various stakeholders from institutions and sectors, including the public, private, NGOs and local communities at District, Provincial and National levels. These consultative meetings provided the basis for formulation of the PEAP and finally the National Environment Action Plan Framework.

The DEAP report addresses environmental issues from various sectors in an integrated manner and 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 report 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 through the Annual State of the Environment Reporting.

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

Dr. Ayub Macharia (PhD),

DIRECTOR GENERAL (Ag),

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

ACKNOWLEDGEMENT

On behalf of the National Environment Management Authority (NEMA), I would like to thank the Kilifi 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 Provincial Director of Environment (Coast) and District Environment Officer, for their insights and dedication to this process. Last but not least, we extend our gratitude to all those who contributed towards the finalization of this District Environmental Action Plan.

Dr. Kennedy I. Ondimu

DIRECTOR, ENVIRONMENTAL PLANNING

AND RESEARCH CO-ORDINATION DEPARTMENT

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ACRONYMS

1. EMCA -Environmental management and coordination act
2. DEC District Environ Committee
3. DEAP - District Environment Action Plan
4. DEO- District Environment Officer
5. PEAP - Provincial Environment Plan
6. NEAP-- National Environment Action Plan
7. DDO- District Development Officer
8. DAO - District Agricultural Officer
9. DFO - District Forest Officer
- 9.KEFRI- Kenya Forest Research Institute
10. KWS - Kenya Wild Life Service's
11. NM K - National Museums of Kenya
- 12.CFCU - Forest Conservation Group

CHAPTER 1

1.0 Introduction

1.1 Preamble

Over 92% of the population of Kilifi District is dependent on Natural Resources for their livelihoods. As the population increase more pressure shall be exerted on the environment leading to deterioration of Ecology balance.

Deliberate measures will have to be undertaken to correct the situation. One of the most important of this action is to integrate development and environmental conservation activities. The District Environmental Action Plan (DEAP) will ensure environmental consideration in development programs.

1.1.1 Objective of District Environment Action Plan (DEAP)

The Objectives of the action plan are to:

- Operationalize part IV of Environment Management and coordination Act (EMCA 1999).
- Determine the major environmental issues and challenges facing the District identify environmental Management opportunities
- Create synergy and harmony in Environmental Planning
- Integrate environmental concerns into Social Economic, Planning and development
- Formulate appropriate Environmental Management Strategies.

1.1.2 Provision of EMCA in Environmental Planning

The Environment Management and co-ordination Act (EMCA) of 1999 provides for the integration of environmental concerns into national development process. The 9th National Development Plan (2002 - 2008) advocate for integration of environment concerns in development planning process at all levels.

EMCA provides for every District Environment Committee to prepare after every five years a District Environment Action Plan (DEAP). The Committee shall submit such plan to the chairman of the Provincial Environment Action Plan Committee for incorporation into Provincial Environment Action Plan.

Methodology

The DEO convened a DEC Meeting to brief the committee on DEAP. At this meeting a technical committee was formed to gather information and write the District Environment Action Plan Report.

Technical Committee Members were: -DDO, DEO, DAO, DFO

1.2 Environmental Challenges in Kilifi District

The main Environmental challenges in Kilifi arise from use and misuse of natural resources. There is rampant deforestation caused by charcoal burning, timber and firewood harvesting. Other challenges include soil erosion especially along the seashores, dis-used quarries, human-wildlife conflicts poverty and industrial pollution. Due to high poverty levels, the community has resorted to activities which are detrimental to the environment such as charcoal burning/ firewood for sale to earn a living, deforestation, sand mining and rock quarrying.

Soil Erosion

Soil erosion has direct effect on food, water and wood production. It is much evident in the sloppy landscapes and along riverbanks. Human activities such as overstocking overgrazing), clearing of vegetation (deforestation), poor land use practices etc have left. Bare and exposed to erosion forces and as a result about 20% of all opened land has been affected by soil erosion. A case in point is that of land on steep slopes of Mwangea hill.

Erosion of the Sea Shore

Destruction of mangroves along the coastal shores coupled with other human activities has led to increased erosion of the Seashore by Sea waves, e.g. Kilifi Bay Beach.

Deforestation

This is as a result of Man's activity while expanding agricultural fields; preparing quarrying/mining sites, acquiring trees for timber/fuel and use of fires during bush clearing. Fires are very common in the period preceding the planting season. Trees are cut for charcoal burning and firewood. The two products are a major source of energy for both rural and urban communities. Charcoal burning is rampant in Tsangatsini, Mwanamwinga and parts of Mariakani.

Mining / quarrying

Mining / Quarrying are some of the causes of land degradation. Though mining activities have created employment opportunities for the Kilifi community, a strategy need be put in place to control the process and thus minimize environmental destruction.

Sand Harvesting

Sand harvesting continues to degrade the landscape in Kakanjuni area. Generally there are noted abandoned quarries all over kilifi. Concerted efforts should be put in place to rehabilitate them.

1.3 District profile

Geographical Location

Kilifi District is one of the seven Districts in Coast province. The District covers an area of 4,779 .2km². It borders Taita Taveta District to the West, Malindi District to the Northwest and Mombassa and Kwale District to the South (Figure 1).

Map 1: Location of the District

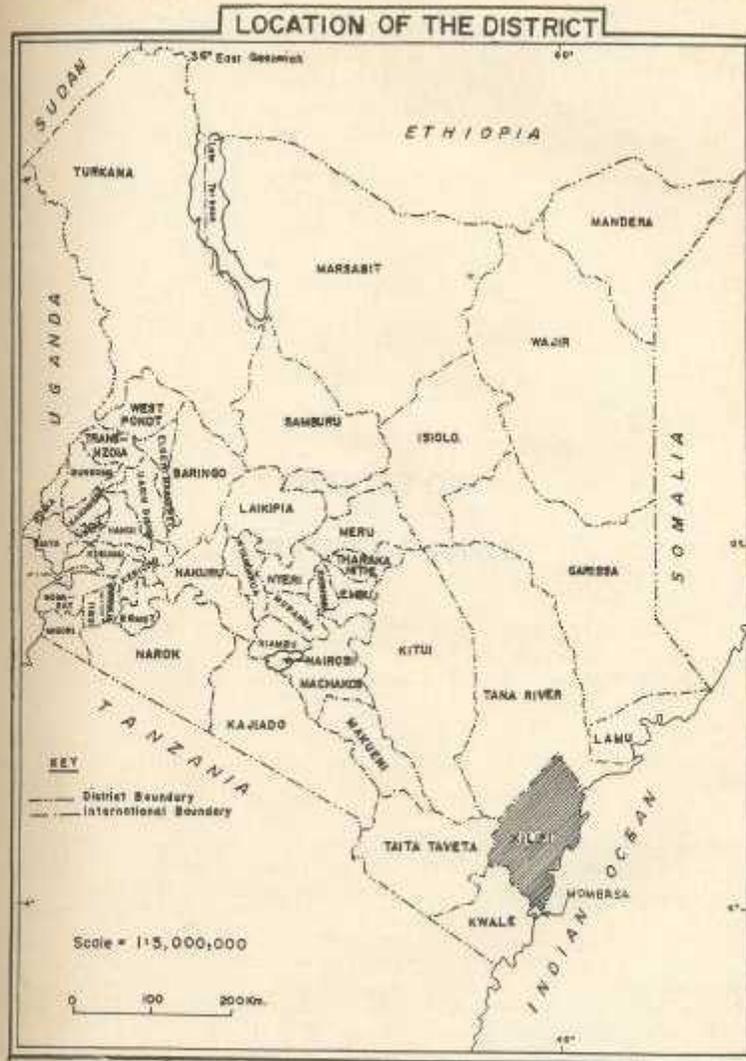


Figure 1 1. Kilifi District Map

Kilifi district lies between latitudes 3°16' and 4° South and longitudes 39° 05' and 40° East with an altitude of between 0-520m above sea level. The shoreline is 144km long and extends from Mtwapa creek to Mida creek.

Kilifi District is divided into 7 (seven) Administrative Divisions namely: Kaloleni, Bahari, Chonyi, Kikambala, Ganze, Vitengeni and Bamba.

Table 1: Area and Administrative Units by Division

Division	Area Km2	Locations	Sub-locations.
Bahari	277.0	5	14
Kikambala	299.7	3	11
Chonyi	202.2	4	9
Kaloleni	909.9	11	33
Bamba	1,743.5	4	13
Ganze	481.9	5	13
Vitengeni	676.9	5	13
Arabuko Sokoke Forest	189.0	-	-
Total	4,779.2	36	107

Source: 1999 Population and Housing Census Report.

1.3.2 Climate and physical features

Rainfall

A bi-modal pattern of rainfall is experienced in the District with the Coastal strip relying more on the long rains (March — July) while the more interior livestock zone depends heavily on the short rains (October — December). Average annual rainfall ranges from 400mm in the hinterland to 1,200mm at the Coastal belt. The Coastal belt receives an average annual rainfall of about 900mm to 1,100mm with marked decrease in intensity to the north and to the hinterland.

Temperatures

Temperature is generally high throughout the year with maximum temperatures ranging between 26.5°C — 34°C whereas minimum temperature ranges between 22.5°C — 24.5°C.

Agro Ecological Zones (AEZ)

Kilifi District can be divided into 5 Agro-Ecological zones (AZE), which defines areas that have similar characteristics such as mean temperatures, vegetation

They are:

- i) Coconut —cassava zone (CL3)
- ii) Cashew nuts —cassava zone (CL4)
- iii) Livestock-millet zone (CL5)
- iv) Lowland ranching zone (CL6)
- v) Coconut cashew nut —cassava zone (CL

Coconut cassava zone (AEZ)

This is the highest potential for crops in the district spreading along the coastal uplands and low land coastal plains. The major farming activities include tree crops and food crops. It has an average precipitation of 900mm and a mean temperature 26c.

Cashew nut cassava zone (AEZ2)

This stretches northwards along the coastal plains to Sokoke forest. It has an average precipitation of 600 mm and mean annual temperature of 24 degrees centigrade it is slide lower than the first zone

Livestock millet zone (AEZ)

The zone is of lower potential with precipitation of 800mm the area is suitable for dry land farming and livestock rearing

Lowland ranching

It varies in altitude from 90-300m with mean annual temperature of 27 degrees centigrade and annual precipitation of 350 —700 major activities include ranching and wildlife

1.3.3 Population Size and Distribution

The District has a population of 544,303 according to 1999 population census.

The distribution is as shown below

Table 2. Population Distribution by Division Kilifi District

Division	Male	Female	Total	H/hold s	Area sq.km	Density
Bahari	44306	45703	90009	15497	277	325
Chonyi	21665	25473	47138	8005	202.2	233
Kikambala	49276	48622	97898	20707	299.7	327
Ganze	15087	18120	33207	4512	481.9	69
Bamba	15872	19988	35852	4564	1743.5	21
Vitengeni	19875	23284	43159	5801	676.9	64
Kaloleni	92471	104616	197033	31115	909	217
Arabuko F	7	0	7	0	189	0
Total	258559	285806	544303	90311	47792	114

Source; District Statistics Office 2003

Table 3. Population Densities by Division (Per sq 1(m))

Division	1999	2002
Bahari	325	356
Chonyi	233	255
Kikambala	327	358
Ganze	69	76
Bamba	21	23
Vitengeni	64	70
Kaloleni	217	238
District Total	114	125

Source; District Planning Unit, Kilifi 2001

The highest population is in Kikambala division, while Bamba division as the lowest population. The total fertility rate is six (6) children per woman while life expectancy rated is at 56yrs. The population of Kilifi is growing at a rate of 3.05% while infant mortality rate is 85 children per every 1000 children born.

1.3.4 Social, cultural and economic characteristics

Poverty

Poverty is a complex multi dimensional problem in Kilifi District. It is one of the driving forces of Environmental degradation. The poor are directly dependent on environment for their immediate survival and they are most vulnerable when the state of environment decline. The poor destroy forest by harvesting terrestrial tree and mangrove to burning charcoal.

Table 4: Poverty Levels by Division

Division	Percentage Of The Poor	Poverty Ranking
Bamba	90	1
Ganze	85	2
Vitengeni	80	3
Kaloleni	70	4
Chonyi Bahari	65	5
	50	6
Kikambala	40	7

Source: District Poverty Assessment Report, Kilifi 2000

CHAPTER 2

2.0 Environment and natural resources

2.1 Forest Resource

Introduction

The district has recorded a decline in the total acreage of forest and Natural Vegetation due to farmers' encroachment on Kaya Forests for cultivation and charcoal burning activities. Charcoal burning is rampant in Bamba, Ganze, Kaloleni and Vitengeni. However, a conservation effort involving neighboring communities in Management of Arabuko Sokoke is bearing fruits. The state of the forest has improved.

The forests are protected and conserved under Forest Act and Monuments and Antiquities Act Cap 315. The total gazetted forest area in the District stands at 20,307 Ha. And can be categorized into four main groups.

Forest conservation

Most forests in the Districts are managed by Kenya Forest Service. The most important forests are discussed below:

Arabuko Sokoke Forest

Arabuko Sokoke Forest is a forest reserve gazetted in 1934 under the Forest Act managed by the forest department. This forest is shared between Kilifi District and Malindi District. 19,000 hectares of the forest falls within Kilifi District.

Mangrove Forests

Mangrove at Takaungu, Kilfi Creek, Uyombo and Mtwapa along the Coast covers an area of 880 hectares.

Kaya Forests

There are four gazetted Kaya forests namely

- (i) Kaya Jibana -- Covers an area of 140 hectares
- (ii) Kaya Ribe --- Covers an area of 36.0 hectares
- (iii) Kaya Kambe -- Covers an area of 56.6 hectares
- (iv) Kaya Chonyi -- Covers an area of 194.5 hectares

Forest plantations

i) *Araucaria aungesetifolia* forest

This forest covers an area of 3.6 hectares. It was established in 1961 just at the edge of

Arabuko Sokoke Forest

ii) Clonial - Trial plot

It was established on 1/6/2002 for research purposes and is approximately 0.6 hectares. It consists of Eucalyptus tree species.

b) Those protected under Forest laws are: -

- Kaya Kauma
- Kaya Mudzimwiru
- Kaya Mudzimuvya
- Kaya Bomu/Fimboni
- Kaya Mzizima
- Kaya Fungo
- Kaya Chivara

State of Forests

Deforestation/Natural resources degradation

Due to high level of poverty some people have resorted to activities which are detrimental to the environment such as: Charcoal burning, harvesting of firewood for sale to earn a living, Cutting down of trees for timber, Sand mining, Rocks quarrying and general forests destruction

This is as a result of human activity while expanding agricultural fields; preparing quarrying/mining sites, acquiring trees for timber/fuel and use of fires during bush clearing. Fires are very common in the period preceding the planting season.

Trees are cut for charcoal burning and firewood. The two products are a major source of energy for both rural and urban communities. Charcoal burning is rampant in Tsangatsini, Mwanamwinga and parts of Mariakani.

Arabuko Sokoke Forest

There are no known cases of encroachment in this forest. Participatory forest management strategy is being used to check this especially in the DIDA section of the forest. This is a strategy that involves community participation in policing and management of the forest. The community has its own guards collaborating with forest guards. They were recruited and trained through stakeholders' joint effort e.g. Kenya Wildlife Services (KWS), National Museums of Kenya (NMK) and Kenya forestry research institute (KEFRI). The community is encouraged to plant their own trees {casuarinas}. A policing unit known as DIFABA covers a stretch of 14km along the forest and 3km to the inside.

Environmental state of Kilifi Kayas

As a result of work by NMK in collaboration with local communities and project support from WWF, the extreme threats that faced many Kayas have been brought under control and the sites improved. Boundaries have been largely respected. Local volunteers act as community guards reporting incidents of destruction to National Museums of Kenya and Forest Department for action. Most of the sites have recorded very significant regeneration of vegetation

Problem Sites

However, there are specific sites, which owing to historical reasons have been the source of continuing conflict and the result has been degradation despite the efforts of conservation agents and local groups. The most serious problems are faced at Kaya Chonyi (Chonyi Division) and Mudzirwiru in Rabai Location, Kaloleni Division. Other sites include Kaya Koyeni, Kaya Kauma, Mwangea Hill and Pangani Rocks.

Kaya chonyi

According to local elders, the process of degradation of Kaya Chonyi started more than 50 years ago and was accelerated in the 60s and 70s. By the time the Kaya was gazetted as a forest reserve in 1994, only a fraction of its original 195 Ha was covered by forest. The rest had largely been taken up by cultivation for annual crops or planted with Coconuts. This has

had a devastating effect on the water catchments functions of the forest, which are very important to the local community for replenishing local streams and springs.

The main challenge has been to protect the remaining less than 20 Ha of forest and the surrounding areas, which are still able to regenerate, as they had not completely lost their original vegetation. Other sections are well suited for forest plantations. However, locals who have cultivated there for many years have steadily resisted conservation efforts by FD and NMK sometimes forcefully and land disputes abound. The local conservation group has been very active and committed. They get supported from area Chief. Forest Department commits very few resources with its main priority being the Key Arabuko Sokoke Forest.

Kaya Mudzimwiru

Kaya Mudzimwiru near Mazeras has been badly affected by Sand harvesting. The practice has gone on for at least 30 years to supply Mombasa. Sand harvesting involves digging and scooping the soil, which holds the root system of trees.

Much of the sand for construction in Mombasa comes from Mazeras. Most of the hillsides in the area have been depleted and the only sand stock remaining is in the Kaya site, a very important and sacred spot for the Rabai Community. The site was demarcated and gazetted in 1996 in consultation with the Kaya Elders and the local farmers.

The local farmers are continually encroaching on the site to sell sand to Mombasa dealers and many of the beacons on the Mazeras side of the Kaya have disappeared. Many argue that the demarcated boundary included parts of their land however there is little evidence to support this allegation. After sand scooping, there are no efforts made to rehabilitate the site and the water sources have also been highly diminished in recent year.

In an effort to rehabilitate the forest, 3,808 seedlings were planted. Unfortunately, the seedlings were uprooted by a few community members who were among the invaders and against the rehabilitation of this sacred forest. Around one thousand big trees have been uprooted. The provincial Administration especially the local chiefs and the CFCU have struggled continuously to try and stop this process.

Kaya Koyeni

Kaya Koyeni was registered under Kilifi County Council plot no. 464 within the Mwarakaya adjudication section. It is badly degraded as a result of human encroachment through tree cutting and cultivation. Its acreage was about 60 Ha. The encroachment and destruction activities began in 1995. The main problem associated with the above is mainly attributed to the administrative boundaries between the Chonyi Community and the neighboring Jibana Community. According to the National Divisional boundaries, the above site is in Mwarakaya Location. Koyeni is a trust land and therefore under the care of Kilifi County Council

At present, the forest is gone and what remains are just a few trees. People are replacing them with exotic species and agricultural crops such as maize and cassava. A stream, which originates from this forest, has dried up. The Coastal Forest Conservation Unit has held several meetings with the local people to help protect the forest. It even supported a vigilant group formed by the local people to protect the site. Several arrests in collaboration with Forest Department Kenya Police and administration police were made but each time the suspects were charged a small fine that they always paid.

The forest has a great potential to regenerate once destructive activities are stopped. This is supported by the rich and fertile soils in the area. Kaya Koyeni forest is a true tropical rain forest with all indigenous trees, which are above 20 metre high. The characteristics of this forest were similar to those of Kaya Chonyi and Kambe.

Kaya Kauma

It is a gazetted National Monument. Its acreage is 87Ha. The original area before gazettelement was about twice the gazetted area. The site has been a major source of iron ore. Anwarali Company has been extracting the mineral for Bamburi cement factory. Several arrests have been made by CFCU in collaboration with the local community, Kaya guards and the local administration.

There are large holes at the abandoned quarry site, which are dangerous to human beings and other animals. Efforts have been made to compel the mining company to rehabilitate

the site but in vain. To date, only cosmetic rehabilitation has been undertaken at the foreground whereas the huge holes are hidden within. The site is a serious environmental concern. . Mwangea is an extensive indigenous forest located at the hilltop in the district. The site is legendary as an ancient settlement for the Mijikenda people of the Coastal Kenya. It is of high biological value with a considerable number of rare plants species particularly at the Mwahera and Mikoba Chenda hilltops of the forest. It is about 35 square Kilometers in acreage and rising about 520m above sea level. It is higher in altitude than the Shimba hills.

Mwangea is an important catchment for several streams, rivers and wells in the area. The severe threat to the site is attributed to human encroachment. Human settlements are distributed over the flat areas at the top of the hill with continuous cultivation.

Conservation interested parties have tried to protect the forest but have received resistance particularly from the local county council. The conservation parties were looking at possibilities of gazettelement of the site as a forest reserve or national monument. The county council felt that the local people would be negatively affected and thus suggested to form a conservation group to look into the affairs of the site. No meaningful protection and conservation has been achieved.

Indigenous Trees species

Some Valuable indigenous trees species are threatened. They are: - Muhuhu (*Brachylleana huillensis*), *Newtonia paucijuga* (Mbwagazembe), *Brastegia speciformis* (Mrihi), *Afzelia quanzensis* (Mbambakofi) *Milicia excelsa* (Mvule) all used for carving wood

Mangroves & Neem Trees. These two are over exploited for timber and Soap manufacturing, Neem trees are being debarked for soap manufacture.

The forestlands are diminishing fast because the rate of clearing is higher than the rate of planting. The use of fire during land preparation is one of the major factors that accelerate the loss of vegetation. Due to rapid population increase, pressure on forest resources has also increased. High population requires more agricultural land for cultivation. Increase in population has increased Communities demand for wood fuel.

Key Environmental Issues on Forests in the District

- Illegal cutting of trees for timber and building poles
- Forest fires
- Encroachment by squatters
- Mangrove forest clearance

Proposed intervention

- Raise awareness on forest resource management
- Promote the use of energy saving stoves
- Initiate re-afforestation and afforestation programmes
- Encourage farmers to establish wood lots
- Enforcement of forest regulations
- Carry out boundary marking to minimize encroachment
- Establish fire breaks and acquire modern firefighting equipment

2.2 Water resources

Kilifi District relies mainly on piped water from Baricho and Mzima pipelines. Both sources are outside the boundaries of Kilifi District; hence pollution at source depends on activities of other Districts. However, provision of water is supplemented through water Pans/Dams constructed with the help of technical expertise from the departments. These facilities are mainly found in the hinterland divisions of Kilifi District i.e. Vitengeni, Bamba, Kaloleni and Ganze Division.

There are few springs' visions found in Kaloleni and Chonyi Divisions. Ground water exploitation plays a key role in the ministry of water development undertaking. Several seasonal rivers are found in the district and need to be protected from destruction through minimized deforestation and River bank erosion etc. Rainwater harvesting is also common through roof catchments especially in institutions found in the drier parts of Kilifi. All the above sources of water need to be protected to avoid pollution and ensure that the

consumer gets safe clean water for domestic, livestock and industrial purposes, even though the latter is in small scale

The department's main role and goal is the provision of clean water that meets the World Health Organization (WHO) and the Kenya Bureau of Standards (KEBS) standards.

Therefore water quality surveillance plays a crucial role.

2.2.1 Ground water

Boreholes/Wells.

Ground water table in Kilifi ranges from shallow to deep as you move into the hinterlands.

Wells and boreholes are too close to each other contrary to water act.

Over pumping of ground water leads to salt water intrusion. Some Wells and boreholes are sitting too close to sewers/soak pit and latrines. Open wells are therefore prone to contamination through foreign objects in form of dead organic matter.

2.2.2 Surface water

Dams and Pans

Water masses are open to all sorts of contamination through Surface runoff, Geological formation, direct human action, Chemical reaction including increase in salt concentration due to evaporation and overgrazing

Springs.

There are several springs in the district but the threatened with contamination and pollution due to agricultural activities.

The springs have been exposure due to vegetation clearing and other activities in catchment areas.

2.2.3 Ocean

Seashores/Beaches.

The sea and beach areas receive Pollution from oil spills, effluent and sewerage from factories and settlement areas. There is also organic matter, including river discharges into the ocean, erosion of the sea shore by waves e.g. Kilifi Bay Beach and Sediment deposits from rivers into the sea during heavy rains.

Table 5:Wells Distributions in Kilifi District.

Division	No. of wells
Ganze	0
Kaloleni	20
Bahari	513
Total	533

Water

Environmental degradation reduces the productivity of water resources. Availability of water of desired quantity and quality among other factors accelerate the economy, creating employment opportunities. Settlements have sprung up along major pipelines with increased economic activities.

Poor quality and quantity of water impaired human health lowers human productivity. More expenses in meeting medical cost, sandman-hours lost in attending clinics. Polluted water sources will invariably require expensive treatment facilities, costly treatment.

Key issues

- Pollution of water dams and pans
- Over exploitation of ground water (bore holes are very close to each other)
- Pollution of sea water due to poor management of domestic and industrial waste
- Pollution from oil spill

Proposed intervention

- Enforce water quality regulation
- Enforce water Act and other water regulation to ensure ground water conservation

2.3 Fisheries

The fishing community believes that the marine resources belong to the government and hence have no sense of ownership or commitment to sustainable utilization. Such attitudes have contributed to deterioration of fishery resources through use of illegal and irresponsible

methods fishing. The uses of undersized nets catch immature fish hence taking away recruitment stock. Most fishermen over-fish in the shallow waters (inshore waters) most of the fishing is carried out along the shallow waters because of the nature of their fishing vessels and gears.

Turtles have been slaughtered for their meat and medicinal value in some areas of the District hence making them an endangered animal species. This calls for the protection of this species.

Environmental Issues

Environmental issues related to the Fisheries sector in the district are:

Illegal fishing methods such as trawling ring net fishing, sale of seashells, severe pollution of sea water by salt manufacturing firms. A detailed analysis is given below.

Trawling

This is a very destructive method of fishing, which targets only prawns but in the process catches other fish, which are later discarded as by-catch. This by-catch, on average, constitutes a ratio of 8:1 of the total catch by weight. That means for every 1tonne of prawns caught, there is 8 tonnes of by-catch. Artisanal fishermen in the district are strongly opposed to Trawlers because they argue, correctly, that trawler operators destroy the fish, which would constitute their catch. This is the root cause of the fisheries resource use conflict between Trawler operators and Artisanal fishermen in the district.

Another quarrel Artisanal fisherman has against trawler operators is that trawlers destroy their fishing gear such as boats and fishing nets. And the Artisanal fishermen correctly argue that this contributes further to their impoverishment. Although trawlers are fitted with Turtle Exclusion Devices (TEDs), these TEDs are not effective and deaths of Turtles and Dugongs from trawlers are always reported by fishermen. This fishing method requires an Environmental Impact Assessment study.

Ring net fishing

Use of ring nets for fishing has been a very controversial subject in the district and it has been a source of a fierce resource use conflict between Artisanal fishermen and the

commercial ring net fishermen. However, ring net fishing targets only fish moving in shoals and its destructiveness arises from its catching of fish en masse.

Use of illegal fishing methods

These range from use of undersize nets, monofilament nets, spear guns, harpoons, beach seines and herbal poison

Although these fishing methods have been declared illegal, some are still in use due to poor enforcement by the Fisheries Department.

Proposed interventions

- Discourage ring net fishing
- Confiscate illegal fishing gear and Prosecute offenders
- Enforce water quality regulations
- Raise awareness on fisheries conservation

Sea Shore Erosion

Destruction of mangroves along the coastal shores coupled with other human activities have led to increased erosion of the sea shores by Sea waves (sea erosion) e.g. Kilifi Bay Beach.

2.4 Agriculture

Farming Systems

The total Agricultural land in Kiifi District is about 3949Km² amongst which is a zone occupied by livestock and extends from northern parts of Mariakani, covering most parts of Bamba, Ganze and Vitengeni. The main farming activities include production of coconuts, maize, cashew nuts, cassava, pineapples, mangoes and citrus.

Livestock activities include cattle (beef and dairy), sheep, goats, poultry, pigs, rabbits and donkeys. The agricultural activities are related at 80% subsistence (small scale) and 20% commercial farming.

Soil Erosion

Soil erosion has direct effect on food, water and wood production. It is much evident in the sloppy landscapes and along riverbanks. Human activities such as: Overstocking (overgrazing), Clearing of vegetation (deforestation) and Poor land use practices have left soils bare and exposed to erosion forces, as a result about 20% of all opened land has been

affected by soil erosion. A case in point is that of land on the steep slopes of Mwangea hill. Protruding stones (rock exposures) can be seen (a sign of soil erosion).

2.5 wildlife management

Human-wildlife conflict

In the last two or three years there has been an increase of wildlife menace in areas surrounding *Arobuko Sokoke* forest e.g. *Roka Dzunguni* and *Kaembeni*. The worst hit areas are Roka location, *Mkongoni* sub-location and *Ezamotoyo* area.

Wild animals like Elephants, Buffaloes, and Hippos etc sometimes stray into farm areas like Mwanamwinga, Chonyi, Bamba Ganze, Kikambala and Kaloleni and cause devastating effect on crops. Wildlife cause crop damage, loss of domestic animals, threat to human life/humans harassment.

Environmental issues on wildlife conservation in the District.

Poor Coordination between different Stakeholders involved in licensing of different products

- Pollution of the beach in marine protected areas
- Poaching of big game
- Illegal collection of turtle eggs
- Beach Degradation
- Beach construction developments interfere with turtle breeding areas
- Construction of Sea walls interfere turtle access of breeding sites
- Beach littering

Proposed interventions

Harmonize licensing of wildlife products to reduce conflicts

Enforce Wildlife Conservation Act

Enforce water quality and waste management regulations

Carry out problem animal control to reduce human wildlife conflicts

Encourage community participation in wildlife conservation

Promote non consumptive wildlife utilization

CHAPTER 3

3.0 Human settlement and infrastructure

3.1 Human settlement and planning

The District settlement patterns are influenced by infrastructure network and climate, which determine various agricultural zones. High population densities are found along the tarmac roads from Mombasa -Malindi and Mombasa -Nairobi up to Mariakani Town. These areas are also well supplied with piped water and electricity.

High population clusters are found in Chonyi Division and some parts of Kaloleni Division where they are high potential for agricultural production. Ganze, Vitengeni, Bamba and some parts of Kaloleni Division are sparsely populated. They are mostly rangelands and less productive agriculturally. 32% of the total District population is found in the large towns namely Kilifi, Mariakani, Mtwapa, Majengo and Bamba. The main population densities concentrate almost in a 'v' shape along the main roads leading to Nairobi and Malindi with deviation along the road to Kaloleni.

3.2 Infrastructure

Roads

Most of the infrastructure in Kilifi is concentrated along the coastline. The main tarmac roads are Kilifi-Malindi and Mombasa-Nairobi road. The district has a total road network of 1000 km, 140 km of which is bitumen while 160 km is gravel roads; the rest 600km is earth road.

Energy

95% of Kilifi population use fuel wood as their main source of energy. Twenty-four trading centers have been connected with electricity while five thousand three hundred and sixty households in Kilifi have electricity. Only 10% of the population use gas and kerosene. One thousand two hundred and ninety five households have been connected with water supply while sixty five thousand people can access portable water.

Kilifi District has two railway stations and twenty-two kilometers of Railways.

3.3 Environmental issues

Public Health

Environment is an important part of the overall picture of human life and behavior. The environment consists of the biological, physical, social and economic aspects. The health and survival of human beings depend on their abilities to adjust to their environment.

The human environment consists of basic elements, which are of importance to public health. These are; air, water, food the climate, space, social and opinion environment.

Environment affects all people as individuals and as communities. Environmental change can be either detrimental or good depending on the direction of change. It can change healthier condition or the change might introduce new health problems e.g. mining introduces chemical dust into the environment, which is a risk factor of respiratory and skin infections.

3.4 Disease Occurrence

a) The biological environment

Pathogenic organisms like viruses, bacteria and worms, vector organisms like insects such as mosquitoes, houseflies and animals e.g. rodents determine disease occurrence and frequencies.

b) Physical environment.

The geographical and physical features like Climatic conditions e.g. abnormal high temperatures; Soil erosion, land degradation and poor yield are some factors that increase chances of disease occurrence in the community

The quality and the quantity of water influence the occurrence of Water-borne diseases.

Poor water quality increased the chances of disease occurrence. The following are common water related diseases in the District; scabies, skin infection, conjunctivitis, schistosomiasis, filariasis malaria, cholera, typhoid and dysentery.

c) The cultural and social environment,

Customs, beliefs and values, religion, family and leadership are structures that, determines community level of basic public health rules

d) Economic and political environment: includes work, economy and the governance. E.g. some places of work can be stressful leading to psychological health problems and fatigue.

e) Chemical factors

These include toxic substances e.g. chemical dust from the mines and acidic gases from factories.

The following are main factors contributing to poor public health

- Rapid urbanization / rural urban migration coupled with poor planning that as caused slum development and poor health conditions
- Weak safety regulation and inadequate enforcement of laws and regulations relating to health.

Noise

There are several sources of noise. Blasting at quarries produces high noise and vibrations. Noise is also evident in factories, ballast-crushing sites, and mechanized coral block mining sites and in disco clubs.

Atmospheric pollution

Mines and quarries produce a lot of dust causing air pollution

High amount of dust is also emitted into the air from earth roads.

Waste management: include wastes from the hospitals and industries.

Industrial waste disposal in Kilifi vary from one industry to another. This applies to both solid and liquid wastes.

Liquid Waste

Most industries in the district do not have proper liquid waste management systems e.g. The EPZ in Mazeras produce about 200,000 liters of liquid waste that is discharged into surrounding seasonal rivers. This pollutes the water system.

Some steel factories in Mariakani, Kokotoni and Mazeras produce high amount of effluent.

The factories have defective oxidation ponds, which emit foul smell. At Mtwapa Creek, Shimo -la -Tewa prison discharges raw sewage directly into the ocean.

The hides and skin Bandas in Mariakani dispose their liquid waste poorly. The slaughterhouse within the same area is a source of foul smell that has made the residence uncomfortable for along time.

3.5 Solid waste

Faecal Waste

The disposal of human faecal still remains a major problem. In urban centers, lack of sewerage system has resulted in individuals using alternative disposal systems such as pit latrines, septic tanks and cesspits that contaminate ground water particularly in Kikambala and Bahari divisions.

Low sanitation coverage (low latrine coverage) in the rural areas particularly in Ganze, Vitengeni and Bamba divisions is a big threat to water sources such as pans and dams.

Domestic Waste

Residential areas generate domestic waste; the largest portion is organic which is readily biodegradable, the other part is usually plastic which is not biodegradable. Foliage is often seasonal and does not pose much environmental health problem.

In the rural areas, wastes is not a big problem since waste production is low and most of it is organic, it is disposed in the farm as manure In urban areas wastes is an environmental health problem since the waste is dumped indiscriminately in the residential areas. This is common in the three main urban center i.e. Kilifi town, Mtwapa and Mariakani.

The dumpsites are favorable breeding area for rats, mosquitoes and flies (health hazards). They are also an eyesore and produce foul smell during decomposition. The other major issue in our urban centers is polythene bags (plastic).

Due to poor management of wastes from the source to the disposal, polythene is scattered all over the market centers. This is an eye sore as well as a cause of livestock deaths.

3.6 Hazardous Wastes

Hospital Wastes: include Pathological waste, infectious waste, Sharp objects and syringes.

Management of the above waste mostly generated from medical institutions still remains a major problem. Few institutions have put up incinerators but majority of the institutions particularly private clinics do not have an organized disposal systems.

Burning in pits is most practiced. Provision of incinerators or alternative disposal methods is highly recommended.

Radioactive Waste

Radioactive waste is still not a big threat in the District. This might be due to inadequate research or sensitization. Concerns are that a lot of radioactive cargo passes through our

District while on transit to upcountry destinations. Mariakani Center particularly the weighbridge is an area where radioactivity cannot be ruled out.

Chemical wastes

Ignorance and lack of sensitization has made it difficult for the above to be noted and monitored. Hazardous chemicals appear not a major problem in the district due to the above.

Pesticides, insecticides and fertilizers are the most commonly used. The District borders the Indian Ocean hence any pollution by marine vessels will definitely affect the beaches and shores.

3.7 LAND USE

Human settlement & Land Tenure

Land ownership is a major issue, which needs to be tackled if there has to be reasonable conservation of the environment. Several areas have not been demarcated and this subjects them to communal use and hence misuse.

Under customary law, men own land and in these scenario women who are the most active in development activities cannot do much without the consent of the rightful owners the men. Land Adjudication of Trust land is however mainly concentrated in Kaloleni and Chonyi Divisions where three quarters of the land is now registered The bulk of the work now remains in Vitengeni, Bamba and Ganze Chonyi Divisions where three quarters of the land is bulk of the work now remains in Vitengeni, Bamba and Ganze Division, Kikambala and Bahari Divisions with high potential. Agricultural land is mainly under settlement programme.

Physical planning

Guidelines on Environmental issues and general planning have in the past been violated during the planning stage of towns and in the constructions of various structures.

The result is evident in the following:

- Unplanned urban development.
- Encroachment of road reserves by developers
- Informal settlements/slums

- wrongly place recreational facilities
- Poor sewerage disposal

This is common in Kilifi, Mtwapa, Matanomanne, Ganze, Bamba and Mariakani towns.

3.7.1 ENERGY

Electricity, Kerosene and firewood/charcoal are the main sources of energy in Kilifi District. Firewood is mostly used in rural areas and account for 85.5% of all energy used. Urban centers, especially those, which have no access to electricity, use kerosene. Large institute e.g. Kilifi Plantation use biogas. Only 5.9% of the population mainly in Kilifi, Mariakani and Mtwapa use electricity

Continuous reliance on fuel-wood as the main source of energy is detrimental to environment conservation. Charcoal burning for example is one of the main causes of deforestation in Kilifi. There is need therefore to move from this source of energy to alternative renewable sources like biogas, solar, wind and sea wave energies.

Key environmental issues

- Poor solid waste management
- Unplanned urban development
- Poor sewage disposal
- Prevalence of informal settlements
- Poor handling of radioactive waste
- Poor disposal of hospital waste
- Poor disposal of human waste (No sewerage system)
- Over dependence of wood fuel as a source of energy

Proposed intervention

- Enforce waste management regulation
- Develop local physical plans
- Develop an efficient sewerage system
- Conduct rigorous development control
- Investigate the presence of radioactive waste
- Promote alternative sources of energy such as biogas, LPG Gas and electricity

CHAPTER 4

4.0 Industry, trade and services

4.1 Industrial Activities

Industrial Waste

Most factories are located at Mariakani, Mazeras and Mtwapa urban centers. Industrial waste may pose health and environmental problems due to their toxicity. This depends on the processes in each particular industry. Most industries in the District do not have proper waste management systems.

Commercial Waste

Includes wastes generated from shops, hotels, institutions and other businesses in our urban centers. Large quantity of this waste is produced by the hotel industry especially in Bahari and Kikambala Divisions. The wastes comprise of spoilt foods and packaging materials. Most of these establishments do not have organized waste disposal system and hence result to crude dumping which pollutes land and water through leaching.

Tourism

Tourism is one of the economic movers in Kenya. In Kilifi the main tourism attractions are beautiful beaches along the coast, water sports, deep-sea fishing, cultural practice historical surrounding including old Arab towns and ruins of the 16th century.

Some of the tourist facilities have adverse impact on the environment. Negative impact caused by uncontrolled conventional tourism; include increased pollution, erosion, natural habitat loss, strain resources and cultural erosion.

Kenya's marine and coastal resources are subject to increasing environmental impacts from coastal tourism, including overuse or over-harvesting of resources, sewage and oil pollution, diminishing fresh water supply, solid waste pollution, deforestation, declining energy supplies, air pollution and siltation. The article traces the growth of tourism in Kenya, reviews industry trends, assesses the economic impacts and discusses environmental impacts. A broad ranging series of recommendations to improve conditions in such areas as drinking water, sewage, beach erosion, energy, education and training, research and hotel development are listed.

Environmental Impacts from Tourism

1. Tourism has spurred development of beach tourist hotels. The constructions of some of these hotels are done within the 30 meters High Water mark strip which is prohibited in marine protected areas. These hotel constructions and sea wall constructions have interfered with Turtle breeding grounds.
2. Tourists, while doing snorkeling and scuba diving, do trample on corals or collect corals for keeping as souvenirs.
3. Over collection of seashells, corals and star fishes which they buy to take home as souvenirs.
4. Beach driving: tourists drive along beaches killing some beach creatures and also scaring away sea animals that do not tolerate high sound levels.
5. Disused swimming pools: Disused swimming pools in tourist hotels are a big environmental problem in the district .This is because during low tourist seasons, swimming pools in these hotels are emptied of swimming water .When it rains, the pools get filled with rain water and then become a breeding ground for mosquitoes.

It is recommended in this plan that even during low tourist seasons, the swimming pool water in these hotels should either be continually treated with the appropriate swimming water chemicals as recommended by the Public Health Department or they are regularly emptied of rain water during the rainy season.

Social Impacts

Apart positive impacts associated with tourism the following negative impacts have been observed:

1. Increase in prostitution especially child prostitution. There is also an influx of commercial sex workers in Malindi during high tourist seasons.
2. Moral decadence: Naked and topless sunbathing by tourists is not only offensive to locals but is slowly being copied by local children.
3. Increase in drug use.
4. General cultural change.

Challenges in the Tourism Sector

1. Poor road infrastructure.

Apart from the Malindi-Mombasa road, which is in fairly good condition, the rest are in very bad condition and unmotorable in rainy weather. This makes access to some tourist attractions during the rainy season impossible.

2. Lack of direct flights from abroad to Malindi. This is because Malindi lacks an International Airport.

Proposed intervention

- Discourage development of tourist hotels within the 30M water mark
- Discourage collection of coral as souvenirs
- Discourage beach driving
- Continue to treat swimming pool water or keep them empty during low tourist season to discourage the breeding of mosquitoes
- Enforce waste management regulation

Mining and Quarrying

Mining and quarrying has had profound impact on the environment because it is not always followed by rehabilitation of quarries. Below is a list of quarry sites and their status

Table 6 : Quarry status.

Mineral	site	location	Status of mine	Factory/processsing
Lead and silver	Kinangoni	Kilifi	Disused mine, no rehabilitation	
Iron ore	Jaribuni	kilifi	Disused mine, no rehabilitation	Bamburi cement factory
barytes	goshi	kilifi	Mine is small scale, no rehabilitation	

Even though mining activities have created employment opportunities, cases of environmental degradation are common. There is need to control the mining and quarrying process to minimize environmental destruction.

There are as indicated below:

Vitengeni Lead Mine

the Company that established the mine is known as Mineral Mining Corporation (1965) Ltd with the head office in Nairobi. Although some products are still on site, the Quarries were abandoned 6years ago and left open without rehabilitation. One of the Quarries is currently an open water reservoir. They are not fenced hence they are a danger to humans/livestock.

Pangani rocks

This is a major limestone outcrop of unique landscape. The local people consider Pangani a sacred site. There are several caves within the site. The area has a biological value according to plant documentation carried out by CFCU. It harbors a high number of rare plant species endemic to the Coastal Kenya. It covers an area of about 50 ha; most of is on private land. There is evidence of severe degradation at its margin where iron ore is mined. The presence of rich limestone rock makes the site favorable for cement processing in future

.

Coral Limestone Block Mining

Limestone block mining /quarrying refers to the cutting/digging into coral lime stone in order to get limestone building blocks. It is done either by machine or manually.

Coral limestone block mining in Kilifi District is mainly concentrated in Bahari Division.

The breadth of the coral mining belt is approximately 1.5km. This mining belt lies approximately 1km from the coastline and it runs parallel to the coastal shores from Bofa to Roka, a distance of about 30 km. However, rocks on either sides of the belt are either too hard or too poor for block mining.

The coral mining belt has undergone immense environmental degradation. The mining process, first starts by clearing of vegetation hence loss of biodiversity. After clearing of trees and shrubs, block digging is undertaken. The end results of quarrying are small, medium and even very deep and wide holes or basins.

There are two (noted) abandoned quarries in Bofa area, which have not been rehabilitated. There could be more abandoned quarries within the belt.

Sand Harvesting

Sand harvesting continues to degrade the landscape in Kakanjuni area. There are noted abandoned quarries.

Key issues associated with mining and quarrying

- Abandoned quarries
- Deforestation due to vegetation clearance for mining and quarrying
- Noise associated with quarrying

Proposed intervention

- Identify map and rehabilitate abandoned quarries
- Promote afforestation
- Enforce EIA/EA regulation
- Enforce Noise and excessive vibration regulation

CHAPTER 5

5.0 Environmental hazards and disasters

5.1 Extent and trends of environmental hazards and disasters

One of the major threats and recurrent disasters in the District is famine and drought that affects the whole district but with severe effects in Vitengeni, Ganze, Bamba and some parts of Kaloleni. Others are areas adjacent to the Indian Ocean which are prone to sea- wave disasters such as capsizing of boats and drowning affecting fisheries and tourism industries.

5.2 Disease epidemics

Table 7: Top 10 causes of outpatient morbidity in 2004-kilifi districts

Disease	Number affected.
Malaria	166,848
Disease of Respiratory System	100,701
Skin disease	35,857
Diarrhea	22,253
Intestinal worms	12,845
Uti	11,843
Anemia	8,573
Accident	7,582
Ear infections	5,324
Pneumonia	9,964

HIV and AIDS

The actual statistic in the district is not known. Available data from sentinel surveillance reveal that 5.3% of rural population is HIV positive.

5.3 Civil Strife and Armed Conflicts

Unresolved land matters are the single major contributors of civil strife and even armed conflicts in the District. Some community members usually invade land that is owned by other people e.g. developers, absentee landlords etc. On the other hand, people are displaced when parcels of land change hands. All these occurrences result to bitter conflicts. Three most recent conflicts are Msumarini farm invasion of 2003, Conflicts between, Athi River mining and the surrounding community and REA Vipingo Vs surrounding community.

Key Environmental Issues

- Disease outbreaks
- Land degradation
- Drying of water sources due to frequent drought
- Loss of biodiversity and habitats
- Loss of livelihoods
- Inadequate early warning systems and response mechanisms
- Inadequate capacity in disaster preparedness and response
- Inadequate capacity to deal with oil spills

Proposed Interventions

- Develop prediction, monitoring and early warning systems
- Build capacity for early warning and response mechanisms
- Promote alternative livelihoods to reduce vulnerability
- Introducing drought tolerant crops.
- Promotion of forest/tree cover
- Advocacy on behaviour change to curb HIV/AIDS
- Support to the affected and infected by HIV/AIDS
- Enhance vaccination
- Build capacity in disaster preparedness and response
- Diversify income generating activities
- Build capacity for effective oil spill response

CHAPTER 6

6.0 Environmental education and training

6.1 Environmental Education

School curriculum has incorporated essential aspects of environmental education in various subjects. Environment Awareness level in Kilifi District is rated at about 20%. It is slightly higher in the urban population than rural population.

The District Environment Office uses the DC's Barazas. Agricultural shows, Films, Pamphlets and posters to disseminate environmental information and education.

Key Issues

- Inadequate funds for Information, Education and Communication (IEC) materials development and dissemination
- Inadequate learning and teaching resources for schools
- Inadequate personnel as well as facilitation
- Inadequate networking with key environmental players
- Inadequate Coordination of environmental awareness
- Low rates of adoption of environment friendly technologies
- Low level of public participation in environmental conservation activities
- Inadequate funding for technology development and adoption
- Utilization, documentation, dissemination of IK has been inadequate

Proposed Intervention

- Enhance resources allocation for environmental education
- Develop relevant environmental teaching aids to schools.
- Enhance co-ordination and inter-departmental consultations
- Capacity building for environmental education
- Incorporate environmental education in school curriculum development
- Build capacity on Environmental Information system at local level

- Promote documentation, utilization, integration and preservation of indigenous knowledge

CHAPTER 7

7.0 Environmental governance and institutional frameworks

7.1 Overview

Environmental governance in Kenya is through various legislations, standards and regulations together with institutions that implement them. Before the enactment of EMCA in 1999 as an overarching framework law, environmental laws were scattered in various sectors and some were conflicting to each other. Environmental Management and Coordination Act (EMCA 1999) devolve administration of a number of environmental and natural resources management issues to communities. It recognizes community rights, benefit sharing, pastoral land tenure and equitable and sustainable access to land.

Environmental Management and Coordination Act addresses land use management issues including sustainable land use, land use planning, and ecosystems protection and management. The law identifies structures that oversee the equitable distribution of benefits and devolution of decision making on natural resources. Further EMCA empowers organised communities to formulate environmental actions and/or conservation and management plans, through National Environmental Council (NEC) NEAPC, PECs and DECs.

7.2 EMCA Structures for Environmental Management

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

Some of the Lead Agencies

- Ministry of Water and Irrigation
- The Kenya Forest Service
- Water Resources Management Authority and related Companies and Boards

- Ministry of Works
- Ministry of Housing
- Ministry of Labour and Human Development
- Mines and Geology Department
- Ministry of Education, Science and Technology Development
- Ministry of Health
- Ministry of Energy
- Ministry of Agriculture
- Ministry of Local Authorities
- Kenya Wildlife Services
- Ministry of Livestock Development and Fisheries

Departments and Committees in NEMA

- Directorate General Department
- Legal Services Department
- Environmental Education, Information and Public Participation
- Compliance and Enforcement
- Finance and Administration
- Coastal, Marine and Fresh Water Environment Sub-Department
- Public Complaints Committee
- National Environment Tribunal
- District and Provincial Environment Committees

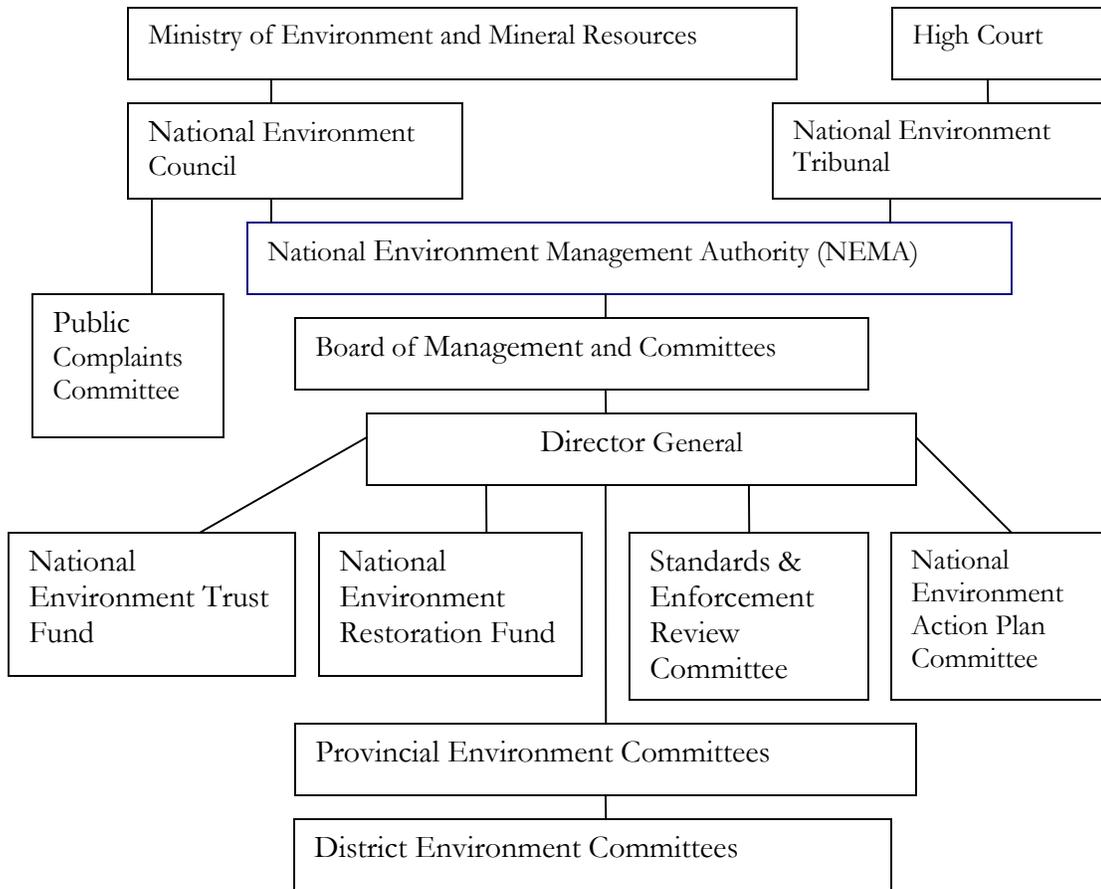


Figure 2. Institutional Framework for EMCA, 1999
 (Source: NEMA Strategic Plan, 2005-2010)

Other Players in Environmental Governance

- The media plays a major part in publicity and advocacy and examples are KBC, KTN, NTV, Citizen radio and TV
- The Private sector has been supporting NEMA in their effort to enforce EMCA in collaboration with Kenya Association of Manufacturers
- Schools and tertiary colleges have infused Environmental Education in their curriculum

- Since EMCA gives *mwananchi*, a *locus standi*, the public has been blowing the whistle on anybody defiling the environment and NEMA has always acted on such cases appropriately
- Some environmental related cases have ended in the Law Courts and prosecuted successfully
- Some cases of environmental degradation have been reported to Public Complaints Committee and investigated thoroughly and action taken

Regulatory instruments

- Environmental Management and Coordination Act, 1999
- Environmental Impact Assessment and Environmental Audit regulations, 2003
- Water Quality Regulations, 2006
- Waste Management Regulations, 2006
- Access and benefit sharing for conservation of biodiversity, 2007

Other sectoral legislations for environmental management

- Public Health Act, Forest Act, Wildlife Act, Water Act, Mining Act, Places of Work Act, Factories Act

Multilateral environmental agreements (MEAs)

Some of these MEAs have been domesticated in Kenya a number donor agencies have released funds towards environmental management through these instruments. The level of domestication of MEAs is very low. There is an urgent need for the public to be informed on the contents of these MEAs.

International agreements

- Convention on Biological Diversity (CBD)
- Cartagena Protocol on Biosafety

- United Nations Framework Convention on Climate Change (UNFCCC)
- The Vienna Convention on the Ozone Layer Protection
- The Montreal Protocol of the Vienna Convention on Ozone Layer Protection
- Kyoto Protocol to the UNFCCC
- United Nations Convention to Combat Desertification (UNCCD)
- Convention on International Trade in Endangered Species (CITES)
- Convention for the Protection of the World Cultural and Natural Heritage
- Convention on the Wetlands of International Importance especially as Waterfowl Habitats (Ramsar Convention)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- United Nations Convention on the Law of the Sea (UNCLOS)
- Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal (Basel Convention)

Regional Agreements

- Bamako Convention on the hazardous Wastes in Africa
- African Convention on the Conservation of Nature and natural Resources

Key Environmental Issues

- Non compliance with environmental regulations
- Conflicting laws and regulations
- High cost of environment impact assessment and audit experts for small projects
- Weak enforcement of environment laws
- Inadequate environment standards and regulations

Proposed interventions

- Harmonize environmental laws and policies
- Gazette more Environmental Inspectors and Prosecutors
- Create awareness on environment laws and regulations at all levels
- Enforce environment standards
- Capacity building for law enforcement officers

CHAPTER 8

8.0 Implementation strategy

The District Environment Action plan calls for the participation of all stakeholders to ensure successful implementation. NEMA will coordinate the different sectors as away of ensuring that activities proposed are undertaken systematically. It is also important that more resources are allocated in every sector to facilitate environmental conservation.

8.1 Implementation matrix

Table 8: Implementation matrix

Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION	Time Frame
Forest	IMP Illegal cutting of trees for timber building poles, wood fuel	<ul style="list-style-type: none">• Raise awareness on forest resource management• Promote the use of energy saving stoves Initiat• reforestation and afforestation programmes	KFS, KWS, NEMA, Min of Agriculture	KFS	2009 - 2013

		<ul style="list-style-type: none"> • Encourage farmers to establish wood lots 			
	Forest fires	<ul style="list-style-type: none"> • Develop forest management plans • Establish fire breaks and acquire modern fire fighting equipment 	KFS, KWS, NEMA, Min of Agriculture	KFS	
	Encroachment by squatters	Carry out boundary marking to minimize encroachment	KFS, KWS, NEMA, Min of Agriculture	KFS	
	Mangrove forest clearance	Enforcement of forest regulations	KFS, KWS, NEMA, Min of Agriculture	KFS	

Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION	Time Frame
Agriculture and Livestock	Soil erosion	Promote soil conservation measures	Min of Agriculture, NEMA, Min of Livestock,	Min of Agriculture	2009 - 2013
	overstocking	Determine sustainable stocking levels Raise awareness on pasture rangeland management	Min of Agriculture, NEMA, Min of Livestock,	Min of livestock	
Wildlife conservation	Poor Coordination between different Stakeholders involved in licensing of different products	Harmonize licensing of wildlife products to reduce conflicts	<i>KWS, NEMA, KFS, Coast Development Authority</i>	KWS	
	Pollution of the beach in marine protected areas	Enforce water quality and waste management regulations	Coast Development Authority, WRMA, KMFRI, NEMA, Kilifi County Council	KWS	
	Poaching of big	Enforce Wildlife	Coast Development	KWS	

	game	Conservation Act Increased surveillance and rigorous anti-poaching campaigns	Authority, WRMA, KMFRI, NEMA, Kilifi County Council		
	Illegal collection of turtle eggs	Identify and protect turtle breeding sites	Coast Development Authority, WRMA, KMFRI, NEMA, Kilifi County Council	KWS	
	Beach Degradation	Raise awareness on beach management	Coast Development Authority, WRMA, KMFRI, NEMA, Kilifi County Council	NEMA	

Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION	Time Frame
Wildlife conservation	Beach construction developments interfere with turtle breeding areas	Enforce EIA and EA regulation	Coast Development Authority, WRMA, KMFRI, NEMA, Kilifi County Council, KWS, KFS	NEMA	2009 - 2013
	Beach littering	Enforce waste management regulations			
	Human wildlife conflicts	Carry out problem animal control to reduce human wildlife conflicts	Coast Development Authority, WRMA, KMFRI, NEMA, Kilifi County Council, KWS, KFS	KWS	
Human settlement and infrastructure	Poor solid waste management	Enforce waste management regulation	NEMA, Local Authority, Mini of lands, Physical planning Dept, Min of Housing	NEMA	
	Unplanned urban development	Develop local physical plans	NEMA, Local Authority, Mini of	Physical planning and local Authority	

			lands, Physical planning Dept, Min of Housing		
	Poor sewage disposal	Develop an efficient sewerage system	NEMA, Local Authority, Mini of lands, Physical planning Dept, Min of Housing, water service Boards, Ministry of water band irrigation	Local Authority	
	Prevalence of informal settlements	Conduct rigorous development control	NEMA, Local Authority, Mini of lands, Physical planning Dept, Min of Housing, water service Boards, Ministry of water band irrigation	Local Authority	

Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION	Time Frame
Human settlement	Poor handling of radioactive waste	Investigate the presence of radioactive waste	NEMA, Local Authority, Mini of lands, Physical planning Dept, Min of Housing, water service Boards, Ministry of water band irrigation	NEMA	2009-2013
	Poor disposal of hospital waste	Enforce waste management regulations	NEMA, Local Authority, Mini of lands, Physical planning Dept, Min of Housing, water service Boards, Ministry of water band irrigation	NEMA	
	Poor disposal of human waste (No sewerage system)	Create awareness on proper human waste disposal	NEMA, Local Authority, Mini of lands, Physical planning Dept, Min of Housing, water service	NEMA	

			Boards, Ministry of water band irrigation		
	Over dependence of wood fuel as a source of energy	Promote alternative sources of energy such as biogas, LPG Gas and electricity	KFS, KWS, NEMA, Min of Agriculture, Min of Energy, Min of Housing	Min of Energy	
Trade industry and services	Poor management of packaging materials	Create awareness particularly impacts of polythene bags and its management	Min of trade, min of industrialization, local Authority, Ministry of Tourism, Min of planning and vision 2030	NEMA, Local Authority	
Tourism	Development of tourist hotels within the 30M water mark	Enforce physical planning Act. (Development control)	Min of trade, min of industrialization, local Authority, Ministry of Tourism, Min of planning and vision 2030	Local Authority	

Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION	Time Frame
Tourism	Excessive collection of corals as souvenirs	Discourage collection of coral as souvenirs	Min of trade, min of industrialization, local Authority, Ministry of Tourism, Min of planning and vision 2030	KWS	2009-2013
	Damage to corals by divers	Discourage beach driving	Min of trade, min of industrialization, local Authority, Ministry of Tourism, Min of planning and vision 2030	KWS	
	During low tourist seasons swimming pools act as breeding areas for mosquitoes	Continue to treat swimming pool water or keep them empty during low tourist season to discourage the breeding of mosquitoes	Min of trade, min of industrialization, local Authority, Ministry of Tourism, Min of planning and vision 2030	Public Health	

	Solid waste from tourist facilities	Enforce waste management regulations	Min of trade, min of industrialization, local Authority, Ministry of Tourism, Min of planning and vision 2030	NEMA	
Mining and quarrying	Abandoned Quarries	Identify map and rehabilitate abandoned quarries	Dept of Mining and Geology, NEMA, Local Authority, Ministry of trade	NEMA	
	Deforestation due to vegetation clearance for mining and quarrying	-Promote afforestation -Enforce EIA/EA regulation	KFS, NEMA, CDA, NMK, Dept of Mining and quarrying, Local Authority, public Health, Min of planning	NEMA	

Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION	Time Frame
Mining and quarrying	Noise associated with quarrying	Enforce Noise and excessive vibration regulation	NEMA, Public Health, Min of public works	NEMA	2009-2013
Hazards and Disasters	Disease outbreaks	-Advocacy on behaviour change to curb HIV/AIDS -Support to the affected and infected by HIV/AIDS -Enhance vaccination	Min of Special programmes, Min of Health,	Min of Health	
	Drying of water sources due to frequent drought	Promote rain water harvesting	MET Department, WRMA, NEMA,	Water Service Board	
	Inadequate early warning systems and response mechanisms	Develop prediction, monitoring and early warning systems	MET Department, WRMA, NEMA,	MET	

	Loss of livelihoods	Diversify income generating activities	MET Department, WRMA, NEMA, Min of Agriculture	Ministry Special Programmes	
	Inadequate capacity in disaster preparedness and response	Build capacity for early warning and response mechanisms	MET Department, WRMA, NEMA,	MET	
	Inadequate capacity to deal with oil spills	Build capacity on oil spill response	MET Department, WRMA, NEMA, Kenya Maritime Authority	Kenya Maritime Authority	

Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION	Time Frame
Environmental education and Technology	Inadequate funds for Information, Education and Communication (IEC) materials development and dissemination	Enhance resources allocation for environmental education	Ministry of Education, NEMA, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of planning,	NEMA	2009-2013
	Inadequate learning and teaching resources for schools	Develop relevant environmental teaching aids to schools.	Ministry of Education, NEMA, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of planning,	NEMA, Min of Education	
	Inadequate	Capacity building for	Ministry of Education,	NEMA, Min of	

	personnel as well as facilitation	environmental education	NEMA, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of planning,	Education	
	Inadequate networking with key environmental players	Enhance co-ordination and inter-departmental consultations	Ministry of Education, NEMA, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of planning,	NEMA	

Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION	Time Frame
Environmental education	<ul style="list-style-type: none"> Inadequate Coordination of environmental awareness Low rates of adoption of environment friendly technologies 	Create awareness on environmental friendly technologies	Ministry of Education, NEMA, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of planning,	NEMA	2009-2013
	Low level of public participation in environmental conservation activities	Promote public participation in environmental conservation	Ministry of Education, NEMA, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of	NEMA	

			Agriculture, Min of planning,		
	Inadequate funding for technology development and adoption	Build capacity on Environmental Information system at local level	Ministry of Education, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of planning,	NEMA	
	Utilization, documentation, dissemination of IK has been inadequate	Promote documentation, utilization, integration and preservation of indigenous knowledge	Ministry of Education, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of planning,	NMK	

Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION	Time Frame
Environmental Governance	Noncompliance with environmental regulations	<ul style="list-style-type: none"> • Gazette more Environmental Inspectors • Create awareness on environment laws and regulations at all levels and Prosecutors 	Ministry of Education, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of planning,	NEMA	2009-2013
	Conflicting laws and regulations	Harmonize environmental laws and policies	Ministry of Education, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of	NEMA	

			planning, Local Authority		
	Weak enforcement of environment laws	Capacity building for law enforcement officers	Ministry of Education, Mines and Geological Department, KFS, KWS, NMK, CDA, Provincial Administration, Min of Agriculture, Min of planning, Local Authority	NEMA	
	Inadequate environment standards and regulations	Enforce environment standards	Min of Education, Mines and Geology, KFS, KWS, NMK, CDA, Prov. Adm, Min of Agriculture, Min of planning, Local Authority	NEMA	

REFERENCES

Burges, D. and Clerke, G. (2002), *Coastal Forest of Eastern Africa*

Earth View Limited (2004) Kaloleni Cement and Lime Works.

EIA Report (2006) For the Proposed Health care EPZ Ltd.

ETA Report (March 2005) for

the Proposed Pickling Factory for Corrugated Sheet

Limited

Nyawira, N. and Waweru, S. (2005), *Community Guide to Environmental*

Management

National Environment Management Authority Action Plan (April 2001-2005)