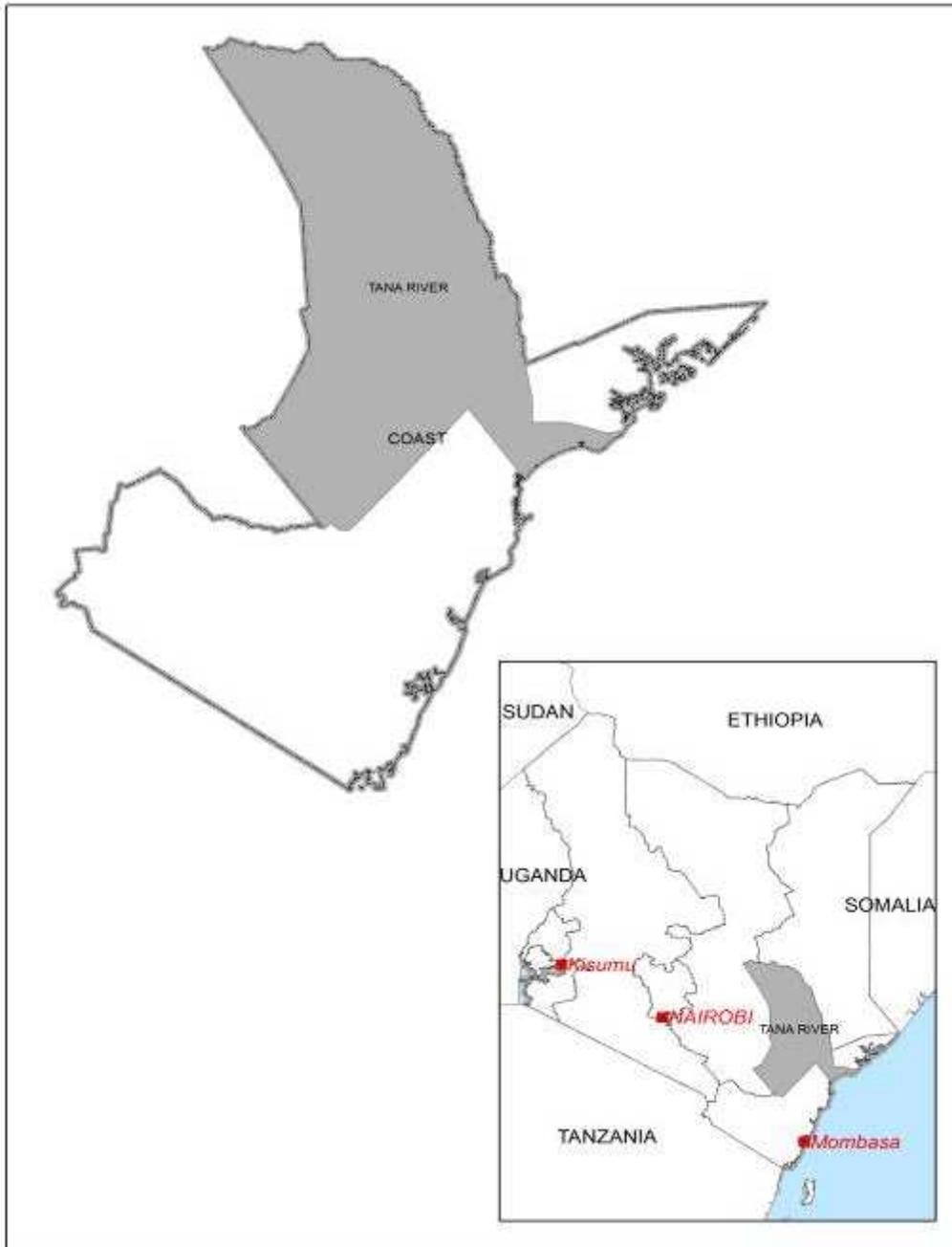




REPUBLIC OF KENYA
MINISTRY OF ENVIRONMENT AND MINERAL RESOURCES
NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY

TANA RIVER DISTRICT



TANA RIVER DISTRICT
TANA RIVER DISTRICT
ENVIRONMENT ACTION PLAN
2009-2013

ACRONYMS

UNCED	United Nations Conference on Environment and Development
NEAP	National Environment Action Plan
EMCA	Environmental Management and Coordination Act
ASAL	Arid and Semi arid Lands
GOK	Government of Kenya
NGO	Non-Governmental Organization
EIA	Environmental Impact Assessment
KWS	Kenya Wildlife Services
NEMA	National Environment Management Authority
ELSI	Environment Liaison Center International
TRPNR	Tana River Primate National Reserve
TRCC	Tana River County Council
EA	Environmental Audit
DEO	District Environment Officer
NEC	National Environment Council
KESSP	Kenya Education Sector Support Program
SEA	Strategic Environment Assessment
ILEG	Institute for Law and Environmental Governance
MOPND	Ministry of Planning and National Development
DLPO	District Livestock Production Officer
DPO	District Planning Office
KPLC	Kenya Power and Lighting Company
TARDA	Tana and Athi River Development Authority
MEA,s	Multilateral Environmental Agreements
CITES	Convention on International Trade in Endangered Species of Flora and fauna
DEAP	District Environment Action Plan
MOA	Ministry of Agriculture
WRMA	Water Resources Management Authority
CBO,s	Community Based Organizations
FUA	Forest User Association
FD	Forest Department
OOP	Office of the President
WUA	Water User Association

KENGEN	Kenya Electricity Generating Company
MOE	Ministry of Energy
NWC&PC	National Water Conservation and Pipeline Cooperation
MOLFD	Ministry of Livestock and Fisheries Development
KEFRI	Kenya Forestry Research Institute
ICRAF	International Center for Research in Agro forestry
ALRMPII	Arid Lands Resource Management Project II
MOT&W	Ministry of Tourism and Wildlife
LATF	Local Authority Transfer Fund
SACCO	Savings and Credit Cooperative Society
KWFT F	Kenya Women Finance Trust Fund
CDTF	Community Development Trust Fund
MOT &I	Ministry of Trade and Industry
EMP	Environmental Management Plan
CWSB	Coast Water Services Board
MOL&S	Ministry of Lands and Settlement
KTB	Kenya Tourism Board
PRSP	Poverty Reduction Strategy Paper
CBS	Central Bureau of Statistics
ERSWEC	Economic Recovery Strategy for Wealth and Employment Creation
DLASO	District Lands And Settlement Office
CRS	Catholic Relief Services
BISP	Bura Irrigation and Settlement Project
DRSS	Department of Remote Sensing and Resource Surveys
CDF	Constituency Development Funds

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, the Act provides for the formulation of National, Provincial and District Environment Action Plans every five years.

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

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

I wish to underscore the importance of this document as a broad-based strategy that will enable the District attain sustainable development as envisaged in the Vision 2030.

Dr. Ayub Macharia

DIRECTOR GENERAL (Ag.)

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

ACKNOWLEDGEMENT

On behalf of the National Environment Management Authority (NEMA), I would like to thank the Tana River 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 (Coast) and the District Environment Officer (Tana River).

Last but not least, I extend my gratitude to all those who contributed towards the finalization of this District Environmental Action Plan for Tana River District. Implementation of the activities identified in this document will see the district attain sustainable development.

Last but not least, we extend our 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
AND RESEARCH CO-ORDINATION**

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The United Nations 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 development commonly called Agenda 21. Kenya domesticated Agenda 21 through formulation of the first National Environment Action Plan in 1994. NEAP 94 proposed a new institution to coordinate, enable, and where necessary, enforce environmental policy, legislation and activities i.e. through the enactment of a framework environmental law. This law (EMCA) was enacted in 1999 and led to the creation of NEMA.

1.1.2 Challenges of Sustainable Development

Communal land ownership. It is difficult to enforce environmental conservation measures on land that is community owned, as ownership is pivotal in maintaining set activities.

- Vegetation destruction in both gazetted and ungazetted forests
- River sand harvesting
- Land degradation through Gypsum mining
- Poor disposal of solid waste
- Disaster floods
- Emergence of alien invasive species e.g. *Prosopis juliflora*
- Uncontrolled commercial fishing and trawler usage
- River diversion/Brook construction on river Tana.

1.1.3 Provisions of EMCA on Environmental Planning

EMCA provides for environmental action planning at the National, Provincial and District Levels. Under EMCA part IV section 40, 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.

1.1.4 Objectives of District Environment Action Plan

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

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

1.1.5 Linkages with Other Processes

According to the PRSP (2001-2004) approximately 80% of Kenyans population earns its livelihood from land and natural resource based production systems. Conservation, sustainable utilization and management of the environment and natural resources, especially land, water and forests, therefore for integral part of national planning and poverty reduction efforts. In the District, Development of ASAL areas to mitigate the effects of recurrent drought is an issue in environmental management; as well, the development of tourism should be enhanced.

1.2 District Profile

1.2.1 Geographical Location, Size and Administrative Units

Tana River is one of the Districts that constitute the Coast province (Figure 1). Its location is between the coordinates 0°N 03S and longitudes 38° 30 East and 40° 15 west. The District has an area of 38, 466.3km² divided into seven administrative divisions namely: Bangal(6125km²), Madogo (1836.40km²), Bura (4834.20km²), Galole (9100km²), Wenje (556.9km²), Garsen (12122km²) and Kipini (841.9km²) with the rest covered by Tsavo East National park(3 049km²) There is only a single local authority in the District i.e. Tana River County Council.

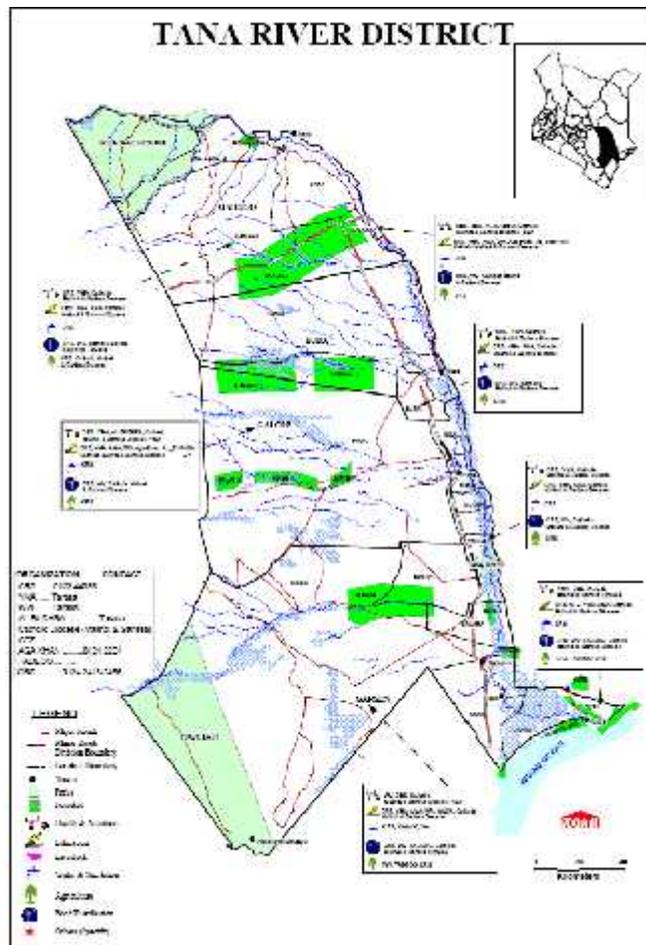


Figure 1: Map of Tana River district

1.2.2 Climate and Physical Features

Rainfall pattern is bimodal and its reliability decreases Northwards and Westwards from coastal strip averaging 800-1000mm per year south and 300-400mm per year north. Over 96% of the District is ASAL with temperatures ranging between 19 and 39°C. Major soils are black cotton soils with clay loam and alluvial deposits, sand soils are found on narrow ridges where they support dense bush formation. The major physical feature is an undulating plain which is interrupted in a few places by low hills, the main ones being Minjila in Garsen Division, Bilbil in Bura and Madogo Divisions which are the highest points in the District. The land generally slopes south-eastwards with an altitude ranging between 0 m along the Coastline to 200 m above sea level on the hills

The River Tana traverses the District from Tharaka District in the North to the Indian Ocean to the south. As the River traverses the expansive coastal hinterland, it meanders in its lower course forming a large basin whose width ranges between two and forty two kilometers. Towards its mouth

between Mnazini area and the Indian Ocean, the river creates an extensive delta, which is characterized by wetlands. There also exist seasonal rivers in the District found in the area west of river Tana in the North-eastern part of the District; popularly known as Laghas. These rivers flow in an East-west direction from Kitui, Makueni and Mwingi Districts eventually draining to River Tana.

The District has a coastline characterized by sandy beaches. Rainfall is low, bimodal, erratic and conventional. Long rains occur in April and May and the short rains fall in October and November. November is the wettest month with the little erratic rainfall especially in the hinterland, the District experiences drought almost every year. The coastline is therefore wetter than the hinterland. Higher rainfall at the coast supports crop production especially around Kipini where cash crops like Cashew nuts, cotton, mangoes and food crops like bananas and maize are grown.

The dry climate in the hinterland can only support nomadic pastoralism. Currently, Tana River District is hot and dry. The average annual temperature is about 30°C. Along the coast, temperatures are hot and humid. Temperatures are highest in February, March and April (before the long rains) and are significantly high in September and October. These high temperatures lead to very high rates of evaporation and evapotranspiration.

On the higher areas there are reddish brown soils while in low-lying areas; rich clays and silt are found. Alluvium deposits including gravel, sand, silt and clay cover the Tana River basin. Low to moderately fertile soils are found in the hinterland.

The District is a typical arid zone found in Agro ecological Zones

- CL3: Coconut/Cassava Zone (Non ASAL)
- CL4: Cashew nuts/Cassava Zone (Transitional)
- CL5: Lowland Livestock/Millet Zone
- CL6: Lowland Ranching Zone (Arid)

1.2.3 Population Size and Distribution

The district is one of the least populated in the country with its population mostly concentrated along the river Tana and small urban centres. The total population is expected to grow by 13% every 5 years. The District has 217219 persons where 111456 are female and 105763 are male.

Table 1: Population of the District by Division

Division	Female	Total	Male
Bangale	8875	8945	16839
Isura	17802	17820	34641
Madogo	13212	76ub	12872
Gable	22095	41994	9899
Wenje	8146	15251	7105
Garsen	31604	6 1939	30335
Kipini	9722	19490	9768

Source: CBS, HOLA

As per 1979-1989 and 89-99 census, death in the under 5 years increased from 140 per 1000 children 147 while infant mortality rate went up from 83.0 to 91.3 children at birth per 1000 birth respectively. Also the data points at more female children dying than their counter parts male. The percentage net migrants in the District stand at 2.1 for the males and 2.3 for females.

Factors influencing population distribution include:

- Nearness to the River Tana
- Insecurity
- Nearness to urban centers
- Availability of infrastructure

1.2.4 Social, Cultural and Economic Characteristics

Livelihood is derived from subsistence farming, pastoralism, fishing and to a small extent business. Nomadic pastoralists occupy the hinterland areas of the district. The area is characterized by rangeland is ideal for pastoral activities.

Most pastoralists overstock leading to soil erosion and vegetation degradation; especially around waterpoints. Agro-pastoralists are found in most parts along the River Tana and mostly in the southern parts where communities practice both agriculture and pastoralism. The Somali' Wardey and Orma are pastoralists while Pokomo are agriculturists. The Malakote pursue mixed economies.

Fishing is done in the Oxbow lakes and in the Indian Ocean. Pokomos and Baum's are the two involve tribes. There are incidences of use of nets of low mesh sizes as well as use of poison-which ends up killing of immature fish (finally disposed of as by catch) and indiscriminate decimation of fingerlings. The two major religions in the District are Islam and Christianity with most of the Cushites being Muslims while Pokomos are in both.

For pastoralists, there is division of lab for our specific roles and functions for males and females. Men do mainly the herding and guarding of livestock as well as the selling and marketing. Women do the milking and selling of milk and ghee. Movement of livestock for search of pasture and water is the role of men. Charcoal burning is another informal widespread income generating activity where all the tribes a involved. The practice has led to total de-vegetation leading to desertification.

The poverty index of the District stands at approximately 72% (CBS, Hola) on average, total monthly consumption expenditure per person in 1997 was estimated at about Ksh. 1846.00 in rural areas (GOK 2000)

CHAPTER TWO

2.0 ENVIRONMENT AND NATURAL RESOURCES

2.1 Soils and Land Use

2.1.1 Soils

The major soils in the District are the black cotton soils with clay loam and alluvial deposits. Sandy soils are found on narrow ridges where they support dense bush formation. Current uses of the soils include-Agriculture, settlement, wildlife conservation, etc.

Key environmental issues include

- Riverbank erosion
- Sheet erosion in the rangelands (hinterland)
- Degradation through overstocking by pastoralists

Proposed interventions

- Construction of gabions where river bank erosion is severe e.g. near Garsen town
- Reseeding and re-forestation to avoid/discourage erosion by wind
- Encourage destocking by pastoralists to maintain manageable herd sizes
- Law enforcement (Agriculture Act, EMCA 99)

2.1.2 Land and Land Use Changes

The land alongside the river Tana has been put to agriculture. The hinterland is mostly rangeland and is on pastoralism. Game parks and game reserves cover a big portion of the district land i.e. the Tsavo East national park, Kora National park and the Tana River Primate National reserve (TRPNR). Unresponsive land adjudication and regimes have bred conflicts in the district. Ostensibly to promote productive land use, the government implemented a controversial land adjudication program in the district. Land was subdivided and allocated to individuals (mainly settled farmers) as private property. However it became apparent that this process did not go down well with the pastoralists since they thought it would limit their movement and thus why they opposed and continue to oppose the policy. Currently, land adjudication is going on in Ngao, Oda, and Tarasaa of Garsen Division (DLASO)

Trends in land use

Land that used to serve as grazing land and livestock marketing yard is now a gazetted as a national reserve. Large-scale agriculture is quickly replacing small-scale agriculture and pastoralism in the Tana delta with introduction of large-scale rice farming and the proposed sugar cane farming

project. Impacts of land use changes include conflicts between different resource users. E.g. diversion of river water for farming, construction of large dykes with a resultant effect of blocking flood waters (Most small scale farmers depend on flood waters)

Regulatory and institutional arrangements governing land administration

currently, most of the land is trust land. The community regards most of the hinterland as communally owned land. Though most of the land is not yet adjudicated, parcels of land adjacent to the river is owned by the Pokomos (Ancestral land)

Key environmental issues on land and land use

- Land degradation is very common in the hinterland especially around watering points
- The land tenure system is a deterrent to conservation efforts i.e. there is lack of land ownership
- Land registration and issuance of Title deeds
- Educate community on importance of land registration

Dry Lands

Land classification according to ecological zones

The District is found in ecological zones III to VI, as it's a typical arid zone. The area under agricultural production is smaller compared to that under livestock. Settlements are mainly along the river. Major causes of land degradation are overgrazing-which mostly takes place in the hinterland and especially around watering points. Deforestation is mostly common along the riverine vegetation where trees are cut down for fodder. In the hinterland, the practice of charcoal making is common as charcoal is locally exported to Malindi, Garissa and Mombassa Districts. Drought also causes vegetation to die away enmass as the soil becomes dry and bare and cannot support life.

Key environmental issues

- Overgrazing
- Deforestation
- Drought

Proposed interventions

- Decongest the delta by opening up the hinterland
- Enhancing forest conservation activities
- Discouraging outdated cultures//Train the community on the importance of reducing herd sizes in order to maintain manageable numbers.
- Commercialization and thus proper utilization of other range resources e.g. resin and gum
- Construction of dams
- Sink more boreholes
- Utilization of lagha water
- Capacity building for destocking and restocking, alternative livelihood

- Establishing of grazing blocks/ranches
- Enhance traditional drought monitoring skills

2.2 Agriculture

Agriculture is solely rural with no urban and pen-urban agriculture in practice.

Key environmental issues

- Cultivation along river bank
- Salinity in the delta paddy
- River diversions/brook formation

Proposed interventions

- Maintenance of river banks
- Improve and enhance extension services
- Proper management of Dams upstream
- Proper EIA before any project
- Decongest the delta and river system by opening up the hinterland

2.3 Livestock

Table 2: Types and Status of Livestock Production

Type	Extent(ha)	% of total District area	location	Livestock products	Current Production level	Potential Production level	challenges	Proposed intervention
Pastoralism (communal Grazing)	16,200km	60%	Whole district	meat	368,000 cattle	750000 cattle	Extended drought	Sink, boreholes
ranching	2000km	9%	Bangale Galole and Garsen division	milk, hides and skins ghee	260000 goats	600000 goats	Rainfall failures	Fodder conservation
Grazing blocks	3000km	10%	Bura, Madogo divisions		58,000 camels	120,000 camels	Influx of Livestock From Garissa And ijara	Controlled Livestock movement

Type	Extent(ha)	% of total District area	location	Livestock products	Current Production level	Potential Production level	challenges	Proposed intervention
nomadism	1500km	5%	Whole district		230,000 sheep	500,000 sheep	Livestock Predation And diseases Farmers/ Pastoralists conflicts	Diseases Surveillance Peace and Security Committees established
Emerging livestock	1500km	5%	Whole district					

Source: DPLO, Tana River

Pollution and wastes in Livestock production

Types of pollutants and wastes

- Acaricides from dips
- Wastes from slaughter slabs
- Animal carcasses
- Invasive species (Prosopisjuhf7ora)

Status and Trends

Low status and trends increasing especially on livestock deaths due to extended drought

Impacts of pollutants and Wastes

- Livestock deaths due to toxicity
- Reduce quality and quantity of pastures

Key environmental issues

- Alien species like Prosopisju1flora
- Persistent drought
- Influx of animal and livestock movement
- Overgrazing in Tana delta
- Human conflicts
- Wastes from slaughter slabs
- Trampling, overgrazing and lack of sanitation facilities in livestock markets/holding grounds
- Livestock/wildlife conflicts at watering points along malkas
- Soil erosion at livestock watering points along malkas.

Proposed intervention

- Capacity build officers in charge (Proponents and public health)
- Ensure ETA is done by proponents
- Environmental education to pastoralists

- Proper treatment of wastes from cattle dips
- Stabilization of malkas
- Fodder conservation activities (Hay making)
- Reseeding in grazing units

2.4 Fisheries Resources

Fisheries production systems include Hook and line, long line, Gill netting and Trawling. Inshore fishery output has generally been on the decline, with increase resource user conflicts and degradation of fishing ecosystems due to considerable sediment input from the Tana River system.

Key environmental issues

- Commercial trawlers catching of non-target fish and then discarding the by catch
- Drying up of ox-bow lakes through inadequate or lack of flooding to replenish ox-bow lakes.
- Decrease of water volume in the river
- Poor attitudes towards investing in aquaculture plus lack of investment capital
- Limited departmental facilitation in terms of working tools and funding. This is with regard to water and land transport.
- Adverse economic activities in the river catchments (Hydroelectric), deforestation and poor farming activities
- Lack of modern preservation facilities. With lack of electricity, most fresh water fish is either smoked or sun dried. This reduces the value and therefore prices of the fish.
- Illegal fishing
- Destruction of fish breeding zones

Interventions

- o Improve vigilance in the sea by fisheries department
- o Insist on trawler owners compensating the artisan fishermen when nets are destroyed
- o Develop modern fish landing facilities and cold room facilities
- o Fisheries department to enforce law on usage of recommended mesh size of nets
- o Ensure unlicensed trawlers don't operate in Kenyan waters

Regulatory and Institutional arrangements

The Fisheries Act, The Wildlife Conservation and Management Act cap 376, EMCA 99, Forest Act are instrumental in the regulation of the fisheries resources either directly or indirectly. Institutions involved in conservation of fisheries resources include the Fisheries department, KWS, KEMFRI and NEMA.

Status and Trends of Fisheries Development

The use of inappropriate fishing methods and equipment poses a great threat to the fisheries resource the use of trawlers has resulted to destruction of young fish which never grows to reproduce, has claimed lives of other marine animals like-sea turtles, who come to the beach to lay their eggs. Beach seine nets are dragged in the water to catch fish, which results in damage to fish breeding and spawning areas. They also destroy coral reefs and sea grass areas; damage the fish traps of other fishermen by either breaking or overturning them.

2.5 Water Resources

Key water resources include ground water reserves, shallow wells, boreholes, rainwater, the River Tana, Lake Shakababu and the vast Tana delta wetland. The river regimes have changed over time as the volume of water flowing has reduced. This is evident as floods are not as frequent as before. The main water uses are-domestic and agricultural.

Key environmental issues in management and utilization of water resources

- Water borne diseases
- Sparse distribution of water and watering points/Perpetual shortage of water for both humans and livestock
- Water user conflicts (farmers/pastoralists)

Proposed interventions

- Dam construction
- Sinking of boreholes
- Utilization of lagha water
- Community capacity building

Key sources of Water include the following:

- Springs - In the district, no well defined springs.
- Shallow wells there are slightly over 350 shallow wells mostly serving population along the river line.
- Boreholes - Ground water surveys have not been carried out exhaustively but few boreholes which were sunk had saline water (e.g. by Catholic Diocese of Garissa), Lagha Tula, Oda etc.
- Rainwater The district receives inadequate rain however some institutions have rain harvesting tanks e.g. plastic tanks and ferrocement tanks.
- Rivers the district has one permanent source of water (River Tana) and other seasonal rivers (Laghas e.g. Kokani, Tula, Hirimani, Kamole etc.
- Lakes we have no permanent lake a part from Lake Shakababu which depends on flooding of river Tana.

- Pans/dams/sand dams — there are several pans in the hinterland which serves pastoralists and 2 sand dams along Lagha Gable.
- Wetlands — the only wetland is Tana Delta

Status and trends of water resources

The status of water resources depends on rains both in the district and up country. Water pans dry up during prolonged dry season while ground water levels drop thus affecting many people in the district. Due to the seven forks constructed in river Tana, the level drops and major irrigation schemes like BISP becomes unable to pump water to the farms.

Regulatory and management arrangements

As per the Water Act 2002 there are two bodies in the district namely:

- a) Water regulatory Board.
- b) Water Resources Management Authority.

Main water uses

Domestic - Supply from Hola Water supply, supply (District Headquarters), Ngao Water supply, Garsen Water supply, in addition to shallow wells.

Industrial use: - In Tana River there is no power from the national grid systems and no industry that might use water.

Agriculture: There are 3 Major irrigation schemes i.e. Bura irrigation and settlement scheme, Hola Irrigation Scheme and Tana Delta Irrigation Scheme however, Hola Irrigation Scheme has been dormant since 1990 and the other two are not operating fully.

Livestock: The district being semi-arid, livestock keeping is practiced and uses water pans constructed in the hinterland supplemented by water holes and river Tana.

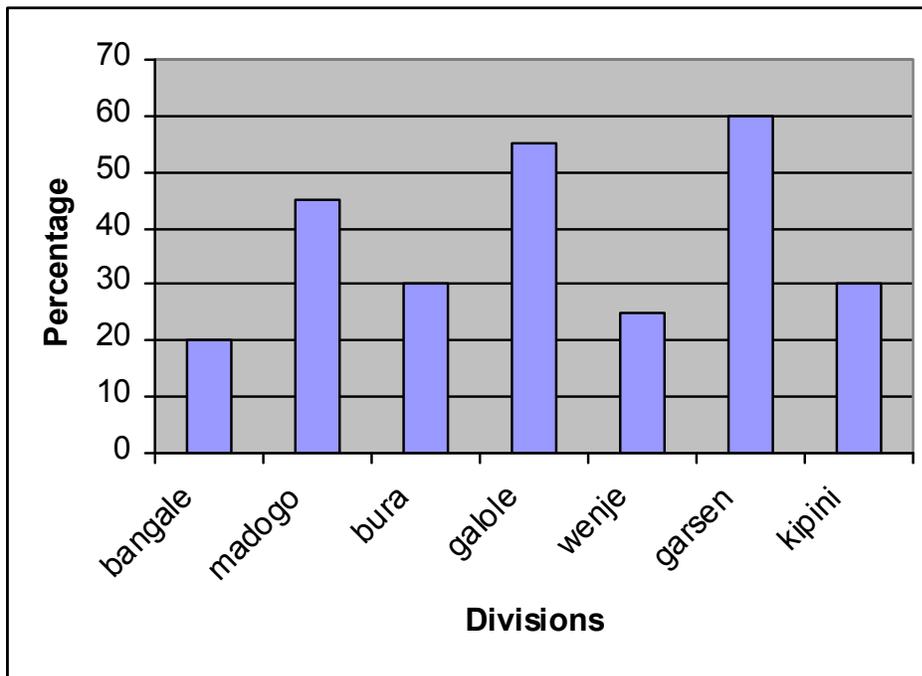


Figure 2: Percentage of population accessible to Safe drinking water

Impacts of water use and demand on the environment and natural resources

The district is neighboring North Eastern Province which has a high percentage of population who are livestock keepers, for the past 5 years pasture has been reducing due to insufficient rains thus a half of the livestock has moved to the district and had the following adverse affects:

- 90% of the pans have dried up.
- Soil erosion near the pans due to high concentration of animals.
- Population of water in the pans due to high concentration of both humans and livestock.

Key environmental issues

- Protection of water catchments.
- Enforcement of the Water Act 2002
- Enforcement of Water Quality Regulations (EMCA)

Table 3: Key Priority Issues and Interventions in the Water Sector

No	Prioritised Issue/ Challenges	Current Invention	Proposed Intervention In the plan period 2006-2010	Responsible Institution	Remarks
1.	Human conflicts on Water sources(pastoralist And farmers)	-peace meetings -provision of malkas -construction of water Conservation structures In the hinterland	-peace meeting -additional malkas -provision of more pans And boreholes in the Hinterland	Various NGOS,CBO, Office of the president, Religious organizations -physical planning office Of the president -water dept,NGOs ALRMPII	-Funds are Required Estimated at 500,000/=
2	Human and wildlife conflict	None	Control of wildlife	KWS	-funds required In tune of ksh 60 million

3..	salinity	none	Proper geophysical surveys To be done -provision of salinity -removal equipments	Water department NGOs	Funds required In tune of kshs.20 M
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Table 4: Sources and Status of Water Resources

Source	Status quantity/ quality		Usage	Management system	Challenges/ threats	Proposed interventions
River	Sufficient	Turbid	Drinking irrigation livestock washing	Inadequate	Human and animal conflicts. Livestock keepers and farmers conflicts	-Provision of drinking corridors for animals.
Pans	Insufficient	Poor highly polluted by animals	Drinking livestock washing	Poor	Human wildlife conflicts insufficient rains to fill in.	-Control of wildlife in Game Parks -Training of water committees.
Sand Dams	Insufficient	Good	Drinking livestock washing	Not in place	-Contamination -Lack of underflow due to inadequate raining	-Formation and Training of water committees on water and sanitation.
Boreholes and wells	Insufficient	Mostly Saline	Drinking Washing	In place	-Inadequate recharge -Salinity Contamination	Training committees in water and sanitation.

2.6 Forestry

Types of forests include:

- River line
- Woodland! Savanna-covering the whole of the hinterland
- Mangrove
- Terrestrial species along the coast (coastal)

Key environmental issues

- De-vegetation for fodder and charcoal
- Logging for timber
- Clearing for farming
- Presence of roaming livestock and wild life

Proposed interventions

- Reforestation
- Capacity building on sustainable forest management
- Enforcing laws and policies e.g. forest Act, EMCA 99, Water Act 2002 etc

2.7 Wildlife

- *Types of wildlife include:* Terrestrial animals-Elephants, Buffalos, Giraffes, Gazelles, Warthogs, Bushbuck, Dikdik
- *Primates:* Columbus monkeys, Baboons, Vervets, Sykes
- *Reptiles:* Aquatic animals-Crocodiles, Hippos, Turtles, Catfish, Tilapia, Frogs. *Marine life forms-* Dugongs, sea turtles, fish.
- *Birds and insects (Terrestrial)-*Quails, Ostrich, Guinea fowls, Marabou stokes, Eagles, Herons, Bustards, Secretary Birds, Doves, Kites, Vultures etc.

Key environmental issues

- Human wildlife conflicts
- Subsistence poaching
- Poor fishing methods
- Habitat deterioration

Proposed interventions

- Promote eco-tourism
- Problem animal control
- Enhance conflict resolution
- Capacity building for community on ways of co existence with wildlife
- Enhance benefits sharing

2.8 Biodiversity Conservation

2.8.1 Biodiversity Data and Information

Environmentally significant areas in the District include the Tana delta wetlands and the sand dunes bordering the ocean. The wetland is the largest of its own kind in Kenya with an area of approximately 1600km². Rare species endemic to the area include the mangabey and the Tana River red Columbus monkeys. Sea-turtles are known to breed (lay their eggs) within Kipini beaches in the district. Utilization is mainly non-consumptive in the parks and reserves -focusing on ecotourism with beneficiaries including the TRCC, KWS and community.

Within the ungazetted areas, there is marked subsistence poaching for wildlife. Institutions that have been involved are mainly KWS and the Forest Department in terms of management and TRCC when it comes to revenue collection. Forests: Tana River District, the forests are inhabited by some rare and endemic species of monkeys (the mangabey and the Red Columbus monkeys). These are forest dependent and are considered threatened. Degradation of these forests and woodlands will therefore lead to disappearance of these species. In addition to their role as a major source of biodiversity, forests and woodlands are important water catchments areas for the Tana river and have environmental and social economic benefits especially to the rural communities e.g. Mkindu (Doum Palm) utilized for mat making in the upper delta and the *Terminalia spinosa* for boat building in Kipini by fishermen.

Mammals:

The district is blessed with mammal species richness and endemism including dikdik, waterbuck, giraffe, Hippos, buffalos, the elephants in Tsavo National Park and the Tana delta ecosystems. The district has about 3049km² of it covered by Tsavo East National Park.

Amphibians:

Conservation and sustainable utilization of amphibians contributes to promotion of tourism in Kenya. The River Tana is infested with crocodiles and this is a great potential as an attraction sites. Besides tourism some of these amphibians e.g. the crocodile has cultural values to the local community. The coastal communities use sea turtle eggs and meat as a source of protein and medicine.

Agricultural Biodiversity:

Tana River District is rich in Agricultural biodiversity that includes both indigenous and exotic plant and animal species. These species are important as sources of food, medicine, animal forage, oil production, fibre and hides among others. Indigenous plant species that are important in the district include, Bananas, maize, millet, cassava, sorghum, sweet potatoes, mangoes, cowpeas and vegetables grown along the riverine zone. Wild fruits and vegetables include water lilies.

Indigenous animal livestock species include - Cattle, Goat, Camels, Donkeys, Chicken, Turkeys, Rabbits, Geese, domesticated guinea fowls etc. Most of these indigenous are being reduced due to preference for exotic species and cross breeding.

Key Environmental Issues

- Habitat loss / and modification of habitats.
- Introduced species/invasive species (both deliberate and accidental)
- Over-harvesting e.g. of medicinal plants and hunting of wild life.
- Pollution — a special case of habitat destruction, chemical destruction rather than physical e.g. turbid waters of river Tana as a result for catchments erosion.
- Habitat degradation
- Human encroachment
- Non compliance to government policy

Proposed Interventions

- Law enforcement (Forest Act, EMCA 99)
- Re-a forestation and promotion of conservation enterprises.
- Capacity building of community
- Promote eco-tourism
- Community involvement in decision making (Planning up to implementation phase)

Table 5: Type, Status and Impact of Invasive Species

Name of invasive species	Ecosystem affected	Size of area affected	Environmental impact	Proposed interventions
Prosopis juliflora (<i>Mathenge</i>)	-Rangeland -Riverine ecosystem -Human settlements	Whole district with Wenje and Bura worst affected	-Reduced grazing/farmland -Inhibits movement -Improvement of vegetation cover -Reduced soil erosion -Inhibits growth of other plants -Water loss through evapotranspiration	-Making charcoal from the <i>prosopis</i> biomass -Investigate potential for fodder production -Seek alternative management through research

Source: NEMA 2004.Hola

CHAPTER THREE

3.0 HUMAN SETTLEMENT AND INFRASTRUCTURE

3.1 Human Settlement and Planning

Most of the land in the district is Trust land mostly communally owned. Land use types include: Human settlements, Agriculture, Pastoralism, Mining, Ranching and National Parks. Rural housing types are grass thatched and manyattas- mostly temporary. Urban housing types include semi permanent and permanent buildings made of blocks, iron sheets, tiles etc. Surface and ground water is available for riverine community but scarce as you move towards the hinterland. Due to inputs of both the ministry and NGO,s accessibility has improved at a percentage of 35%. Sanitation facilities are lacking in villages and major trading centers. This is attributed to culture, local authorities not constructing latrines. This has led to nuisances and ill health.

3.2 Communication Networks

Earth roads that become muddy and impassable during the rainy season cover most of the district. Even part of the Garissa-Garsen road is not tarmarcked i.e. the area between Bura and Garsen thus transport is not efficient during the rainy season. Laghas are major bottlenecks to road transport as they cut off roads during the rainy season, making the District virtually landlocked. The District is well served by radio as postal services are mainly found in the major urban centers. The telephone fixed line is problematic as communication is not very reliable. The introduction of the mobile telephone network has improved communication.

Key impacts of communication networks on the environment include creation of borrow pits during road construction which are not rehabilitated after construction is complete.

Priority issues

- Improve accessibility to rural areas
- Improve the shelter situation in the rural and urban areas in the District (PRSP, 2001-2004)

3.3 Social Economic Services and Infrastructure.

3.3.1 Water

The major sources of water in the district are the Tana River which traverses the district with an approximate length of about 700km. Boreholes dot the district as well though sparse. Shallow wells are also found along the river i.e. some few kilometers from the river. Existing water-harvesting facilities are sand dams along laghas, water pans roof catchments, Infiltration galleries etc. Domestic waste is the major source of pollution as defecation is by bush sites or open verges leading to water bone contamination.

Proposed interventions

- Increasing access roads
- Improving water supply
- Rehabilitating and augmenting the existing water supply systems in Hola, Garsen, Oda, Ngao, Madogo and Bura.
- Developing water resource management plans
- building capacity for communities to build pit latrines
- Provision of sanitation facilities by the county council
- Sinking more boreholes in the hinterland
- Enhancing water harvesting through dam and construction of roof catchments

3.3.2 Sanitation

The proportion of people with toilets to that without is low i.e. sanitation standards are low or poor. There are few toilets within the urban areas. Most people in the rural areas go to the bush. Only Hola and Bangale trading centers have public toilets.

Key impacts of poor sanitation on environment

- Exposed human waste and sewage is a nuisance
- Public exposed to dangers of water borne diseases

3.3.3 Energy Supply

Types and Status of Energy Sources

conventionally, various types of energy exist in Kenya. This include hydropower, Geothermal, Biomass (e.g. wood fuel, cow dung, crop residue, wind, solar, biomass, steam energy and co-generation. However, in the case of Tana River District not all of the above mentioned types exist. We shall examine these types individually with emphasis on production, consumption and costs.

Hydropower

The altitude of Tana River District ranges from 0 M at the Coast to 200m in Minjilla and Madogo hills. The potential to generate hydropower does not exist due to this flat terrain of the district. However, Tana River has been used in generating electricity upstream at Masinga Dam.

Geothermal

Although the district is characterized by arid and semi arid conditions, underground energy sources have not yet been explored. In addition underground water harvesting reveals no clue of existing geothermal potential as boreholes have been drilled almost throughout the district.

Biomass

This is the use of waste materials such as leaves, crop residue, cow dung, dead twigs and wood fuel as a source of energy. Due to the dry conditions characterizing the district, the source of wood fuel is the ‘Mathenge’ trees (*Prosopis Juliflora*) which grow widely in the district. It is believed that up to 99% of the total population in Tana River use wood fuel for cooking and lighting. (MOPND, 1997) Due to erratic rainfall, farmers within the district plant fast maturing crops except bananas and mangoes as their major perennial crops. Consequently, only those who engage in farming along River Tana rely on crop residue as a source of energy for their domestic purposes. In terms of cow dung, Tana River District is basically a rangeland whose livestock production closely follows the precipitation pattern. Although there are high numbers of livestock within the district (See table below), the use of cow dung as a reliable source has not been realized yet. At household levels, livestock keepers use it to complement wood fuel for cooking.

Table 6: Livestock by type in Tana River District, 2006

Animal Type	No.
Cattle	370,000
Sheep	280,500
Goats	369,000
Donkeys	19,700
Camels	58,600

Biogas

Due to the nomadic lifestyle of the livestock keepers in the district, the use of biogas has not been explored as it can be realized from the livestock statistics available, there is a huge potential for biogas development if livestock production is centralized with proper provision of fodder and water

Solar

Tana River District is endowed with high insulation where temperatures average 30°C. A number institutional office has installed solar units to provide power. It is estimated that in the seven major urban centers within the district (Bangale, Charidende, Madogo, Bura Hola, Garsen and Kipini) one out of ten households own a solar unit. (District Planning Office, 2005) However, there are other potentials for solar energy uses which have not yet been explored. These include solar water pumping, solar driers, solar cooking, solar pasteurizers and solar water heating.

Wind

Wind energy can be used either in its mechanical form (Windmill) or to generate electricity (Wind turbines). In Tana River District there is only one windmill at Madogo for water pumping. Wind turbines for generation of electricity have not been done yet. However, there exist enough potential due to arid condition where strong winds blow.

Cogeneration

This is the simultaneous production of heat and electricity. Currently there are cogeneration units within the district; however, the sugarcane project in the Tana Delta which is at the piloting stage envisages to produce about 35 MW through cogeneration once the project is fully implemented (TARDA, 2004).

Rural Electrification

Although electricity was identified as a development priority over 30 years ago, Tana River district is not supplied with grid electricity (MOPND, 1976). Consequently, a study was conducted by a German company between 1988 and 1993 and the report handed to the Ministry of energy in September 1994 recommending connecting the high voltage lines (132 kVA) from Kilifi to Mwingi with sub stations at Bura, Hola and Garissa. (KPLC 1996) Unfortunately, the study recommendations have not been implemented. Instead a low voltage line has been extended from Malindi to Garsen (66/11 kVA) to provide power for the intended sugar project. In effect other parts of the district may not benefit. Currently, institutions use stand-alone gensets to provide power for their uses although this approach is a bit costly and unsustainable in the long run due to high fuel costs.

Trends in Energy Production, Consumption Costs and Projections

Table 7: Energy Consumptions and Costs

No	Source of energy	Points of production	Points of consumption	Per capital consumption	Unit cost (Kshs.)	Environmental impact
1	Charcoal	Within District	In & outside		100sack	Deforestation desertification
2	Petrol/diesel	outside	In & outside		68/liter Diesel 80/liter petrol	Emission of green house gases
3	Solar	outside	In & outside		-	-

Table 8: Key Environmental Issues in the Energy Sector

Type	Status	Trends and projections of pollutants	Waste impact on environment
Hydropower	-	-	-
Geothermal	-	-	-
Biomass	99% of population using		In house air pollution through smoke. Deforestation due to charcoal burning
Co-generation	35MW envisaged	-	-
Wind	One wind mill	-	-
Solar	>150 low voltage	-	-
Energy Type	Factors		
Hydro power	Water falls		
Geothermal	Underground steam		
Biomass	Demand(population) Agriculture(crop residue) Livestock(cow dung)		
Cogeneration	Agriculture(crop residue)/baggase		
Wind	Wind speeds		
Solar	Solar isolation		

Table 9: Regulatory & Institutional Arrangement

Energy Type	R&I Arrangements
Hydro power	-Need for a license from MOE/Kengen
Geothermal	As above
Biomass	-Burning of charcoal is illegal and transporting however, consumption is legal.
Co-generation	As hydro power above
Wind	-
Solar	-

Management Challenges

- Burning and transporting of charcoal is illegal while consumption is not
- KPLC's monopoly in electricity distribution (What about the electricity generated from stand alone generators where KPLC does not cover e.g. Hola).

Types of Energy sources include fuel wood, gas, solar and generators (electricity). The number of households connected to electricity, solar and generators is about 20% with wood fuel accounting for almost 80%.

The factors determining types of energy use

- Population,
- Literacy levels,
- Occupation, location of District,
- General marginalization,
- Exposure of the inhabitants,
- Apathy,
- Advocacy,
- Ignorance
- Political blackmail.

Trends in demand and supply tend to favor wood fuel at the expense of other types. Wood fuel is everywhere, electricity is to be installed in the southern parts of the District; while gas and generators are rarely found in a few towns.

Key environmental issues in the energy sector

- Release of previously dammed water is not regulated causing flash floods.
- De-vegetation resulting from use of wood fuel.
- Noise and air pollution resulting from generators

Proposed interventions

- Capacity building community on use of cleaner energies
- Promote agro forestry amongst farmers
- Enforce relevant Acts
- Rural electrification
- Proper management of dams upstream
- EIA by KENGEN

CHAPTER FOUR

4.0 INDUSTRY, TRADE AND SERVICES

4.1 Industrial Sector

Main Industrial activities include Baking and floor milling. Jua kali sheds are to be found in Madogo, Hola, Bura and Garsen (most major urban centers). Gypsum mining is done in Bura division. Jaridende There is craft making i.e. weaving of mats by women from reeds and makuti palm.

There are no large scales or even medium scale industries in the District. Small scale industries include Bakeries, Flour mills, artisan (mat making), Juakali and to a small extent building. The raw materials used include: Wheat flour, maize, palm leaves, metals, textiles, cement, stones and iron sheets. Industrial development in the district has favored small-scale industrial activities due to lack of electric power and poor infrastructure network. Of late there has been mention and some ground work on some proposed industries e.g. the Sugar Cane Industry at Garsen, Meat processing industry and fruit processing industry near Bogie. These are yet to see the light of day as the bottlenecks in their development are still with us.

Environmental issues in the industrial sector

- Exploitation of reeds and doum palm
- Careless disposal of waste oil
- Garages set in residential centers which
- Un-rehabilitated decommissioned queries
- The miraa (*cartha edullis*) after chew is a nuisance
- During the mango harvesting season, mango wastes litter the environment
- Polythene piper used for wrapping commodities is not disposed of carefully.

Proposed interventions

- Reforestation for doum palm
- Enforcement of environmental regulations (E1A and EA)
- Ban use of low density polythene

4.2 Trade Sector

Trade is practiced at a wider and small scale and types of trade include: Wholesale, Retail, Distribution, Livestock, Banking, Agricultural Produce and Insurance. Products include: Consumer products like Maize meal, Cooking fat and Oils, Cereals etc; building and construction products:

Agriculture produces from farms.

Liberalization is hurting the farming community in the immigration zones who do not have a high purchasing power for farm inputs.

Key Environmental Issues

- Polythene and plastic wastes
- Exploitation of palm leaves for the mat making industry has had its sizable share of vegetation especially along the riverine ecosystem where the Mkindu (*Hyphaene Compressa*) thrives.
- Jua kali/Garages are located within the town center which produce noise and effluents bad human health
- The building industry has had the effect of stone quarry pits, (unrehabilitated) sand harvesting Tana and lughas (Degradation of river causing ecosystem imbalance)
- Jua kali garages are also stuffed with lots of dumped junks of disused vehicles that litter the environment in an eyesore.

Interventions

- Reforestation of the threatened *Hyphaene Compressa* (Mkindu).
- Relocation of Jua kali garages located within the residential areas.
- Rehabilitation of stone quarries.
- Training to entrepreneurs (artisan) to ensure sustainability

4.3 Services Sector

- Major Service sectors in the district include the following:
- Road transport most of the road network is rough road - all muram except for a short distance between Bura and Garissa and Garsen -Malindi.
- Water transport this is mainly by boats in the Indian Ocean and by Dhows across river Tana (Inland)
- Air travel services - there are two airstrips in the district at Hola and Garsen.

Environmental Issues

- During rains, road short cuts are made which destroy vegetation
- During roads construction borrow pits were not filled up / rehabilitation never took place in the area
- Oil leaks by boats in the ocean and the rivers water tdestroy aquatic and marine life

Interventions

- Tarmacking of roads network in the district
- EIA before major road construction projects are embarked on
- Monitor marine and water vessels frequently.

4.4 Tourism

4.4.1 Type of Tourism, Attraction and Potential

There exists a high potential for Eco-tourism in the Tana Delta and Mchelelo (Tana River National Primate Reserve) Game reserve that are habitats to unique primates. Also have historical sites like Ras Wasini in Kipini, which are degenerating as are not in use. (NEMA 2003, Tana River District). The major type of tourism in the district is wildlife tourism. The main attractions are the red Columbus monkeys (Tana primate national reserve as well as Kora national park) and the crested Mangabey in the Tana River national reserve. Tourism development is very low in the district. Other types include leisure and sports, historical i.e. Ras wasini. The extensive delta created by river Tana present great potential for the district industrial development (if done sustain ably) it is a natural habitat, an enormously diverse fauna and flora ideal for the promotion of eco-tourism.

Key environmental issues

- Habitant deterioration of the natural primate reserve (rare and endangered biodiversity species)
- Proposed large scale farming within the Tana delta fragile ecosystem
- Degenerating historical sites
- Unchecked wildlife movements
- Increased wildlife populations

Intervention measures

- Promote eco-tourism by capacity building community members in areas of high tourism potential
- Problem animal control
- Enforcement of EIA! EA regulation and ensure compliance
- Put in place a management plan for Kora and Tana private national reserves
- Improve infrastructure within and outside the above reserves
- Develop eco-tourism attraction sites within the Tana delta (between Mnazini and Kipini).
- Establishment of game reverses

Management challenges

- Kora National park is in Tana River district but is not managed from the District
- Tsavo East national park extends to Tana River district but proceeds of gate collected never improve the communities' lives in Tana River district, only Wildlife-human conflicts.

The resettlement I relocation of community from Tana River National Primate Reserve has met some resistance with community members vowing to clear the forest as if cleared there wont be any need to have a reserve

4.5 Mining and Quarrying

4.5.1 Mining

The District is endowed with gypsum in the northern parts specifically within the Tula valley in Bura/Bangale Division. The Tiomin Company has shown interest to explore for Titanium in the lower Tana delta. Mining is open cast with both mechanized and manual methods used in the mining.

Key environmental Issues

- Exploration for minerals has proved to cause more environmental damage than the mining itself especially when mining is done manually. This is evident in Charidende where gaping holes litter the whole area posing danger to livestock and humans.
- Decommissioned quarries are not rehabilitated-this leaves behind explored sites and pits where water accumulate in pits serving as a breeding grounds for mosquitoes, stagnant water (dirty)leading to water borne diseases. Un-rehabilitated open pieces of land encourage desertification.
- Compliance to environmental law is low. This is because EA for existing mining companies are not done.-as mining field takes over grazing is reduced thus aggravated soil erosion due to overgrazing on remaining land.

Proposed interventions

- Enhancing monitoring of mining activities
- Ensure EIA and EA are done in good time by proponents
- Enforce implementation of the environmental management plans by proponents.

Identified potential environment impacts from mining

- Land surface-land degradation as the soil become of low value after decomposing thus decreased fertility. The terrain is also interfered with.
- Soil –mostly subjected to soil erosion by both wind and water s the soil lays bare during the process.-Air-Air pollution results as a result of dust-this tends to cause many diseases to workers and as well dust tends to interfere with visibility.
- Loss of biodiversity during the mining process, vegetation is destroyed and wild animals disappear to other areas. Disturbance / noise keep wildlife away from the mining site. Vegetation around dries up due to loss of soil moisture.
- Ground water level the level of underground water tends to recede due to exposure to evaporation.
- Emergence of alien species due to accumulations of water and emergence of other factors new species alien to the environment come up

Mitigation Measures

- Compliance to environmental laws
- Adherences to the environmental management plan by proponents.

Management challenges

- The mining sites (Tula valley) is about 150 km from Hola Town, its also off road so getting there by public transport to do monitoring for environmental compliance is difficult given the level of funding to the environment office currently.
- The TRCC which collect revenues from the mining companies should enhance environmental conservation.
- Other animal products. Livestock owners were forced by circumstances to sale their skinny animals at throwaway prices thus incurring heavy losses.
- Crop failure was between 40 and 60%.The crop yield in the district was low in the last season, which made people seek short-term solutions like charcoal burning, hunting of wild animals etc at the expense of long term environmental conservation goals.
- Due to animal/livestock movements, there are high chances of disease outbreaks and transmission; from the North-eastern to Tana River District. (Now that animals were being moved at night). There was also the danger of transmission to wildlife, as livestock were not inspected

Lots of resources have been used to mitigate the effects of drought. For example funds are used to purchase emergency relief food and engage in programmes such as water tinkering, which are meant to arrest the situation. Besides communities taking a lot of time in search of water and pasture, a lot of livestock die because of lack of water and pasture. The migration of the pastoral community to the South in search of water and pasture increases ethnic tension and pressure on available resources (*Source: Tana River District Development plan 2002 - 2008 Ministry of Finance and Planning*).

Floods have become destructive in that the water quality deteriorates. Water carries silt of which leads to stunted growth of crops, human disturbances and diseases especially to the riverine communities. Infrastructure has been destroyed e.g. during *Elnino* rains.

Key Environmental Issues

- Lack of water and pasture during drought leading to death of livestock in the hinterland.
- Community conflicts i.e. between farmers and Pastoralists as Pastoralists migrate to the South in search of water and Pasture.
- Pressure and degradation of the Tana delta wetland resources due to overgrazing.
- Destruction of infrastructure by floods.

CHAPTER FIVE

5.0 ENVIRONMENTAL HAZARD AND DISASTERS

5.1 Extend and Trends of Environmental Hazards and Disasters

The two main environmental disasters in the district are:-

Drought : This limits food production and cases of insecurity .in the year 2005/2006 alone ,drought had the below impacts :In the entire district drought has caused lack of essential resources like food ,water, pasture etc, he impact has been parts of the district like the hinterland, Bangale, Madogo and Bura compared to the southern parts of Kipini and Garsen .Amongst others, the effects include: Most of the northern and hinterland negligible amounts of rains that registered very little impact on the water sources. Areas most affected include Assa in Garsen division, Wayu and Walden in Galole division, Subukia and Chifiri in Bura division and almost the whole of Bangale division. All pans went dry as people dug wells within the dam to access water. The water table deepened with 80% of the pans drying up leaving only Charidende (IandII)and Koticha. This caused pastoralists to walk long distances in search of water and pastures.

The Arid lands Resource management project II in collaboration with the Districts water office did water tankering using a water boozer for communités having to walk long distance in search of water .The same caused intrusion of the Indian ocean waters into the rice fields as the delta levels went down. This affected rice production in Ozi. As most of the hinterland was dry, pastoralist were forced to migrate with their livestock herds towards river Tana where they cut down trees to serve as fodder for their livestock. Livestock started pouring in from the North Eastern District of Wajir. Mandera, parts of Garissa and from Eastern parts of Isiolo.Very high influx of livestock was observed at Boka due to reliable sources water from perennial springs. This resulted to destruction of the riverine vegetation and overgrazing in the area.

Due to the persistent drought, some vegetation withered, dried and died naturally.Though no serious incidences were reported tense security situations over range resources were experienced in Bangale (Bua, Mbalambala) Bura (Nanighi, Charidende) and Wayu in Galole.There were conflicts among pastoralists from the neighboring districts of Garissa,Mwingi etc for water in the north moving towards the south and river Tana for water and pasture. The residents of Bura especially protested against the destruction of the riverine vegetation. This made some areas tense. Rotting livestock carcasses along the Garisa –Malindi road became a nuisance. Livestock being ferried to the market in Mombassa up dying on transit (hunger and thirst) and ended up dropping them off their Lorries any howly.This has caused strong foul smell along the road. The dying livestock increased the community's level of poverty thus increasing their dependency rate on relief food as pastoralists lost their daily sources of income in terms of milk sales.

Key environmental issues associated with drought

- Inadequate capacity in drought preparedness
- Growing of inappropriate crops by farmers

Proposed intervention

- Develop a drought early warning system
- Promote drought tolerant crops
- Promote rain water harvesting techniques
- Document and disseminate indigenous knowledge on drought mitigation measures

CHAPTER SIX

6.0 ENVIRONMENTAL EDUCATION AND TECHNOLOGIES

6.1 Status of Environmental Education

In the District, there are both wildlife and Environment clubs in both secondary and Primary Schools. Primary schools with Environment and Wildlife clubs include:

- Hola . Kipini
- Bondeni
- Laza
- Ziwani
- Gamba
- Garsen

Secondary schools include:

- Hola
- Kipini
- Hirimani

Informal education programs include Public *barazas*, Public talks with CBOs and NGOs

6.2 Public Awareness and Participation

Public awareness and participation in environmental conservation programs is low in the district.

Key players include:

- TADEMFO Trust- bring CBOs and NGOs together for purposes of promoting networking and joining efforts in handling environmental, socio-economic and cultural issues in the Delta region
- TADECO-Natural resource conservation
- TAFMEN-Mangrove and Turtle conservation programs
- ALRMPHII- Drought and Natural Resources management
- Green Laza CBO- Tree planting and Clean up campaigns
- Kenya Marine Forum- Marine ecosystem conservation
- EAWLS- Environmental conservation

Priority issues in environmental education

- Inadequate environmental education
- Inadequate collaborations
- Inadequate learning materials

Proposed Interventions

- Coordination to be carried out by departments or organizations working on environmental education.
- Establish an environmental information and documentation centre
- Develop adequate learning material

CHAPTER SEVEN

7.0 ENVIRONMENTAL GOVERNANCE AND INSTITUTIONAL FRAMEWORK

7.1 Status of Environmental Governance and Institutional Arrangement

EMCA 1999 came into force on 14th January 2000. The Act aims at providing an appropriate legal and institutional framework for the management of the environmental and the sustainable use of natural resources.

The institutions created by EMCA are as follows:

- NEC (National Environmental Council)
- NEMA Board of management
- The National Environment Action Plan Committee (NEAPC)
- Standards and Enforcement Review Committee (SERC)
- Environmental impact Assessment technical Advisory committee
- The public complains committee (PCC)
- The National Environment tribunal (NET)
- National Environment Trust Fund
- Provincial and District Environment Committees

District Environment Committee - this is established by sections 29 of EMCA to serve as a forum for people to discuss their environmental issues and action plans to address the issues. The committees are composed of government officials, (as per their statutory mandates), NGOs and members of local community. They are responsible for proper management of the environment within the district

7.2 Regulations and Management Tools

Environmental Impact Assessment (EIA) -this is a critical examination of the effects of a project on the environment an EJA identifies both negative and positive impacts of any development activities, or projects how it affects people, their property and environment. It also identifies measures to mitigate the negative impacts, while maximizing on the positive ones. It is worth noting that this Act does not replace existing laws which deal with special sectors of components of the environment e.g. the Water Act, Wildlife Management and Coordination Act, the Forestry Act, the Fisheries Act, and the Physical Planning Act, to name but a few. It will be applied alongside these Acts governing the different sectors of the environment (ILEG, 2003) the goal on an EIA is to ensure that decision on proposed project and activities are environmentally sustainable.

Environmental audit (EA)

It is the systematic documented, periodic and objective evaluation of how activities and processes of an ongoing project to determine how those activities and programs conform to the approved environmental management plan of the specific project and sound environmental mgt practices. A

comprehensive EA promotes safe and healthy environment at all stage of a project operations, as well as commissioning.

Environmental quality standards

Environmental restoration order requires the person on whom it is served to restore the environmental as near as it may be to the state in which it was before the taking of the action which is the subject of the order (EMCA, 1999). It is also aimed to prevent the person on whom it is served from taking any action which would or is reasonably likely to cause harm to the environment among others. There other orders namely: Environmental conservation orders and Environmental easements orders

Strategic Environmental Assessment (SEA)

This is a formalized systematic and Comprehensive process of evaluating the environmental impact of a policy, plan, program and its altitudes, including the preparation of a written report on the findings of the evaluation, which findings should be reviewed by the responsible authority. In the district, this has been done with the KESSP program by the ministry of education

Multilateral Environmental Agreements (MEAs)

The Ramsar Convention - conservation NGOs led by TADEMFO have been spearheading for the listing of the Tana delta as a Ramsar site; this is still in its initial stages as the communities in the areas have to be educated and involved in the process. Agenda 21- the district has embarked in the preparation of the DEAP (2006 / 2010) this is as a result of the world summit held in Rio de geneiro in 1992. CITES convention on endangered species of flora and fauna elephants in Tsavo East n/p are still endangered thus are still under protection through KWS.

Constraints in the implementation of MEAS

Personal interests are overlying national interests. This is because sensitization of communities on e.g. the Ramsar convention was not done satisfactorily and community involvement is minimal because most of the community members are not well versed with the convention / there is great need to carry out through awareness to educate the public

Convention on Biological Diversity

Kenya became a party to this by ratifying it on the 26th of July 1994. This was a commitment by the Government to fulfill the obligations specified in the different articles of the convention. This convention has 3 objectives:

- Conservation of biological diversity
- Sustainable use of its components
- Fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant

technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

Key Environmental Issues

- Inadequate capacity to interpret and enforce environmental legislations
- Limited networking and sharing between organizations
- Conflict of environmental legislations and institutional mandates
- Undefined pre-existing ownership rights and utilization of natural resources
- Use of incentives to strengthen compliance for environmental management
- Inadequate capacity to domesticate MEAs

Proposed Interventions

- Build capacity on interpretation and enforcement of environmental legislations
- Formation of district forum that will facilitate greater consultation and afford opportunities for sharing information and resources in environmental matters
- Incorporation of community pre-existing rights in natural resource utilization
- Raise awareness on environmental legislations
- Devolve funds for environment management
- Build capacity to domesticate MEAs
- Institutionalize participatory, consultative and community inclusive environment management
- Promote use of incentives to promote compliance
- Enhance enforcement of EMCA, 1999 and other legislations for natural resource utilization
- Devolvement of funds with specific percentage for environment management

CHAPTER EIGHT

8.0 IMPLEMENTATION MATRIX

The District Environment Action Plan (DEAP), Provincial Environment Action Plan (PEAP), and National Environment Action Plan (NEAP) preparation is guided by national priorities as contained in major policy documents including the ERSWEC, the National Development Plans and the District Development plan. The objective of this DEAP is to integrate environmental concerns in development planning and implementation.

8.1 Stakeholders Involvement

Stakeholder identification was done as per the coverage and content of the DEAP as provided in the manual. This was by direct involvement right from the workshop held, the DEAP committee meetings held and the all inclusive stakeholders meeting held for the preparations of the DEAP implementation and Monitoring and Evaluation matrices

Strength and weaknesses of stakeholders vary from one sector to the other. Some sectors lack technical staff to handle specific technical work. Some departments are one man kind of this characterized the low turnout for meetings as officers were either out in the field or attending to official functions outside the district Some departments are not represented in the district e.g. mines and geology, Trade and industry e.g. this made the District Environment Action Plan Committee (DEAPC) do with information that was within reach and readily available. The greatest challenge posed was the ability to bring officers together or make them gather information for the DEAP with the little resources provided given that they could be engaged in other well paid assignments in the field working for projects.

8.2 Resource Requirements

Human and financial resources towards implementation of the DEAP will be from the government departments Parastatals Development partners, NGO,s CBO,s, Religious organizations The private sector and the community Some of the public funds/community based resources include: LATF, CDF and Government budgetary allocations.

8.3 Monitoring and Evaluation

The M&E of the implementation of the Action Plan will be carried out using participatory approaches whose stakeholders will be involved at all stages. This will be done through meetings and field visits Reports will be discussed and reviewed. Evaluation will be done periodically on annual basis in line with the Performance contracting period in the public service and the State of Environment Indicators.

Table 10: Implementation Matrix

Sector	Environmental Issue	Proposed Interventions	Stakeholders	Responsible Institution
Soils	<ul style="list-style-type: none"> • Riverbank erosion 	Construction of gabions where river bank erosion is severe e.g. near Garsen town	Min of Agriculture, NEMA, Ministry of Water	Ministry of Agriculture
	<ul style="list-style-type: none"> • Sheet erosion in the rangelands (hinterland) 	Reseeding and reafforestation to avoid/discourage erosion by wind	Min of Agriculture, NEMA, Ministry of Water	Ministry of Agriculture
	Degradation through overstocking by pastoralists	<ul style="list-style-type: none"> • Encourage destocking by pastoralists to maintain manageable herd sizes • Law enforcement (Agriculture Act, EMCA 99) • Capacity building for destocking and restocking, alternative livelihood 	Min of Livestock, NEMA, Min of Agriculture, min of Northern Kenya and other Arid lands	Min of Livestock
Dry lands	<ul style="list-style-type: none"> • Overgrazing 	<ul style="list-style-type: none"> -Decongest the delta by opening up the hinterland -Establishing of grazing blocks/ranches 	Min of Livestock, NEMA, Min of Agriculture, min of Northern Kenya and other Arid lands	Min of livestock
	<ul style="list-style-type: none"> • Deforestation 	<ul style="list-style-type: none"> • Enhancing forest conservation activities 	KFS, NEMA, Min of Agriculture, Northern Kenya and other Arid lands	KFS

Sector	Environmental issue	Proposed Interventions	Stakeholders	Responsible Institution
	• Drought	Enhance traditional drought monitoring skills	Department of Meteorology, Northern Kenya and other arid lands	Northern Kenya and other Arid lands
Agriculture	• Cultivation along river bank	Maintenance of river banks Improve and enhance extension services	Min of Agriculture, NEMA, WRMA	Min of Agriculture
	• Salinity in the delta paddy	Proper management of Dams upstream	Min of Agriculture, NEMA, WRMA	Min of Agriculture
	• River diversions/brook formation	Decongest the delta and river system by opening up the hinterland		WRMA
Livestock	Overgrazing in Tana delta	Promote fodder conservation activities Environmental education of pastoralist	Min of livestock, KWS, KFS, Min of Agriculture	Min of Livestock
	• Human conflicts	Build capacity in conflict resolution	Provincial Administration, Mini of special programmes, Northern Kenya and other Arid lands, department of social services	Provincial administration
	• Wastes from slaughter slabs	• Proper treatment of wastes from slaughter slabs	NEMA, WRMA, Water Service Board, Ministry of Livestock	NEMA
	• Livestock/wildlife conflicts at watering points along malkas	Provide more water points Promote rigorous problem animal control	Min of water, Water service boards, water service providers, min of livestock,	KWS, Min of livestock

Sector	Environmental issue	Proposed Interventions	Stakeholders	Responsible Institution
	Soil erosion at livestock watering points along malkas.	Stabilization of malkas	Min of Agriculture, Min of livestock, Min of Northern Kenya and other Arid lands	Min of livestock
Fisheries	• Commercial trawlers catching of non-target fish and then discarding the by catch	Improve vigilance in the sea by fisheries department	Min of Fisheries,	Min of fisheries
	• Decrease of water volume in the river	Promote water conservation measures	WRMA, MEMR, NEMA, Northern Kenya and other Arid lands	WRMA
	• Poor attitudes towards investing in aquaculture plus lack of investment capital	Raise awareness on importance of aquaculture	Min of Fisheries, NEMA, Min of agriculture	Min of Fisheries
	• Limited departmental facilitation in terms of working tools and funding.	Acquire modern equipment and source for more funding	Min of Fisheries, NEMA, Min of agriculture, WRMA	Min of Fisheries
	• Lack of modern preservation facilities.	o Develop modern fish landing facilities and cold room facilities	Min of Fisheries, NEMA, Min of agriculture, WRMA	Min of Fisheries
	• Illegal fishing	enforce law on usage of recommended mesh size of nets	Min of Fisheries, NEMA, Min of agriculture, WRMA	Min of Fisheries
	• Destruction of fish breeding zones	Identify and protect fish breeding zone	Min of Fisheries, NEMA, Min of agriculture, WRMA	Min of Fisheries

Sector	Environmental issue	Proposed Interventions	Stakeholders	Responsible Institution
	<ul style="list-style-type: none"> • Adverse economic activities in the river catchments (Hydroelectric), deforestation and poor farming activities 	Conduct EIA before major development along rivers	Min of Fisheries, NEMA, Min of agriculture, WRMA	NEMA
Water resources	<ul style="list-style-type: none"> • Water borne diseases 	Promote water treatment before use <ul style="list-style-type: none"> • Community capacity building 	Min of Fisheries, NEMA, Min of agriculture, WRMA	WRMA
	<ul style="list-style-type: none"> • Sparse distribution of water and watering points/Perpetual shortage of water for both humans and livestock 	<ul style="list-style-type: none"> • Dam construction • Sinking of boreholes • Utilization of lagha water 	Min of Fisheries, NEMA, Min of agriculture, WRMA, Water Service Board	Water Service Board
	Water user conflicts (farmers/pastoralists)	Develop a conflict resolution mechanism	WRMA, Ministry of water, ministry of livestock, Northern Kenya and other Arid lands	WRMA
Forestry	<ul style="list-style-type: none"> • Devegetation for fodder, charcoal 	<ul style="list-style-type: none"> • Reforestation • Capacity building on sustainable forest management 	KFS, NEMA, KWS, Min of Agriculture, Northern Kenya and Arid lands	KFS
	<ul style="list-style-type: none"> • Logging for timber 	<ul style="list-style-type: none"> • Enforcing laws and policies e.g. forest Act, EMCA 99, Water Act 2002 etc 	KFS, NEMA, KWS, Min of Agriculture, Northern Kenya and Arid lands	KFS

Sector	Environmental issue	Proposed Interventions	Stakeholders	Responsible Institution
	<ul style="list-style-type: none"> • Clearing for farming 	Raise awareness on forest conservation measures	KFS, NEMA, KWS, Min of Agriculture, Northern Kenya and Arid lands	KFS
	Presence of roaming livestock and wild life	Protect planted trees from roaming livestock and wildlife	KFS, NEMA, KWS, Min of Agriculture, Northern Kenya and Arid lands	KFS
Wildlife	<ul style="list-style-type: none"> • Human wildlife conflicts 	<ul style="list-style-type: none"> • Problem animal control • Enhance conflict resolution • Capacity building for community on ways of co existence with wildlife 	KWS, NEMA, NMK	KWS
	<ul style="list-style-type: none"> • Subsistence poaching 	Increase anti-poaching campaigns	KWS, NEMA, NMK	KWS
	<ul style="list-style-type: none"> • Habitat deterioration 	<ul style="list-style-type: none"> • Promote eco-tourism 	KWS, NEMA, NMK	KWS
Biodiversity conservation	Habitat loss / and modification of habitats.	<ul style="list-style-type: none"> - Law enforcement (Forest Act, EMCA 99) - Re-a forestation and promotion of conservation enterprises. • Community involvement in decision making 	KWS, NEMA, NMK	KWS, NMK

Sector	Environmental issue	Proposed Interventions	Stakeholders	Responsible Institution
	- Introduced species/invasive species (both deliberate and accidental)	Control of invasive species	KWS, NEMA, NMK, KARI, KEFRI, Min of Agriculture, KFS	KWS, NMK
	Over-harvesting e.g. of medicinal plants and hunting of wild life.	• Capacity building of community	KWS, NEMA, NMK, KARI, KEFRI, Min of Agriculture, KFS	KFS
	- Pollution — a special case of habitat destruction, chemical destruction rather than physical e.g. turbid waters of river Tana as a result for catchments erosion.	Enforce water quality regulations	NEMA, WRMA,	NEMA
Human settlement and infrastructure	Poor access roads	• Increasing access roads	Min of Roads, County Council	Min of Roads
	Inadequate water supply	• Improving water supply	Water Service Board, water service providers, Min of water, NEMA, Min of Public Health	Min of water
	Degradation of water supply systems	• Rehabilitating and augmenting the existing water supply systems in Hola, Garsen, Oda, Ngao, Madogo and Bura.	Water Service Board, water service providers, Min of water, NEMA, Min of Public Health	Min of water
	Lack of planning of water res	• Developing water resource management plans	WRMA, Water Service Board, water service providers, Min of water, NEMA, Min of Public Health	WRMA

Sector	Environmental issue	Proposed Interventions	Stakeholders	Responsible Institution
	Poor disposal of human waste	• building capacity for communities to build pit latrines	NEMA, County Council, Public Health, provincial Administration	NEMA
Energy	chemicals used in the generation of hydropower upstream cause stunted growth of crops down stream and sudden release of previously dammed water is not regulated causing flash floods.	• Enforce relevant Acts	KENGEN, KPLC, NEMA, Min of Energy	KENGEN
	Devegetation resulting from use of wood fuel.	• Promote agro forestry amongst farmers • Rural electrification	KENGEN, KPLC, NEMA, Min of Energy, KFS,	KFS
	• Noise and air pollution resulting from generators	Capacity building community on use of cleaner energies	KENGEN, KPLC, NEMA, Min of Energy, KFS, NEMA	NEMA
	Destruction of wildlife habitat during hydro dams construction	• Proper management of dams upstream • EIA by KENGEN	KENGEN, KPLC, NEMA, Min of Energy, KFS, NEMA, KWS	KWS
Industry trade and services	- Exploitation of reeds and doum palm	• Reforestation for doum palm	Min of trade, KFS, NEMA, KEBs, Min of Tourism,	
	Careless disposal of waste oil	• Enforcement of environmental regulations (E1A and EA)	Min of trade, KFS, NEMA, KEBs, Min of Tourism,	
	Unrehabitated decommissioned queries.	Identify decommissioned quarries and ensure rehabilitation	County Council, Dept of mines and Geology, NEMA	Dept of Mines and Geology
Sector	Environmental issue	PROPOSED INTERVENTIONS	STAKEHOLDERS	RESPONSIBLE INSTITUTION
	Garages set in residential centers which generate lots of	Enforce noise and excessive vibration regulations	County Council, Public Health, NEMA, Physical	NEMA

	noise		planning Dept	
	The miraa (cartha edullis) after chew is a nuisance	Create awareness on proper disposal of miraa waste	County Council, Public Health, NEMA	County Council
	Poor disposal of polythene papers	Ban use of low density polythene	County Council, Public Health, NEMA	NEMA
Tourism	- Habitat deterioration of the natural primate reserve (rare and endangered biodiversity species)	- Promote eco-tourism by capacity building community members in areas of high tourism potential - Put in place a management plan for Kora and Tana private national reserves	Ministry of Tourism, KWS, County Council, Ministry of Environment and mineral resources, NEMA, NMK	KWS
	- Degenerating historical sites	Identify and protect historical sites	Ministry of Tourism, KWS, County Council, Ministry of Environment and mineral resources, NEMA, NMK	NMK
	- Unchecked wildlife movements	Promote problem animal control	Ministry of Tourism, KWS, County Council, Ministry of Environment and mineral resources, NEMA, NMK	KWS

Sector	Environmental issue	Proposed Interventions	Stakeholders	Responsible Institution
	- Proposed large scale farming within the Tana delta fragile ecosystem	- Enforcement of EIA/EA regulation and ensure compliance	Ministry of Tourism, KWS, County Council, Ministry of Environment and mineral resources, NEMA, NMK, WRMA, Ministry of water and irrigation	NEMA
Hazards and Disasters	Drought and famine	Develop an early warning system	Min of special programmes, Northern Kenya and other Arid Lands, Met Department, Ministry of water, Min of Agriculture	Meteorological Department
		Promote drought resistant crops and animals	Min of special programmes, Northern Kenya and other Arid Lands, Met Department, Ministry of water, Min of Agriculture	Ministry Agriculture
		Adopt indigenous knowledge in drought management	Min of special programmes, Northern Kenya and other Arid Lands, Met Department, Ministry of water, Min of Agriculture	Special programmes
Environmental education	Inadequate environmental education	Curriculum to be developed	Ministry of education, NMK, NEMA, Local Authority, KFS, KWS	NEMA, Min of Education
Sector	Environmental issue	Proposed Interventions	Stakeholders	Responsible Institution
	Inadequate collaborations	Coordination to be carried out by departments or organizations working	Ministry of education, NMK, NEMA, Local Authority, KFS,	NEMA

		on environmental education.	KWS	
	Inadequate learning materials	Establish an environmental information and documentation centre	Ministry of education, NMK, NEMA, Local Authority, KFS, KWS, Min of planning and Vision 2030	NEMA
Environmental Governance	Inadequate capacity to interpret and enforce environmental legislations	Build capacity on interpretation and enforcement of environmental legislations <ul style="list-style-type: none"> • Raise awareness on environmental legislations 	Ministry of education, NMK, NEMA, Local Authority, KFS, KWS, Provincial administration, Mines and Geology, Ministry of Agriculture	NEMA

Sector	Environmental issue	Proposed Interventions	Stakeholders	Responsible Institution
	Limited networking and sharing between organizations	Formation of district forum that will facilitate greater consultation and afford opportunities for sharing information and resources in environmental matters	Ministry of education, NMK, NEMA, Local Authority, KFS, KWS	NEMA
	Conflict of environmental legislations and institutional mandates		Ministry of education, NMK, NEMA, Local Authority, KFS, KWS	NEMA
	Undefined pre-existing ownership rights and utilization of natural resources	Incorporation of community pre-existing rights in natural resource utilization	Ministry of education, NMK, NEMA, Local Authority, KFS, KWS	NEMA
	Use of incentives to strengthen compliance for environmental management		Ministry of education, NMK, NEMA, Local Authority, KFS, KWS	NEMA
	Inadequate capacity to domesticate MEAs	Build capacity to domesticate MEAs	Ministry of education, NMK, NEMA, Local Authority, KFS, KWS	NEMA

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