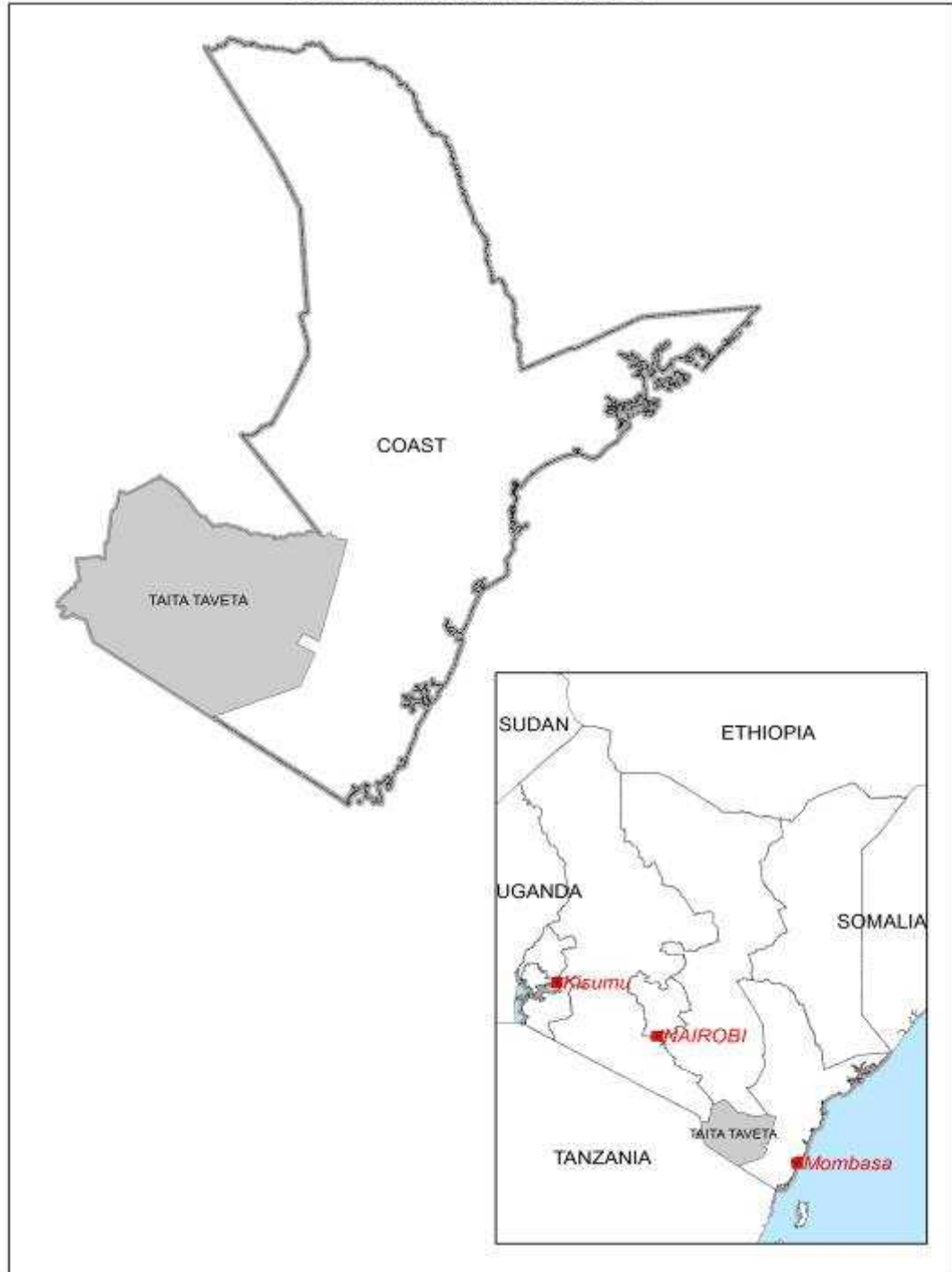




REPUBLIC OF KENYA
MINISTRY OF ENVIRONMENT AND MINERAL RESOURCES
NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY

TAITA TAVETA DISTRICT



ENVIRONMENT ACTION PLAN
TAITA TAVETA DISTRICT
2009-2013
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 environmental management into development planning.

Poverty has led to the over-use and destruction of the environment. Continued reliance on trees for fuel and sand for construction has continued to impact negatively on the environment.

The DEAP highlights priority themes and activities for the District towards achieving sustainable development. The report is divided into 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 main profile covering the physical features, demographic, agro-ecological zones, and main environmental issues.

Chapter two describes the District's Environment and Natural resources such as Water, Biodiversity (forest, wildlife, and Dry lands biodiversity), agriculture and livestock. For each resource, major environmental issues and proposed interventions are identified.

Chapter three details the human settlements and infrastructure in Taita Taveta District covering situation analysis, challenges and proposed interventions. Environmental challenges addressed include; waste management, sanitation, pollution, diseases, demand for water, energy, materials for construction, and measures that need to be put in place to ensure sustainable human settlements.

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 and weak enforcement of relevant legislations.

Chapter five discusses environmental hazards and disasters. The major hazards covered drought and landslides. To mitigate impacts of drought an early warning system should be

developed and drought resistant crops promoted. Landslide prone areas should be mapped and residents informed of dangers associated with such areas.

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

Governance, Policy and Legal Framework as well as Institutional arrangements are 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.

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On behalf of the National Environment Management Authority (NEMA), I would like to thank the Taita/Taveta 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.

We also 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.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Environmental issues have been of concern to Kenya for a long time. Evidence of these concerns can be seen in the large number of newspapers, articles and the many workshops and seminars, which have been held at local and national levels on environmental problems in different parts of the country.

THE Kenyan government has been advocating for proper environmental management since independence. This has been articulated in various government policy statements, directives and pronouncements sessional papers and development plans.

The earth summit held in Rio de Janeiro in 1992 adopted the global environmental strategy for sustainable development commonly known as Agenda 21. This commitment is demonstrated by the development and adoption in 1994 of the National Environment Action Plan (NEAP), which was followed by the development of the national policy on Environment and Development of 1999 and the enactment of the Environment Management and Coordination Act (EMCA) in 1999. EMCA created an institution framework for managing the environment with the National Environment Management Authority (NEMA) as the key government institution for coordinating all matters relating to the management of the environment.

The government is also committed to the achievements of the broader goals of sustainable development stated in Agenda 21, the Millennium Development Goal and the World Summit on Sustainable Development (WSSD).

1.2 Objectives of District Environment Action Plan (DEAP)

The objectives of the Environmental Action Plan are;

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

1.3 Environmental Challenges in the District

Some of the challenges facing environmental management in Taita Taveta district include;

- Inadequate capacity for communities to facilitate their own environment management initiatives.
- Over dependency on natural resources base for livelihood.
- Inadequate political will for environmental management initiatives
- Prolonged drought.
- Landlessness, thus people are unwilling to invest in the pieces of land they live in.
- Inadequate land-use planning.

Provisions of EMCA on Environmental Planning

District Environment Action Plan (DEAP) is provided for in section 40 of EMCA, which says every District Environment Committee to prepare after every five years DEAP and submit such a plan to the chairman of the Provincial Environment Action Plan (PEAP) for incorporation into the PEAP.

Strategies for Sustainable Development in the District

The strategies to be adapted for sustainable development include stakeholder mobilization for environmental management, use of environmental management tools, awareness creation and education, and use of participation methodologies.

1.4 District profile

1.4.1 General Introduction

Taita Taveta District is one of Kenya's ASAL Districts with 89% of the district area characterized by semi-arid and arid conditions. Only 2.5% of the district (located in the highlands) can be classified as high potential area. The highlands of the district are experiencing high human population pressure and ongoing down-slope migration into the agro-Sahel (semi and lowlands). More than 60% of the district is covered by the Tsavo National Parks thus further restricting settlements in the lowlands and creating an additional problem, the human-wildlife conflict.

The district can be divided into three major geographical regions:-

The mountainous zone of the Taita Hills (Kasigau, Sagalla and Taita Ranges),

Taveta at the foot-slopes of Mt. Kilimanjaro, and

The lowlands (Tsavo National Parks and rangelands)

The district has two main rainy seasons (bimodal). The long rains occur between March and June, the short rains from October to December. The mountainous zone serves as rain catchment area with more the 900mm of rainfall per annum. Descending the hills, rainfall becomes less.

Due to high rainfall and low evaporation, the hills feed rivers and streams running down to the lowlands. Natural mist and secondary forests are typical for the Taita Hills. Taveta and the lowlands are characterized by ASAL vegetation – grasslands, woodlands and shrub lands with Savannah species.

1.4.2 Location, size and administration

Taita Taveta District is one of the seven districts in the Coast Province. It is situated at latitude between $2^{\circ} 46^{\prime}$ and $4^{\circ} 10^{\prime}$ N and a longitude between $37^{\circ} 36^{\prime}$ E and $39^{\circ} 14^{\prime}$ E. It

borders Kwale District to the southeast, Kilifi to the east, Makueni, Kitui and Tana River districts to the north, Kajiado to the northwest and the Republic of Tanzania to the west/south-west.

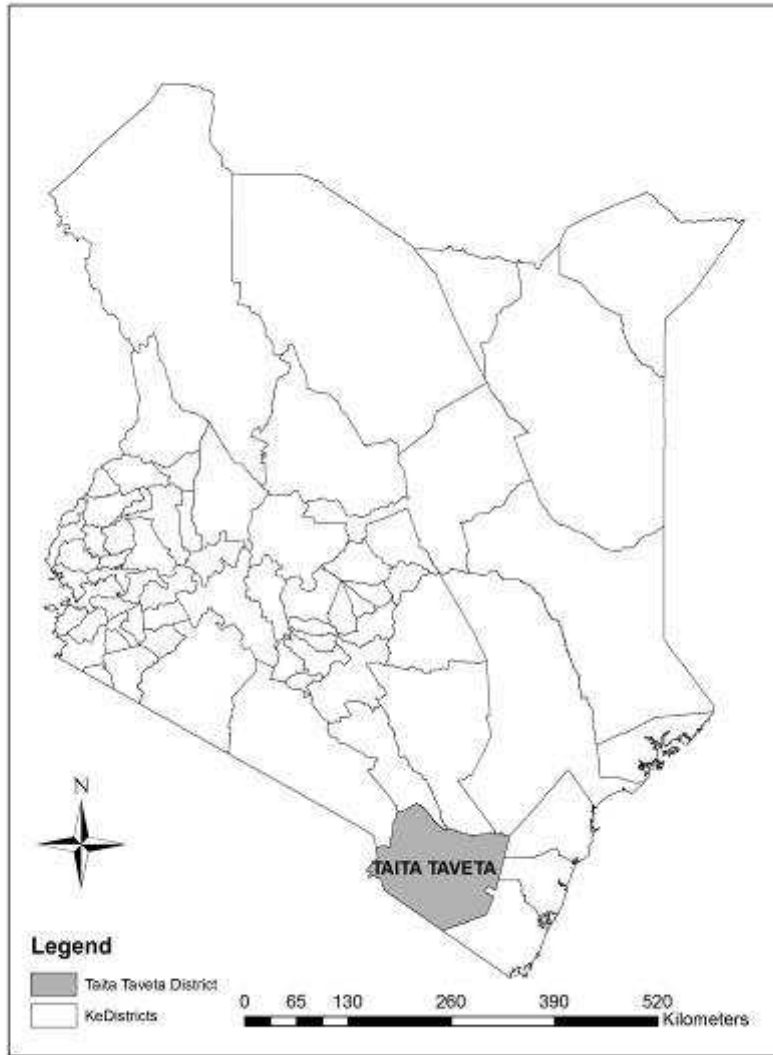


Figure 1. Location of Taita/Taveta district in Kenya.

The district covers an area of 16965 km² and is divided into five divisions namely Mwambirwa, Tausa, Voi, Wundanyi and Taveta sub district.

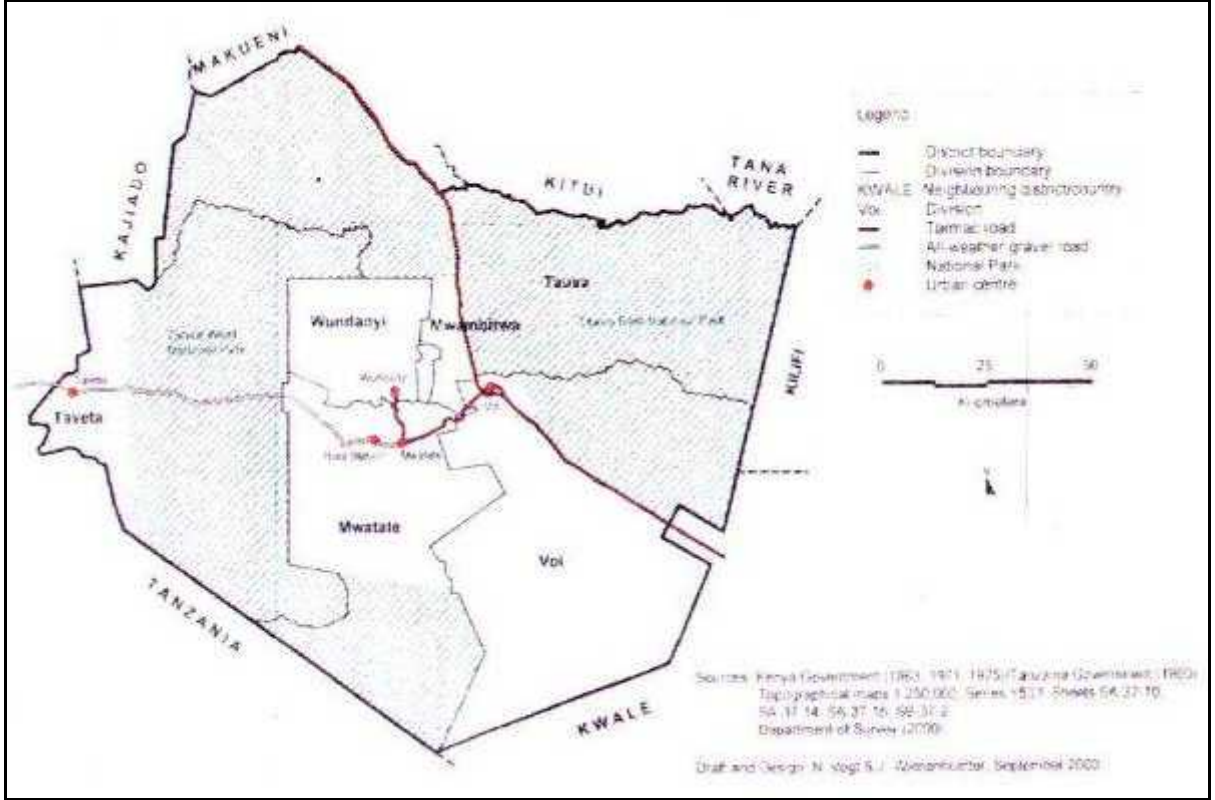


Figure 2. Administrative boundaries of Taita/Taveta district.

There are 28 locations and 76 sub-locations.

Table 1: size of administrative units in Taita Taveta District

Area	Size (Km ²)	%
Voi Division	2 978	17.55%
Taveta sub District	627	3.70%
Mwatale Division	1 712	10.09%
Tausa Division	309	1.82%
Mwambirwa Division	44	0.26%
National parks	10 604	62.51%
Total	16 965	100%

Source: DSO (2001)

1.4.3 Population distribution and density

According to the 1999 census, the district has a population of 244945 persons, and the projected population for the year 2004 is 269683. The population distribution is varied with most people living in the high potential areas of the foot slopes of the hills and in urban centres.

Table 2: Population distribution in Taita Taveta District (population census 1999)

Area	Population	Density
Mwambirwa Division	4 959	113
Mwatate Division	56 892	33
Tausa Division	20 541	66
Taveta Sub District	52 142	83
Voi Division	53 316	18
Wundanyi Division	55 118	80
National parks	1 977	0.2
Total	244 945	14

Source: DSO April 2001

1.4.4 Agro-climatic zones / agro-ecological zones

There are three main areas of agro ecological zones (AEZ) that can be distinguished; - the high, medium and low potential area. The highlands belong to the high potential area, the transitional zone to the medium potential area and the lowlands to the low potential area.

Agro ecological zones (AEZ) ranges from the lower highland zone (LH2) and upper midland zone (UM3, UM4) in the Taita hills, down to the lower midland zone (LM4, LM5, LM6) and lowland zone (L5, L6)

Again the high potential (i.e. AEZ 2 and 3), the medium potential (i.e. AEZ 4) and the low potential (i.e. AEZ 5 and 6) can be subdivided into high rainfall and low rainfall sub-zones:

The highest elevations of the Taita Hills belong to the very small lower highland zone (LH2)

The main parts of the Taita Hills belong to upper midlands (UM3). The valley bottoms are of higher agricultural potential and are suited for vegetables.

Steep slopes mainly dominate zones UM4 and LM4

In the foothill zone, it is too dry to grow maize but some early maturity new sorghum and millet varieties can do better.

Most of the lowlands belong to LM5, LM6, L5 and L6 and are dry most of the year.

Table 3: Agro-climatic zones/agro-ecological zones

AEZ	Altitude (M)	Annual mean Temp. (°C)	Annual av. rainfall (mm)	Size		Location
				Km ²	%	
LH2 wheat/maize-pyrethrum zone	1680-2208	<18.2	>1200	40	0.6	Highest elevation of Wundanyi division
UM3 marginal coffee zone	1370-1680	20.1 –18.2	900-1200	118	1.9	Highest areas of Sagalla and Kasigau and main areas of Taita Range
UM4 sunflower-maize zone	1220-1520	20.9-18.8	700-900	103	1.6	Midlands of Taita hills
LM4 Marginal cotton zone or sisal zone	910-1220	22.9-20.9	600-800	442	7.0	Foot slopes of the mountains and NW of Taveta sub District
LM5 Lower midland livestock	790-980	23.5-22.4	480-700	762	12.0	Lowlands around the mountains,

AEZ	Altitude (m)	Annual mean Temp. (°C)	Annual av. rainfall (mm)	Size		Location
– millet zone						north and central of Taveta sub district
LM6- Lower midland ranching zone	<610	>23.5	<500	1902	30.0	Rangelands
L5 Lowland livestock – millet zone	610-790	24.6 –23.5	480-680	1029	16.2	Lower parts around the highlands, southern Taveta sub district
L6 Low land Ranching zone	<610	>23.5	<500	1943	30.7	Rangelands

Source: GTZ pre-feasibility study (Taita Taveta, 2000)

Geology and soils

The Taita hills complex rises above the erosional plains of the lowlands with small inselbergs. Volcanic foothills and lava flows occur in Taveta. Three major blocks constitute the Taita hills – the Sagalla, Taita and Kasigau. The Taita hills are block-faulted basement (crystalline) rocks in the Mozambique belt composed of Precambrian paragneisses from metamorphosed pelitic arenaceous and calcareous sediments from about 290 to 180 million years ago. Technically, the folded lineaments trend N-S and therefore the Taita hills are related to the evolution of the East African Rift system. They belong to the chain of Block Mountains referred to as the eastern arc mountains. The Taita hills are the northern outliers of the system stretching southward to Pare, Usambara, and Uluguru, Ukaguru, Udzungwa and Mahenge range of mountains in Tanzania. Industrial minerals such as graphite, asbestos, iron ore, gemstones and others are found in the hills and in the surrounding lowlands.

Taveta may generally be considered as part of the piedmont plain between the Pare Mountains and Mt. Kilimanjaro. Isolated hills such as Riata, Eldoro, and Salaita rise above the plain. The residuals are directed NNW, parallel to the regional structural trend of the

basement system rocks and the Pare mountains as well as the Chyulu range. The area close to the Chyulu range and Mt. Kilimanjaro are covered with quaternary lavas, pyroclastics and debris flow deposits and fluvial and lacustrine volcanic sediments (Omenga, 1993, Toya et al. 1973). Some of the lava flows originate from Mt. Kilimanjaro while others erupted from several parasitic cones that are related to the mountains. The rocks are mainly basalts, phonolites and tuffs. Fertile soils developed on volcanic rocks and ashes.

The lowlands are characterized by erosional and sedimentary plains. They are occasionally interrupted by residual hills and inselbergs and pedimental slopes. The extensive plateau gently slopes coast-wards ranging between 1000m and 300m a.s.l. It is underlain by the Precambrian basement system of rocks consisting mainly of crystalline limestones, gneisses and schists. The plateau surface is an erosion surface covered by recent and Pleistocene weathered soil and calcareous crustal deposits.

On Taita Hills, the dominant soils are cambisols. They originate from weathered gneiss and are often gravelly to sandy-loamy and shallow. They are well drained and moderately fertile. Many cambisols are in a transitional stage of development from a young soil to a mature one. On steep slopes and transitional zones the dominant soil types are Regosols, which are shallow soils, have high permeability and low water holding capacity.

The drier foothills bordering the hills are characterized by Luvisols, Acrisols and Arenosols soils. They are moderate to low in fertility. In valley bottoms, alluvial soils (fluvisols) are apparently noticed. These are young soils with fertility being moderate to high. They receive fresh sediments and nutrients during regular floods and occur in all larger river basins of Bura, Lumi, Mbololo, Mwatate and Voi Rivers.

Deeply weathered soils are widespread in Taveta sub-district. Saline and sodic soils occur around Lake Jipe while in the western part of the sub-district are soils developed from the basement rock system with some influence of volcanic ashes.

The lowlands are characterized by reddish, very deep. Acid sandy-clayey soil (Ferralsols). They are found in most of the Tsavo National Park and the ranches. They are vulnerable to soil erosion, have a low water holding capacity and low soil fertility.

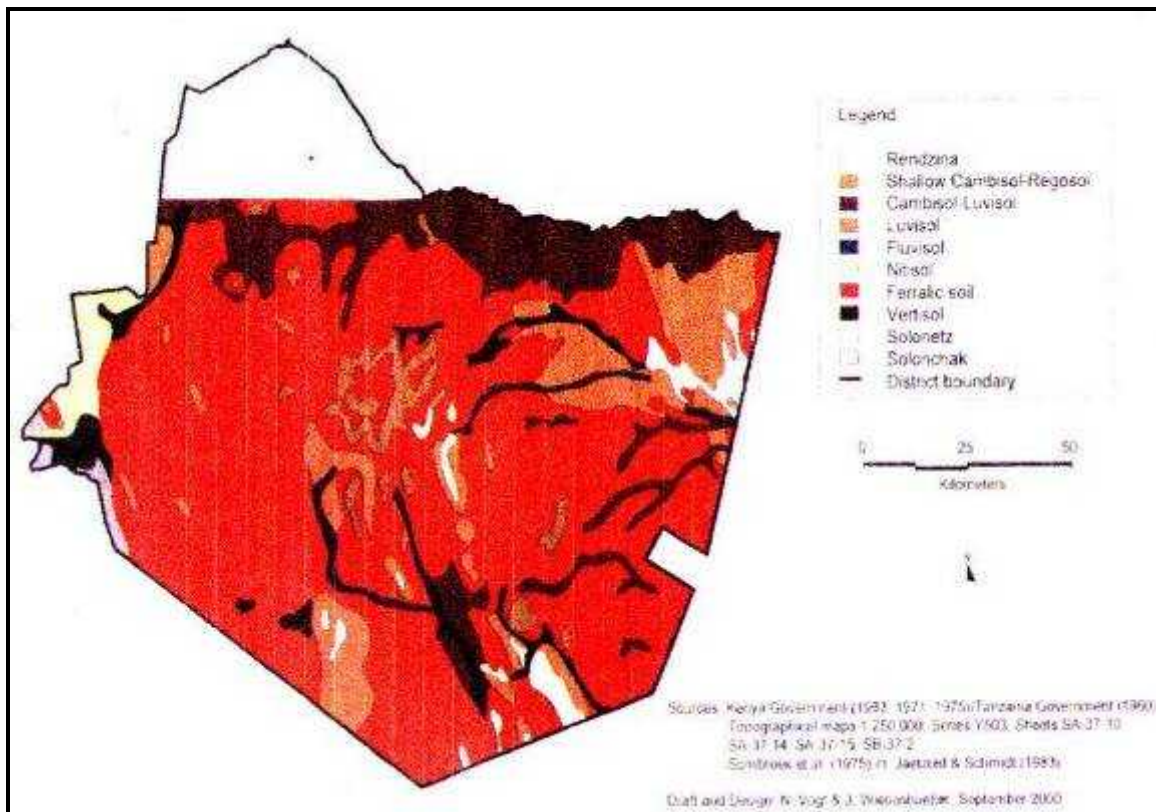


Figure 3: General soil types in Taita Taveta District

1.4.5 Climate and Hydrology

The district has a bimodal rainfall pattern with two rain seasons. The long rains occur between March and May with a maximum in April. The short rains take place between October and December with a peak in November. The rainfall distribution varies depending on elevation and aspect. The annual potential evaporation (E_0) ranges from 1200 to 2100 mm.

Taita Hills receive the highest amount of rainfall. The high potential areas in the Taita Hills (LH_2 , UM_3) receive more than 900 mm of rainfall per annum. (e.g. Wundanyi 1300 mm, Wesu 1400 mm). The temperatures average 15 – 20⁰c. The medium potential areas receive 700 to 900 mm, with higher temperatures, and evaporation. The Taita hills have a net water surplus. Several rivers drain from the Taita hills (Bura, Kishushe, Mbololo, Mwatate,

Paranga and Voi Rivers). The rivers are perennial in their head waters in the highlands but become seasonal in the drier lowlands (Dijkstra and Magori 1994, Krhoda 1998)

The annual average rainfall in Taveta is 350 mm to 750 mm. The temperature ranges between 21 to 38⁰c and potential annual evaporation is 1950 mm. Taveta has a high ground water table. There are several springs – Salaita, Little Lumi, Njoro Kubwa and Kitobo. Several of the springs and the perennial river Lumi drain into Lake Jipe. Ruvu River springs from Lake Jipe and flows towards Tanzania. Lake Challa and Jipe are the two freshwater lakes in the district and are located right on the border to Tanzania.

The lowlands receive a maximum of between 450 – 750 mm annually and rainfall is more unreliable in amount and distribution. The lower parts are hot with mean temperatures of about 30⁰c. The potential annual evaporation rate is about 1800mm. There is therefore a net water deficit. All the rivers flowing through the lowlands are intermittent, with the exception of the Athi, Tsavo and Galana rivers.

Land Cover

The Taita Hills used to be covered by montane mist forests whose remnants can still be found on the highest peaks, namely Mbololo, Ngangao, Chawia and many smaller patches in the Taita ranges and the relicts of natural forests in the Sagalla and Kasigau Ranges. These are the northern most members of the eastern arc mountains globally recognized as one of the biodiversity hotspots.

The flora of these mountains is characterized by a high level of species and generic endemism: the forest ecosystem has more the 2000 species of plants of which 25 to 30% are endemic (Lovett 1993). The Taita Hills forests fauna consists of over 400 species with at least 123 endemic plants. Ngangao and Mbololo forests have 7 of the endemic species (Beentje 1988).

The midland of Taita Hills (<1200M a.s.l.) are drier and are dominated by woodland formation and dry forests of *Acacia* – *Euphorbia* species, *Commiphora* sp., *Ficus* sp., *Tamarindus indica* and *Terminalia brownii* among others (DFO April 2000; Krhoda 1998).

Taveta-Sub district is covered mainly by an ASAL vegetation, grassland, woodlands and shrubs lands with savanna species (*Acacia* sp, *Commiphora* sp.) where the groundwater table is high, riverine/permanent wetland vegetation types occur with *Acacia xanthophloea*, *Milicia excelsa*, *albizia* sp, *Ficus* sp. etc. (Greenway, Krhoda 1998). The Kitobo forest (about 160ha) is a ground water forest dominated by *Diospyros mespiliformis*, *Albizia glaberrima*, *A. xanthophloea*, *Celtis africana*, *Newtonia buchananii*, *Trichilia emetica*, *Cordyla africana* and *M. excelsa*.

In lowlands, different vegetation occurs. These are woodlands, wooded grasslands, bush lands, grasslands and riverine forests/swamps. Different forms and savannah vegetation are found as influenced by different climatic conditions, animal and human activities. The wettest Savannah environment is represented by the moist savannah or savannah woodland with high trees and grass species (grass cover higher than 150 cm). The dry savannah (*acacia*, *commiphora*) occupies an intermediate position on the rainfall gradient between the moist savannah and the drier thorn savannah. The grass cover is lower, about 60 – 150 cm and *Acacia*–*Themeda* scattered tree grasslands dominant. The thorn savannah has characteristic grass species of less than 60 cm and with declining rainfall; it is gradually replaced by dwarf shrubs and desert grass communities. Riverine vegetation is found along streams flowing through the dry shrub lands.

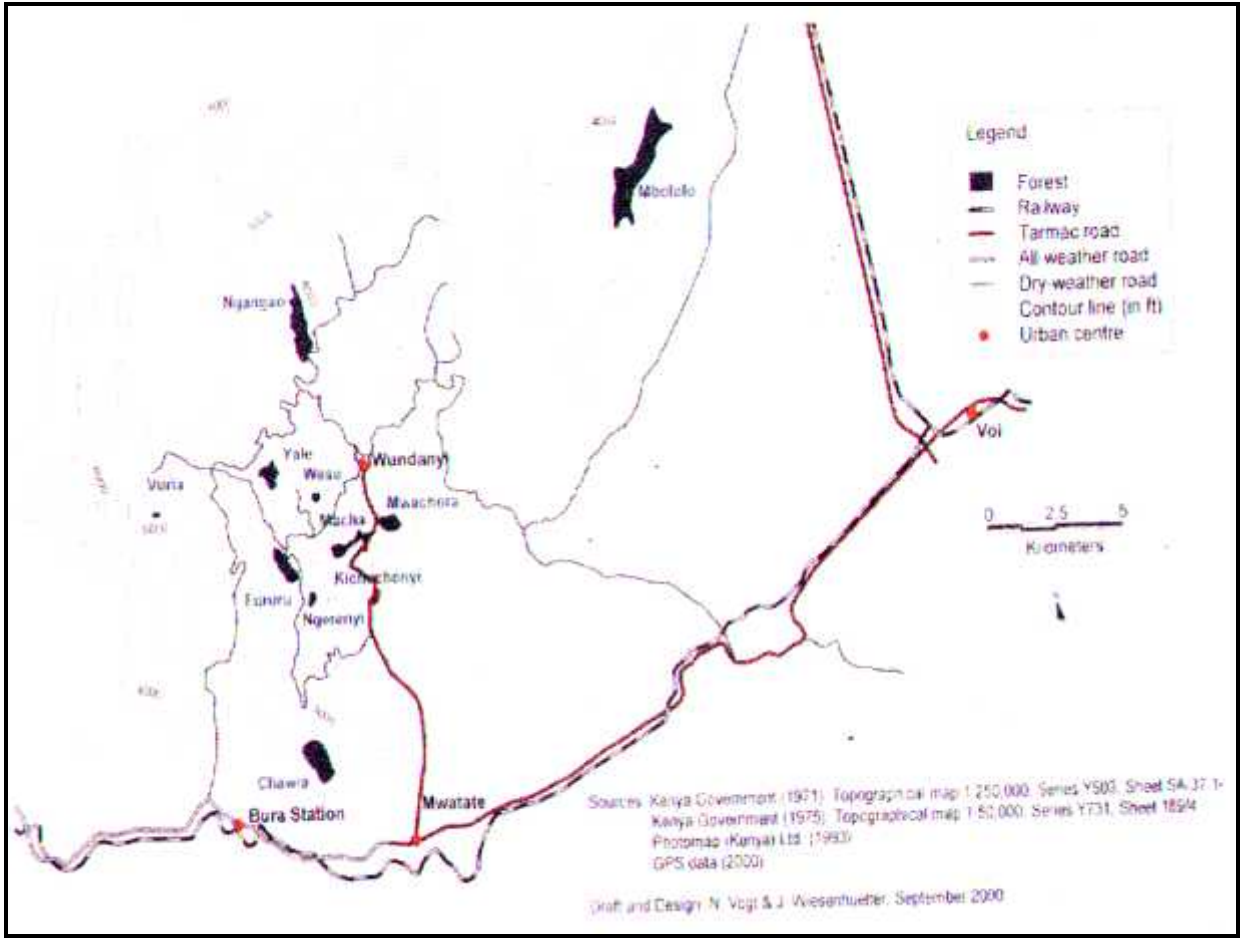


Figure 4: Taita Hills forests

CHAPTER TWO

2.0 ENVIRONMENT AND NATURAL RESOURCES

2.1 Agriculture

Horticulture is the largest agriculture based economic activity in the Taita Hills and in the irrigation schemes in Taveta sub-District. Among the major horticultural crops are tomatoes, cabbages, kale, onions, carrots, cauliflower, marrows, spinach, Okra, green papers, garden peas, brinjals, leeks, lettuce, chillies, sweet melons, cucumbers, French beans, karella, furia and rianya. Tomatoes and cabbage are the most important horticultural crop in the Taita hills while in Taveta cultivation of tomatoes, onions and bananas is dominant. Perennial horticultural crops include bananas, citrus, avocado, papaya, mango, passion fruits etc. The major industrial crops are sisal, cotton, coffee, coconuts, Macadamia, Sunflowers, cashew nuts, groundnuts, Sesame, Jojoba and castor.

Maize and beans are the most important food crops and are mainly grown for subsistence. Other pulses are also grown and are mainly intercropped with maize. Planting of sorghum and millet in the hills is rare, because their acceptance as food crops is low due to their unpopularity as food. Arrowroot and cassava are very important food crops and an alternative when the maize crop fails. Sweet and Irish potatoes are also grown and consumed locally.

The main crop in the lower zones is maize that is often seriously affected by drought. Beans and pulses such as green grams, pigeon peas and cowpeas are widespread. Cassava is also grown to supplement maize. Cotton used to be a cash crop for the lowland communities, but the marketing situation is poor and there is little production. The only large-scale farming is sisal growing. There are two sisal estates remaining, namely Teita and Voi sisal estates. These estates also practice fruit, beef, dairy and vegetable production to diversify and reduce reliance on sisal production alone (DALP 2000; DAO 2000).

2.2 Livestock production

The main livestock products are meat, milk and hides. Dairy production is more common in the upper zone of the Taita hills where the climatic condition and small land holdings are favourable for zero-grazing. The types of dairy cattle found in those areas are Friesian, Ayrshire, Guernsey and Jersey as well as crossbreeds (1990 and DLPO 2000). Dairy production is concentrated in Wundanyi Division, Werugha location and the Bura areas. Most farmers practice zero-grazing. There are approximately 20,000 graded dairy cattle with a milk production of 8 – 12 litres per cow per day while Zebu cattle numbering 11,000 produce on average only 1.5 litres milk per cow.

In Taveta sub-district dairy production is low due to tsetse fly infestation and a natural inclination to horticulture. There is plenty of milk during rainy season from local cattle especially from Maasai livestock, but the production is significant during dry season (Table 8). Few people practice dairy farming. Goats are kept especially in Njukini area. Goat milk is consumed locally.

There is great potential for dairy production in the sub-district due to possibilities of growing fodder but transport of milk is restricted by bad road conditions. Milk production figures for Taveta are given at 9 642 litres per month.

In the lowlands dairy production is low. Zebu breeds are preferred due to their better tolerance of prevailing harsh conditions – climate and diseases. The average milk production is low and milk is consumed locally.

Table 4: Number of dairy production in the district in 2004

Division / sub-district	Livestock population	Milk produce per year (litres)
Wundanyi	8000	5,941,906
Voi	630	560 100
Mwatate	4000	3,252 520
Tausa	490	294,000
Mwambirwa	1200	976,000
Taveta	235	1,15,704

Source: DAPO 2004

In Taita hills there is no beef production because of small farm sizes. In Taveta sub-District, most of the livestock is kept on communal land due to the fact that there are no ranches and more than $\frac{2}{3}$ of the land is privately owned. The climate is not very suitable for livestock (hot and dry), so there are only indigenous cows, goats and sheep (Dijkstra and Magori 1994). Livestock is owned by the Maasai, Kamba and Taveta tribes and most common cattle breed read is Zebu.

In the lowlands, there are 25 ranches with different systems of organization. The size of the ranches varies between 20 205 and 43 096ha (DALEO 2005, Were 1986). The ranches are reserved for livestock production through an individual or central herding system. The percentage of livestock kept in the ranches has reduced during recent years due to lack of economic activities, basic infrastructure, harsh climatic and environmental conditions (drought, land degrading etc). Goats are better adapted to such conditions than cattle and sheep. Currently, most of the ranches are operating far below their carrying capacity. As the ranches are under stocked, the Somali community is leasing ranches to graze and fatten cattle that are in transit between North Eastern Province and the market.

There is only one auction ring (Small-scale) for animals in the district, Chumvini market, situated in Njukini location in Taveta sub-district. Middle-men buying cattle from the ranches play an important role in the sale of cattle. Butchers also purchase livestock directly from the ranches. To date the marketing strategies have been poor.

Bee keeping is also practiced. The log hive is most common, where a hollow tree is used with timber lids at both ends. The raw product from the fixed comb hives is called crude honey that is crushed combs, containing honey, wax, pollen and other particles. Other technologies are also famous. These are the modern movable comb hives such as the Kenya to Bar Hive (KTBH) and the langstroth hive. Currently, the amount of honey harvested per year is 7,200 kg from KTBH and 12,000 kg from log hives. The potential of bee keeping has not been fully exploited.

Environmental Issues in Agriculture and livestock

- Soil erosion
- Overgrazing
- Prolonged drought
- Degradation of water points

Proposed Intervention

- Increase livestock water points
- Promote rain water harvesting
- Monitor stock levels
- Promote alternative livestock and crops

2.3 Water Resources

The various hills in the district are a source of streams and springs providing water for domestic and livestock consumption.

The district can be divided into four major drainage basins:-

Lumi river basin in Taveta division- River Lumi arises from Mt. Kilimanjaro in Tanzania and empties into Lake Jipe and the Ruvu River is a surface outlet of Lake Jipe flowing into Tanzania. There are 2 lakes within the Lumi basin. The Crater Lake Challa and Lake Jipe.

Tsavo river basin in Taveta and Wundanyi division- Tsavo River arises from Njukini springs in Taveta Division. It flows into Athi River.

Voi river basin in Voi and Wundanyi Divisions- Voi River arises from the Taita hills and flows into Aruba dam in Tsavo East National Park.

Mwatate river basin in Mwatate Division- Mwatate river has Bura river as its major tributary and flow southwards through the national park into Kwale District.

Voi town is supplied with water from Mzima springs. However, despite rapid population increase and demand, the water supply to Voi has never been improved since the Mzima – Mombasa pipeline was built in 1952. The supply from Mzima springs is not sufficient to meet the demands of Voi town.

Two setbacks affecting mainly the ASAL areas have been the lack of sufficient supplies of water for household consumption and lack of animal watering points. Human Wildlife conflicts are a result of wildlife leaving the parks in search of water during dry seasons. Some of the private ranches and KWS have established water pans in their respective areas to water livestock and wildlife. Small dams can be found in the district, particularly in the ranches (Mramba and Lualenyi dams) most of the dams contain water the year round and quality is fairly good.

Taveta sub district has a high ground water table and substantial water resources due to its proximity to Mt. Kilimanjaro. The rainfall at the slopes of Mt. Kilimanjaro is often heavy and run off is high causing floods which are a menace to roads, bridges and irrigation projects.

Table 5: Status of boreholes and shallow wells in the district

Division/ sub district	No. Operational	No. dry	No. saline water	No. abandoned	Total
Bore hole data					
Mwatate	10	12	13	23	58
Taveta	2	1	0	4	7
Voi & Tausa	6	4	2	11	23
Wundanyi	1	0	8	9	18
Shallow wells data					
Mwatate	6	2	0	-	8
Taveta	47	23	2	-	72
Voi & Tausa	10	2	0	-	12
Wundanyi	5	2	0	-	77
Total	68	29	2	-	99

Key issues

- Competition between human and wildlife over water resources
- Lack of adequate watering points
- Insufficient distribution with water supply
- Water pollution
- Over abstraction of water resources
- Destruction of water catchment

Proposed intervention

- Provide adequate water points for livestock and wildlife
- Reafforestation and deforestation of water catchment areas
- Enforce water quality regulations

- Create awareness on water conservation
- Inventory of wetlands

2. 4 Forestry

There are different types of forests in the district. The most important of these are the moist forests of the Taita Hills, which belong to the Eastern Arc Forest Mountains of East Africa. The indigenous forest area has been severely reduced due to encroachment for activities, plantation of exotic trees, demand for firewood and agricultural land.

The total area of forest is currently 10,233.62 ha. Statistics on private forests are not available. They consist of exotic tree plantations and bush land but also pockets of indigenous forests. Of the total area, 41.5% are indigenous forests, 12% exotic forests, 1% contains endemic species and 46% are bush land (DFO, 2004).

Table 6: Disturbance of the Natural Vegetation in Taita Taveta District.

Major Forest Patches	Disturbance
Chawia	<p>Livestock grazing and watering</p> <p>Exotic species</p> <p>Timber harvesting (exotic species)</p> <p>Road construction to a transmission booster</p> <p>Encroachment</p> <p>Firewood collection and pole-cutting</p> <p>Selective logging in the past</p>
Kasigau	Undisturbed
Kitobo	<p>Fire</p> <p>Selective logging in the past</p> <p>Livestock grazing and watering</p>

	Charcoal burning
Macha	Exotic species Fire
Mbololo	Exotic species
Mwachora	Fire Exotic species Encroachment
Ngangao	Exotic species Selective logging in the past
Sagalla	Exotic species Fire
Vuria	Cleared for agriculture Fire Exotic species Livestock grazing
Yale	Fire Exotic species Encroachment
Woodland/bushland in the lowlands	Uncontrolled and intensive charcoal burning Livestock grazing

Source: DFO 2004

Table 7: Size of forested areas in the district

Type	Area in ha	Forestry	Bush land
Gazetted	1,118.21	613.46	563.70
Non-gazetted	9,165.41	1,452.80	7,107.84
Total	10,283.62	2,066.24	7,644.54

Source: DFO 2004

Key issues

- Encroachment to provide land for Agriculture,
- Plantation of exotic trees threaten indigenous forest,
- Demand for firewood.
- Illegal logging
- Rampant Charcoal burning

Proposed intervention

- Rigorous patrol to contain illegal loggers
- Promote on farm agro forestry
- Create awareness on the importance of indigenous forest

2.5 Wildlife Conservation

Wildlife protection areas form an important land use type Taita Taveta. National Park such as Tsavo East and Tsavo West National Park are play an important role in wildlife conservation and promotion of tourism in Kenya.

Kenya Environmental issues

- Human wildlife conflict

- Poaching of game
- Poor attitude towards wildlife

Proposed interventions

- Contact vigorous problem animal control
- Promote land use that is compatible with wildlife conservation
- Promote ecotourism and other revenue generating activities

CHAPTER THREE

3.0 HUMAN SETTLEMENTS AND INFRASTRUCTURE

3.1 Population Dynamics and Trends

The total district population according to the last Census (1999) was 244 945 persons. The census projected a population of 252 000 persons by 2000. The population was projected at 269 683 persons by 2004 using the population growth rate of 1.8%. However, there are variations in the population distribution and in the rates of population distribution and in the rates of population change across the district.

Most people live in higher potential areas of the Taita Hills and Taveta sub-district and in urban centres.

Table 8: Population in Taita Taveta District

Area	Population	Density
Mwambirwa Division	4 959	113
Mwatate Division	56 892	33
Tausa Division	20 541	66
Taveta Sub District	52 142	83
Voi Division	53 316	18
Wundanyi Division	55 118	80
National Park	1 977	0.2
Total	244945	14

Source: Population census 1999, DSO

Majority of the population lives in areas between 1000 and 2000m a.s.l. especially in Wundanyi, Mwambirwa and Tausa Division. These high potential agricultural areas have experienced growth rates above the districts average, which has led to increasing land

fragmentation and land shortage. The result is down slope migration to the foothills and lowlands.

Besides, many Kambas have settled in Taveta and the drier, less densely occupied areas of Taita, especially around the Kasigau area. Many Duruma and Mijikenda have settled between Buguta and Maungu where they have outnumbered the indigenous Taita. The Luo and Luhya are mainly found in and around the sisal plantations (Taveta, Ziwani, Mwatate, and Voi (where they are employed). Other tribes are mainly found in urban areas, especially Voi and Taveta and in the mining areas. There is an increasing number of the Somali leasing ranches in Taita's for keeping livestock.

3.2 Infrastructure

The various colonial land ordinances between 1902 and 1930 and the crown lands ordinance categorized land into crown land and native reserves. Most of the crown land in the district was gazetted as the Tsavo East and Tsavo West National Parks in 1948, covering more than 62% of the district. At the same time larger parts of crown land also became a game reserve and hunting blocks. Vast area amounting to 73 560 ha were leased or sold to sisal estates. After independence the crown land became trust land under the Local Authorities. The government initiated a land adjudication programme in 1968. Most of the upland areas have now been adjudicated while in the lowlands and transitional zones, the land privatization has not yet been completed.

The landownership in Taita Taveta District fall under the following categories:-

Communal land: This land is not yet fully adjudicated. It belongs to the community members who have rules and regulations governing its use.

Government land: The government including government properties, national parks and rangelands owns this land

Trust land: This land is entrusted to the local Authorities on behalf of the local community.

Freehold: The owner holds a title deed and the land is transferred either through sale or inheritance.

Leasehold: this is land leased from the government or local authority. The lease may be for 49 or 99 years.

Population distribution in the district is mainly influenced by rainfall and to some extent the availability of off-farm employment. As a result, areas with higher rainfall or with irrigation potential have a higher population than the drier areas. Urban centers too have higher population densities due to availability of off-farm employment. Thus, Taita hills, Taveta sub-district and urban centers of Mwatate, Taveta, Voi and Wundanyi have higher population concentrations.

In Taveta sub-District, 430 km² (68%) of a total 632 km² belongs to two private companies, the agro- development company and the Gicheha farm. In the lowlands, a larger portion forms the Tsavo National Parks. There has been also a recent trend towards land speculators settling in the district, especially in Taveta sub district. This migration coupled with a general shortage of land has created a large squatter population.

In recent years the government has initiated several settlement schemes in the district to settle the squatters and other landless people.

Table 9: Settlement schemes in Taita Taveta District.

Scheme	Location	Size (ha)	Remarks
Lake Jipe	Taveta	11716	Registered but with poor infrastructure
Mulughi	Mwatate	285188	Registered but with poor infrastructure
Wananchi	Mwatate	8903	Registration in progress
Mwachabo	Mwatate	11979	Registration in Progress
Maungu/Buguta	Voi	23786	Registration in progress

Source: DLASO, 2000

Road network

The district has a total classified road network of 1038.1 km (150.6 km paved road, 268.7 km gravel and 585.8 km earth, and 33 km government access roads). Road infrastructure is poor and often non-existent. During rain season's accessibility on the gravel and earth road network is very difficult.

As most of the populations are farmers, they require good motorable roads to reach the markets, to access agricultural inputs, extension services and other complimentary services like education and health care. The poor state of the roads is a major setback on agriculture and general development.

Health facilities

There are three district hospitals (Moi, Wesu and Taveta), 8 health centres and 25 dispensaries supported by GOK. There are also a number of NGO supported dispensaries namely Wusi, Wutesia, Bura Mission, Vighombonyi and Eldoro Mission and three others are managed by the sisal estates, namely Teita Estate Sisal clinic, Ziwani Sisal Clinic and Taveta Sisal Clinic.

Health facilities are distributed fairly across the district with 60% of the population having access to a health facility and health education within a five-kilometre radius. The main cause of morbidity in the district is malaria, upper respiratory tract infections, skin diseases, diarrhoea and intestinal worms. There is a high incidence of HIV/AIDS resulting in high mortality rates.

Educational facilities

The district has a fair number of educational facilities although the nine of classes. Laboratories, workshops and home science rooms are not evenly distributed. There are 184 public primary schools, 6 private primary schools, 38 public secondary schools, 4 private secondary schools almost 300 ECD centers and 1 private teachers training college.

The literacy level in the district is estimated at 78%. Access to educational facilities is good in the highlands as compared to the lower regions of the district, e.g. Kishushe, Sagalla, Tausa and Wumingu. This is attributed to the fact that poverty levels in the lowlands are higher and parents cannot provide adequate facilities. They do not pay fees on time and parents/pupils in general have negative attitudes. The distribution of teachers is poor.

Energy

The main source of energy is fuel wood (firewood and charcoal). Firewood is predominant in the rural areas while charcoal is common in the urban and pre-urban areas. Other energy sources utilized are electricity, Kerosene and liquefied petroleum gas (LPG). Renewable energy sources (solar, biogas and wind) are not exploited even though the potential of solar and biogas utilization appears to be high. There are three types of fuel wood sources in the district. These are on-farm fuel wood collection, collection from rangelands and forests and purchases from markets.

Over 90% of the rural population use firewood, while the remainder uses charcoal and/or kerosene. Most of the people living in urban and peri-urban centres use a combination of charcoal, kerosene and firewood and a small proportion use gas and electricity. The total demand for fuel wood is estimated at about 41,000 tons per year. The requirement per household is approximately 200kg firewood, about 2 sacks of charcoal and 20 litres of kerosene per month.

Major energy end-uses include cooking, lighting, and milling. In milling, diesel powered engines are used especially where electricity is not supplied. These include posho mills, farm machinery (tractors) and water pumps. Some farmers use animal draught power for ploughing and cart pulling mainly by oxen and / or donkey.

The availability of wood energy can only be sustainable if the annual growth of wood (supply) is greater than the amount being cut (demand). Unfortunately, the Taita hills,

formerly covered by dense forests, have been severely deforested to create room for crop production. This has led to a wood energy deficit resulting in Environmental degradation resulting from decreasing tree cover in the high potential areas, Increased use of branches, tree, stumps and roots, agricultural residues (maize cobs ad stems) and animal wastes, Increasing distances walked in search of fuel wood and rising prices of fuel wood.

Strategies/Recommendations

The relevant government departments should formulate a policy on fuel wood energy and in particular deal with the charcoal production, sale and use issues, promote forestry extension service and encourage landowners such as ranchers and other private individuals to plant trees with the aim of meeting fuel wood demand and finally promote alternative energy resources and fuel-efficient stoves.

3.3 Environmental Health and Human Health

3.3.1 Solid Waste management

Solid waste has been categorized as trade, industrial, municipal, agricultural institution, domestic, construction debris and waste from mining operations. Unsuitable patterns of production and consumption are increasingly generating large quantities of waste. At domestic level, solid waste is mainly managed by use of refuse pits that are then burnt or composted.

In urban centers, the business of handling solid wastes is vested to the local authorities. The collection service is not sufficient. Uncollected waste is found all over in play fields, between houses, along the roads, waterways, and sometimes on top of trees, collected solid wastes are disposed off in open dumps and burned. In health institutions, bio hazardous wastes are managed by crude burning. Some few have incinerators.

On site sanitation in human settlements use both dry and wet conservancy. In rural areas pit latrines are the most commonly used, built using local materials and skill. A few ventilated

improved pits (VIPs) are also in use in selected homesteads. Urban and peri-urban centres also use pit latrines, the VIPs and the pour-flush toilets, septic tank and soak pits.

3.3.2 Liquid Wastes Management

The main mode of liquid waste management in the district is through septic tanks and soakage pits. These are individual owned. Sikujua estate in Voi and Voi sisal estate use lagoons to manage their liquid wastes.

3.3.3 Pollution

Pollution is a potential problem in the district. The main areas of concern include soil and water pollution. Among the major pollutants are plastics, agro-chemicals, urban waste and industrial waste. The extensive use of agro-chemicals in the horticulture industry particularly in the Taita hills and in Irrigation schemes in Taveta is a potential issue. Good amount of agro chemicals (fertilizers and pesticides) are applied in farms. Most farmers do not follow the indication of use and end up using them incorrectly. These chemicals accumulate gradually and with time leach out into streams, rivers and other water bodies.

Urban and industrial wastes are also gradually becoming environmental issues. This is because the urban centers in the district lack proper drainage and sewerage systems, for example, Voi sisal estate discharges some of its waste into Voi River.

3.4 Management Challenges and Strategies

The main challenges facing pollution and waste management in the district include lack of resources and management plans. All the urban centers in the district lack any form of sewage treatment and disposal system. Besides, the urban centers do not have plans on how issues of waste disposal should be handled. Issues are handled in a haphazard manner. The simple collection and dumping of solid waste need to be looked into more seriously.

3.5 Recommendation/Strategies

Develop a waste management plan, pollution and waste management monitoring system. This will help in taking appropriate actions at any given time

Assisting the local authorities set up sewerage system and waste disposal systems.

3.6 Disease incidences

3.6.1 HIV/AIDS prevalence

Reports show that there was no tool for HIV status monitoring in the District until the year 2003. The prevalence rate per division is shown in table 7 below:-

Table 10: HIV/AIDS Prevalence.

Division	2003	2004
Wundanyi	5	2.8
Mwatate	15	7.6
Voi	8.5	5.4
Taveta	4.8	5.9
Tausa	-	-

Source: DPHO, 2005

The root cause of the spread of HIV/AIDS in the District can be attributed to urbanization, poverty and population growth. As more and more school leavers migrate to major towns in search of jobs there is a tendency for these peoples to “Import” the disease into the district. There is also the aspect of influence from tourism. This lures small girls into commercial sex in town within the district such as Bura, Mwatate, Voi and Taveta. The cross-border trade activities in Taveta are other contributing factor where there is a high rate of movement in and out of the region. The Mombasa-Nairobi highway, too has contributed to this factor where the long distance truck drivers rest overnight and in the process interact with commercial sex workers in town such as Voi and Maungu.

Prevention and control

Several strategies have been employed in the district to curb this scourge. Voluntary Counselling and Testing (VCT) and Prevention of Mother to Child Transmission (PMTCT)

centres have been established. Education to the general public on methods of prevention is an on-going activity. Several community-based organizations have been formed and some have got support from National Aids Control Council (NACC). Condom distribution and use has been effective in the entire district.

3.6.2 Tuberculosis (TB)

The number of TB cases increased from 242 in 1993, 791 in 1996, 974 in 1991 to 1030 in 2002. The rise could be attributed to the following predisposing factors. Immuno-compromising infections especially HIV/AIDS, TB is one of the common opportunistic infections of HIV/AIDS. Increased number of reservoirs of the tuberculi – the bacteria causing TB (the more people with infective bacilli, the more will be exposed and infected), Poverty (more than 60% (almost 153,000) of people living in the District are absolute poor), Poor housing (no proper ventilation and lighting, dampness and overcrowding) and poor ways of feeding leading to lowered immunity.

Several interventions have been employed in the District to control the spread of TB. Health education has been administered at individual and community level. Provision of drugs has been facilitated almost in all health facilities. Defaulters of TB treatment have been traced and their treatment resumed. Free sputum test is being done at all government hospitals and health centers in the district.

3.6.3 Water borne disease

These are diseases such as eye infections, skin infection, cholera, and intestinal worms. They are favored by either water shortages and/or use of contaminated water. The lowlands of Taita Taveta District are subject to water shortages and these do not meet the demand or are heavily contaminated as they are shared among man, domestic and wild animals. This is evident in Voi, Taveta, Tausa and Mwatate Divisions.

3.6.4 Vector-borne diseases

The main vector borne disease in the district is malaria which is also a leading cause of outpatient morbidity in the district. It is more prevalent in the low-lying divisions, due to

warm climate favoring mosquito breeding. These include Mwatate, Voi, Tausa and Taveta Division. However, malaria has been realized in the highlands as well.

Wastewater disposal both in urban and rural areas has contributed much to mosquito breeding which is the malaria vector.

3.7 Recommendation

The relevant government departments should carry out awareness creation on matters to do with health such as the HIV/AIDs scourge, malaria prevention and other related diseases, create a conducive atmosphere for the creation of jobs such as the provision of affordable capital and facilitate the enforcement of the Public Health Act, Food Drugs and Chemical Substances Act, EMRA among others.

3.8 Poverty and Environment

3.8.1 Livelihoods

The high population density in the highlands has led to serious land fragmentation. The resulting land holdings are small and are needed to grow food crops. Poverty in general and limited technical and materials resources, coupled with small landholdings, has meant that investments in soil conservation have been inadequate. Likewise, populations migrating from the hills to the transitional zone and the lowlands generally apply the same farming techniques as they used before they migrated, which are not suitable for the drier areas.

3.8.2 Incomes

The largest proportion of the labor force in the district is engaged in small scale farming activities and unskilled labor in the agricultural sector followed by the public and formal sector. Poverty is a major constraint to rural development. The majority of the people in the district depends mainly on subsistence farming and do not have other sources of income. The average income for most of the households is Ksh 2,000 per month. Therefore, savings for most farmers are impossible and investments are low. The agricultural production in 1977 amounted to less than one third of the required quantity of food in a district that already has a protein deficit of 71.5%. Areas like Kishushe, Mwambirwa, Mwatate and some

parts of Taveta face serious food shortages and are targets for food relief operations that are currently taking place. Crop failure results in movement into petty trade along the roads, particularly during the dry seasons. The few protein sources the community may have, i.e. eggs, milk etc are sold to generate income rather than consumed locally.

The reasons for Taita Taveta District being a net importer of food included among other things, harsh environmental conditions, and slow/little adoption of early and drought resistant crop varieties. Slow adoption of modern farming and storage techniques and finally agricultural development has not fulfilled the demand of the increasing population. These setbacks have resulted in low output and, consequently, in low income from agricultural produce leading to food shortages. There is need to enhance the production of drought resistant crops as well as adequate farming methods to improve productivity and hence income/food security.

The management of forest resources is based on the National Forest Policy and supported by the forest act. The Forestry Department under the Ministry of Environment and Natural Resources is responsible for the management of gazetted forests. The non-gazetted, forests (trust land) owned by the County Council are held in trust by the Councils on behalf of the local community. The forests are managed purely for conservation and water catchment protection. Since the Presidential ban in 1977, on harvesting of indigenous tree species, no more harvesting of the same has taken place. The little harvesting before was done on a selective-cutting basis, i.e. no clear cutting or felling. However, the harvesting of exotic trees continued until 1998 through licensing from the Forest Department but the District Commissioner stopped this after a public outcry. Apart from the planting of trees in the forests and their protection, no other conservation activities are taking place.

The Taita hills used to be covered by montane mist forests whose remnants can still be found on the highest peaks, namely Mbololo (Mraru) Ngangao, Chawia and many smaller patches in the Taita range and relicts of natural forests in the Sagalla and Kasigau ranges.

The vegetation in these ecological fragile areas has been severely reduced and the remnants are in different stages of degradation.

In 1991, approximately 11,900 ha of the District's area was in use for agricultural production. In terms of area, the largest crop was cereals and pulses (54%), followed by vegetables, fruit and tubers (25%) and industrial crops (20%). Most people in the district are engaged in subsistence farming. However, large-scale farming is also practiced although to a lesser extent. The average farm size in the district varies from 0.4 ha in the hills to 4.8 ha in the drier areas. The small farm sizes are insufficient for middle or larger scale cash crop production. This is the major reason why farmers mainly grow food crops and vegetables in the highlands.

The Taita are traditionally found in the high potential areas of the Taita hills but have also settled in the transitional zones and the lowlands around the hills and in Taveta sub-district. Traditional religious and social practices are drying out due to increasing christianised generations with modern education. Receptiveness to new ideas and a positive attitude to development are values that are in progress. Respect to elders and co-operation in cattle herding and other main tasks are traditional values that are still strong.

Poverty reduction strategies – Kenya's poverty eradication plan was formulated in line with the goals and commitments of the international development goals, notably to reduce the proportion of people living in extreme poverty by half by 2015. It is estimated that by 2015, the incidence of poverty will have reduced to less than 30% of the total population. In line with the above, in Taita District, strategies have been put in place to ensure that agro-forestry systems have been enhanced through the integration of appropriate woody plant species to increase and stabilize soil fertility, through nutrient uptake and release, improvement of the microclimate and provision of wood resources among other functions. This is schematically presented by figure 5 below;

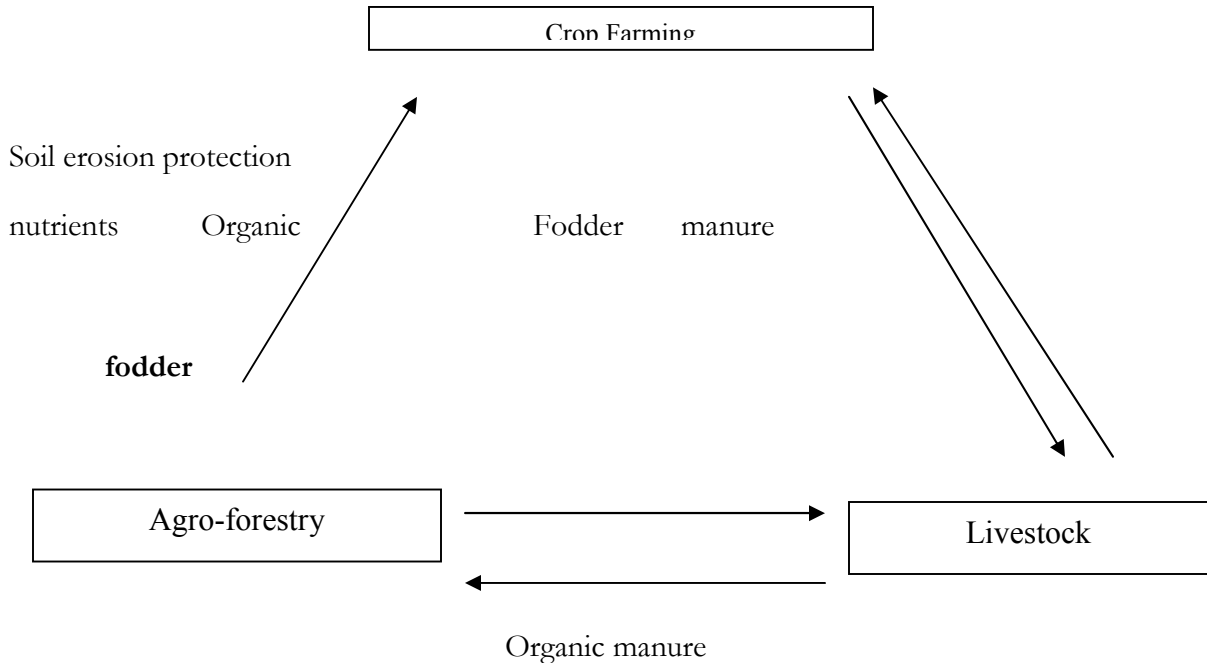


Figure 5: Integration of appropriate woody plant species to increase and stabilize soil fertility through Agro-forestry

3.9 Production and Consumption

Taita Taveta District is primarily an agricultural District and agriculture continues to play a leading role in the Districts economy. Most of the local people depend on the agricultural economy, especially crop growing and livestock farming. Some people rely on small-scale business such as hawking and the informal artisanal sector, for their income. According to the district development plan, the industrial sector is one of the best developed in Taita Taveta District. Many of the districts products are consumed locally (MPND).

Industrial activities are distributed mainly in the urban centres in the form of production and service industries. Production embraces processing activities e.g. Jua Kali and manufacturing industries, power and water industries, processing of mining products ad the construction industry. The service activities comprise of for instance banking, insurance and hotel/restaurant trade.

CHAPTER FOUR

4.0 TRADE, INDUSTRY AND MINING

4.1 Industrial activities

This sector has not well found its place in the district, however, sisal, as industrial crops is widely grown. Processing and fabricating industries are therefore mainly agricultural based. Industrial activities are distributed mainly in the urban centers in the form of production and service industries. There are four sisal estates, one in Voi division, and another in Mwatate division and two in Taveta division., The sisal estates in Taveta division are no longer in production.

Production embraces processing activities e.g. Jua Kali and sisal processing, processing of mining products and construction industry. The service industry comprise of, for instance, banking, insurance, and the hotel/lodge/restaurant trade.

4.2 Industry and Environment

According to the District Development Plan, the industrial sector in Taita Taveta District is the least developed. Most of the local people depend on on-farm employment to earn their living. Some depend on small-scale enterprise/industries to earn a living. These small-scale enterprises are geared to the needs and income of the local people and are mainly dependent on local markets.

Some processing industries, for instance, Voi sisal estate have not put in place infrastructure to properly treat their effluent to reduce bad odour in the surrounding

4.2.1 Industrial potential

The district has the potential for agriculture/based processing industries because of the economic activities in horticulture, dairy production, beekeeping and livestock keeping not forgetting mining.

4.2.2 Mining, quarrying and sand harvesting activities

The district has different geological resources namely, minerals, rocks and sand. Mining is done in the lowlands, where especially harvesting of gemstone attracts mainly people from outside the district. The Taita community is usually not in the mining business. Mineral processing industries e.g. polishing industries are not located in the district. There is a gemstone market in Rukanga (Kasigau) once a week.

Only private companies e.g. Rock Land Limited, Hardrock Mining Co. Limited, Megalith Co. Limited, Aquamine Co. are successful; due to high levels of funding required for capital expenditure which the locals do not have. In addition, quarrying for building stones also takes place in the district. These are found in Taveta sub district and in Wundanyi Division. Quarrying for limestone and murrum for road building also takes place.

Disused mines and quarries are as a result of the intensive mining activities taking place to the area. The quarries are mainly as a result of building stone quarrying near Taveta town. The available tuffs in this area have been a major source of building materials for long. The abandoned mines and tunnels have been the works of gemstones seekers looking for the highly valued green garnets, rubies, sapphire, n tourmaline, etc. The trouble, however, is that nobody takes interests in restoring the quarrying sites to their original state after recovering the natural resources and making runner-way profits.

The damage of the mining activities present in the following manner

- i. Open pits / quarries – accelerate soil erosion, present a safety risk and may collect rainwater to form pond.
- ii. Piles of water rock/soil – they disturb the natural terrain and affect the scenic beauty of he country side as well as increasing siltation.
- iii. Underground tunnels – affect the ground water movement, introducing pollution and creating an unstable ground.
- iv. Abandoned plant and machinery – rusty machinery and scrap metals pollute the soil; they create cove for rodents, mosquitoes and even criminals.

Most of the mines are abandoned while a few are still active. Among the abandoned ones a small number can be rehabilitated using the available earth material dug out. A majority of these will have to be landscaped since they cannot be refilled.

Table 11: Disused mines and quarries

No.	Location Name	X Coord	Y Coord	Alt	Area	Tunnel length	Volume	Remarks
TT1	Mwatate-Lualenyi	422777	96098 32					Limestone quarry
TT2	Mgama ridge	419685	96042 83	125 1	3.5X3.5		3.5X3.5 X2	Can be filled with available material
TT3	Mgama hill	419836	96039 96	127 0	4.5X4.5		4.5X4.5 X3	Insufficient material to refill. May be planted
TT4		419775	96040 68	127 3				No certain solution
TT5		419863	96039 60	127 6			2.5X2.5 X4	Sufficient material to refill. May be planted
TT6	Kamtonga	430275	95970 49	850	2.8X1		2.8X1X 1.6	Active pit owners need to develop rehabilitation plan
TT7 (Pit 1)	Mwaririmba estate – Saulo Mwangola	430064	95968 78	847	5X5	1 tunnel – 7m	5X5X4	Insufficient material to refill. May be planted
Pit 2		430040	95968 80	852		1 tunnel – 20m	8X8X6	Can be filled with available material
Pit 3		430002	95965	846	57X57	2 tunnel –	57X57X	Try landscaping but no solution for

No.	Location Name	X Coord	Y Coord	Alt	Area	Tunnel length	Volume	Remarks
			60			20m	5	tunnels
Pit 3a		429986	95968 63					
Pit 3b		429964	95968 54					
Pit 4		430049	95967 70	845		1 tunnel - 10m	3.5X10 X7	Can be refilled with available material- active
TT8(Pit 1)	Mwairimba Estate	430087	95967 87	859		2tunnels - 20m	50X25X 8	Can be refilled with available materials
Pit 2		430741	95967 59	846			40X20X 7	Can be filled with available materials
Pit 3		430769	95967 56	842			20X10X 8	Can be refilled with available material- not the tunnel
Pit 4		430766	95967 48	843			30X40X 7	Can be refilled with available material
Pit 5		430179	95967 86	836		1 tunnel – 10m	25X10X 7	Can be refilled with available material-to tunnel entrance
Pit 6		430151	95968 37	844			30X20X 6	Can be refilled with available material- shallow

No.	Location Name	X Coord	Y Coord	Alt	Area	Tunnel length	Volume	Remarks
Pit 7		430740	95968 49	848		2 tunnel – 10m	45X15X 8	Can be refilled with available material- shallow
TT9 (Pit 1)	Mwananchi area Mkungusi	429603	95900 47	824			20X10X 8	Can be refilled with available material
Pit 2		429593	95900 56	821		1 tunnel– 00m	15X7X6	Can be refilled with available material-to tunnel entrance
TT10(Pi t 1)	Mr. Muchemi	429614	95900 02	821			15X5X7	Can be filled with available material- active
Pit 2							40X40X 15	Can be filled with available material - active
Pit 3		429638	95899 39	829		1 tunnel - ?m	15X15X 12	Insufficient material to refill. May be planted
Pit 4		429669	95899 01	831		2 tunnel - ?m	40X20X 10	Insufficient material to refill. May be planted
TT11(Pi t 1)		429675	95898 75	837		3 tunnel - 15m	70X20X 10	Insufficient material to refill. May be planted
Pit 2		429701	95898 25	827			80X50X 12	Can be filled with available material
Pit 3		428743	95896	836			2X10X3	Can be filled with available material

No.	Location Name	X Coord	Y Coord	Alt	Area	Tunnel length	Volume	Remarks
			93					
Pit 4		429730	95896 97	835			3X20X7	Can be filled with available material
Pit 5		429745	95896 50	832		1 tunnel – 20m	5X20X7	Insufficient material to refill. May be planted
Pit 6		429779	95895 89	833		1 tunnel - ?m	3X5X3	Insufficient material to refill. May be planted
Pit 7		429792	95395 50	827			10X8X1 2	Can be filled with available material - active
TT12	Kimotho	429847	95894 84	831			100X30 X20	Insufficient material to refill. May be planted
TT13	Mwangi's claim	430085	95890 37	813		3 tunnel - ?m	80X20X 10	Can be filled with available material
TT14(Pit 1)	Daudi's claim						60X20X 10	Insufficient material to refill. May be planted
Pit 2		430121	95889 56	807			20X50X 8	Insufficient material to refill. May be planted
Pit 3		430330	95887 36	734		1 tunnel - ?m	80X40X 18	Insufficient material to refill. May be planted

No.	Location Name	X Coord	Y Coord	Alt	Area	Tunnel length	Volume	Remarks
Pit 4		430319	95887 43	793		1 tunnel - ?m	30X20X 15	
TT15(Pit 1)	Mwema's claim	430870	95886 90	783		2 tunnel - ?m	50X10X 8	Insufficient material to refill. May be planted
Pit 2		430376	95886 73	738			50X40X 7	Can be filled with available material
TT16(Pit 1)	Mama Fatuma Haji claim	432280	95853 80	791		3 tunnel – 20m	7X7X3	Can be filled with available material
Pit 2		432323	95853 84	802		1 tunnel – 20m	7X7X5	Active
Pit 3		432255	95853 50	789		1 tunnel – 5m	20X20X 5	Can be filled with available material
TT17	Hussein Dery Iron Site	408340	96409 56	941	500X500			Inactive mine site
TT18	Ndononi village	354266	96309 79	935				Building stone quarry – an EA is needed
TT19	Kenya – Tanzania border	353619	96295 50	872				Building stone quarry – an EA is needed
TT20	Kenya – Tz small quarry	354627	96302	888				Building stone quarry – an EA is needed

No.	Location Name	X Coord	Y Coord	Alt	Area	Tunnel length	Volume	Remarks
			35					
TT21	Taveta quarry	354874	96300 98	872				Building stone quarry – an EA is needed
TT22	Lake Challa quarry	356389	96307 26	858				Building stone quarry – an EA is needed
TT23	Shasha Limestone quarry	442859	96179 61	661				Insufficient material to refill. May be planted
TT24	Shasha quarry 2 – Nanak Limeworks	444029	96180 59	657				Has submitted an EA

Sand is found along rivers and is mined by individuals, e.g. in Voi river.



Plate 4. Disused limestone quarry.



Plate 5. Gemstone mining in Kasigau, Taita/Taveta District.



Plate 6. Building stone quarry near Taveta town.



Plate 7: Building stones near Taveta town.

4.3 Trade and Environment

There are different types of trade going on in the district, which includes motor vehicles garages, Jua Kali workshops, carpentry workshops, supermarkets, wholesale shops, timber yards, retail shops/Kiosks, hotels/food kiosks, saloons and hawking among others. This trade litters the town with a lot of solid wastes and more so, plastic bags. The local council has stepped up their effort to clean up these towns in addition to providing litterbins. The biggest challenge however is to the general public to change its habit of disposing of litter with no regard to cleanliness of the environment and the syndrome of “out of sight out of mind”. Of greatest concern is the disposal of wrapping materials and in particular plastic bags. These litter most of the urban centres and it is not uncommon to see plastic bags trapped in tree branches and get reports of animals (especially livestock) deaths caused by feeding on the material.

4.3.1 Other Trade / Economic Activities

Housing / rental activities are mainly undertaken in the urban centres of the district, e.g. Wundanyi, where the Local Authorities, together with the 100 housing units of Mbela Estates are generating income. The district is also rich in tourist attractions due to picturesque scenery in the National Parks and the game sanctuaries as well as a rich wildlife. There are many low star tourist facilities as well as five first class lodges including Hilton safari, Voi safari, Ngulia and Kilaguni Lodges. There are also tented camps in the protected areas. Amazingly, the communities adjacent to the parks and sanctuaries do not derive any substantial benefits from

the tourism facilities other than employment. The participation of local people in marketing of curios and handicraft is low.

Despite abundance of wildlife in the national parks and in the ranches which until the mid 1970's have been known worldwide as a "Big Five" stronghold. Tourism performance has reduced substantially during recent years and many tourist facilities are non-operational (Allen-Rowlandson 2000). Apart from the Districts abundant wildlife which supports the multi-million dollar coast tourism circuits. Taita hills forests are also unique as a tourist attraction / destination point in that they have one of the highest levels of endemism and species diversity in the country that is related to the Eastern Arc mountains forests. Yet the Taita Taveta District remains almost completely detached from the Coast tourism circuit as illustrated by its share of bed nights in the province below:-

Table 12: Bed occupancy in Coast tourism circuit.

District	No. of bed nights	No of classified Hotels
Mombasa	12,977	144
Kwale	8704	75
Malindi	5180	74
Kilifi	1698	39
Lamu	717	42
Taita Taveta	1427	32
Tana River	76	6

Source: Kenya Bureau of statistics, 2004

4.3.2 Trading Opportunities and Constraints

The potentials of economic activities are not fully exploited due to several set backs, mainly poverty, low investment opportunities, poor infrastructure, marketing problems, land tenure and lack of adequate management and entrepreneurial skills. Furthermore poor marketing guidance and channeling, lack of business-orientation and the poor co-operatives management are constraining Trade Development

The opportunities / potentials in trading activities include:-

- Improvement in quality and quantity of production
- Food processing activities, marketing and use of by-products (from bee keeping, oil pressing etc)
- Encouraging diversification of products / services
- Venturing into new market niches (e.g. eco-tourism, tourism, wildlife utilisation, etc)
- Developing better market strategies
- Establishing ways to access start up capital (credit) in close connection with training in Business Management and leaderships skills.

CHAPTER FIVE

5.0 ENVIRONMENTAL HAZARDS AND DISASTERS

Drought and Famine

Taita is classified as and a Semi arid area and therefore drought and famine are fairly common occurrences. Droughts that have occurred in the district have had devastating impact on peoples livelihoods and general economic development of the District.

Land Slides

Land slides occur in Hilly areas of the District Particularly during the rainy Season. The main cause of land slides is the encroachment of mountainous areas for agricultural purposes and settlement. Deforestation of hilly areas have also contributed to loosening of the soils

Key Environmental Issues

- Disease outbreaks
- Lack of an effective early warning
- Deforestation of mountainous areas
- Drying of water sources due to frequent drought
- Loss of biodiversity and habitats
- Loss of livelihoods
- Landslides
- Inadequate early warning systems and response mechanisms
- Inadequate capacity in disaster preparedness and response

Proposed Interventions

- Develop prediction, monitoring and early warning systems
- Build capacity for early warning and response mechanisms
- Promote alternative livelihoods
- Introducing drought tolerant crops.
- Promote afforestation and reforestation
- Build capacity in disaster preparedness and response
- Diversify income generating activities
- Raise awareness on land slide prone areas and control mechanisms

CHAPTER SIX

6.0 ENVIRONMENTAL INFORMATION, TECHNOLOGY AND NETWORKING

Environmental education is incorporated in primary schools, secondary schools and tertiary institutions in the District. Education programmes are offered in 4K-Clubs, wildlife clubs, Geography in secondary schools, Science, Agriculture in secondary and tertiary institutions.

Key players in non-formal environmental Programs

These include Community Based Organizations (CBOs), Farmer Field Schools, Faith Based Organizations (FBOs), women groups and youth groups. Other key players are NEMA, Ministry of Agriculture, Ministry of Water and Irrigation, Kenya Forest Service and Kenya Wildlife service, Ministry of Youth and Sports, Ministry of Culture and Social Services Office of the President (Provincial Administration) and Ministry of Livestock and Development.

Key Environmental Issues

- Inadequate funds environmental education
- Inadequate learning and teaching resources for schools
- Inadequate provision of reference and basic class textbooks.
- Inadequate networking with key environmental players.
- Poor information sharing between different lead agencies

Proposed Interventions

- Prioritizing funding activities.
- Avail relevant teaching Aids to schools.
- Enhance co-ordination and inter-department consultations.
- Support Environment Clubs and Education Programs.
- Capacity building for environmental education
- Use of locally available materials for environmental education.

6.1 Public Awareness and Participation

The status of public awareness and participation in environmental conservation programmes in the district is high. Awareness creation has been done through Barazas, Stakeholder meetings, focus groups field days and demonstrations.

Key players in environmental awareness and public participation are the Government departments, NGOs and CBOs.

The main activities include public barazas in market centers, public talks in learning institutions, workshops and seminars. Little has been done to integrate environmental awareness programmes into development planning.

Channels/Awareness creation materials are inadequate and people do not easily access some information. Some environmental awareness materials have been produced by the lead agencies, NGOs in collaboration with other development partners. However, the materials produced are not enough to meet the demand.

Key Environmental Issues

- Inadequate Coordination of environmental awareness programmes.
- Inadequate personnel to help preparation of programs and other activities
- Inadequate funds.
- Inadequate equipment such as computers, vehicles.
- Inadequate awareness materials.

Proposed intervention measures

- More funds should be availed towards enhancing environmental education.
- Collaborative approach in raising awareness
- Employment of more technical staff
- Acquire modern ICT infrastructure
- Development of materials for raising environmental awareness.
- Collaboration and networking with public and private sectors
- Capacity building on modern methodologies of raising awareness.

6.2 Technologies

Information technology has become a powerful tool for environmental information dissemination. Formal and informal education is helpful in changing people's attitudes towards conservation. Existing technologies include;

Solar energy:

This is used for lighting and heating. A few individuals are using solar in their homes for lighting while a few hotels use it for heating water because electricity is expensive.

Use of energy saving devices

There are energy saving devices which include florescence bulbs, Upesi jikos, Kuni moja jiko, fireless cooker, sawdust jiko among others used in hotels, institutions and some homes. Through use of these technologies, destruction of forests could be reduced considerably.

Key Environmental Issues

- land degradation
- Lack of adoption of environment friendly technologies
- Inadequate capacity of DEC
- Low level of public participation
- Inadequate funding for technology development and adoption
- Attitude change

Proposed Intervention

- Raise awareness on environmental friendly technologies
- Identification of a better approach for that initiative
- Training DEC on EMCA, their roles, other relevant Acts and general issues on environmental management & conservation
- Awareness creation on need for public participation in environmental conservation
- Collaboration and networking with stakeholders
- Capacity building of such institutions

6.3 Environmental Information Systems

The major gap in accessing environmental information and communication technology is due to lack of knowledge sharing networks at the grass root level, inadequate resources and capacity in collection, analysis, storage and dissemination of information as well as inadequate knowledge among the public.

. There is also a regional publication called *The Link*, which is published on a quarterly basis.

Constraints in Collection, Dissemination, Co-ordination of Environmental Information & Data

- Low institutional skills in collection, documentation and dissemination and management of information. Technical officers have inadequate knowledge on the need and how to manage information.
- Poor ICT development.
- Low levels of funding for raising and acquisition of ICT infrastructures in the district.

Proposed Interventions

- Build capacity on ICT to facilitate easy acquisition, storage and retrieval of environmental information.
- Train staff on Information management

6.4 Indigenous Knowledge

Taita District is inhabited by different communities with a rich indigenous knowledge that should be harnessed for environmental conservation. It is important to document such information and promote its application in management of natural resources.

Issues application of IK in conservation

- Utilization, documentation, dissemination of IK has been inadequate
- Lack of scientific evidence to validate IK
- Accuracy in precision & measurement not validated
- Low IK awareness

Proposed Interventions

- Research to be conducted by institutions
- Enhance incorporation of IK into modern science
- Conducting surveys and documentation of IK
- Raise awareness on IK

CHAPTER SEVEN

7.0 ENVIRONMENTAL GOVERNANCE AND INSTITUTIONAL FRAME WORKS

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

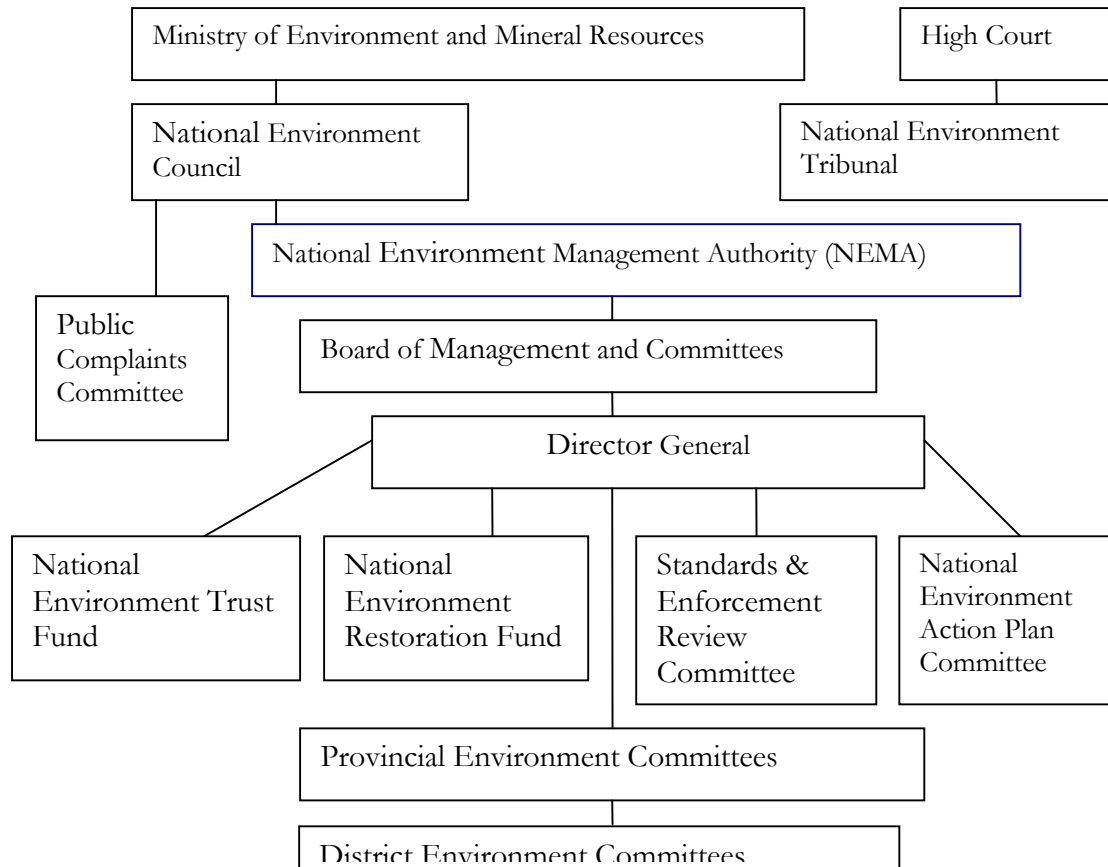


Figure 6: *Institutional Framework for EMCA, 1999*

(Source: NEMA Strategic Plan, 2005-2010)

7.3 Other Players in Environmental Governance

- The media plays a major part in publicity and advocacy and example 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

7.4 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

7.5 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)

Cartegena 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)

Convention on the Control of Transboundary 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 EIGHT

8.0 IMPLEMENTATION AND MONITORING STRATEGY

8.1 Stakeholders' involvement

Identification of stakeholders

The stakeholders will involve, all Government agencies, State corporations, NGOs, Civil Society Organizations, Private Sector organizations and individuals.

Strengths and weaknesses

Lack of knowledge on environmental issues, environmental governance, and the intervention measures forms a major draw back for these institutions.

Opportunities and challenges

The problems of the District are diverse and will require concerted efforts from all the stakeholders including the full participation of the communities in an attempt to get a sustainable solution. There is need to develop appropriate intervention measures in order to address the prevailing situation and promote environmental conservation in the District. Opportunities for enhanced environmental conservation include the following:-

- Streamline policies guiding the conservation and management of the natural resources and harmonize institutional mandates, in order to enhance their capacity to protect the resources.
- Raise levels of environmental education, awareness, and capacity building for all the stakeholders in the District, including the community, GoK delivery system, CBOs, and private sector in all aspects of environmental conservation.
- Increase community participation in conservation and develop alternative income generating activities such as ecotourism and bee keeping with a view to relieve pressure on land and reduce over dependence on fragile ecosystems.

The major challenges that the conservation efforts may face is that, the participatory approach to development may create a situation where the communities may come up with a shopping list reflecting the immediate needs of the local people. This is likely to be the case where the

communities are to be given incentives to stop cultivation on the river frontage, reclamation of wetlands and participation in the rehabilitation of the communal lands including the trust lands.

Environmental challenges are of catastrophic nature and could well nullify any efforts aimed at stabilizing an environment that is already prone to disturbance, especially areas prone to soil erosion and land slides.

8.2 Collaborative mechanisms among stakeholders

The collaboration will be in consultative regular meetings of all the stakeholders, whereby each stakeholder will give progressive report, of undertakings of the sector, and how it is incorporating environmental issues into development plans, programmes, and projects.

Priority activities in the District.

Streamline policies guiding the conservation and management of the natural resources and harmonize institutional mandates of KWS and FD in order to reduce institutional conflicts and enhance their capacity to protect the forest reserve.

- Involve the communities neighbouring the forest in the sustainable management of the National Forest Reserve. As an incentive to these communities the whole issue of the shamba system should be re-visited, with new guidelines that would address issues of governance and ensure smooth implementation.
- In order to improve the quality of the implementation of the environment action plan, there is a need for the District to create synergies with the development partners including GEF/SGP COMPACT, NGOs, CBOs and other organizations operating in the District and tap on their comparative advantage..

Resource Requirements

Adequate capacity is essential for sustainable development and environmental governance. It comprises human, scientific, technological, organizational, financial and institutional capabilities. Among others, the institutional capacities include laboratories, machinery and tools. This is critical for developing skills, knowledge, technical knowledge, policy analysis, institutional building, technical cooperation and development management.

Institutional and Human resources.

There is need to capacity build the Staff for continuously upgrade their skills in the management of the environment and natural resources. In the district, the institutions, which are capable of

offering environmental education, do not exist. Hence, there is need for creation of these institutions for the sake of our environment.

There is also little research or follow-up to determine the impact of environmental education in the district. The training and public awareness are always generalized, such that they do not address specific environmental needs. The inadequate skills development and under utilization of trained personnel contribute to unchecked environmental degradation.

However, other civil society organizations compliment government efforts in public capacity building. These include the NGOs and Community Based Organizations, Religious Organizations, Private Sector and development partners.

Financing the environment

The government needs resources to fulfill its public role of funding environmental management activities. EMCA provides for resources for environmental management. Over the years, the government has provided funds for the management of the environment. These have mainly been in forestry department, wildlife conservation, soil and water conservation, resource surveys and remote sensing, public health/training of personnel, pollution control and waste management as well as promotion of clean technologies. These activities are spread throughout the government's institutions and departments. Because of the cross-cutting nature of the activities it is not possible to determine the exact amount of money the government is using to support environmental management in the district. However the public funds for environmental activities have always been low although the presence of MKEPP has created hope to the environmental sector.

Challenges facing resource mobilization and utilization

There is a problem of resentment from the target group due to lack of immediate benefits from environmental projects. In addition, lack of adequate funds for these projects has resulted to poor implementation of the same. Resource allocated for recurrent expenditure is not based on an annual work plan and budget with clear targets

Proposed interventions

- ❖ There is need to base the district allocations, for both recurrent and development expenditure on annual work plans and budgets based on clearly set targets
- ❖ More resources should be channeled to development projects that directly affect the welfare of the local community or improve service delivery
- ❖ There is need for the government to review their service delivery system, based on their core functions and resources allocated accordingly.
- ❖ Resource utilization should be clearly planned, and progress reports prepared on quarterly basis.
- ❖ There is need to follow up all the field activities in the initial stages in the process of inculcating the M&E culture for participants to acquire insights into field activities and identify simple methods of soliciting information.
- ❖ There is need for improved coordination of planned activities management, at the district level so that the multi-sectoral approach to intervention is realized

8.3 Monitoring and Evaluation

The purpose of Monitoring and Evaluation of the Environmental Action Plans is to ensure their efficient and effective implementation as well as ensuring that environmental concerns have been addressed and integrated in development process. It will involve documentation of "Best Practices" for purposes of replication

The monitoring will be, through consultative meetings and field visits, of all the stakeholders.

The information will be contained in quarterly and annual reports.

Table 13: Implementation Matrix

Priority Issues	Objective	Output	Activities	Time Frame	Stakeholders	Responsible Institution
Deforestation and loss of vegetative cover	To stop illegal logging	Improved forest cover	Forest patrols	2009-2013	Forest Dept. K.W.S Provincial Administration D.E.C Community	Forest Dept K.W.S
	To curb charcoal burning activities	Improved vegetation cover	Community sensitization and awareness Curb charcoal transportation Forest patrols	2009-2013	Forest Dept K.W.S Provincial Administration D.E.C Community	Forest Dept K.W.S Police
	To protect and manage indigenous forests as main catchments	Improved forest cover Protected and well conserved catchments	Forest patrols Gazettement of important catchments and hills	2009 - 2013	Forest Dept K.W.S Provincial Administration Community D.E.C	Forest Dept K.W.S
	On farm tree planting	Increased vegetation cover	Establish tree nurseries Tree planting Training of farmers		Forest Dept Provincial Administration Community D.E.C	
Encroachment of Wetlands	To reclaim and rehabilitate encroached wetlands	Improved water catchments and flow of rivers Rehabilitated wetlands Restored biodiversity	Identify and inventorize the existing Wetlands Public education & awareness on wetlands Planning of Trees Gazettement of the wetlands	2009-2013	WRMA County Council D.E.C Forest and Dept. Ministry of Agriculture Water users Associations	WRMA NEMA
Destruction of Water Catchments areas	To maintain constant water flow in Rivers and springs	Constant water flow Preserved ecosystems	Afforestation and re-afforestation of catchments areas Spring and streams	2009-2013	WRMA D.E.C Forest Dept. County	WRMA

	To preserve the biological diversity in the district		protection To survey and rehabilitate catchment areas and riparian reserves.		council	
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Priority Issues	Objective	Output	Activities	Time Frame	Stakeholders	Responsible Institution
Water Pollution	To reduce water pollution	Cleaner and Safer water	Riverbank Afforestation Protection of the riparian reserves Community sensitization and awareness	2009-2013	WRMA NEMA Min. of Agriculture Forest Dept Water users Associations	WRMA
Over abstraction and diversion of river water	Regulate water Abstraction	Increased volume of river water flowing	Inspection of river water abstractions Curb water diversions	2009 - 2013	WRMA Water users Association Community	WRMA
Drought and Famine	To mitigate the impacts of drought & famine on people and animals.	More preparedness against the effects of drought and famine	Establish the cyclic nature of drought Identify areas that suffer most from the effects of drought	2009 - 2013	DEC Min. of Agriculture Min. of livestock Provincial Administration	Provincial Administration
Landslides	To mitigate the impacts of landslides	More preparedness against the effects of landslides	Identify landslide prone areas Re-allocate people from landslide prone areas	2009-2013	Department of Mines & Geology Provincial Administration Min. of Agric, DEC	Provincial Administration
Land degradation	Protection of Hills against illegal cultivation Conservation of soil and water To improve on the current agricultural practices	Hills protected Less siltation of rivers Reduced soil erosion	Survey of all Hills Establishment of nurseries and Tree planting Making of conservation structures (gabions) Farmers' training	2009-2013	Min. of Agriculture Min of land Survey of Kenya Forest Dept Local Authority	Local Authorities Min. of Agriculture D.E.C
Quarrying	Reduce	Rehabilitated	Nursery	2009-	Local	Local

	Illegal and haphazard Quarrying activities	quarries	Establishment Planting of Trees Refilling of Abandoned and exhausted quarries	2013	authorities Community D.E.C Provincial Administration	Authorities Quarry owners
Human Wildlife Conflict	To reduce incidences of human wildlife conflict	Reduction of the conflicts (No. of cases)	Electric fetching KWS patrols	2009- 2013	KWS, Forest Dept Community	KWS Forest Dept

Priority Issues	Objective	Output	Activities	Time Frame	Stakeholders	Responsible Institution
Poor Sanitation	To Improve liquid waste and effluent management	<p>Improve sanitation</p> <p>Reduced water related diseases</p> <p>Reduced sewer over flows & sewer lines bursts</p>	<p>Construct standard septic tanks</p> <p>Regularly inspect waste disposal techniques</p> <p>Plan for implementation of standard sewerage systems</p> <p>Slaughter houses & other source points surveillance</p>	2009-2013	Local authorities Ministry of health Community D.E.C	Local authorities
Poor solid Waste Management	<p>To improve the solid waste management – especially in the urban centres</p> <p>To reduce the litter load of polythene containers</p>	<p>Reduced garbage in towns</p> <p>Systematic procedures in collection and disposal of solid waste</p>	<p>Construction of sanitary landfills.</p> <p>Introduce dustbins in towns</p> <p>Intensify collection of garbage</p> <p>Identify alternative dumping site for Municipality</p>	2009 - 2013	Local authorities Ministry of health Community D.E.C	Local Authorities NEMA

Table 14: Monitoring and Evaluation Matrix

Activity	OVI (objectively verifiable indicators)	MoVs(Means of Verification)	Reporting schedule	Implementers	Responsible institutions for M&E
Forest patrols	Increased vegetation cover Reduced cases of logging	No of patrols Illegal cases of logging reported Reports	Quarterly	D.F.O	Forest Dept K.W.S
Establishment of tree nurseries	Number of seedlings raised	No. of tree nurseries established	Quarterly	Forest Dept Community	Forest department
Tree Planting and re-afforestation programmes	No. of hectares afforested	No. of trees planted	Quarterly	Forest Dept Community	Forest department
Community sensitization and awareness on wetland conservation	No of people sensitized	No. of trainings conducted Reports	Quarterly	WRMA	WRMA
Curb charcoal burning and transportation	Reduced cases of charcoal burning	No. of cases reported	Quarterly	Forest Dept KWS Police Provincial Administration	Forest Dept KWS
Identify and inventorize the existing Wetlands	No. of wetlands identified	No. of inventories(entry)	Quarterly	D.E.C WRMA Ministry of land and settlement	
Reclamation and rehabilitation of wetlands	No. of wetlands reclaimed & rehabilitated No of wetlands covered with trees	No. of wetlands identified and surveyed (functional) No of seedlings planted	Quarterly	Forest Dept	Forest Dept D.E.C County council Water boards
Gazettelement of wetlands	No. of wetlands gazetted	No. of gazette notices	Quarterly	D.E.C WRMA Ministry of land and settlement	D.E.C

Inventory of wetlands	No of inventories	Reports	Quarterly	D.E.C	N.E.M.A
Hilltops survey	No of hills surveyed	Survey Reports	Quarterly	N.E.M.A County Council	N.E.M.A
Hilltops rehabilitation	No. of Hectares planted	No. of hills planted with seedlings	Quarterly	Forest Dept. N.E.M.A County Council	N.E.M.A
Re allocation of people from landslide prone areas	Landslide prone areas identified and persons living there notified	No of people reallocated	Quarterly	County Council Ministry of lands and settlement D.D.C	Ministry of lands and settlement D.D.C
Gazettement of important catchments and hills	No. of hills and catchment areas gazetted	No. of gazette notices	Quarterly	D.E.C Forest Dept WRMA County Council Ministry of land and settlement	D.E.C
Afforestation and re-afforestation of catchments areas		No. of hectares re-afforested	Quarterly	NEMA KWS Forest Dept	Forest Dept WRMA
Protection of spring, streams, riverbanks and the riparian reserves		No. of streams and springs protected No. of riparian reserves protected	Quarterly	WRMA NEMA KWS Forest Dept Community	Forest Dept WRMA
Survey and rehabilitation of catchment areas and riparian reserves.		No. of catchment areas surveyed No. of riparian reserves rehabilitated	Quarterly	WRMA NEMA KWS Forest Dept Min of Lands & Settlement Community Water Users association	Forest Dept WRMA
Inspection of river water abstractions and water flow volumes	Reduced illegal Abstraction	Increased volume of water in the Rivers	Quarterly	WRMA C.B.O	WRMA
Curb water diversions		Increased volume of water in the Rivers	Quarterly	WRMA C.B.O	WRMA
Establish the cyclic	Established and	Study reports	Annual	DEC	Provincial

nature of drought in the area	verified cycle	Precautionary measures taken		Provincial Administration	Administration
Identify areas that suffer most from the effects of drought	Areas identified and defined	No. of areas identified Extent defined	Quarterly	DEC Provincial Administration	DEC Provincial administration Min. of Agriculture
Identify landslide prone areas	Areas identified and defined	No. of areas identified Extent defined	Quarterly	DEC Provincial Administration	
Re-allocate people from landslide prone areas	Precautionary measures taken to avert landslides disaster	No. of families re-located	Annual	DDC Provincial Administration	DDC Local Authorities Provincial administration
Making of conservation Structures (e.g. gabions)	Reduced soil erosion	No. of conservation structures constructed	Quarterly	Min of Agriculture Public Works	Min of Agriculture
Refilling of abandoned and exhausted quarries	Rehabilitated Quarries	No. of Queries Refilled	Quarterly	C.B.O NEMA County Council	N.E.M.A
Electric fetching around wildlife conservation areas	Reduced human/wildlife Conflicts cases	Kms of electric fence elected	Annual	K.W.S Community	K.W.S
KWS patrols	Reduced reported cases of poaching Reduced reported cases of human wildlife conflict	No. of patrols	Quarterly	KWS	KWS
Introduction of dustbins in towns	Reduced solid waste load garbage in towns	No of dustbins installed Collection trucks available	Quarterly	County council	County Council D.E.C
Construct standard septic tanks in residential and commercial estates	Reduced over flow of sewerage into the open	No. of standard septic tanks and soak pits constructed	Annual	County council	County council D.E.C
Regularly inspect waste disposal techniques	Improved efficiency in solid waste collection	No. of inspection visits	Quarterly	County council	County council D.E.C

Plan for implementation of standard sewerage systems	Proper liquid waste and effluent disposal	Progress report on the level of planning and implementation	Annual	County council	County council D.E.C
Slaughter houses & other effluent source points surveillance	Reduced and well disposed effluent	No. of surveillance and inspection visits	Quarterly	County councils Public Health	County council D.E.C
Construction of sanitary landfills	No. of landfills constructed Properly disposed solid waste	No. of landfills properly used	Annual	County council	County council
Intensify collection of garbage	Reduced garbage accumulation in the town centres	No. of times solid waste is collected per week	Monthly	County council	County council D.E.C
Identify alternative dumping site	Site identification and survey	Site identified	Annual	County council Min. of Lands & Settlement	County council D.E.C

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