


DISTRICT ENVIRONMENT ACTION PLAN

(DEAP)

2006 – 2011

MERU SOUTH DISTRICT

MAY 2007

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CHAPTER 1: INTRODUCTION

1.1 Background

The United Nations conference on environment and development (The Earth Summit) was held in Rio de Janeiro, Brazil in 1992 and one of the key outcomes of the summit was agenda 21 (Global Environment Action Plan). This required countries to domesticate agenda 21 through the development of national environment action plans. Kenya domesticated agenda 21 through the formulation of the first national environment action plan (NEAP) in 1994 and anchored its provisions by enacting the environmental management and coordination act (EMCA) in 1999. EMCA provides for the integration of environmental concerns in national policies, plans programmes and projects. In this regard, EMCA provides for the formulation of national, provincial and district environment action plans every five years. This is the first DEAP for Meru South District.

1.2 Challenges of sustainable development in Meru South

The major development challenges that the district faces are broad and cut across all the sectors. These include;

1.2.1 Poor Communication Network

The present telephone services in the district are insufficient and unreliable. This situation hampers efficient communication, which is an important component of business transactions. This situation negates the enabling environment to attract investors in the district who could have created some employment. The most affected areas include the whole of Igamba Ng'ombe Division and the lower parts of the other four divisions in the district.

1.2.2 Road network

Most of feeder road in the agriculturally high potential areas are poor inhibiting access to markets for produce resulting to low prices of products. Impassable roads during rain season cause delay in marketing of farm produce and purchase of farm inputs. During this plan period priorities should be given to this sector if the economy of the district is to grow.

1.2.3 Poor Marketing and Storage Facilities

The district lack appropriate technology and skills to process and preserve agricultural and daily products. Products such as mangoes, tomatoes, avocados, paw paws, passion fruits and dairy products are the most affected. The existence of general lack of market information and skills amongst the farmers and business community has hampered the expansion of the market for the products from the district. Poor road condition in the district is a hindrance to marketing process.

1.2.4 High cost of Artificial Insemination Services:

The stock of high –grade livestock breeds is insufficient in the district. It has been noted that since the privatization of Artificial insemination services it has become very expensive for farmers, resulting to most of them keeping low quality breeds. This calls for intervention aiming at educating farmers to keep high grade livestock in order to improve their standard of living.

1.2.5 Inaccessibility to Credit Facilities:

Banking services in the district are not adequate. The Co-operative Bank of Kenya, the Equity Bank and Kenya Commercial Bank are the only banks in the district. The inadequacy of banking services has contributed to many potential investors not being attracted to the district .The majority of the district residents, particularly the business community are affected adversely by the services as well as investment opportunities in the district.

Since the existing credit facilities from commercial banks and other financial institutions tend to exclude small-scale business holders, the co-operative sector in the district has not benefited much from loan facilities normally available to societies especially the producer co-operatives. Where credit facilities are available, borrowing conditions discourage potential investors.

1.2.6 Encroachment

Encroachment areas on public utility plots including access roads, riparian reserves are rampant. This has been experienced in most of the towns and major market centres making development in those towns/centres to be very difficult. During this plan period, the DDC, District Plot Allocation Committee and Local Authorities will ensure there is no more encroachment on public utilities and where encroachment has occurred repossessions will be effected.

1.2.7 Sub Division of Existing Land Parcels:

As the population continues to grow, pressure on land continue to increase leading to further sub division into uneconomic units. Also these small units have been intensively put into agricultural use and thereby use of fertilizers and pesticides have been intensively applied. Excessive use of these chemicals leads to pollution of rivers as most of them find their way there. In the lower regions of the district where livestock rearing is the main economic activity, sub division of land into small units has been experienced and crop farming has been introduced. These areas have very fragile soils, which once exposed are easily eroded.

1.2.8 Poverty

Poverty is one of the major development challenges the district is facing. It is manifested in various forms, and can be defined both in monetary and human capability terms. It has significantly reduced the disposable incomes of a large part of the district population over the years. These phenomenon have impacted negatively on the general welfare of the community particularly in terms of access to basic services, such as education and health care.

The major economic activities in the local community include agricultural and livestock production, sand harvesting and small scale industrial production. These activities have support systems, variations of weather and slow response to changing situations among others. These have consequently bogged down the rural population in a vicious cycle of poverty who are now living on mere subsistence.

Thus the poor population in the district could be defined as largely comprising those who barely meet their food requirement and have very limited options in meeting other basic needs such as health care, water and sanitation and education services. The se people are also unable to fully exploit their comparative advantage in resource endowment

1.2.9 HIV/AIDS

The first AIDS case was diagnosed in Kenya in 1984. Since then the HIV prevalence has been rising rapidly until now it has been declared a national disaster. This scourge has no social or economic boundaries, class or religion. It seems to be taking advantage of the moral weakness in the society.

It should be understood that AIDS continues to spread and will inevitably destroy the fragile economy and society leading the country into retrogressive state whose destination is an existence of poverty, perpetual suffering and perhaps eventual extinction.

Since 1990 admissions at Chuka District Hospital have been increasing due to HIV/AIDS pandemic. HIV prevalence rate is 30 per cent and is prevalent more in females than males in 20-40 years age-group, the very group that should be economically active.

The way forward to contain the spread is by intensification of campaigns geared towards behavioral change, observance of the society cultural beliefs, which are development oriented. Counseling to encourage voluntary testing, establish Home Base Care programmes need to be intensified. This includes training families and relatives on the care of the affected/infected. Syndrome management, inventory of orphans, the infected and widows/widowers, continue offering services to deserving clients' e.g. Ante-natal mothers and also offering anti-retroviral drugs to those infected. Establishment of recreation centres for peoples living with HIV/AIDS and orphanage homes is necessary.

1.2.10 Lack of Awareness

Though the literacy level may be considered high compared to the rest of the country (around 60%), the consequences of unsustainable rural livelihoods has led to deterioration of the environment and consequently contributing to escalation of poverty.

1.3. Provisions of EMCA on Environmental Planning

Part IV of the Environmental Management and Coordination Act (EMCA), 1999 deals with environmental planning at the national, Provincial and district level. Section 40 specifically deals with environmental planning at the district level and states in part: Every District Environmental committee, shall every five, years prepare a district environment action plan in respect of the district for which it is appointed and shall submit such plan to the chairman of the provincial environment action plan committee for incorporation into the provincial environment action plan proposed under section 39. Details of what the DEAP should contain is given in appendix 1

1.3.1 Objectives of District Environment Action plan (DEAP)

The objectives of DEAP include:-

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

1.3.2 Linkage with other processes.

The state of environment report for the district is prepared every year and it documents the current state of the environment. The district environment action plan therefore is an attempt to come up with a plan of action that would address the pertinent environmental concerns in the district over a five year period. The plan also aspires to be in tandem with other district and national goals as expounded in policies such as Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC), District development plan, Poverty Reduction Strategy Paper (PRSP), sectoral strategic plans among others. This DEAP will inform the next District Development Plan, the Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC), the Provincial Environment Action Plan (PEAP) and the National Environment Action Plan (NEAP).

CHAPTER 2: DISTRICT PROFILE

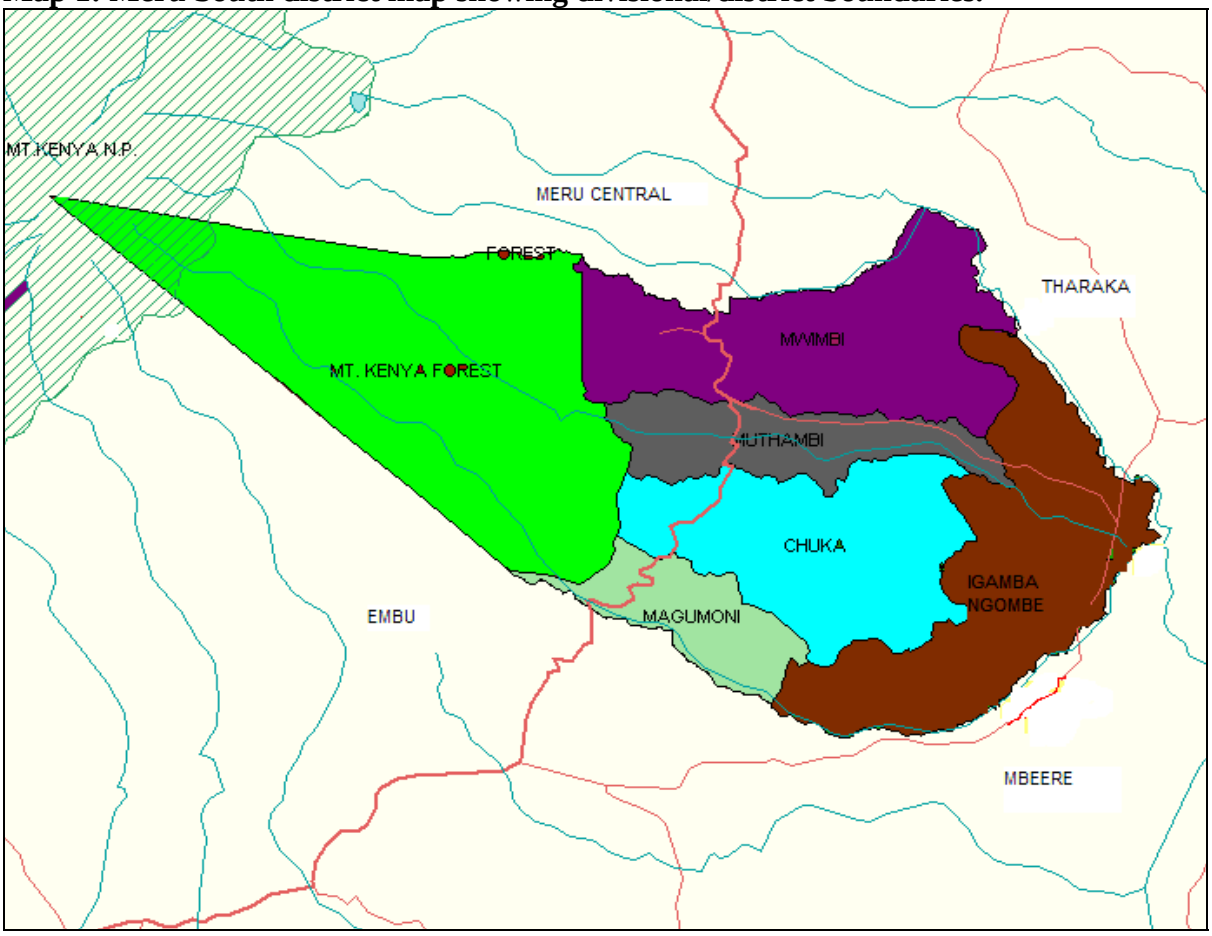
2.1 Geographical Location, Size and Administrative Units

Meru South is one among Thirteen Districts in Eastern Province. It was curved out of the larger Meru district in 1992 to create the former Tharaka Nithi District. In 1997 Tharaka Nithi District was divided into two creating the Tharaka District and Meru South Districts respectively. It is situated between Longitudes 37 18'37"and 37 28'33"East & Latitude 00 07'23" and 00 26'19"South.
The total area of the District is 1092.9km^2 and this includes 360km^2 of Mt. Kenya forest. It borders Meru Central to the North, Embu to the South, Tharaka and Mbeere to the East, Kirinyaga and Nyeri to the West at the peak of Mt. Kenya. See map 1

Administrative Units and Local Authorities

The District is divided into five administrative Divisions namely Chuka, Igamba Ng'ombe, Magumoni, Muthambi and Mwimbi Divisions. It has a total of 25 locations and 76 sub locations see map 2.

Map 1: Meru South district map showing divisional/district boundaries.



(Source: Central Bureau of Statistics)

Table 1. Administrative Boundaries

Division	Area Km^2	No. of Locations	No. of Sub-locations
Chuka	169.6	6	19
Igamba Ng'ombe	210.9	5	12
Magumoni	64.2	6	14
Muthambi	84.8	3	10
Mwimbi	203.4	5	21
Total	732.9	25	76

Source: District Statistics Office

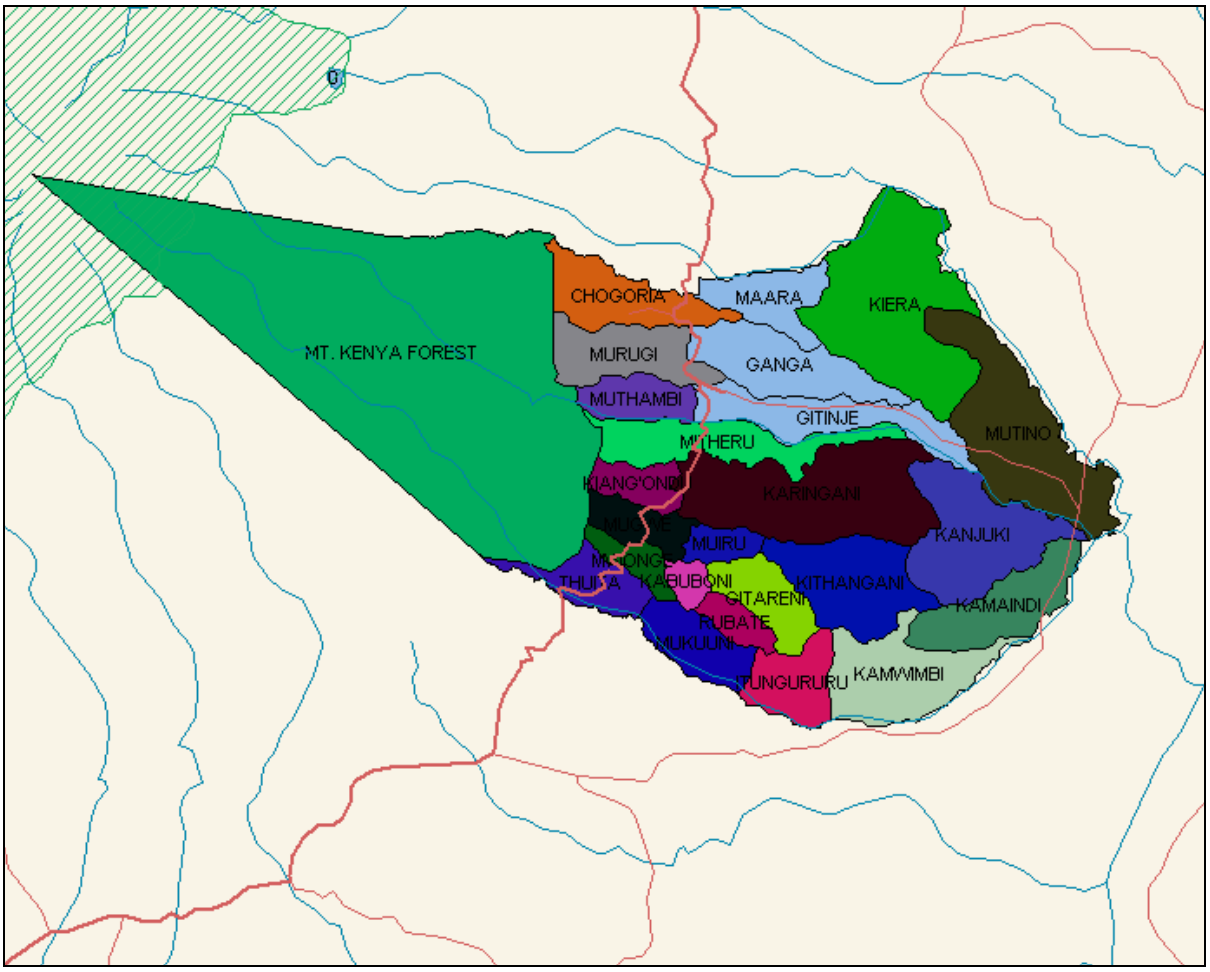
The District has one constituency – Nithi and three local authorities – Chuka Municipal Council, Chogoria town Council and Meru South County Council all with a total of 19 wards as shown below:-

Table 2. Local Authority Wards

Local Authority	No. of wards
Chuka Municipal Council	5
Chogoria Town Council	4
Meru South County Council	10
Total	19

Source District development office- Meru South

Map 2: MERU SOUTH DISTRICT: map-showing Locational boundaries



Source: Cenral Bureau of Statistics

2.2 Climate and Physical Features

The altitude of Meru South Ranges from 5200 meters above sea level at the peak of Mt. Kenya to 600 meters in the lower areas. The topography of the district is influenced by The volcanic activity of Mt. Kenya. Numerous rivers which originate from Mt. Kenya Forest traverse the district and flow eastwards as tributaries of Tana River, which discharge its water into the Indian Ocean.

The soils of Meru South District are characterized by deep red loam soils in Mwimbi, Muthambi, Chuka, and Magumoni Divisions. These soils are well drained and fairly fertile but require fertilizers to improve their fertility, as this has been lowered by Continuous cultivation.

The District has bi-modal rainfall pattern with rains falling during the months of March to May and October – December. The highest amount of rainfall ranges from 2200mm in Chogoria forest station to 500mm in the lower areas of Igamba Ng'ombe Division. The

upper areas experience reliable rainfall while middle areas, medium rainfall and lower regions unreliable and poorly distributed rainfall. The short rains October-December are more reliable than long rains (April-June).

Temperatures in the highlands, range between 14^{o}c to 17^{o}c while those of the lowlands between 22^{o}c to 27^{o}c.

Unusual climate variability incidences arising from climate change were evident during the 1997 elnino rains and the 2001 drought, when flooding, landslides, high levels of erosion resulted to damage of infra structure, and high levels of malaria. During the drought period food production declined and water quality went low leading to high incidences of waterborne diseases.

2.3 Population Size and Distribution

The district has an estimated population of 205,451 as broken down by divisions in the table below. The distribution and density have a positive correlation to climate and land productivity such that the more favorable the climate and land productivity, the more concentrated the population is in distribution and density.

Table 3. Population Size and Distribution.

Division	Population		Area Km^2	Density	Differences
	1989	**1999**			
Muthambi	28,532	31,539	84.8	372	(3007)
Magumoni	35.704	32,715	64.2	510	(-2989)
Mwimbi	59,956	64,380	203.4	317	(4424)
Chuka	45,221	53,517	169.6	316	(8296)
Igamba Ng'ombe	13,545	23,300	210	110	(9755)
Forest	-	-	360	-	-
Total	**182,958**	**205,451**	**1092.9**	**188**	**(22493)**

Source: Population and Housing Census 1999.

Population of Chuka Municipality: 7,271

Infant mortality rate - 76.4 per 1000 live births
Crude birth rate - 37.2 per 1000 population
Life expectancy - 61.7 years – Males, 67.5 - women
Total fertility rate - 6.1 births per woman

Migration rate - 5.6% of population for men
Migration rate - 5.0% of population for women
} move out of the District

Average household size – 4.4
Average No. of persons per room – 1.6
Urban migration population – 3.2%

2.4 Socio-economic characteristics

The major economic activities which are the livelihood systems engaged in by the local community, include agriculture and livestock production specifically dairy, coffee and tea farming. They also engage in sand harvesting and small scale industrial activities.

These activities have however, been beset by various obstacles such as breakdown of institutional support systems, variations in weather and slow response to changing situations, among other factors. These have consequently bogged down the rural population in the vicious cycle of poverty due to persistence levels of subsistence.

Poverty in the district is manifested in various parts which can be defined both in monetary and human capability terms.

According to the 1994 Survey 57% of the population in Meru South lived below the poverty line. The same had shot up to 72% by the year 2000.

Table 4: Breakdown of divisional poverty levels

Division	Population	Percent of the poor as per report
Chuka	53,517	90%
Magumoni	32,715	80%
Mwimbi	64,380	75%
Muthambi	31,539	70%
Igamba Ng'ombe	23,300	60%
Total	**205,451**	

Source: 1999 population and Housing census

Table 5a: PROJECTED POPULATION BY AGE GROUPS – MERU SOUTH

YEAR / AGE COHORTS	1999		2001		2002		2003		2004		2005	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
0-4	13695	13681	14016	14002	14180	14165	14346	14331	14513	14498	14683	14668
5-9	12974	12636	13279	12933	13433	13083	13590	13236	13749	13390	13909	13547
10-14	14888	14796	15238	15144	15415	15320	15595	15499	15777	15679	15962	15863
15-19	12338	12528	12628	12822	12775	12971	12924	13123	13075	13276	13228	13431
20-24	8336	10076	8532	10313	8632	10433	8732	10555	8834	10678	8936	10803
25-29	7000	8592	7164	8793	7248	8896	7333	9000	7418	9105	7505	9212
30-34	5991	6474	6132	6626	6203	6703	6276	6782	6349	6860	6423	6941
35-39	5619	6073	5751	6216	5818	6288	5886	6362	5954	6436	6024	6510
40-44	4319	4245	4420	4345	4472	4395	4524	4447	4477	4498	4630	4550
45-49	3861	3807	3952	3896	3997	3942	4044	3988	4093	4034	4139	4082
50-54	3060	3149	3132	3223	3168	3260	3204	3299	3243	3337	3281	3376
55-59	2008	1980	2055	2027	2079	2050	2103	2074	2128	2098	2153	2123
60-64	1773	2075	1815	2124	1836	2148	1857	2174	1879	2199	1901	2225
65-69	1278	1449	1308	1483	1323	1500	1339	1518	1354	1536	1370	1554
70-74	1151	1365	1178	1397	1192	1413	1206	1430	1220	1447	1234	1463
75-79	794	860	813	880	822	890	832	900	840	910	850	922
80+	993	1332	1016	1363	1028	1380	1040	1395	1052	1411	1065	1428
NS	148	107	151	109	153	111	155	112	156	113	159	115
TOTAL	100226	105225	102580	107696	103774	108948	104986	110225	106210	111505	107452	112813

Table 5b

YEAR / AGE COHORTS	2006		2007		2008		2009		2010	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
0-4	14854	14838	15026	15011	15201	15186	15380	15364	15559	15543
5-9	14072	13705	14235	13864	14401	14026	14570	14190	14740	14356
10-14	16147	16048	16335	16234	16526	16424	16719	16616	16914	16810
15-19	13382	13588	13537	13746	13695	13906	13856	14069	14017	14233
20-24	9040	10928	9146	11055	9253	11184	9361	11316	9470	11447
25-29	7592	9319	7680	9427	7770	9537	7861	9649	7953	9761
30-34	6498	7022	6573	7103	6650	7186	6728	7270	6806	7355
35-39	6094	6587	6166	6663	6237	6741	6310	6820	6384	6900
40-44	4684	4604	4739	4658	4794	4712	4850	4767	4907	4823
45-49	4188	4129	4236	4177	4286	4226	4336	4275	4387	4325
50-54	3319	3415	3358	3455	3397	3495	3436	3536	3477	3578
55-59	2178	2149	2203	2173	2229	2198	2255	2224	2280	2250
60-64	1923	2250	1945	2277	1968	2303	1991	2330	2014	2357
65-69	1386	1572	1402	1590	1419	1608	1435	1627	1452	1646
70-74	1248	1480	1263	1498	1278	1516	1293	1533	1308	1550
75-79	860	933	872	944	880	955	892	966	902	977
80+	1077	1445	1089	1462	1102	1479	1115	1496	1128	1513
NS	161	116	162	117	164	118	166	120	168	122
TOTAL	108703	114128	109967	115454	111250	116800	112554	118168	113865	119546

CHAPTER 3: HUMAN SETTLEMENT AND INFRASTRUCTURE

3.1 Human Settlement and Planning-Introduction

Rational planning of land is important for two basic reasons. First, productive land resources are becoming increasingly scarce due to urbanization, land degradation and pollution. Land use planning is therefore imperative for sustainable development in the context of a limited resource. Secondly, land use often entails the generation of environmentally adverse side effects. Land use controls are therefore necessary to anticipate in order to pre-empt negative impacts.

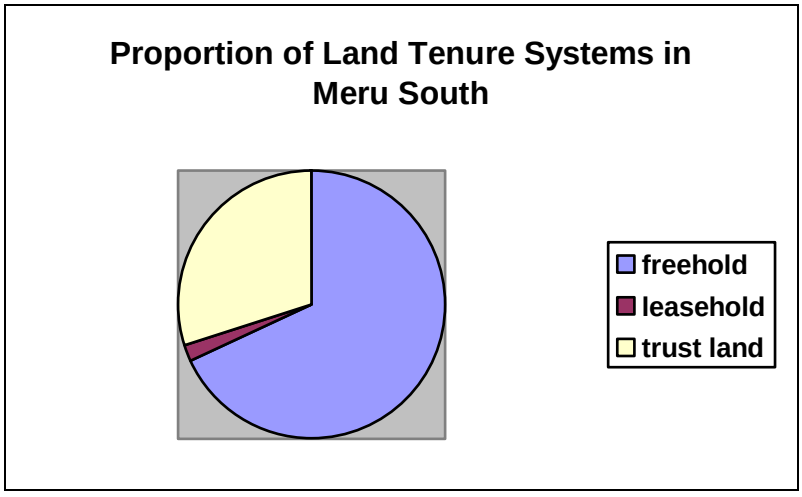
3.1.1 Land Tenure

Three tenure systems can be recognized in Meru South and these are:-

Freehold land:
Confers absolute title to the owner and around 68% of land is owned this way.

Lease hold:
Around 1% of land is owned this way and is mainly in urban land.

Customary rights/Trust land
Approximately 30% of land is owned this way in the District in trusteeship of Meru South County Council. The whole of Igamba Ng'ombe and the lower parts of Chuka and Magumoni Divisions represent the main land tenure systems.



3.1.2 Trends

Freehold – Land adjudication is on going i.e. change from trust land to freehold. The process is slow due to and of reasons including human resources, conflicts resolution takes time because of objections and complaints etc.

The government may acquire compulsory land under freehold for public use. In Chogoria compulsory acquisition on a small scale to create space for offices has been effected. Compulsory acquisition for Thuchi/Nkubu road was affected in the 1980s.

Land use types – These land use types include urban, rural/urban areas:-

1. Chuka
2. Chogoria
3. Marima
4. Kibugua
5. Kaanwa

Land use types in urban areas include:

- Commercial
- Public utilities
- Education
- Transport
- Recreation
- Agricultural

Land use types in rural areas include:

- Agricultural
- Livestock – pastoralism, apiary
- Industry
- Mining/quarrying/ sand harvesting

3.1.3 Regional and district physical development plans

- There is a regional development plan for eastern province.
- Chuka is under physical Development 1988 which is soon to be revised. Heavily abused in implementation.
- Chogoria – physical Development plan which had been developed in 1994 was never implemented but another plan is being prepared.
- Kaanwa – physical Development plan done in 1992 is under proper implementation.
- Other markets are being run by the council using lay out plans. Marima is developing on freehold land and is not planned after the town shifted. The same case applies to Mitheru.
- Lay out plans are also in use in Itugururu, Kibugua, Ikuu and Kathwana

All these areas lack public utility facilities. The open air market in Ikuu was converted from open air to market stalls and this need to be corrected.

3.1.4 Rural settlement schemes

There are no rural settlement schemes found within the District.
Squatter settlement – Around 30 families have settled on private land on an area close to a riparian reserve land in Chuka municipality. No developments are allowed on plots falling on riparian reserves though the municipal council has given leases for stalls.

Land adjudication is ongoing in the lower parts of the district including the whole of Igamba Ng'ombe division and parts of Magumoni, Mwimbi, Muthambi and Chuka.

Impacts of displaced persons – These have been experienced in Mwimbi arising from a land-slide threat.

Factors influencing shelter and settlement patterns include:

i) Terrain
ii) Building materials available
iii) Availability of services

Areas needing urgent planning services due to rapid growth are:

- Chogoria
- Marima
- Kibugua

Environmental concerns in settlements include:

- Roof drainage run-off
- Waste water
- Solid waste
- Burial sites for dead bodies , human/animals
- Conservation of fragile environment sites

Table 6: Land tenure system and area (ha) in the district

Tenure type	**Area (ha)**						**Remarks**
	1960	**1970**	**1980**	**1990**	**2000**	**2005**	
Leasehold						0.5	
Freehold						44.5	
Trust land						55	
Others							
Total							

Source; District physical planner.

Table 7: Planned urban areas

City/Municipality	Local plans						Regional plans					
	1960	1970	1980	1990	2000	2005	1960	1970	1980	1990	2000	2005
Meru South	N/A	N/A	N/A	6	6	6	N/A	N/A	N/A	1	1	1

County												
Chuka		1	1	1	1	1	N/A					

Source: District physical planner.

Table 8: Types of shelter by location

City/ Municipality	Urban			Rural			Remarks
	permanent	temporary	Traditional Thatched/ mud	permanent	temporary	Traditional Thatched/ mud	
	80 %	15 %	5 %	20 %	65%	15 %	

Source: Central Bureau of Statistics & D. P. Planner

Table 9: No. of households with access to water and sanitation services

Location	Water						Sanitation					Remarks
	Piped	borehole	well	River	Lake	Other (pod)	Connected To sewer	WC	Pit latrines	Flying toilets	Other (Septic Tanks)	
Meru South	12244			27551	33	408	Nil		45000		415	

Source: Ministry of Water

Table 10: Average distance (km) from household to services

Location	Water			Markets		Schools			Roads		Energy			Re-marks
	piped	well	river	shops	town	nursery	Pry	Sec.	Dirt	Tarmac	Elec-tricity	Wood fuel	other	
Meru south			1.2km											

Source: Ministry of Water

3.2 Human and Environmental Health

- **Water borne diseases – (2005)**
  - Amoebiosis – 7532 cases
  - Intestinal worms – 46095 cases
  - Diarrhea - 8162 cases
  - Typhoid – 1603 cases
- **Vector borne diseases – (2005)**
  Malaria – 210066 cases
  Bilharzia- 168 cases
  Rabies- 3 cases

- **Respiratory diseases – (2005)**

Respiratory tract infections – 125437
Pneumonia – 14272 cases
Radiation safety – sources of radiation include x-ray machines, computer, cell phones and natural radiation from ultra violet rays from the sun. The levels from all these sources are not very high as to cause significant cancerous effects.

- **Occupational health and safety**
  Issues related to health and safety are not well addressed in the District. Residents working in Tea and coffee factories, welding, hospitals, farm laborers who do spraying of farm crops such as coffee, fruit orchards etc and people engaged in vector control activities need to be informed on the safety and health issues that they may be exposed in these occupations.

  Enforcement of relevant laws relating to occupational health and safety needs to be enhanced.

Table 11: Incidence (number of cases) of common environmentally related diseases

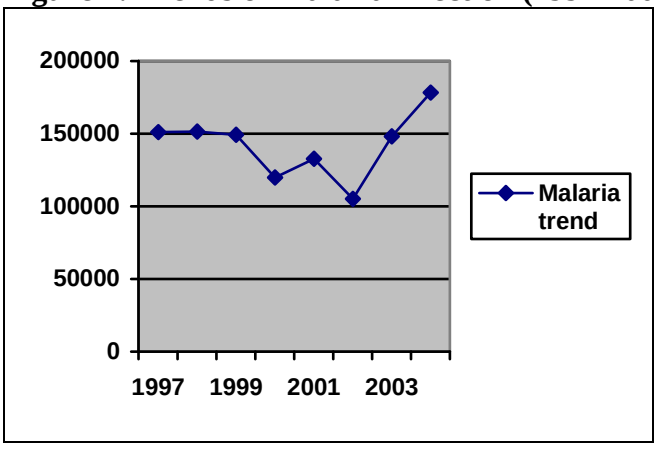
i) Malaria

Year	No. of cases	Remarks
1997	150972	
1998	151511	
1999	149418	
2000	120012	
2001	132738	
2002	105511	
2003	148093	
2004	178311	
2005	210066	

Source: Public Health Department

From the table, Malaria incidences appear to be generally increasing

Figure 1: Trends of Malaria infection (1997-2003)



3.3 Pollution and Waste Generated From Human Settlement

3.3.1 Major pollution sources

- Pollution from leachates at dumping sites
- Pollution from waste washed to water sources
- Pollution from gases emitted during burning of wastes especially that contain hydrocarbons i.e. polythene, polyethylene etc.
- Pollution from seepage through the soil to the water sources
- Pollution from surface runoff washing away waste containing chemical and hazardous wastes.
- Pollution from industrial processes
- Pollution from inefficient sewerage works.

3.3.2 Types of wastes

- **Domestic wastes**
  Generated from household activities and include farm/garden wastes and polythene papers. These can be putriscible, non putriscible, combustible and non combustible.

- **Agricultural wastes**
  Include garbage, maize stalk, cobs, animal feeds, chemicals, fertilizers, inert materials sacks, leaves, animal drugs and plastic containers. These can be divided into three categories readily putriscible, Non putriscible and chemicals.

- **Commercial wastes**
  These are generated from activities such as buying, selling, manufacturing processes i.e. from retail shops, hotels Posho mills, butcheries, supermarkets, tailoring shops etc. they can be readily putriscible, non putriscible, combustible and non combustible. Due to lack of sewerage facilities some of the business premises empty their waste water into the streets. In some cases, soakage pits are emptied on to the streets at night once full, mainly during the rainy season.

Fig 2: Storms drain being used to discharge waste water

Storms drain being used to discharge waste water at Chuka town. This eventually ends up at the nearby Naka River, posing serious health risks to downstream users

- **Industrial wastes**
  Generated from manufacturing processes and include effluent from coffee factories, metallic wastes and used oils from garages and Jua kali sheds. Fumes and dusts from Posho mills and timber workshop including noise pollution. The waste generated includes – hazardous wastes and toxic wastes.

- **Construction wastes**
  Includes pieces of timber, iron bars, blocks, glass, iron sheets, tiles, empty cement bags, plastic tins etc.

- **Street wastes**
  These are wastes that accumulate on the streets and roads and include street surface dirt, dropped materials from vehicles, leaves, sweepings from pavements, food wrapping, fruit peeling, cigarette, buts etc.

- **Junks/Old vehicles**
  Result from left over equipments old motor vehicles, ovens gas cookers, old refrigerators etc.

- **Mining wastes**
  Include broken stones, minerals, salts, dusts etc.

- **Dead animals**
  These arise from unclaimed dead animals that are left to rot along the road sides, public and private establishments e.g. dogs, cats, cattle, goats etc.

- **Sewerage treatment wastes**

These arise from the sludge that is removed from septic tanks and emptied onto sludge dry beds. While on the beds, they pose high risks of infiltration into ground water and nearby streams. Air pollution arising from the foul smells and odors poses a threat to the nearby residents as well as rodents and vectors. Chogoria hospital has a well functioning sewage plant.

- **Pathological wastes (Hospital)**
  These comprise of ordinary or general wastes and special wastes. Ordinary wastes include carton, plastics, bottles, hair, cotton wool and rags.

- **Special wastes** include wastes from operating theatres, laboratories, wards, maternity, gynecology, pharmacy and radio active emissions. Most common include bandages, pads, dressings, used gauze, syringes, needles, plasters, broken bottles, tins, metallic containers, placenta, used cotton waste paper etc.

3.3.3 Waste Disposal facilities

The following are methods used or can be used in the District to dispose off various wastes.

- **Incineration**
  This method uses fire and is aimed at sterilizing the refuse to significantly reduce the volume so that the residue can be disposed off hygienically and economically as clinkers, ashes and gas.

- **Sanitary land filling (controlled tipping)**
  This is a system of disposing of refuse by tipping or dumping in a methodical manner (as distinct from crude or indiscriminate manner).

- **Crude dumping (Indiscriminate Disposal)**
  This is the method adopted mostly in the District and involves solid disposal in a manner that disregards any precautions either in a specific chosen area or dumped anywhere in the open. This method of disposal causes a lot of nuisance and many health hazards arise as a result of their decomposition.

- **Composting**
  This is an aerobic biological process in which decomposition degrades susceptible organic materials (O.M.) into CO_2, HO_2 and stable humus like substance called compost is left which can be used in the farm.

3.4 Communication Networks

Road Network

The district has only one tarmac road-Thuci-Nkubu road (B6) with a total of 34.9 Kms. The road is currently being rehabilitated. Other key roads include,

- Mate road (C92) that connects the district with Mbeere and Tharaka districts
- Chuka town-mate road (D472)
- Keria-Kathwana (D473)

Table 12: Total number of roads (earth/murrum) per Division

No.	Division	No. of Kms
1.	Magumoni	40.5
2.	Chuka	119.9
3.	Muthambi	57.2
4.	Mwimbi	91
5.	Igamba Ng'ombe	69.6
6.	**Total**	**378.2**

Source: District Works Office

Other Services

- Households with telephone connections-764
- Private organizations with telephone connections-87
- Mobile service coverage- 70% (Celtel), 60% (Safaricom). Celtel has 3 masts at Murugi/Mugumango water offices, Chuka Town and Ikuu while Safaricom has 2, one in Chogoria and the other in Chuka town.
- Number of post offices-1 post office
  -2 departmental post offices
  - 4 sub post office
- Number of post boxes- Coporate-720
  -Individual-1660
- Number of telephone booths-86

3.5 Water Supplies

There are two main water sources in the District namely Surface Water and Ground Water. Ground water sources include Boreholes, springs and shallow wells mostly found on the lower part of the district (semi-arid area).

Surface water sources include rivers, seas, lakes, dams, pans and wetlands. No lakes or seas within. Rainfall is also a source of water attained through roof catchment which is mainly under utilized in the district.

- Major Drainage Patterns in the District

There is sufficient surface water in Meru South. The main rivers are:-

-Thuchi, shared between Embu and Meru South
-Ruguti
-Tungu
-Nithi

-South Mara
-North Mara
-Mutonga, shared between Meru South and Tharaka

All the rivers drain to Tana River which enters the Indian Ocean.

- Status and Trends of Water Resources

Meru South is drained by many streams most of which are perennial. Rivers in the lower zone of the district are big having drained all the streams up stream. The rivers however have low flows during the dry seasons. Due to environmental degradation up stream the levels are on a down ward trend. The river water is also turbid, the reason being the cultivation of the river banks and the water source catchments which are under intensive farming using unsustainable methods.

3.6 Energy Supply

The no. of homesteads with electricity connections was 900 by 1999 census and 94% of total households use firewood and charcoal as a source of fuel. Around 5% total households use kerosene, gas etc.
There are two micro hydro power stations- Tungu and Baraani which will increase usage of electricity once commissioned. The following sites can be developed into micro-hydro power generation sites:

- Naka River, Machui falls
- Ruguti River, two sites, one in the forest and the other outside
- South Mara, Kanda kame falls and Enamwamba falls
- Tungu River, a site in the forest
- Nithi River, a site in the forest
- South Mara, a site in the forest

There is potential of bio-gas, particularly from farms practicing zero-grazing. There is also high potential for solar energy which is being utilised at very low levels. There is need for research for wind energy potential.

3.7 Sanitation

The two urban centres in the District Chuka and Chogoria have septic tanks, soakage pits and pit latrines as the only means of liquid waste disposal. In the rural settings the locals use pit latrines which numbered 35,670 by last census.

3.8 Health Facilities

Table 13: Health facilities in the District

	GOK	Private	Mission	Community	Total
Hospitals	2	1	2	0	5
Heath centres	4	6	0	0	10
Dispensaries	13	1	26	1	39
	19	**8**	**31**	**1**	**54**

Source: Ministry of Health, Meru South

Health indicators data - 2004

Crude birth rate 241/1000
Crude death rate 9.6/1000
Infant mortality rate 76.4/1000
Maternal mortality rate 124/1000
Under 5 mortality rate 87/1000
Neonatal mortality rate 143/1000
Population growth rate 3%
Immunization coverage 70%
Doctor patient ratio 1: 1300
Life expectancy: male 62 Female 68
Fertility rate 3.6%

3.9 Educational Facilities

The district has five (5) administrative /Education divisions and eleven (11) education zones.
The divisions are:-

1. Mwimbi Division with 3 education zones
2. Muthambi Division with 2 education zones
3. Chuka Division with 2 education zones
4. Magumoni Division with 2 education zones
5. Igamba Ng'ombe Division with 2 education zones.

Table 14: School Enrolment

Type of School	Number of schools	Enrolment
Pre-School	272	6,797
Pry Schools	230	48,581
Secondary	70	14,344
Tertiary	5	244

Source: District Education Office

1. **PRIMARY SCHOOL GROSS ENROLMENT RATE**

a) Total Enrolment
- Boys = 24,069
- Girls = 24,512

Total =48,581

b) Age Going 6 – 14 yrs
- Boys = 29,232
- Girls = 28,783

Total = 58,015

c) Gross Enrolment Rate
- Boys = 82.33%
- Girls = 85.16%

Total = 83.73%

d) Pupil Teacher Ratio

Pupils enrolment = 48,581
Teachers No. = 1,955

Ratio = 24:84:1
= 25:1

e) Orphan Children in Primary School
i) Mother dead - 1, 417
ii) Father dead - 2, 453
iii) Both dead - 672

4,542 Pupils

f) Physical Facilities – Primary

Table 15: Status of Physical Facilities in Primary Schools

Facilities	No's Required	No's available	Short fall
1. Classrooms	2071	1277	794
2. Latrines	1782	773	1009
3. Dorms	56	34	22
4. D/hall	33	11	22
5. Admin. Block	230	145	85
6. Stores	230	67	163
7. Desks	24,290	8,220	16,070
8. Teachers Chairs	1,955	1,098	857
9. Teachers Tables	1,955	1,099	856

Source: District Education Office, Meru South

g) Special needs Education Enrolment in primary School
- Boys = 1,050

- Girls = 742
= 1,792 Pupils

2. SECONDARY SCHOOLS

a) No. of Schools
- Boys = 6
- Girls =13
- Mixed Day = 51
Total = 70 Schools

b) Type of School
- Day = 33
- Boarding = 18
- Day/Boarding = 19
Total = 70 Schools

c) Gross Enrolment
- Boys = 6,425
- Girls = 7,919
Total = 14,344 students

d) Age going 14 -18 yrs in the District
- Boys = 12,944
- Girls = 13,144
Total = 26,088

e) Gross enrolment Rate
- Boys = 49%
- Girls = 60%
District GER =54%

f) Net Enrolment Ratio (14-18yrs)
- Boys = 5,960
- Girls = 7,040
13,000
- Boys NER = 46%
- Girls NER = 53%
- NER = 49

g) Orphaned Students in the district
- Mother dead = 315
- Father dead = 689
- Both parents dead = 196
Total = 1,200 students

Table 16: Status of Physical Facilities – Secondary

Facilities	No's Required	No's Available	Short fall
Classrooms	318	385	16
Library	70	26	44
Laboratory	210	60	150
H/Science Room	42	4	-
Work Shop	8	8	-
Teachers Houses	833	114	719
Dorms	122	108	14
D/hall	70	31	39
Kitchen	70	33	37
Admin. Blocks	70	40	30
Stores	70	40	30
Pit Latrines (Boys)	211	24	-
Pit Latrines (Girls)	316	190	126
Pit Latrines (Teachers)	140	68	72
Rockers	14,344	11,251	3,093
Student Chairs	14,344	12,041	2,303
Teachers Tables	833	455	378
Teachers Chairs	833	374	459
Duplicating (Machines)	70	49	21
Computers	2,869	167	2,702
Electricity	70	16	54

Source: Meru South District Education Office

(i) Students with special needs in Secondary Schools
- Boys = 9
- Girls = 19
Total = 28

- In view of the information given above, Meru South District deserves assistance, especially for Igamba Ng'ombe division, which is arid. There are also other pockets of poverty in the District. Most of the schools do not have the required physical facilities.
- Transition from primary to Secondary and Tertiary level is low.
- Environmental Education currently is not fully emphasised. There is therefore need to introduce Environmental Education for sustainable development.

Proposed Intervention:

1) All Schools have worked out their school action plans and budget with a view to secure funding from the GOK through KESSP 5 years plan.

2) Mobilization of the community through school management committee in endeavor to improve existing infrastructures.
3) Capacity building of all stakeholders to ensure maximum utilization of available resources.
4) Introduction of environmental education for sustainable development from primary schools to tertiary level.

CHAPTER 4: SOILS AND LAND USE

4.1 Soils

The District can geologically be separated into the volcanic western part and basement system on the eastern part. The volcanic part has ridges on the middle and lower slopes of Mt. Kenya with uplands and scattered plateaus. The basement system show several different landforms such as hills, uplands, plateaus and valleys. The soils of the ridges are derived from volcanic parent material and are very deep red clay (nitisols and andosols). The soils of the volcanic plateau are moderately deep to shallow with various textures. The soils derived from the basement system rocks are predominantly moderately deep to shallow with loam to clay textures (cambisols lavisols and regosols). The soils of the hills are very shallow and rocky (leptosols). The exact natural vegetation reflects soil, altitude, relief and climate

Table 17: Extent and Distribution of soil Erosion

Extent	**Extent (Ha)**	**Percentage of the total district area**	**Geographic area of occurrence**	**Proposed interventions**
- wide spread in areas where there are economic activities	Various spots spread in all divisions in the district	25%	- Along river banks - along feeder roads - on very steep slopes in farms and rangelands	- Terracing - farmers harvesting run-off -Cut-off drains and artificial waterways - Gullies controlled by simple check dams - pegging along river banks -infiltration ditches -contour ridges -Forestation

Fig 3: Road Run-off Gullies

A road turned to a gully by runoff from the road and a banana crop on a cut off drain (COD) used to harvest road runoff.

Table 18: Distribution, Use and Degradation Status of the Major Soil Types

Type of Soil	Characteristics	Distribution Km^2	% coverage	Potential Use	Current Use	Degradation hazards	Proposed interventions
Andosols	-well drained -very deep -dark, red brown -very friable -clay loam -Humic top soil	299.57	29%	-Annual crops, maize, beans, cash crops, tea, pyrethrum, pasture and foliage crops. Livestock, dairy cows, sheep, poultry fallow land.	- Annual crops maize Cash crop tea and coffee Livestock, dairy cows -Grazing for foliage	-deep gullies resulting from steep slopes -river bank erosion -soil pollution due to farm inputs -soil fertility degradation due to poor agronomic practices -water/river pollution from factories i.e. coffee factories -soil erosion	-good maintenance of organic matter by manure application -soil erosion control -avoid acid fertilizers in food crops -recycling and conservation of nutrients within the farm units - Water harvesting along feeder roads.

						due cultivation on steep slopes	
Regosols	-Excessively drained/well drained. -Shallow -Dark red/brown -sandy day -Rocky	10..33	1%	-Annual crops, maize, cash crops, tea, pyrethrum, pasture and foliage crops. Livestock, dairy cows, sheep, poultry fallow land.	- Annual crops maize Cash crop tea and coffee Livestock dairy cows -Grazing for foliage	-Soil fertility degradation to do poor agronomic practices -Water /river pollution from factories. Coffee factories - Gullies due to steep slopes - River bank erosion - Deforestation	-avoid acid fertilizers in food crops -recycling and conservation of nutrients within the farm units - Gullies on steep slopes - Afforestation
Nitosols	-Well drained -Extremely deep -Red-dark red/brown -Friable -clay -Acid human topsoil.	361.55	35%	Annual crops, maize, cash crops, tea, pyrethrum, pasture and foliage crops. Livestock, dairy cows, sheep, poultry fallow land.	- Annual crops maize Cash crop tea and coffee Livestock dairy cows -Grazing for foliage	-Coffee factories -Soil erosion -steep slopes - Gullies - Declining soil fertility	-Application of content of organic mineral Soil fertility improvement. -Use of biological and cultural methods for soil fertility .
Ferralsols	-Well drained -Very deep -Dark reddish brown dusky red -friable clay -	289.24	287.	- Cotton -Maize -Meat goats -Dairy cows -Beans -Poultry	- Maize - Beans - Sun flower - Cotton - Bananas - Citrus - Grazing & forage	-Coffee factories -Soil erosion -steep slopes - Gullies - Declining soil fertility	-conservation and improvement -conservation of soil, water and other nutrients within the farm
Lithosols	-Well drained -Very shallow to moderate deep -Very dark brown -firm -stony/rocky -clay loam.	72.31	77	-Livestock keeping -Drought resistant crops i.e. millet, sorghum	-Livestock -drought resistant -low sorghum and millet varieties	-Poor livestock breeds -fodder crop deforestation due to pastoralism -Soil fertility -Water shortage	-Improve livestock breeds -Water tank building -Local improved seeds

Table 19: Land Use Potential

Agro-ecological Zone	Potential land use	Current Land use	Location	Extent (Ha)	Constraints	Proposed Interventions
UH_0 Forest Zone	Forest	Forest	Forest	276	- Illegal logging -Soil erosion deep/gulley - Land slides	-controlled entry Areas by forest officers -tree planting -Enhancing conservation
LH_1 Tea/Dairy Zone	-Annual crops -Maize -Beans -Irish potatoes kales -Permanent crops -tea -pyrethrum Pasture - Livestock/dairy	-Maize -tea -pyrethrum -coffee -Dairy cows -grazing and storage -Local improved cattle -sheep and goats	-Mwimbi -Muthambi -Chuka -Magumoni	-115	-Reduce soil fertility -reduction in crop yields -reduce livestock yields -decreased agricultural yields. - Animal/ crop diseases -Animal diseases -Crop diseases -information source -Riverbank cultivation	-Good maintenance of soil organic matter by manure residual and other biomass retention -Well controlled soil erosion -Directed by soil analysis -Avoid acid fertilizers for food crops -increase seedling of trees out puts -River bank
UM_I Tea / coffe zone	-Fallow -Other use Dairy cows sheep and poultry - Coffee -Tea	-Local improved cattle -sheep and goats - Coffee -Tea	Same as above	93		
UM_2 Main Coffee Zone	Annual crops -permanent crops -coffee Pasture -other uses	-Maize -Beans -Coffee -Bananas -Grazing forage -Sheep and goat -cattle	Same as above	92	Same as above 2 -Plus Pollution of water/lives of coffee factories	-Soil erosion control as through maintenance of terraces -manure should be added in the cultivation

		improved -local breeds -Napier grass				yield to maintain soil organic matters
UM_3 Marginal Coffee Zone	-Coffee -Maize -Sweet potatoes -Cassava and yams	-Tomatoes -Onions -Avocadoes -papaws -passion fruit	Same as above	78	- Same as above	
LM_3 Cotton Zone	-Cotton -Maize -Meat (goat) -Livestock dairy -bees -Poultry	Maize -Beans -Sunflower -cotton -Bananas -citrus -Grazing and forage	Same as above	184	-Lowering of soil fertility -Low soil fertility -H2o shortage -Low crop yield -Health issues -Poor breeds -Poor farm tech	-Soil and water conservation -Water harvesting -Addition of manure and mineral fertilizers for chemical and physical -Soil management -Demote plots -Forestation -A.I services -Bubs of superior breeds -Field rotation
LM_4 Marginal Cotton Zone	-Cotton -Maize -Livestock -Cow(dairy) -Meat goats -Poultry -Bees		Igamba-Ng'ombe -Chuka -Muthambi -Mwimbi	129		
LM_5 Livestock/ Miller Zone	-livestock -Millet -Sorghum -Cow peas -Mangoes -Tobaccos -Sunflower -Maize -Meat goats -Local cattle -Poultry -Bees	Livestock -sorghum -Plus above	Igamba Ng'ombe	69	- same as above	- Same as above

4.2 Dry Lands

The District has a significant share of such lands in nearly the whole of Igamba Ng'ombe Division and a part of Mwimbi, Chuka and Muthambi Divisions.

- **Production systems**
  Mainly cattle rearing on free range. Food crop production mainly sorghum, millet, drought resistant varieties of maize and beans, cash crops include tobacco and cotton, pawpaw and mangoes slowly gaining popularity.

- **Encroachment**
  Cultivation along the main rivers banks mainly for horticulture – kales and tomatoes, pulses etc. Sand harvesting encroaches river banks and river cause.

- **Land use changes**
  Migration from the upper zones has led to more area under crop cultivation and depletion of natural vegetation to give way to more land for agriculture
    - Frequent crop failure due to unreliable rainfall leads to burning of charcoal for subsistence.

- **Resource use conflicts**
  In areas where land adjudication is incomplete conflicts in resource use arise in form of grazing and charcoal burning.

  Water users associations are used to address water resource use conflicts, e.g. Tungu hot spot. Forests are illegally cut down to meet timber demand and also grazing lands. Cutting and growing of trees in the farms mainly along farm boundaries sometimes attracts conflicts between neighbours.

- **Efforts towards sustainable utilization of ASALs**
    - Water harvesting techniques to improve crop production is limited. These include dams and pans, bore holes and shallow wells, rock catchments and roof harvesting.

    - Introduction of drought resistant crop varieties developed from Katumani by Kenya Agricultural Research Institute.

    - Practicing Agro-silvo-pastoralism is picking up, though at a limited pace.

CHAPTER 5: AGRICULTURE, LIVESTOCK AND FISHERIES

5.1 Agriculture

The agriculture and rural development sector is the main source of employment and is key to poverty reduction. The sector provides 80 per cent of food requirements and contributes 45 per cent of household incomes. It employs 64,000 people. The main food crops are maize, beans, millet, sorghum and pigeon peas while the main crops are tea, coffee and cotton.

Table 20: Fertilizer and Pesticides usage

Crop	Fertilizer (in KGs)	Pesticide (in KGs)
Coffee Tea	(i) NPK 20.20.0=220 (ii) 17.17.17=551 (ii) DAP 230kgs (iii) (iv)CAN(26%)-350 (iv) (v) ASN -150 (vi) UREA-60 (vii) MAZMAX— FOLIC FEED-37 (ix) BOOSTER-504 (x) EASYZIO-76 (xi) BAZGOLON-304 Figures are kg /ha NPK 200 kg per acre	FUNGICIDES (i) Copper oxychloride-274 (ii) Copper cobox-300 (iii) Daconil-6 INSECTCIDES (i)lebaycid-433 (ii)Sumithion-33 (iii)Dursban-829 (iv)Malathion-22 (v)Fursban-5 HERBICIDES (i)Touch down-5 (ii)Mamba-80 (iii)Erason-22
Tomatoes	(i)CAN-300kg/ha (ii)DAP-200kg/20kg at flower per hole	(i)Buldock (ii)Karate (iii)Kelthon Ec (iv)Metazy (v)Nemazon (vi)Nemacur (vii)Diazinon (viii)Lebaycid (ix)Melathion (x)Polyron (ix)Milras
French Beans	---DAP 200kg/ha --CAN top dress –100kg/ha	-Metasystock -Dimathoate -Bizade -Buldock 025Ec Karate -Omethote

		-Kelthane -Polyion -Locide
KALES	---CAN 300kg/ha -split---200kg/ha -DAP—200kg/ha	-Huricide -Blizade -Buldock -Karate -Malathion -Diazinon -Copper based fungicides -Dithane
BANANAS	DAP/TSP—200kg/ha	-Chock /Dimethoate -Melathion -Servin -Folimat -Mancozeb
SORGHUM	DAP---50kg/ha	Thiram
SWEET POTATOES	17.17.17-----100kg/ha	None
BEANS	DAP--------200kg/ha	none
MAIZE/GRAINS	CAN-------75kg/ha 23.23.0 &20.20.0 at 125kg/ha	Dipterex -Buldock -Marshal -Gauchu

Fig 4: Tea on Steep Slopes

Steep slopes can be used sustainably if put under permanent crops such as tea

5.2 Livestock

Type of Livestock Production System
a) *Intensive*- Common with dairy cows, dairy goats and exotic poultry- common in upper and middle zones. Many are fed and housed in sheds (store feeding).
b) *Semi intensive*- The animals are left to graze, with limited area and time. This is common in middle coffee zones
c) *Extensive (free range)*- Animals are left to loam extensively in search of fodder/pastures and water. It is common in lower parts of the district

Area and Coverage

- Upper zones-LH1 UM1, UM2
- Middle zones-UM3
- Lower zones-LM3, LM4, LM5

Production Patterns

- Dairy production is on the increase both in terms of animals and milk production. The same is true for dairy goats.
- Meat cattle- the population is slowly declining due to land subdivision and competition with other agricultural practices e.g. sheep and goats.
- Poultry- These are kept in each homestead, a few exotic layers and broilers are available in areas near market centers.
- Pigs- Production follows availability of food for humans as most are fed on swirl. There is limited external market i.e. most are slaughtered in various market centres. The number has reduced drastically over the last two years.

Status and Trends
Dairy cattle - (2005)
Estimated population----24,426
Population and quality of cows slowly improving.

Beef Cattle – (2005)
Estimated Population -----14,676
Numbers reducing slowly

Goats and Sheep – (2005)
Population ------60,917
Population increasing slowly.
Pigs – (2005)
Population -----1,671
Population decreasing.

Rabbits – (2005)
Population -----17,106
These rarely increase in numbers.

Table 21: Types and Status of Livestock Production Systems

Type	Extent (Ha)	% of total district area	Location	Livestock products	Status		Challenges	Proposed interventions
					Current production level	Potential production level		
Dairy production	4669	5	upper and middle zones	-Milk -Meat from culls	6 lts/cow/day	10 lts/cow/day	-Decrease in land size -Low management levels -Uncontrolled market for milk -High cost of feeds and supplements -Disease outbreaks -Reduced soil fertility	-Farm planning -Farmers training -Intensify vaccination of animals -Value adding of milk products -Introduction of high yielding pastures -Soil management
Beef production	4644	5	lower zones	Meat	-	-	-Poor grazing management -Lack of good breeds -Disease outbreaks -reduced land fertility due to soil erosion	-Introduction of superior breeds -vaccination to control diseases -establish pasture and fodder trees -Training farmers on soil management, farm planning and stocking rates
Sheep and Goats (Shoats)	4644	5	all over the district but concentrated in Lower zones	-Meat -Milk (dairy goats)	-	-	-Poor management -Poor breeds -Disease outbreaks	-Training -Vaccinations
Poultry	Data not available	Data not available	District wide	-Meat -Eggs	240eggs/bird-exotic -60 eggs/bird-local	280-300 eggs/bird-exotic -90 eggs/bird	-poor management -High cost of feeds and other inputs -Unresponsive market -Disease outbreaks	-Training of producers -disease control through vaccination

5.3 Fisheries Resources

5.3.1 Types of Fisheries Production Systems

- Aquaculture production (which involves fresh water culture in the fish ponds)
- River captures fisheries production (fishing along rivers e.g. River Maara, Nithi, Tungu, Naka, Kamaara, Thuci, Mutonga, Mitheru, Ruguti).

5.3.2-Status and Trends of Fisheries Development

The Meru South is endowed with permanent rivers all originating from Mt. Kenya. They form excellent network and transverse the whole district. These rivers forms the potential region for fisheries activities e.g. River Capture fisheries and aquaculture fisheries.

The main fish reared and harvested in rivers are:
Tilapia (Oreochromis Niloticus)
Mudfish (Claria Gariepinus)
Trout
Common Carp
Labeo

More fish farmers are entering fishing activity as a means of economic sustainability and food source.

5.3.3 Production Patterns

In the year 2005 the aquaculture production was as follows for the Oerochromis Niloticus and clarias gariepinus

- Oerochromis Niloticus (Tilapia) – 2812.8 kgs Worth 281,200/=
- Clarias Gariepinus (mudfish) – 366kgs worth 36,600/=

Local market was supplement with Nile perch from Nairobi and Kisumu in tune of 12010kgs worth Ksh. 780,650/= by fish traders.

2004 Production

Tilapia (Oerochromis Niloticus) – 1487.2kgs worth 148,720/=
Catfish (Clarias Gariepinus) – 151.5kgs worth 15,150/=
Was harvested in pond and sold locally to consumers.
Amount harvested was however not enough to satisfy the local demand. 10,685kgs
Nile Perch worth 694,525/= was imported from Nairobi by fish traders.

River Capture Production

The fish captured in the rivers are Tilapia, Catfish, Common Carp, Eel, Labeo.
In 2004 7890kgs was captured in the rivers and in 2005 9640kgs of fish was captured in all the rivers in Meru South.

5.3.4 Fisheries Legislation and Law Enforcement

The department manages the fish industry in Kenya through legislative powers provided by the Fisheries Act Cap 378 of the Laws of Kenya. This is an act of parliament enacted to provide for the development, management, exploitation, utilization and conservation of fisheries. It is a powerful instrument in ensuring proper development and management of fisheries resources.

Fisheries Act Cap 378 Divides Into:

- **The Principal Legislation – which deals with**

a) Administration (describes the powers of the minister and director of fisheries).
b) Registration of fishing vessels.
c) Licensing provision – while fishing or handling fish from Kenyan fisheries waters.
d) Offences and enforcement (offences with regard to harvesting and dealing with fish from Kenyan fishery waters and penalties).
e) General provision of powers for authorized officers to act as prosecutors, minister's powers to make regulations, protection of marine mammals, fishermen loan scheme.

- **Subsidiary Legislation**

This details various provisions that mandate the main Act. Subsidiary legislation is basically the regulation made under section 14 and 21 of fisheries Act and includes:-

- Registration of local fishing vessels
- Various fisheries licenses
- Administration of licenses, permits and certificates
- Trout fishing
- Importation of live fish
- Prevention of pollution and protection and conservation of fishery waters
- Private marks for fishing gears
- Enforcement provisions

- **Maritime Zones Act (Cap 371)**

  This is an Act of Parliament enacted to consolidate the law relating to the territorial waters and continental shelf of Kenya.
  -Establish and delimit the exclusive economic zone of Kenya (EEZ)
  -Provide for the exploration, exploitation, conservation and management of the resources of the maritime zones.

- **Enforcement**

There is poor enforcement of fisheries rules and regulations
The reasons cited for this were legal loopholes found in the Act and poor operationalization of the provision of the law.

5.3.5 Key Environmental Issues

a) All the rivers traversing the district are the main source of fishery resource. Catches are declining tremendously in size and numbers. This is due to over-exploitation, illegal fishing (using herbicides) and use of unauthorized fishing gears. The government stopped funding the restocking of the rivers with fish fingerlings to refurbish the fishery resource.

b) Decline in water levels. Low water levels increases the water temperatures thus change in aquatic environment. Deforestation, unsustainable crop and animal husbandry practices have interfered with environment. The water volumes in our existing river capture fisheries resource zones have highly caused decline in fish resource.

c) Pollution from processing factories e.g. coffee factories have severally caused deaths of fish in the rivers and existing fish ponds. Pollution from tea factories e.g. Weru whose effluent enters River Maara have killed fish.

Proposed Interventions

1. Encourage restocking of all Meru South Rivers to fingerlings to refurbish fishery resource.
2. Control pollution mainly from factories.
3. Control illegal fishing and use of unauthorized fishing gears (e.g. through river patrols and educating fishermen).
4. Water abstraction should be regulated to avoid decline in water levels.
5. Intensify extension services to fish farmers and fishermen.

Table 22: types and Status of Fisheries Production Systems

Type of Production system	Location	Status		Challenges	Proposed Interventions
		Current production level	Potential production level		
Aquaculture production (*Oerochromis niloticus, Clarias gariepinus*)	Meru South (District Wide)	3,178 Kgs	10,000 Kgs	- Lack of fishing gears which farmers can use during harvesting of their ponds -Lack of GOK demonstration ponds where farmers can be trained on good fishing methods -Inadequate recurrent funding which makes extension work extremely difficult. -farmers lack proper lending institutions to assist them invest in commercial farming -lack of transport, which is a major drawback in programming for extension services -lack of hybrid fingerlings for fish farmers	-Source of fingerlings to fish farmers from established hatcheries -Provide appropriate transport to cover the extensive Meru South district. -Intensify extension services to fish farmers -channels for credit facilities be available to fish farmers to enable them apply new farming techniques -Encourage fish farmers to adopt modern pond construction and management techniques so as to compete with other farm activities
River Capture Production	Meru South (District Wide)	9,640 Kgs	27,000 Kgs	-Pollution -Lack of authorized fishing gears -Lack of loan or grant facilities -Rivers not restocked with fish	-Restocking of Rivers -Sources of loan facilities -Provide fishing gears -prevent pollution

CHAPTER 6: WATER RESOURCES

6.1 Water Sources

6.1.1 Sources of Water in Meru South

There are two main water sources in the District namely Surface Water and Ground Water.
Ground water sources include Boreholes, springs and shallow wells mostly found on the lower part of the district (semi-arid area).

Surface water sources include rivers, seas, lakes, dams, pans and wetlands. No lakes or seas within. Rainfall is also a source of water attained through roof catchment which is mainly under utilized.

All rivers in Meru South District originate from Mt. Kenya. The following are the main water sources.

1. Ground water from forests and farmlands
2. Springs and wells from forests and farmlands
3. Swamps
4. Rain harvesting from roof water

The ground water is available in most parts of the district. However the lower zone of the district has most of the land dug wells and boreholes.

Springs and wells are found in the upper zone of the district of which most of them are perennial.
Swamps are also found at the lower zone, Igamba Ng'ombe and lower parts of Chuka, Mwimbi and Muthambi divisions.
Rains in the upper zone are higher with a minimum of 1200mm. The lower zone receive a minimum of 800mm. Rain harvesting is not very common.

6.1.2 Major Drainage Patterns in the District

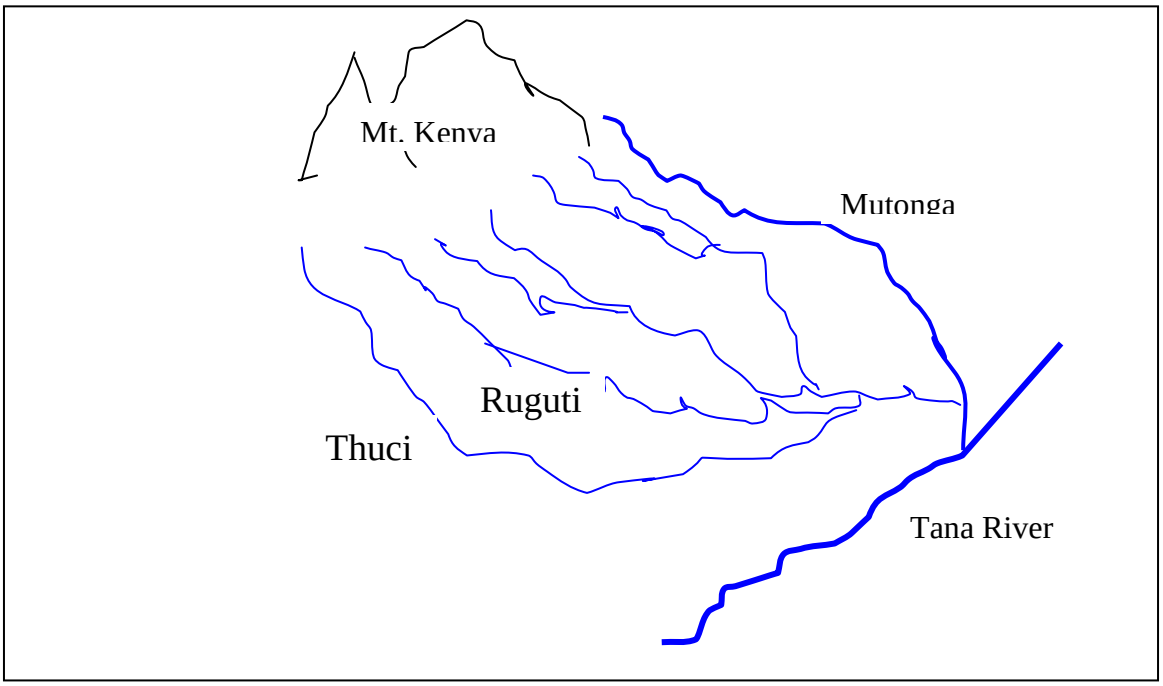
There is sufficient surface water in Meru South. The main rivers are: Thuchi, Ruguti, Tungu, Nithi, South Mara, North Mara and Mutonga. All the rivers drain to Tana River which enters the Indian Ocean. All the rivers have river gauging stations for monitoring of discharge, sediment carriage and water quality.

Fig 5: Upper and Lower Mara River Flow

Maara River near the edge of Mt. Kenya Forest: clean unpolluted water

The Same River After Chogoria Town: polluted by waste from the town and quarrying activity (Background)

Map 3: Meru South Drainage Patterns



Meru South Water office

6.1.3 Status and Trends of Water Resources

Meru South is drained by many streams most of which are perennial. Rivers in the lower zone of the district are big having drained all the streams up stream. The rivers however have low flows during the dry seasons. Due to environmental degradation up stream the levels are on a down ward trend. The river water is also turbid, the reason being the cultivation of the river banks and poor management of the catchments.

6.1.4 Regulatory and Management Arrangement of Water Use in Meru South

In order to ensure that there is proper regulation of water especially in the rivers, the water right section gets discharges from the hydrology section. These discharges enable the water bailiff to determine the availability of flow before allocating any amount of water to the interested applicant. 30% of the total flow must be left in the river. This ensures that there is water for down stream users. The other special mandatory condition to be met by the application is the installation of measuring and controlling devices. This ensures that the amount of water applied for is the exact amount that is abstracted by the applicant. The other stakeholders are not left out in determining the approval of any application. There should be “NO objection” as a result of advertisement in the Kenya

gazette. For any irrigation purposes there must be ninety (90) days storage facility constructed for the purpose of storing of flood flow which is used for the above stated purposes. The water permit is then issued if all the conditions are met; it is issued for a period of five (5) years subject to renewal in written request. This ensure that proper monitoring is done to determine if there has not been any changes which have taken place during that period of use. To ensure proper management of water resources the office of water bailiff is facilitating the formation of water resources users association.

The main objectives of the WRUA are:-

i) Promote legal abstraction of water from the rivers.
ii) To promote efficient and proper use of the water abstracted from the river.
iii) To promote sustainable water use, water management and water development.
iv) To promote soil and water conservation practices within a given catchment area.
v) To promote the conservation of water quality of the given river.
vi) To promote a situation in which the available river flow is reasonably shared between the environment, wildlife, livestock and all the communities that rely on that river in a manner that recognizes the following priority of water use.
    a) Domestic
    b) Environment, wildlife and fisheries
    c) Manufacturing industry
    d) Irrigation
    e) Other use
vii) To promote a forum to discuss, prevent and resolve water use conflicts.
viii) To promote dialogue between the water users and the government in regard to water policy and enforcement of the water act in respect to all activities related to the use of the given river.

The formation of the water resources users Association has greatly helped the office in management and conservation of water resources. With consultation with the WRUA the office can recommend cancellation of any water permit in case of draught or any other reasons agreed upon by the parties which compromise the relevant provisions of the water Act 2002. Water resources are not adequate in our country but with effective and efficient conservation and management activities the limited resources can at least be equitably used by all users.

6.1.5 Main Water Uses

The main water uses in the district are:-

i) Domestic Water Use

Majority of the people are peasant farmers who rely on mixed subsistence farming for their livelihood.
Domestic water use is therefore mainly for:-

a) Washing and cleaning of the household utensils.
b) Washing of personal household clothing.
c) Cleaning of the dwelling premises.
d) Cooking family meals
e) Drinking for both human beings and their livestock.

ii) Industrial Water Use:

The only major factories include tea processing and coffee pulping which require water for processing purpose. The coffee factories are scattered all over the district but mainly in the Tea/coffee zones owned by co-operative societies for pulping member's coffee. These societies draw their water directly from the streams and rivers close to them. Individuals have small coffee pulping plants which almost entirely rely on water meant for domestic use for pulping.

iii) Agricultural Water Use:

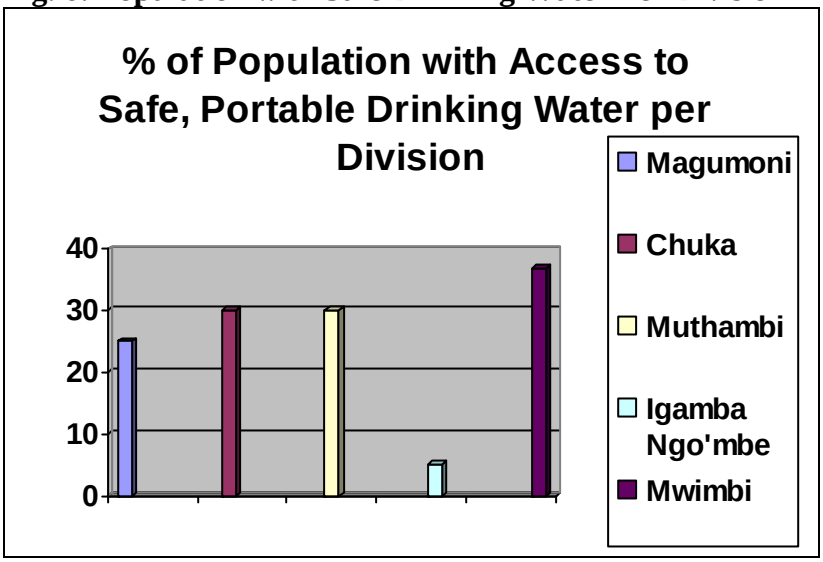
Water for agricultural use is mainly for irrigation of food crops and livestock needs. There are no major irrigation projects in the district, but a few small community based irrigation projects exists. Among them are:-

- **Ciambaraga Irrigation Project:**
  This project is initiated by individual farmers as a community based Irrigation Project and financially supported by SISDO for minor irrigation of horticultural crops for external sale. However, due to operational logistics the project has not yet picked up well. The project is found in Chuka Division and mainly covers parts of Karongoni and Mariani in Karingani location.

- **Nthambo Multipurpose Irrigation Project:**
  Another community based irrigation project implemented with assistance from IFAD under the Eastern Province Project for promotion of Horticultural and Traditional food crops. Although the project has been fully implemented, serious mass production of horticultural crops has not yet commenced fully since the management is still busy connecting individual farmers with water.

6.1.6 Accessibility to Safe, Portable Drinking Water

Fig. 6: Population with Safe Drinking Water Per Division



Source: Ministry of water and irrigation (1999)

Table 23: Sources and Status of Water Resources

SOURCE	STATUS		USAGE	MANAGEMENT SYSTEM	CHALLENGES THREATS	PROPOSED INTERVENTION
	QUALITY	QUANTITY				
Rivers	Safe	Fairly sufficient	Domestic agricultural industrial (minimal)	Gravity W/s canals	Diminishing flow volumes	Catchment Protection. River bank protection
Ground water reserves	Safe	Insufficient	Institutional domestic agricultural	Boreholes/ shallow wells	Pollution through seepage or infiltration	Protection of ground water resources
Rain water	Safe	Insufficient	Domestic	Roof catchments storage tanks	Pollution of roof surfaces by dusts	Awareness creation
Springs	Safe	Fairly sufficient	Domestic	Draw with buckets & jerry cans	Diminishing /drying up of sources	Spring protection
Shallow wells	Safe	Sufficient	Domestic	Rope and bucket	Contamination by runoff surface waters	Protection and proper development
Wetlands	Unsafe	Insufficient	Domestic minor irrigation	Drawn with jerry cans	Contamination by runoff, grazing livestock	Proper protection

6.1.7 Impacts of Water Use & Demand on the Environment and Natural Resources

i. Siltation: Due to agricultural activities along the river banks, earth dams and water pans and within the catchment areas there is massive soil erosion causing siltation on the sources.
ii. Depletion: This is caused by the felling of trees either in forests (timber purposes) or within catchment areas. This reduces the water retention power. Illegal water abstractions also lead to over utilization of water in rivers on the upper zones.
iii. Pollution: the main causes of pollution are poor domestic waste disposal, industrial wastes e.g. from tea and coffee factories and also from slaughter houses and slabs. Poor management of liquid wastes within towns is a major cause of pollution. Agricultural activities lead to soil erosion hence polluting the water resources through agrochemicals and herbicides used in farming.

6.1.8 Key Environmental Issues in Management of Water Resources.

Conflicts:

Water shortages lead to disagreements between water consumers or farmers who irrigate their land. Illegal abstractions upstream may cause conflict from the people downstream during the low discharge periods.

Water Pricing:

The government has come up with a generally affordable tarrifs (water rates) to all consumers, though there are cases where project members feel they have to agree on their own rates of payments.

Apportionment:

Before any project undertakes any construction works the ministry has to be satisfied that the discharge from the river /source is adequate and that all the rules and regulations are adhered to.

Interventions

In 2002 the ministry of water and irrigation introduced water act 2002 which controls and authorizes water use to ensure sustainable use of water resources. The act also allows formation of water services Regulatory Boards to run water supply and sewerage services together with the Water Resource Management Authority that is charged with task of sustainable management of water resources.

Table 24: Priority Environmental Issues and Interventions

No	Prioritized issues/ challenges	Current interventions	Proposed Intervention in the plan period 2006 – 2010	Responsible institutions	Remarks
1.	Pollution	- Have industries construct circulatory systems - Improve waste disposal methods - Provide treated water - Protection of springs - Pit latrines far from water sources - Soil erosion control methods	- Teach the community on how to keep water sources safe - Formation of WRUAs i.e. Water Resources User Associations - E.I.A. on all water projects and Environmental Audits - Sensitize all sectors and players	- MW & I - Ministry of Agriculture - Ministry of Health - NGO's - CBOs - NEMA - Forest Department - Geological department - Ministry of works	-Cover plan period
2.	Depletion/ Degradation of water catchments	- Protection of catchment areas - Avoid farming along the river banks - Soil erosion control measures - Gazette the catchment areas - Plant trees in catchment areas	- Formation of WRUAs - Tree planting exercise - Construction of water conservation structures - Training - E.I.A and E. Auditing	- M O A - M W & I - CBOs - Provincial administration - Forest department - Mines department - Ministry of works	Process has already picked up
3.	Illegal water abstraction	- Follow the laid down procedures before any abstraction or diversion is done. (proper water appointment) - Illegal water works being asked to get	- There exists water apportionment Board to control the authorization of any abstraction or diversion. - Water Users Associations are being formed	- M W & I - M O A - M W & P - Forest Dept - Ministry of works	

		permits.			
4.	Conflicts	- Have all projects/ individuals authorize their activities before any construction works begin	- Have WRUAs within their reach to oversee the activities - E.I.A and E. Auditing	- M W & I - M O A - Administratio n - Community Based Organisations - Non Governmental Organisations	

CHAPTER 7: FORESTRY AND WILDLIFE RESOURCE

7.1 Forestry

7.1.1 Types of Forests and area under each Forest

The Forests of Meru south is of the montane type which are found in the Mt. Kenya forest, Kiera hills and Muunguni hills. The Kiera hills and Muunguni form part of the Nyambene complex. The forest types are further divided into high potential forest, bushland, grassland, bamboo and plantation forest.

The high potential forest is composed mainly of indigenous tree species the most common being Newtonia buchanan, *Croton macrostychlis*, *Brachyleana*, *Calodendrum*, *Prunus africana*, *Ocotea usambarensis*, *Podocarpus*, cedar, and *Hagenia abyssinica*. The bush land consist mainly of low growing tree species such the giant hearths and shrubs while the bamboo zone consist of pure bamboo species. The grass land, grass species are mainly the Kikuyu grass. The plantation forest consists of pine, cypress and eucalyptus as the main forest.

The high potential forest cover an area of 29,000 ha, the bush land cover an area of 7,036.2 ha, grass land 2300 ha, bamboo 5800 ha. The district has no private forest which is either owned by an individual or a company. However the district is well covered with trees at least at farm hold level. The most dominant tree species is grevellea robusta "Mikima". They are mainly planted along the common farm land bonders and sometimes intercropped with coffee.

7.1.2 Status and Trends of Forest Cover in Meru South

The main forest is Mt. Kenya forest which covers 400sq Km of the district. The forest has recently shown signs of recovery following the imposition of the ban on timber logging in the year 2000 and the subsequent dual Gazettement of the forest as a Nature reserve as well as forest reserve. Improved patrols in the forest have helped in reducing incidence of timber poaching to a large extent.

The other forest of Kiera hill and Muunguni have also had remarkable improvement in the protection and conservation. The acceptance of forests adjacent communities in management has helped in reducing these activities. The trend now is to involve the community more into the management of the forest through participatory forestry management which is slowly but rapidly being accepted as a new way of managing the forest. There has been a lot of timber coming from the farmlands. The farmlands have therefore an increased rate of felling trees to meet the market demands. However this rate of cutting has not been measuring to the rate of replanting and this has caused a lot of concern to environmentalist. Campaigns have now been launched to ensure that tree planting efforts are boosted and that controls have been put in place to reduce the rate of cutting.

7.1.3 Regulatory and Management Arrangements

The Mt. Kenya forest is a natural forest, important as a water catchment area for so many rivers draining into the Tana River basin. Because of this important role as water shed commercial exploitation of the indigenous tree species is not allowed to ensure that it continues to be well preserved. The rules regulating entry into the forest are stated in the existing forest act and the yet to be implemented forest act of 2005. The forest department and the Kenya wildlife services are jointly managing the forest through a joint task force and the two existing acts governing the two bodies. In the other forest Kiera and Muunguni the forest department is fully responsible for their day to day running. Forest guards have been posted to patrol the beats.

7.1.4 Exploitation of Forest Resources for Timber and Non-Timber Products

The forest resources include water, timber, firewood, grass, resins and honey. The exploitation of forestry in the forest is currently limited to non-timber products. The ban on timber exploitation on government forest has not allowed the exploitation of timber products in the forest in the past seven years. The non-timber products that are exploited in the forests in Meru south are grass, honey and water. Eco-tourism is also being done but on a small scale.

In the private lands forestry the product that is exploited is timber mainly the grevillea robusta species. It is heavily exploited for timber and firewood for domestic use.

Initially it was used as an agro-forestry specie as livestock feeds and to provide shade to the coffee bushes. With the decline in coffee production and the ban in timber harvesting form Gazetted forest this tree has found ready market for its utilization in the local markets demand and other major towns.

Honey is also being harvested form the beehives which are hanged around trees in Mt. Kenya forest and this has also helped in improving the economy of the people through its sale.

7.1.5 Key Environmental Issues

1. Unsustainable tree felling in the farmlands which has lead to soil erosion and changes in weather patterns.
2. Over reliance on one type of tree species (*Grevillea robusta*) for forestry development in the district. Pests and diseases can attack the tree and wipe it out completely with serious effects on the environment.
3. Poaching of timber trees (*Ocotea usamberensis*)
4. Bhang cultivation in the forests.
5. Forest fires
6. Grazing in key forest areas
7. grazing in forest areas

7.1.6 Proposed Interventions

- Established of tree nurseries
- Enrichment planting on areas where the bhang is being grown
- Intensified tree planting
- Introduction of more tree species in the farmlands.
- Controlled grazing
- Forest fire surveillance
- Improve forest protection through joint forest management programs with local communities.

Table 25: Types and status of Forests

Type of forest	Extent (Ha)	Distribution % total	Location	Forest uses	Status				Proposed intervention
					Gazetted	Under trustland	Private land	% degradation	
Montane	44,228.2	44%	Mt. Kenya forest Kiera hill,Mununguni	Water catchment area fodder wood	All are gazzetted	No trustland forest	No private land	Kiera degraded because of frequent fires	Increased patrols and enrichment planting

				fuelH					

Source: The District Forest Officer Meru south

Fig. 7: Afforestation in coffee and tea zones

Afforestation in coffee and tea zones was quite successful but this is under threat from excessive harvesting for timber and tea processing since the burn on logging from Mt. Kenya Forest

7.2 Wild life

7.2.1 Type of Wildlife and Area under Wildlife

The main types of wildlife are located in the Mt. Kenya National park and forest reserve. The wildlife include the following;-

- The African elephant (*loxodontia Africana*)
- Leopard (*Diceros bicornis*)
- Giant forest hog (*Hylochoerus meinerthageni*)
- The Bongo (*Tragelaphus earyceros*)
- The black fronted duiker. (*Cephalos nignihook*)

There are over ten species of ungulates in Mt. Kenya. These include the duiker (*Neotrragus moschatus*), bushbuck (*Tragelaphus scriptus*), water buck mountain reedbuck (*Redunca fulvorufula*), bush pig (*potamo choerus*), the common zebra (*Eguus burchali*), eland (*tragelephus oryx*), steinbik (*Raphicerus campestris*) Haveys red duiker (*cephalophus, Harveyi*), cape buffaloes (*syncerms caffer*), the black and white colobus (*colobus shereza*),the syke monkeys (*cercopithecus mitis*) The olive baboon (*papio anubis*) is common on the forest margins where it is a nuisance to farmers from nearby communities. The bush baby (*Galago semesalences*) other species include the giant

pouched rat (*cricetonys gambianns*), giant cane rat (*thryonomys swinderanns*), Mole rat, zonilla and the tree hyrax (*dendro hyrax arboreus*). Mt. Kenya forest is also an important bird area with many bird species.

7.2.2 Identify Status and Trends of Wildlife Resources

There has been an increase in the elephant population because of concerted efforts by the K.W.S on improved wildlife conservation efforts. The other wildlife species have also seen a rise in their population. However isolated cases on poaching for game meat has been reported in some parts of Mt. Kenya forest. The animals that have reportedly been targeted for poaching are the buffaloes, antelope and gazelle species.

7.2.3 Regulatory and Forms of Wildlife Management

The Mt. Kenya National park is managed by K.W.S through an act of parliament. There are no other forms of wildlife management in the district apart from the one which is guided by the wildlife act.

Wildlife Utilization (Consumptive and Non-Consumptive**)**. The only park located in the district is Mt. Kenya National park, which is on the Mooreland. The local community illegally kills wild game for meat mainly in the lower parts of the district.

7.2.4 Priority of Key Environmental Issues

1. Decline of certain animal species and threats of extinction.
2. Declining wildlife areas in the lower parts of the district which are range lands.
3. Poaching for game meat and trophies.
4. Human wildlife Conflicts.

Fig 8. Promotion of forestation activities

Promotion of forestation activities through support to tree nurseries

Table 26: Priority issues

No.	Prioritized issues	Current interventions	Proposed interventions 2006-10	Responsible institutions	Remarks
1	Declining animal species	Awareness on importance of conservation	Protection of the few existing species	KWS	
2	Declining wildlife areas	Establishing wildlife areas	Policy change to delineate wildlife dispersal areas	KWS	
3	Poaching for game products	Awareness creation of the menace	Enforcement of relevant laws	KWS	
4	Human wildlife conflicts	Construction of fence	More areas be secured through fence construction	KWS, CBOs, NEMA, FD	

CHAPTER 8: BIODIVERSITY CONSERVATION

8.1. Biodiversity Data and Information

- Type, extent, status, trends of biodiversity and environmentally significant areas such as hilltops, hill slopes, wetlands.

Fig. 9: Forest Conservation

Seedlings of the endangered Prunus Africana species at a forest nursery key bodiversity conservation area and the threatened indigenous Mt. Kenya Forest.

The most important biodiversity area is the Mt. Kenya forest. There are other hills such as Kiera, Muunguni which are significant in biodiversity. The hills and Mt. Kenya forest have had their biodiversity threatened by Human activities of deforestation and wildlife poaching.

Rare species
- *The Bongo*
- *The Black Rhino*

Vulnerable Species;-
- *The African Elephant*
- *Ocotea Uambarensis*

8.2 Species Conservation Status

The elephant is protected under the CITES convention. The camphor tree is enjoying protection following the ban on exploitation of indigenous tree species a few years ago.

8.3 Type of Utilization, Major Beneficiaries and Stakeholders

The presence of wildlife in the forest and parks promotes utilization of biodiversity for tourism. The presence of a variety of plant species encourages utilization of biodiversity for research and medicinal purposes. The presence of various types of birds has prompted bird specialist to declare Mt. Kenya an important bird area. It is also important to note the presence of a rich biodiversity has led to increased conservation efforts which are fronted by the government agencies, local N.G.O's and international agencies. Job's have therefore been created in the process of conserving the biological diversity.

8.4 Regulatory and Institutional Arrangements

The forest act, the wildlife act and the EMCA have been employed in the conservation of biodiversity.

Major Threats to Biodiversity
- Illegal felling of trees of high value in the forest for timber
- Charcoal burning
- Forest fires
- Forest Excisions
- Grass fires meant to improve pasture
- Poaching of wild game
- Shifting cultivation

- Pastoralism

Key Environmental Issues

- Deforestation
- Land degradation
- Pollution of water sources
- Escalation of poverty

There is no significant invasive species in Meru south district. However, *Lantana camara* tends to invade areas that have lost tree cover on Mt. Kenya forest, thereby hindering regeneration of tree species.

Table 27: Priority issues and interventions

No.	Prioritized issues/Challenges	Current Interventions	Proposed interventions in the plan period (2006-2010)	Responsible Institution	Remarks
1	Loss of biodiversity		Carry out survey on status of biodiversity	NEMA/KARI/ Forest Department/ KEFRI/NMK	
			Enforcement of legislation to protect endangered species	NEMA/ Forest	
2	Land degradation	Tree planting & protection of the few remaining indigenous species	Re-afforestation. Enrichment planting	-Min. Agriculture -K.F.S -NEMA -Locals -CBOs -NGOs	
3	Pollution of water resources	Soil & water conservation measures through digging of terraces and tree planting	Enhance tree planting and soil conservation measures	-Min. Agriculture -K.F.S. -NEMA -CBOs -NGOs	
4	Escalation of poverty	-Poverty Reduction Programs - Famine relief issues	-Institute strategies aimed at minimizing poverty	-Min. Agriculture -K.F.S. -NEMA -CBOs	

				-NGOs	
5	Human-wildlife conflict	-Scaring animals	Erecting of two strand electric fence	-KWS	

CHAPTER 9: ENERGY SECTOR

9.1 Energy resources

Wood fuel which consists of fuel wood, firewood and charcoal is found in plenty in the district. In the farmlands there is plenty of wood fuel because of the high percentage of tree cover. Cow dung is rarely used for fuel due to the presence of large of volumes of fuel wood and farm yard manure. Crop residue is rarely used as source of energy for cooking as it finds an alternative use as an animal feed for the dairy. Wind energy is not in use for now in the district but has huge potential especially in the lower parts of the district. Solar energy is slowly gaining popularity, though its initial cost is prohibitive to the residents. Biogas has the potential but has not been fully tapped and developed, in the district. Steam energy is not in use though there have been proposals by a tea factory to initiate its use and converting it to electric energy. No energy is currently being generated from the waste systems in the district. Brikets could be made from coffee husks which can be obtained from the pulping process.

Rural electrification project has not been very successful in the district. The only urban centres with electricity are Chuka, Chogoria and Kibugua market. Only 1,946 households have electricity connections and this is a very small figure compared to the size of the district.

Table 28: Types and Status of Energy Sources

Energy source	Status
Hydro-power (Electricity for cooking)	There are two mini-hydro-power projects in the district. There are several water falls which can be used as source of hydropower. Kenya power and lighting company has supplied power to few urban centres in the district. According to 1999 census there were only 135 households which were using electricity for cooking
Hydropower(Electricity) for lighting	It was recorded in the 1999 census that 1,946 household were using electricity for lighting.
Solar energy for lighting	Only 568 households were using solar for lighting but its use is now the increase.
Firewood	This is the most dominant source for the majority of the residents of Meru south. 133,009 households were using firewood for cooking.

Charcoal	2,271 households were using charcoal and this was mainly in the main town within the district.

9.2 Trends in Energy, Production, Consumption, Costs and Projections

There are only two small scale hydro-power Generating plants in the district. One is located in Chogoria location along the Maara River while the other is located along Tungu River near Kaanwa market in Chuka division.

Table 29: Energy Consumption

No.	Source of energy hydro-power	Point of production	Point of consumption	Per capita consumption	Environmental impacts
1.	Hydro-power	Negligible amount produced in the district	Main market centres, coffee and tea factories	N/A	Has little impact on the environment except when constructing Hydro-power dams andwhen cutting down trees to pave way for constructions Of transmission lines.
2.	Fuel wood	Mainly lower parts of the district	District wide	N/A	Tree cutting/felling which results in reduced tree cover with increase land degradation.
3.	Solar	-	District wide	N/A	Has no negative environmental impact.
4.	Gas	Outside the district	District wide	N/A	Has little negative environmental impact.
5.	Paraffin	Outside the district	District wide	N/A	Emission of smoke during its use, which contains CO, hydrocarbons, CO_2, VOCs, and particulates

Fig. 10: Stacks of fuel wood at Weru tea Factory

Stacks of fuel wood at Weru tea Factory: Tea factories are a Major consumer of fuel wood in the District.

CHAPTER 10: INDUSTRY, TRADE AND SERVICES

10.1 Industrial Sector

10.1.1 Type of Industries

Key industries in the district are agri-based dealing mainly with coffee and tea processing

Table 30: Type and trends in industrial development

NO	Type of industry	1991-1995	1996-2000	2001-2005	Projections for 2010	Remarks
1	Tea processing	-	-	1	-	
2	Coffee processing	-	-	130	-	
3	Timber W/shops			39		Most collapsed after closure of Mt. Kenya forest
4	Garages	1	3	11		
5	Hotels			3	6	
6	Bakery	1				
7	Slaughter house/slabs	1				

Fig. 11: Dry tea leaves and Saw dust- solid waste from Weru tea Factory

Table 31: Type and impact of industries on environment

NO	Type of industry	Raw materials	Product	No of people Employed	Wastes (solid, liquid and gaseous	Key environmental impacts	Mitigation measures
1	Tea processing	Green tea leaves	Black tea	- exact data not available	-Waste water -gaseous emissions -solid waste	-water pollution -air pollution -soil erosion from runoff from the roofs - Deforestation	-treatment of waste water -water harvesting from the roofs
2	Coffee processing	Coffee berries	Dry coffee cherries	- do-	-Waste water -coffee husks	Water pollution	Waste water treatment/ recycling
3	Timber	Logs	-timber -furniture etc	- do -	sawdust	deforestation/ land degradation	Promote farm forestry
4	Slaughter house/slabs	Animals	Beef	- do -	Offal contents, blood & bones	Pollution	Proper waste disposal
5	Service Industry (hotels)	Raw food stuffs	Ready food	-do -	Liquid and solid wastes	Pollution of water sources	Proper waste disposals
6	Transport industry (garages)	Hydro-carbons	Gaseous emission	-do –	-Used Oils -Metal Parts	-Pollution	Use of un leaded fuel, enforce traffic laws

Table 32: priority issues and intervention

Prioritized issue /challenge	Current intervention	Proposed ,intervention in the plan period	Remarks
Waste water	Use of soak pits	Waste water treatment/recycling	
Solid waste	-Open dumping - Reuse e.g. as organic manure	-Use of waste to produce byproducts e.g. charcoal from coffee husks	

Deforestation	-Forestation -Re-afforestation	-use of alternative sources of energy especially in tea factories which are the main consumers of fuel wood	

10.2 Trade sector

Trade in the district is also not well developed with the bulk of trade being carried out in the agriculture (sale of grains, horticulture products) and Livestock (sale of live animals). The rest of trade is dominated by retail of consumer goods and wholesale.

Table 33: Type and Impact of Trade on Environment

No.	Type of Trade	Raw Materials	Product	No. of People Employed	Wastes (Solid, Liquid & Gaseous)	Key Environmental Impacts	Mitigation Measures
1.	Livestock	Live animals	Meat Hides Skins	-	-Waste water from slaughter slabs -manure -Waste salt from skin curing	-pollution of rivers -Pollution of towns by solid waste -Land degradation	-proper sitting of slaughter slabs/houses -Conversion of solid waste to manure for sale to farmers
2.	Retail/wholesale shops	Cereals, pulses and other consumer products	Various	-	Solid waste especially papers (polythene bags)	-Making towns dirty -death of livestock -blockage of drainage systems	

Source: Meru south county council

Table 34: Type of trade and impact on Environment

No.	Type of Trade	Linkages (Impacts) to Environmental Degradation	Proposed interventions
1.	Livestock	-overgrazing and soil erosion leading to land degradation -waste water leading to	-Establish livestock marketing yards. -proper disposal of

		pollution of rivers	waste water
2.	Retail/wholesale shops	Waste papers leading to dirty towns	Burning Establishment of a proper dump site Recycling/reuse

Source: Meru South County council

Table 35: Priority issues and interventions

Priority issues/challenges	Current intervention	Proposed intervention	Responsible institution	Remarks
Solid waste	-Burning - Collection/dumping	Proper disposal/dump site	Tharaka county council	
Land degradation by livestock		Controlled grazing	DLPO County council	
Waste water from slaughter slabs/slaughter houses		County council to construct central abattoir and treat waste water before discharging to rivers	County council	

10.3 Services sector

The services sector plays an important role in creating and supporting an enabling environment that facilitates private sector investment, growth and job creation. The provisions of adequate services, coupled with macroeconomic stability and a long- term development strategy, are essential preconditions for sustainable economic and social development.

Number of hotels-222
Number of tourist class hotels-3
Main tourist attractions-Mountaineering (Mt. Kenya)
Number of registered hotesl-12
Number of banks-3
Number of SACCOs-4
Number of microfinance Institutions-3

Table 36: Service sector linkages to environmental degradation

No	Service sector	Linkages (impacts) to environmental	Proposed interventions

		degradation	
	Hotels	-Pollution of rivers from waste water -Generation of solid waste	-provision of sewerage services in urban centres

Table 37: Priority issues and interventions

Priority issues/ challenges	Current intervention	Proposed intervention	Responsible institution	Remarks
Waste water	-discharge to open drains -Septic tanks	Construction of sewage system	County/municipal council	
Solid waste	-Uncoordinated dumping -Burning	Development of a proper dumping sites	County/municipal council	

CHAPTER 11: TOURISM

11.1 Type of tourism, attraction and potential

The main tourist attraction in the district is mountaineering. However there is potential for ecotourism and nature trails but these have not been exploited. The main tourist circuit is Mount Kenya

Table 38: Types of tourism

No	Type of Tourism	No of facilities	Geographical location
1	Mountaineering	1	Mt. Kenya
2	Eco tourism	1	- do -

Table 39: Priority issues and interventions

Priority issues /challenges	Current intervention	Proposed intervention	Responsible institution	Remarks
Solid waste	-Uncoordinated dumping -Burning	Development of a proper dumping sites	County/municipal council	

CHAPTER 12: MINING AND QUARRYING

12.1 Mineral potential

Commonly found minerals

-Clay
-Sand
-Building stones
-Aggregate (i.e. ballast & hard core)

12.2 Status of Mining

- Stone quarrying results in deep water filled pits, eroded steep slopes pollution of water sources.
- Several stone quarries along Mutonga River.

Table 40: priority issues and interventions

Priority issues / challenges	Current intervention	Proposed intervention	Responsible institution	Remarks
Pollution of water sources	-	Restrict quarrying near water sources	County council	
Deep pits	-	Rehabilitation of quarries	Quarry owners	

Fig. 12: Stone quarrying near Chogoria Market

Stone quarrying near Chogoria Market. There are numerous quarries along Mutonga and Maara River

12.3 Sand Harvesting

Sand harvesting is carried out mainly in Igamba Ngo'mbe division in seasonal rivers such as muthangacwe.

Sand harvesting Sites

- Muthangacwe sand harvesting
- Kaare sand harvesting
- Kajuki sand harvesting
- Kathwana sand harvesting
- Kajiampau sand harvesting
- Kiaritha sand harvesting
- Igamba Ng'ombe sand harvesting

Quarries

- Mwoga Quarry
- Chogoria Quarry

Table 41: method of extraction

No.	Source of sand	Method of sand harvesting	Geographical location/name of site	Size of site Ha	Quantity extracted (annual)	Regulatory agency	Environmental impacts
1	Igamba Ng'ombe	Manual scooping	-	River Valleys	N/A	none	-Water pollution -river bank erosion

Table 42: Priority issues and interventions

Priority issues	**Current Intervention**	**Proposed Intervention**	**Responsible institution**	**Remarks**
Erosion of river banks	None	-Rehabilitation of the river bank -Organize the sand harvesters to form an association for ease of regulation	-Provincial administration -county Council - water department	
Water pollution	None	Regulate sand harvesting to ensure harvesting is only done on designated areas	-Provincial administration -county Council -Law enforcement	

CHAPTER 13: ENVIRONMENTAL HAZARDS AND DISASTERS

13.1 Extent and trends of environmental hazards and disasters

- Road accidents

Most notable disasters stem from Nithi River bridge where a number of fatal accidents have occurred. When they occur the accidents overstretch the capacity of the local District Hospital. An example is in the year 2001 when over 40 people perished in a bus accident on this bridge and many were critically injured. It has been proposed that the bridge be relocated to a less dangerous route.

- Disease out break

The following diseases have occurred in the District claiming several lives; malaria, cholera, diarrhoea esp. in Kamwimbi, Gitareni and Mwimbi areas.

Causes: poor sanitation, water contamination, poor personal hygiene
Strategies: timely notification of diseases, community involvement and sensitization, disease surveillance, provision of adequate medical facilities

- Drought

Although the District has not been experiencing frequent droughts in the past, it is important to note that a severe drought was experienced in 1999-2000 which brought about food & fodder shortages. During the period there was upsurge in cases of malnutrition, poor health, school drop out, low livestock production etc.

Mitigation: promotion & production of drought tolerant crops, cotton & sunflower production, start up of fodder-bulking projects

- Settlement on steep slopes

One of the most frequent calamities occurring in the District is a landslide such as at Giampampo and Kaunju slopes. It is in this area for example where over 150 families occupy a very sloppy area of around 195 Ha and where severe erosion and landslides occur regularly endangering the families.

- HIV/AIDS

HIV/AIDS continues to spread at an alarming rate. Since 1999 admission at Chuka District Hospital has been increasing due to the HIV/AIDS pandemic. It has been increasing yearly with the HIV prevalence standing at 30% with more females affected than males. The high prevalence is attributed to slow response of behavioral change, irresponsible sex, breakdown of social structure and poverty among others.

- Fire outbreaks in learning institutions & residential areas.
- Notifiable Pests:

E.g. locusts and armyworms, aphids etc. occur every now and then threatening food security and fodder.

Table 43: Priority issues and interventions

No	Prioritized issues/challenges	Current intervention	Proposed intervention in the plan period (2006-2010)	Responsible institution	Remarks
1	Road accidents	Construction of barrier	Change road design	D.W.O	
2	Diseases outbreaks	Surveillance	Intensify & improve	Public Health	
3	Land slides	Planting of trees	- do -	D.F.O D.A.O	
4	Drought	Research in drought resistant plant varieties	- do -	KARI KEFRI	
5	HIV/AIDS	Awareness creation on avoidance & management	- do -	Public Health M.O.H	
6	Pests	Surveillance	- do -	D.A.O D.F.O	

CHAPTER 14: ENVIRONMENTAL EDUCATION AND TECHNOLOGIES

14.1: Status of Environmental Education

Environmental education in schools is not offered as a subject but various elements of the environment are taught in subjects such as agriculture, geography, biology etc. Pupils/students get practical knowledge on environment through clubs such 4k clubs, young farmers clubs, wildlife clubs and environmental clubs

Table 44: status of environmental programmes in school

Type of club	No. of schools			Types of environmental programmes	remarks
	primary	secondary	tertiary		
4-k clubs	29	-	Nil	Organic farming -Rabbit keeping	

Young farmers clubs	-	18	3	-Farming -Bee keeping -Rabbit keeping	
Wildlife clubs	Nil	50	-	Tree planting	

Source: District Agriculture Office, Meru South/District Education office

Some of the environmental issues incorporated in the subjects taught in schools include Agro forestry, Soil conservation, environmental conservation, ecology among others. These help to create awareness on the part of students on the need for environmental conservation in general

Non- formal Environmental Programs

These are mainly carried out through community based environmental CBOs farmer field Schools, women groups and youth groups. Some of the key players include key government department (Agriculture/livestock/water/forest) donors especially IFAD and SIDA, NGOs notably the Green Belt Movement and the National Council of Women of Kenya.

Table 45: status of environmental programmes in the district

Environmental programmes	Key players	challenges	Proposed interventions
Soil Conservation	Agriculture/Community	Sustainability/Tools	Use of locally available materials
Group nurseries	IFAD/Forest department	Sustainability	Use of locally available materials
Forestation/Agro forestry	IFAD/Forest department/Agriculture/ CSOs	Survival rate	-Protection against livestock -Water harvesting
Soil Fertility Management	Kenyatta University/Agriculture	Limited coverage	-Expand activities

14.2 Public Awareness and Participation

Public awareness and participation in the district is being coordinated by the NEMA office through the District Environment committee. Assistance in carrying out public awareness has been received from GOK departments NGOs and donors, notably IFAD (through the Mt. Kenya East Pilot Project for Natural Resources Management-MKEPP)

Table 46: status of Environmental awareness and participation in the district

program mes	Key players	Sector	Environmental benefits	opportunities	challenges	intervention s
MKEPP	Agriculture	Natural	-Sustainable use	Integration of	Coordinati	

	Livestock Water Social services Forest NEMA	resources	of natural resources -Environmental conservation	natural resources conservation efforts	on of the various activities	
NALEP	Agriculture/ Livestock	Agriculture	Soil conservation -improved productivity	Stakeholder participation		

14.3 Technologies

Some of the technologies being promoted include:

- Energy saving devices
- Use of renewable sources of energy especially solar
- Water harvesting techniques

Table 47: priority issues and interventions

No.	Prioritized issues/challenges	Current intervention	Proposed intervention in the plan period(2006-2010)	Responsible institution	Remarks
1	Public participation still low	Awareness creation Barazas	Intensify awareness creation and involve all sectors	NEMA	
2	Low level of awareness on the part of environmental committees	-	Train environmental committees on their role in environmental conservation	NEMA	
3.	Low level of funding	-	Involve all stakeholders	NEMA	

CHAPTER 15: ENVIRONMENTAL INFORMATION SYSTEMS

The broad challenge in harnessing environmental information and communication technology include inadequate resources and capacity for information collection, analysis, storage, and dissemination, inadequate awareness among environmental managers and the public; and lack of knowledge sharing networks at grass root level.

15 .1 Types and sources of environmental information

The table below outlines the type of environmental data and information available in the district and the institutions where it can be accessed.

Table 48: Information and Data Types in the district

sector	Information/ Data types	Form (GIS /maps /reports /electronically, books)	institutions	Access Conditions/ policy	Users	System Of updating
Agriculture, Livestock & fisheries	Soil conservation In the district	Reports	Dist. Agric. Office	Easily accessible	Planners Policy makers Students	Updated annually
	Rainfall data	Reports	Dist. Agric. Office	Free access	Planners Policy makers Students	Monthly records
	Crop & livestock/ fishing production trends	Reports	Dist. Agric. Office	Free access	Planners Policy makers Students	Updated annually
Water	Water resources in the district	-Reports -Maps	District water office	Free access, some are paid for	-as above-	Updated annually
Lands	Adjudication status in the district	-Reports -Maps	District lands adjudication office	Free access	-as above-	Updated annually
Forestry	Distribution of forests in the district	Reports maps	District forest office	Free access	-as above-	Updated annually
Sand harvesting/ murram quarrying	Sites quantities	Reports	Local government offices	Free access	Free access	Free access
Tourism	Sites and visitor statistics	Reports	KWS		Free access	Free access
Energy	Energy demand and	Reports/ surveys	Ministry of energy			

	distribution					
Industry	Types and their distribution	Surveys/ reports	Ministry of industry			

15.2 Status of environmental information management systems

- **Adequacy of institutional skills in information management system**

A number of institutions have acquired computers which are crucial in any information management system. However most of the technical staff in the departments are not trained in basic computer skills

- **Number of documentation centers, archives and libraries**

The district has one District Information and Documentation Centre (DIDC) under the district development officer (DDO). However it is not yet operational since it still lacks furniture.

15.3 Constraints/challenges in environmental information/data collection

- Poor ICT infrastructure
- Low institutional skills in information management
- Lack of funding and human resources to collect data.

15.4 Indigenous knowledge

- Use of loglines, trash lines and stone lines to control soil erosion.
- Establishment of sacred places (Iri) as a way of protecting water catchment areas and conserving biodiversity.
- Shifting cultivation
- Use of certain materials to treat various livestock ailment
- Use of aloe Vera to treat chicken diseases (Newcastle)
- Use of various abstract to control worm e.g machui/ igati.
- Use of some plant roots/seeds to hasten productive functions e.g. expulsion of after birth
- Use of various trees, herbs and shrubs to treat various diseases and to boost immunity to diseases.
- Sudden emergence of certain insect species which is an indication of onset of catastrophes.

Table 49: Types of IK, key players and Challenges

Sector	Types of IK	Form (oral,music,artifact)	Instructions/individuals holding knowledge	Access conditions/policy	Users
Livestock	Use of plant extracts to treat various human and animal ailments eg Aloe Vera	Oral	Traditional practitioners	Not readily accessible	Public
Agriculture	-Treatment of crop pest and diseases -Soil Conservation (Loglines,trashlines etc) -Value addition of traditional food crops	-Oral -Music	-old men/women instructors -practitioners ie farmers or farm workers	-available during farm work -Consultation	Public

15.5 Constraints/Challenges in utilization/documentation Indigenous Knowledge (IK)

- Bias and preference of modern technologies
- Inadequate /lack of proper documentation of IKs
- Lack of scientific studies to validate these technologies
- Only very few people have the knowledge
- Materials used not readily available
- Dosage and amounts not known
- There is a weakness in passing of knowledge from old to new generation hence eroding Indigenous knowledge.

Table 50: proposed interventions

No.	Prioritized issues/ challenges	Current Intervention	Proposed intervention in the plan period (2006-	Responsible institution	Remarks

			2010)		
1	Inadequate documentation	-	Carry out a survey to document all IKs	FD,MOA	
2	Lack of scientific studies to validate IKs	- Documentation by the national museums of Kenya (NMK)	Research institutions to carry out studies	KARI/KEFRI	
3	Bias/preference of modern technologies	Awareness creation	Carry out sensitization/training of the community on the importance of IKs	FD, MOA, NEMA	

CHAPTER 16: ENVIRONMENTAL GOVERNANCE AND INSTITUTIONAL FRAMEWORKS

16 .1 Status of environmental governance and institutional arrangements

16.1.1 Collaborating Government Departments

Key collaborating departments in environmental conservation in the district include forest department, ministry of agriculture, ministry of livestock development and fisheries, ministry of water, provincial administration, county council and public health department.

16.1.2 Environmental NGOs/CBOs/Private sector organizations

These include, the Green Belt Movement, Council of Women of Kenya, several community based environmental conservation groups and churches.

16.1.3 Donor Organizations Active in the District

- **IFAD (International Fund for Agricultural Development)-** Through the Mount Kenya East Pilot project for Natural Resources management (MKEPP) –integrated project for the sustainable utilization of natural resources
- **SIDA (Swedish International Development Agency)-**Through the National Agriculture and Livestock Extension Programme (NALEP) which incorporates aspects of environmental conservation as part of its activities
- **EU (European Union) –**Through Community Development Trust Fund (CDTF) - CEF

16.1.4 Regulatory and management tools

Table 51: legislation that impact on human health and environment quality

Title of legislation	Year of enactment	Aspects of environment addressed by the act	Implementing Agency(ies)	Coordinating mechanisms	Areas on the overlaps and conflicts with EMCA
New forest act	2005	Forest conservation	Forest department	Forest conservation communities	none
Water act	2002	-Management and conservation of water resources -Protection of water catchment areas	-Water services board	Formation of water users associations and river user associations at community level	-
Public health act (CAP 242)		-Sanitation and hygiene	Department of public health	-	-
Agriculture Act (CAP 318)	-	-Soil Conservation -River bank protection	Ministry of agriculture	-	-
Factories Act (CAP 519)		Occupational health and safety	Ministry of labor	-	-
Mining		Conservation of Nat. Resources	MENR		
KWS Act	1976	Conservation of Natural resources	KWS		
Local Government (CAP 265)		Waste Management, conservation	Local Authorities		
Physical Planning	1999	Land use planning	Physical Planner		
Chiefs Act		Conservation of resources	Provincial Admin		

Land Adjudication		Conservation of resources	Lands and Settlement		
Land Registration (CAP 303)		Conservation of resources	Land registrar		

16.1.5 Environmental Management Tools in the District

Some environmental tools being employed in the district include:

- Environmental impact assessment
- Environmental Audit
- Inspection of premises by public health
- Enforcement of regulations
- Prosecution of offenders

CHAPTER 17: IMPLEMENTATION STRARATEGY

The District Environment Action Plan (DEAP) preparation and implementation is guided by national priorities as contained in major policy documents including the ERSWEC, National Development Plans and The District development Plans. The objective of this Environmental Action Plan is to integrate environmental concerns in development planning and implementation. It will seek to address the poverty environment nexus where by poverty leads to environmental degradation, which in turn exacerbates poverty.

17.1 Stakeholders' involvement

The implementation strategy of the DEAP will involve as many stakeholders as possible. These include all Government Departments, Agencies, State Corporations and any other organ of Government as well as Civil Society Organizations, Private sector and individuals.

17.2 Resource requirement

The implementation of the Environmental Action Plan requires a deliberate and targeted allocation of resources-financial, human and technology. The implementation strategy will call for the identification of resources needs and their allocation to identified priorities. Among the various resources are at community based resources, local Authority Transfer fund; Constituency development Fund; GOK Budgetary allocations; Support from NGOs; CBOs; Religious Organizations, Private Sector and development partners both multilateral and bilateral.

17.3 Monitoring and Evaluation

The Monitoring and Evaluation of the implementation of the Environmental Action Plans will be carried out using participatory approaches where stakeholders are involved at all stages. Monitoring will mainly be undertaken on continuous basis through meetings and field visits. Reports will be discussed at all stages but quarterly reports will be prepared and reviewed. Evaluation will be undertaken periodically preferably on annual basis in line with the performance contracting period in the Public Service.

The purpose of Monitoring and Evaluation of the Environmental Action Plan is to ensure their efficient and effective implementation as well as ensuring that environmental concerns have been addressed and integrated in the development process. It will involve documentation of “best practices” for the purpose of replication.

The implementation strategy will monitored and evaluated using matrices 17.1 and 17.2

Table 52: Implementation Matrix

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
Priority Issue 1: Awareness creation on Environment and sustainable development Objective: Improve awareness on proper environment management by the Meru South residents.										
Awareness created thro environmental management campaigns and introduction of environmental education for sustainable development in schools and colleges	1. Enhanced environ-mental management campaigns thro baraza's field days	Through out 5yrs	DSO, DFO, DAO, CSO, Community, NEMA	DEnv.O	100,000	100,000	100,000	100,000	100,000	
	2. Introduction of environmental education for sustainable development in schools and colleges	1yr	DEO, NEMA, CSO, DEB	DEO	50,000	50,000	50,000	50,000	50,000	
Priority Issue 2: Indiscriminate Felling of trees on Farms Objective: Maintain Proper on farm tree cover.										

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
Trees Planted and conserved on farm	1. Est. group tree nurseries (25)	On farm throughout the 5 yrs period	DAO, CSO, DFO, Local Govt, NEMA, Community	DFO	150,000	150,000	150,000	150,000	150,000	Support for 5 nurseries each year in all the sub-locations to produce 100,000 seedlings
	2. Alternative Energy sources	5 yrs	WRMA, DEO, DAO, NEMA, Min of Energy	NEMA	100,000	100,000	100,000	100,000	100,000	Conduct feasibility study. One study/Year on micro-hydropower production
	3. Demos/training on bio-gas production	5 yrs	CSOs, Community, NEMA, DLPO, DVO	DLPO	60,000	60,000	60,000	60,000	60,000	5 trainings in each location each year
	4. Hold tree planting campaigns/ Barazas (25)	5 yrs	DAO, NEMA, CSOs, DFO, OP	DFO	120,000	120,000	120,000	120,000	120,000	25 barazas in each location i.e six (5) barazas per year.
	5. Plant trees on public hills (3)	Oct/Nov April/ May	DAO, NEMA, CBO, DFO, OP	DFO	50,000	50,000	50,000	50,000	50,000	Plant trees in 5 sites, one per division each year to cover 50 ha.
	6. Plant trees	Oct/No	NEMA,	DFO	50,000	50,000	50,000	50,000	50,000	Plant trees on 5

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
	on other public lands /schools, road reserves	v April/ May	DFO, OP, CSOs, DEO, community							sites each year per sub-location
	7. Training on energy saving	5 yrs	NEMA, DAO, DFO, CSOs, community, OP	DAO	120,000	120,000	120,000	120,000	120,000	One training per location (5 trainings/yr)
Priority issue 3: unsustainable water management practices Objective: To ensure proper management of water resources										
Reduced illegal water abstraction & Promote water harvesting initiative	1. Community mobilization to form water users associations	1 year	WRMA,DSDO, OP,NEMA, community	WRMA	50,000	50,000	50,000	50,000	50,000	Formation of RUAs and WUAs, one per major basin/yr
	2. community awareness creation on water harvesting structure	5 year	WRMA, WSB, OP, WUAs & RUAs, NEMA	WRMA	120,000	120,000	120,000	120,000	120,000	One baraza per location within the 5yr period
Priority issue 4: River banks wetland degradation and erosion leading to drying up and siltation of rivers Objective: conserve water sources to provide sufficient and clean water to all communities										

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
River banks protected	1: Educate community on water sources protection	5yrs	WRMA, WUAs, RUAs, OP, Community,CSOs,NEMA	WRMA	120,000	120,000	120,000	120,000	120,000	Conduct training on river basin in upper, mid and lower catchment
	2: Pegging of river banks and planting of trees and grasses	5yrs	WRMA, Community,CSOs, DFO, NEMA	DAO	120,000	120,000	120,000	120,000	120,000	One bank in each basin each year
	3: Surveying and demarcating wetlands, secure by fencing and planting of trees	Through-out the 5 years	WRMA, Local govt,OP, NEMA, CSOs	WRMA	180,000	180,000	180,000	180,000	180,000	One wetland per location in the 5yr period
priority: Issue 5: Pollution of rivers by effluents from coffee factories 8 slaughter houses and dips Objectives: Maintain clean water for all users										
Safe disposal of effluent	1: Erect incinerators for 2 public slaughter houses		DVO, Local authority, DPHO, proprietor, NEMA	DVO	500,000					At Chuka and Chogoria town to be funded by proprietors. To be recommended by EA or EIA

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
	2: Establish condemnation pits in all slaughter houses and slabs	5yrs	DVO, DAO, DPHO, Local authority, NEMA	DVO	100,000					To be funded by proprietors as recommended thro EA or EIA
	3; Est. seepage pits for all coffee factories		DAO, DCO, DPHO, Fisheries NEMA	DPHO	100,000					To be funded by societies as recommended thro EA or EIA
	4. Continuous water quality analysis and enforcement of laws		WRMA, DPHO, NEMA, community	WRMA	100,000					To be funded by societies as recommended thro EA or EIA
	5. Recycling waste water in factories		Water dept, DPHO, NEMA	Coffee factory management	100,000					To be funded by societies as recommended thro EA or EIA
Priority: Issue 6: Degradation of farms due to soil erosion Objective: minimize erosion to increase farm productivity										

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
Reduced erosion	1: Educate farmers on soil and water conservation through field-days, seminars & work-shops	Jan-Mar Jul-Sep	DAO, comm., CSOs, OP, DFOs, NEMA	DAO	180,000	180,000	180,000	180,000	180,000	One Field day in each location in the 5 yrs
	2: Demos on water harvesting of road run off	Mar-Apr	DAO, OP, Community, CSOs, WRMA,	DAO	30,000	30,000	30,000	30,000	30,000	To be combined with the above in each location
	3. Demos on domestic/ roof water harvesting	Oct-Dec	DAO, WRMA, comm. CSO, NEMA, OP,WSB	WRMA	27,000	27,000	27,000	27,000	27,000	To be combined with the above in each location
Priority issue 7: Unsustainable forestry practices Objective proper management of protected forests										
Reduced illegal logging/ poaching and marijuana cultivation in Govt forests	1. Continuous aerial surveillance and intelligence gathering on illegal activities	5Yrs	DFO, KWS, NEMA, OP, community	DFO/KWS	800,000	800,000	800,000	800,000	800,000	

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
	2; Ground patrols and uprooting	Continuous	DFO/ KWS Community,OP	DFO and KWS	800,000	800,000	800,000	800,000	800,000	
	3: Sensitization of Community on participatory forestry management practices	continuous	DFO,OP,community, CSOs, and NEMA	DFO	120,000	120,000	120,000	120,000	120,000	These will be done in areas where these forests occur
	4: Install VHF communication and improve roads in the hot spots	continuous	KWS DFO, local govt. OP	DFO and KWS	1 M	1 M	1 M	1 M	1 M	
	5 Feasibility studies on eco tourism	Quarterly	KWS, DFO, NEMA	KWS	100,000	100,000	100,000	100,000	100,000	Studies to be conducted by consultants

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
	6 Fence construction	Continuous	KWS & DFO	KWS						To be funded by EIAs in the hotspots of conflicts
Priority issue 8: Overgrazing in communal and private lands in semi-arid areas Objective: proper management of pasture and maintenance of good stocking rate										
Reduced overgrazing of pasture lands on LM4 and LM5 areas	1: Establish bulking sites for pasture, fodder, grasses, trees	5yrs	DLPO, CSOs, Community, DFO, DAO, OP	DLPO	120,000	120,000	120,000	120,000	120,000	
	2: Educate farmers on stocking rates ,pasture and fodder management	5yrs	DLPO commuity, DAO, OP, NEMA	DLPO	120,000	120,000	120,000	120,000	120,000	
Priority issue 9: unsustainable waste management in urban centres Chuka town and Chogoria Objective: To ensure proper waste management in urban centres										
Improved Liquid waste management Safety and prepared	1: To secure land for construction of sewage plant in Chuka and Chogoria	1yr	Local authority DPP, NEMA, DPHO, Community, OP, DWO	Local Government	800,000					To purchase land for each town (4acres)

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
ness for hazards	2: To secure land for solid waste management in Chuka and Chogoria	1yrs	DPHO, DPP, NEMA, local authority, OP, DWO	Local Government	600,000					To purchase land (3acres)
	3: To secure land for waste management in all centres in the district	5yrs	M.S County Council, NEMA, DWO DPHO, DPP, OP	Local authority						To be secured during planning of all existing market centers
	4: To construct residential and commercial buildings to requirements of building codes and physical plans	5yrs	NEMA, DPHO, DPP, OP, local authority DWO	Local authority						Vigilance in administration of existing laws

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
	5: To open up service lanes to ensure efficient management of wastes in Chuka and Chogoria.	5yrs	NEMA, DPHO, OP, DPP, local authority DWO	Local Government						
	6: To secure fire management facilities -To develop necessary infrastructure	5yrs	M.S County Council, NEMA, DPHO, OP, DPP, DWO	Local government						
priority issue 10: unsustainable fishery practices Objective: proper management of fishery activities										
Reduced illegal fishing activities and restocking	1: Restocking activities	continuous	Fisheries Fisheries dept, community, NEMA	Fisheries dept	100,000	100,000	100,000	100,000	100,000	
	2: Community involvement through awareness	continuous	Fisheries, OP, WRMA	Fisheries	120,000	120,000	120,000	120,000	120,000	

Output	Activity	Time Frame	Stakeholders	Responsible Institution	Estimated Cost 07/08	Estimated Cost 08/09	Estimated Cost 09/10	Estimated Cost 10/11	Estimated Cost 11/12	Remarks
	creation policing & proper fishing methods									
	3: To increase fish farming and utilization	Continuous	Fisheries, DAO, WRMA	Fisheries	100,000	100,000	100,000	100,000	100,000	Demonstration ponds in each sub-location in 5yrs
priority issue 11: Unsustainable sand harvesting , quarrying and mining practices Objective: To proper management of sand harvesting ,quarrying and mining activities										
Improved sand harvesting activities	1: Mobilization of harvesters to form co-operative	1 year	Community OP, NEMA, Local authority DCO,	M/S County Council	50,000	-	-	-	-	
	2: Awareness creation of the members on proper practices	Continuous	NEMA, Local authority	NEMA	50,000	50,000	50,000	50,000	50,000	Barazas in areas where sand harvesting is practiced
	3; Reclamation of abandoned sites by land filling and tree planting	continuous	Local authority, NEMA, OP, DFO, operators	NEMA	100,000	100,000	100,000	100,000	100,000	To survey degraded sites and to prepare and execute work plans of rehabilitation

Table 53. Monitoring And Evaluation Matrix

Activity	OVIs (Objectively Verifiable Indicators)	MOVS (Means of Verification)	Reporting Schedule	Implementers	Responsible Institution For M+E	Remarks
1. Enhanced awareness creation	No. of baraza's/campaigns	- Reports	Quarterly	NEMA, OP, CSOs, Local govt. DFO, DAO, DLPO, Community	DEC	
2. Introduction of environmental education	No. of Env. clubs formed & participation in environmental mgt. activities	-Reports	Quarterly	DEO, NEMA, CSOs, DFO, DAO, DLPO	DEC	
3. Est. group tree nurseries (25)	NO. of nurseries established	- Reports -Field visits	Quarterly	DAO" s office, CSOs, Communities, DFO	DEC	
4. Alternative Energy sources	No. of units built	-Reports -Field visits	Quarterly	Community, DLPO, DAO, WRMA, NEMA	DEC	
5. Hold tree planting campaigns/ Barazas (5)	No. of Barazas held	-Reports	Quarterly	DAO DFO CSOs, OP	DEC	
6: plant tree on public hills	No. of trees planted No. of hills replanted	-Reports -Field visits	Quarterly	DFO, OP, NEMA	DEC	

7: plant trees on other public lands and road reserves	No. f trees planted	-Reports -Field visits	Quarterly	DAO, DFO DWO, OP	DEC	
8: Training on energy saving	No. of Devices	-Reports -Field visits	Quarterly	NEMA, DAO, DFO, OP	DEC	
9: Community mobilization to form water uses associations community awareness creation on water harvesting structure	No of WUAs formed	-Reports	Quarterly	WRMA, DSDO, OP	DEC	
10: Educate community on water sources protection	No. of Sources protected	-Reports -Field visits	Quarterly	WRMA, NEMA, DAO	DEC	
11: Pegging of river banks and planting of trees and grasses	No. of Pegs/banks peged	-Reports	Quarterly	DFO, WRMA, DAO	DEC	
12: Surveying and demarcating wetlands, secure by fencing and planting of trees and grasses	No. of wetlands surveyed	-Reports -Field visits	Quarterly	WRMA, DFO, DAO, SoK	DEC	
13: : Erect	No. of incinerators	-Reports	Quarterly	DPHO, DVO,	DEC	To be

incinerators for 2 public slaughter houses	erected and working	-Field visits		Local Councils		recommended through EAs and EIAs
14: Establish condemnation pits for all slaughter houses and slabs	No. of slaughter house with pits	-Reports -Field visits	Quarterly	DVO, DPHO, proprietors, Local authority	DEC	To be recommended through EAs and EIAs
15: Est. seepage pits for all coffee factories	No of factories with seepage pits	-Reports -Field visits	Quarterly	DAO, WUAS, RUAs, DPHO, OP	DEC	To be recommended through EAs and EIAs
16 Continuous water quality analysis and enforcement of laws	No. of water quality assessments	-Reports Field visits	Quarterly	WRMA, DPHO and NEMA	DEC	To be recommended through EAs and EIAs
17: Recycling water in factories	No. of factories with recycling facilities	-Report	Quarterly	DAO, DCO, Factory management	DEC	To be recommended through EAs and EIAs
18: : Educate farmers on soil and water conservation through field days	No. of field days held	Reports	Quarterly	DAO, DFO, WRMA, NEMA	DEC	
19: Demos on run-off water harvesting on roads	No. of Demos	Reports	Quarterly	DAO, DFO, WRMA, NEMA	DEC	
20; Demos on domestic/ roof	Number of demos	Reports	Quarterly	WRMA, NEMA	DEC	

water harvesting						
21: Aerial surveillance and mapping	No. of flights	Report	Quarterly	KWS, DRSRS	DEC	
22: Ground patrols and uprooting	No. of patrols and area uprooted	Reports Field visits	Quarterly	KWS, DFO	DEC	
23; Sensitization of Community on participatory forest management practices	No. of Management plans drawn	-Reports	Quarterly	OP,DSDO, DFO	DEC	
24: Install VHF communication and improve roads	VHF installed & Kms of roads maintained	Reports	Quarterly	DFO, KWS	DEC	
25: Feasibility studies on Eco tourism	No. of studies conducted	Reports	Quarterly	KWS	DEC	
26: Fence construction	No. of Kms covered	Reports	Quarterly	KWS	DEC	
27; Establish bulking sites for pasture, fodder, grasses, trees	No. of sites established	"	Quarterly	DAO, DLPO, DFO	DEC	
28: Educate farmers on	No. of Trainings held	Reports	Quarterly	DLPO	DEC	

stocking rates ,pasture and fodder management						
29: To secure land for construction of sewage plant	Land acquired	Report	Quarterly	Municipal council of chuka	DEC	
30: To secure land for solid waste management	Title deed of land	Report visit	Quarterly	Chuka municipal council DPHO, DPP, NEMA , OP	DEC	
31: To secure land for waste management in all centres	Land secured	Report Visits	Quarterly	Clerk M/S County council, OP	DEC	
32; To construct residential and commercial buildings to requirements of building codes and physical plans	No of plans approved	Report Visit	Quarterly	Clerk municipal council(Chuka) DPP, DPHO, NEMA, DWO, OP	DEC	
33: To open up service lanes to ensure efficient management of wastes in Chuka town.	Length of lanes opened up	Report Visit	Quarterly	Clerk municipal council (Chuka) DPP, DPHO, DWO, OP NEMA	DEC	
34: To secure fire	No. of equipments	Reports	Quarterly	Local	DEC	

management facilities -To develop necessary infrastructure				authorities, DPHO, NEMA, DWO, OP		
35: Fish restocking activities	No. of fingerlings introduced	Reports	Quarterly	Fisheries, NEMA, OP	DEC	
36: Community involvement through awareness creation policing & proper fishing methods	No. of river basins with participatory fisheries management	Reports	Quarterly	Fisheries, NEMA, OP	DEC	
37: To increase fish farming and utilization	No. of Ponds established	Reports	Quarterly	Fisheries, DAO, OP	DEC	
38: Mobilization of sand harvesters to form co-operatives	No. of cooperatives formed	Reports	Quarterly	Local authorities, DCO, NEMA, OP	DEC	
39: Reclamation of abandoned mined sites with vegetation.	No. of sites reclaimed	Reports		Local authority, NEMA, FD, OP	DEC	

REFERENCES

Meru South District Development Plan 2002-2008 (Ministry of Finance and Planning)

Mt. Kenya East Pilot Project for Natural Resources Management Vol.1

District State of Environment Report (SOE) 2003 and 2005

Farm Management Handbook of Kenya-Schmidt and Jaetzold 1978

Local Authority Service Delivery Action Plan (LASDAP)-2006/2007-Meru south County Council

Annual Reports-MoA & Forest Department-2004/2005

APPENDIX

PART IV OF THE ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT (1999-ENVIRONMENTAL PLANNING (EXTRACT FROM EMCA)

37. National Environmental Action Plan Committee.

1. There is established a committee of the authority to be known as the National Environmental Action Plan Committee and which shall consist of;

a) The permanent secretary in the ministry for the time being responsible for national economic planning and development who shall be the chairman;

b) The permanent secretaries in the ministries responsible for the matters specified in the first schedule or their duly nominated representatives;

c) Four representatives of the business community to be appointed by the minister;

d) Representative of each of the institutions specified in the Third schedule;

e) Five representatives of non-governmental organizations nominated by the National Council of Non-Governmental Organizations;

f) Representatives of specialized research institutions that are engaged in environmental matters as may be determined by the minister; and

g) A Director of the Authority who shall be the secretary.

2. The National Environmental Action Plan Committee shall, after every five years, prepare a National Environmental Action Plan for consideration and adoption by the National Assembly

38. Provision of the National Environmental Action Plan

The National Environmental Action Plan Shall:-

a) Contain an analysis of the natural resources of Kenya with an indication as to any pattern of change in their distribution and quality over time;
b) Contain an analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational equity;
c) Recommend appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes;
d) Recommend methods for building national awareness through environmental education on the importance of sustainable use of the environment and natural resources for national development;
e) Set out operational guidelines for the planning and management of the environment and natural resources;
f) Identify actual or likely problems as may affect the natural resources and the broader environment context in which they exist;
g) Identify and appraise trends in the development of urban and rural settlements, their impacts on the environment, and strategies for the amelioration of their negative impacts;
h) Propose guidelines for the integration of standards of environmental protection into development planning and management;
i) Identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general adverse effects on the environment;
j) Prioritize areas of environmental research and outline methods of using such research findings;
k) Without prejudice to the foregoing, be reviewed and modified from time to time to incorporate emerging knowledge and realities; and
l) Be binding on all persons and all government departments, agencies, state corporations or other organs of Government upon adoption by the National Assembly.

38. Provincial Environmental Action Plans

Every provincial environmental committee shall, every five years, prepare a provincial environment action plan in respect of the district for which it is appointed, incorporating the elements of the relevant district environmental action plans prepared under section 40

and shall submit such plan to the chairman of the National Environment Action Plan Committee for incorporation into the National Environment Action Plan

40. District Environmental Action Plan

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

41. Contents of Provincial and District Environmental Action Plans

Every provincial environment action plan and every district environment action plan prepared under section 39 and 40 respectively shall contain provisions dealing with matters contained in section 38 (a), (b), (c), (d), (e), (f), (g), (h), (i), and (j) in relation to their respective province or