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Gully erosion in Nyando area, Kisumu.

The above scenario has a negative impact on productivity, causes pollution and reduces the economic value of land.

b) Consequences of soil erosion

Loss of productivity

The productivity of a piece of land is demonstrated by the capacity of the soil to produce crops. When the soil is eroded, there is a general decrease in the reservoir of exchangeable nutrients absorbed by the

plants for their metabolism and growth. When this reservoir is truncated and washed away, so is the source of nutrients making the remaining sub-soil less fertile and less suitable to support optimal plant growth. Loss of topsoil is therefore directly a loss of the best reservoir of soil nutrients.

Similarly, when the topsoil is removed, it means loss of the soil moisture-storage capacity. The loss arises from changing the soil water-holding characteristics of the rooting zone (which is reduced in volume

Table 22. Sand movement potential in Kenya.

Station	Lodwar	Mandera	Moyale	Marsabit	Makindu	Voi	Wajir	Garissa
Annual potential sand movement (m/s) ³	99.2	62.1	86.5	828.6	23.2	64.8	104.9	144.9
Risk rating	*mod.	mod.	mod.	high	low	low	mod.	mod.
*moderate								
Source: GOK/UNEP 1997.								



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Silt-laden Tana River in the lower course.

via truncation) limiting the water-holding capacity. This leads to reduced plant growth due to limited moisture. At the same time, a larger proportion of the precipitation is lost as runoff causing more erosion and destructive floods. Plants grown on such eroded soils wither due to lack of moisture and nutrients leading to significant drops in yields.

With the removal of the topsoil, the structure of the soil becomes poorer leading to the formation of soil clods. The clods then facilitate the development of surface sealing and crusting limiting plant germination. The crusts and seals also

reduce water infiltration, promoting runoff and subsequent flooding.

Pollution of water systems

In 1965, the Tana River and Athi–Galana–Sabaki carried 250,000 and 150,000 t per year of sediment respectively. By 1986 Tana River carried 2.5 million t per year while Athi–Galana–Sabaki had risen to 2 million t per year (KSS, 1989). This sediment loads have destroyed inland water bodies and marine life.

Loss of economic value of land

Eroded soil is transported in the form of silt by rivers and deposited in the lakes and the ocean. Over the years, silt accumulates and changes the colour of water from clear blue to reddish brown. This is an unattractive colour for people who organize aesthetic activities such as tourism and exclusive settlements around water bodies. To the north of Sabaki River mouth, the village of Mambrui is being submerged in sand dunes and silt deposits from the river. The silt emptied in the ocean kills coral reefs and damages marine life. Homes also have been abandoned.

Some dams and pans have had their lifespan severely reduced due to the accelerated sediment deposits through erosion. The hydro-power dams along the Tana River have been silted on several occasions reducing their capacity to generate power, leading to power rationing and frequent blackouts.

Frequently, the silt is deposited on the white coral beaches turning them into mud beaches and damaging the scenic beauty. Some hotels in Malindi town have lost business as tourists moved to other white sandy beaches. Consequently jobs have been lost and social structures disrupted.

2.2 Pollution

a) Air pollution

Air pollution arises from gaseous emissions from domestic operations, power generation, agricultural practices, uncontrolled disposal of solid waste, industrial and vehicular emissions. The major sources of air pollution are industries manufacturing chemicals, rubber and plastics, paper mills, cement and excavations, ceramic tiles and glass factories, and leather industries.

Vehicle emissions contain carbon dioxide, greenhouse gas (GHG), that is a cause of global warming. Road and railway transport systems in Kenya rely on fossil fuels which are linked to high emissions of GHGs. Road transport accounts for 80–90% of the passenger and freight transport and accounts for 80% of CO₂ emissions.

Air pollution from agricultural practices include emissions of carbon dioxide, methane and nitrous oxide from cropping e.g. rice and sugarcane cultivation, and bagasse production. Methane emitted from flooded rice fields due to anaerobic decomposition of organic matter in the soil is the largest source of greenhouse gases in Kenya. Others are animal husbandry—due to enteric fermentation, manure management facilities and anaerobic decay; application of synthetic manure and organic fertilizer; and burning savannah grasslands and scrubland. Domestic sources include the use of biomass, pit latrines and waste.



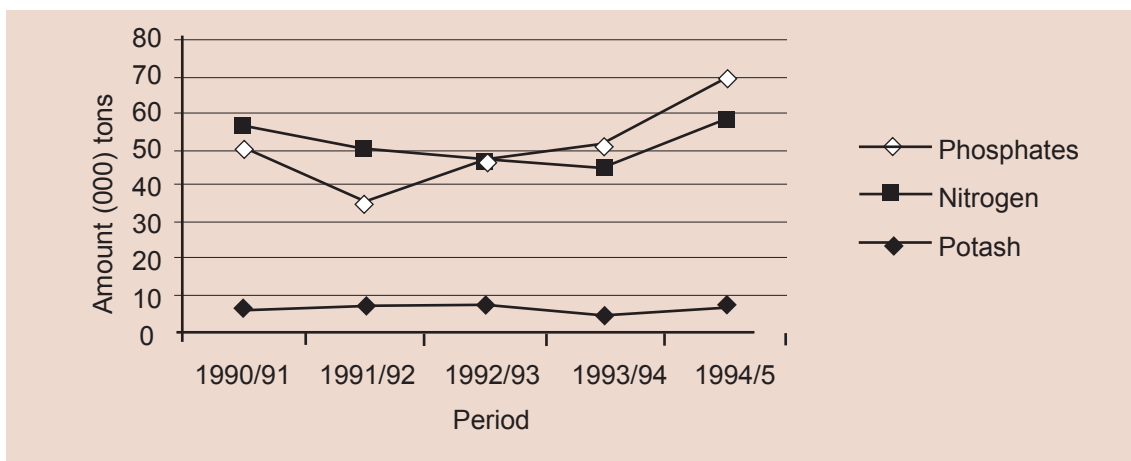
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Gaseous emission from poorly maintained vehicle.

b) Land pollution

Chemical fertilizers, pesticides and fungicides are important in agriculture. However, their improper use has poisoned and compacted the soils. Fertilizer is the dominant farm input in Kenya averaging 275,270 metric tons/year. The use of industrial fertilizer is on the increase

(see figure 9). The government, in cooperation with local non-government organisations and other stakeholders, is promoting the use of organic manure, which is easy to access and is environmentally friendly. There are success stories on the use of organic manure among smallholder farmers as exemplified by the Chanderema Women Group, Vihiga District.



Source: FAO, 1996.

Figure 9. Chemical fertilizer use in Kenya.

c) Water pollution

Water resources in Kenya are increasingly becoming polluted at point and non-point sources due to agriculture, urbanization, and industry. Intrusion of saline water in the coastal region, leachates from solid waste dumps and infiltration of fertilizer and pesticide residues threaten ground water. The five principal sources of water pollution in Kenya include sediments and agrochemical residues (biocides and fertilizers); industrial processing of agriculture and forestry products which produce liquid effluent, gaseous emissions and solid waste; industrial manufacturing—heavy metals, acids, dyes, oils; domestic/municipal effluents—sewage and garbage; sedimentation—soil erosion; and mining which produces tailings and effluents.

d) Noise pollution

Traffic generates noise. With increasing number of vehicles and aircraft, most urban areas are becoming increasingly noisy. Loud music in public service vehicles is a public nuisance. Other sources of noise pollution include noise from factories, ballasting at quarries and mining sites.

2.3 The polluting agents

a) Persistent organic pollutants

Persistent Organic Pollutants (POPs) have become more concentrated as they move up the food chain and can travel for thousands of kilometers from the point of release. The

most notorious chemicals in POPs include Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, and Toxaphene. Despite their worldwide ban, they are illegally used in Kenya as fertilizer and or crop protection chemicals. These POPs can persist in the environment for decades and accumulate in marine and land-based food chains posing health risks long after exposure (see table 23).

b) Heavy metals

Heavy metals include lead, copper, zinc and mercury among others. Industrial products made from these metals are used in all aspects of life. Lead is used in plumbing, and insecticide and battery manufacturing; mercury is used in the preparation of cosmetics and is a base in some painkillers. It is also used extensively in gold mining especially in South Nyanza and Lolgorien area of Trans Mara District.

Table 23. Reported levels of DDT residues in fish from Kenyan lakes

Species	Residue concentration (mg/kg) wet mass
Lake Baringo	
<i>Tilapia nilotica</i>	0.009
<i>Clarius mosambicus</i>	0.019
<i>Burbus gregorii</i>	0.028
<i>Labeo cylindricus</i>	0.400
Lake Naivasha	
<i>Tilapia spirulus nigrax</i>	0.001
<i>Micropterus salmoides</i>	0.003
Lake Nakuru	
<i>Tilapia grahami</i>	0.015
<i>Latesilatica</i>	0.004

Source: UNDP/UNEP 1996.



Gaseous emission from the paper factory in Webuye.

c) Gaseous emissions

Air pollution especially from industries is a growing problem. The public outcry against KEL Chemicals in Thika in 1991 is symbolic of the problem. Large concentrations are evident at Webuye where the paper and pulp factory emits sulfur compounds into the air turning trees yellow in the region.

Mzee Moses Luyuku of Nabuyole village in Webuye says that the smoke from the paper factory causes rusting on iron sheets within a year of building the house. Local people around Webuye say they suffer from allergies and respiratory diseases due to gaseous emissions from the factory. Farmers have also complained that crop yields have dropped by over 80% due to chemical pollution from the factory.

Vehicle emissions contribute significant volumes of carbon dioxide, one of the

greenhouse gases causing global warming. In 1991 there were 159,000 passenger and 150,000 commercial vehicles in Kenya (GoK, 1999). This figure has since increased adding to serious air pollution in urban areas. If these cars use leaded petrol, they contribute significantly to the accumulation of lead in the environment. Lead is added to petrol to boost the octane rating and hence increase power. Lead poisoning affects the brain, kidneys, the reproductive and cardiovascular systems. Also lead has residual effects in contaminating water and land resources in the long run.

d) Liquid effluent

Chemical discharges from industries and other urban waste have degraded the fresh water sources in rivers, lakes, and other water bodies. Such pollutants have interfered with the flora and fauna of these areas.

Sediment yield and discharge of industrial waste into the major river systems have reduced the volume of fresh water, interfered with fish species and wetland life forms such as riparian forests and marshlands. Pollution of inland fisheries has far-reaching implications. There is a possibility that some of the health disorders suffered by human beings could be linked to eating contaminated fish.

The marine resources are prone to not only land-based pollution, but also to pollution by ships, especially oil tankers. For example in 1993, a tanker at the port of Mombasa spilled approximately 80,000 metric t of oil. The impact on the natural resources of such oil spills is monumental. There is deliberate pollution from ships during de-ballasting and tank washing.

In 1930, scientists synthetically produced chlorofluorocarbon compounds to replace the use of ammonia and other coolants in

refrigeration, air conditioning, aerosol propelling and fire depressants. At the time they were preferred due to their advantage over the leaks and explosions that were associated with ammonia products. These chemicals are unfortunately responsible for the depletion of the ozone layer in the stratosphere above the atmosphere. The direct impact of reducing the protective ozone layer has been the increase in ultraviolet radiation which raises surface temperatures (as a result of the greenhouse gas effect) causing changes in weather systems and bringing about extreme episodes of drought and floods

e) Pesticide and nitrate contamination

Pesticides are valuable agricultural inputs used for protecting crops to increase yields. However, they also have severe effects on health due to their toxicity. They can cause headaches, flues, skin diseases, blurred vision and many neurological disorders. The most notorious pesticides causing health problems



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Liquid waste disposal into Mtoine River from Kibera/Nyayo High Rise Estate, Nairobi

are organophosphates and carbamates. Most of them are banned or restricted in use worldwide.

Together with pesticides, nitrogen fertilizers increase yields tremendously and their application in Kenya has increased five-fold since the sixties. The dissolved nitrogen that is not taken up by plants contaminates surface and ground water because the excess nitrate is water-soluble and easily washed down the soil profile by rain or irrigation water. Water contaminated with nitrates can cause disorders in red blood cells leading to conditions of low oxygen commonly called "Blue-Baby".

2.4 Urban waste

Wastes are solid, liquid or gaseous materials that are discarded by people and industries. They are released carelessly into the air, water and land as though the latter have an infinite capacity to absorb these wastes.

a) Solid waste

Household and consumer waste are the major component of solid municipal waste. Per capita municipal waste production in Kenya is 1.2 t per annum. Solid waste consists of a mixture of organic materials, paper, plastics, textiles, glass, metals, ash and grit. Food remains are solid waste. The moisture content of household waste is generally high and is therefore not readily combustible.

Packaging material, glass and plastic bottles, cans, paper clips, paper and plastic wrappings

are the major constituents of litter. The use of non-returnable containers has increased the volume of litter. Furthermore, the production and widespread use of non-biodegradable plastics in packaging materials has compounded the litter problem. Plastic litter in marine environments at the Coast arises from fishing gear such as nylon, buoys and nets; packaging bands straps and synthetic ropes; general litterbags, bottles and plastic sheering. The same litter is also found in large inland water bodies.

Treatment of domestic and industrial wastewater at the plants yields sewage sludge. This is a type of slurry made up of fine organic-rich particles with a high chemical composition. Such sludge will require a highly efficient system to treat and clean. Demolition of old buildings and construction sites also generate waste. Currently, contractors in Kenya seem to have a free hand in dumping their waste. Commercial mining sites (for instance rubies, gold, marble, cement, and soda ash) leave behind trailings and spoils. Such waste may include soil, rock and inert dirt or trailings from extraction that are contaminated with metals or chemicals used for mining separation.

Solid waste in most urban centres in Kenya is disposed of in open dumps or crude sanitary landfills, burned or left to decompose in open places. In low-income residential areas, collection is very poor and waste is disposed of by simply dumping it along streets, playing fields and in between houses. Burning is practiced in some estates leading



Garbage dumping site in Dandora, Nairobi

to gaseous effluents like carbon dioxide, nitrogen oxide, methane and smoke.

The main method used by municipal authorities to dispose of solid waste is by crude and unsanitary land-filling mainly because it is cheap and there is scarcity of disposal sites in most municipalities. These grounds are left open and create dangerous health risks to both the public and animals. The collecting efficiency in most towns is very low leaving waste uncollected at the sites, or is dropped in the wrong place.

A study by the Japan International Cooperation Agency reveals that in Nairobi City only 20% of the generated waste is collected and disposed of. The rest lies along roadsides or riverbanks. The City Council has over time reneged on collecting industrial waste, which is now done by the individuals. Table 24 summarizes solid waste generation in Nairobi City.

Of the total solid waste generated in Nairobi, the largest quantities by weight are petricibles

(65.5%) followed by paper and cardboard (23%), metals (2.6%), textiles (2.6%), unclassified (3.1%), glass (1.7%) and plastics (1.5%). The per capita solid waste production for Nairobi is 0.5 kg/day—a total of 1 million t per day for a population of 2.2 million (JICA, 1998).

The main method used by municipal authorities to dispose of solid waste is by crude and unsanitary land-filling mainly because it is cheap and there is scarcity of disposal sites in most municipalities.

Uncollected and or collected and untreated solid waste releases methane gas in to the atmosphere. The gas raises temperatures that cause climatic change. The average methane production from solid wastes in Kenyan municipalities is shown in table 24.

Table 24. Estimated municipal solid waste generated in Nairobi.

Year	Population (million)	Annual municipal solid waste generated (tonnes)	Annual municipal waste disposed (tonnes)	Methane gas generated (tonnes)
1992	1.72	332,734	66,547	2,050
1993	1.79	346,276	69,255	2,133
1994	1.87	361,752	72,350	2,229
1995	1.92	377,228	75,446	2,324
1996	2.03	392,704	78,541	2,419
1997	2.11	408,179	81,636	2,514
1998	2.20	425,590	85,118	2,622

Source: JICA, 1998.

b) Liquid waste

Liquid waste is generated from industry, service premises and domestic areas. They contain a wide range of chemicals and physical components which when decomposed generate various amounts of greenhouse gases, such as methane.

The amount of methane emitted depends on the organic loading in the wastewater normally measured as the Biochemical Oxygen Demand, and the extent to which the material will decompose under anaerobic conditions. This is the condition under which sewage and industrial waste streams are maintained.

c) Hazardous waste

This is waste whose properties may be radioactive, toxic, explosive, corrosive, flammable or infectious. The waste is likely to harm people, livestock, crops or the environment either on its own or when mixed.

In Kenya, there are no facilities to store and move such harmful classified waste. Major towns such as Nairobi, Mombasa, Kisumu and Nakuru have facilities for storing and transporting clinical waste from the major medical institutions like hospitals and research centres, clinics, pharmaceuticals factories. Each medical institution is required by law to maintain an incineration plant for disposing clinical wastes.

Despite the presence of such facilities and guidelines cases of careless disposal of such clinical waste in Nairobi, like dumping it at Dandora dumping site, have been highlighted in the print media. Expired drugs and other waste from pharmaceuticals is not being incinerated but instead also dumped in Dandora.

d) The causes of inadequate waste management

The underlying causes for poor, urban waste management include:



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Mzee Lukuyu pointing at the damaged roof from contaminated rain next to Webuye paper factory.

for individuals or companies willing to adopt efficient waste management technologies. Such incentives may include tax reductions, awards, access to cheaper credit facilities as well as information and technology. The waste management and sanitation sector does not feature as a priority in the development agenda of the country. As such, it never receives adequate resources or consideration when articulating national development issues.

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- Weak enforcement of existing laws and regulations due to inadequate human resources and cumbersome procedures. The municipal councils and quality control organizations like the government departments in the Ministry of Environment and the Kenya Bureau of Standards are not able to fully implement the provisions of the existing statutes. Even where they may be able to do so, the penalties stipulated in the statutes are unrealistically low to be a deterrent.
- The policies and laws regulating waste management do not provide incentives
- The lack of comprehensive discharge standards and methods of measuring the quality and quantity of effluent makes it difficult for any authority to contain waste generation. This scenario has systematically led to a situation where industry and urban dwellers have become insensitive to legal regulations on the safety of the environment and health. The practice of following standards for health and safety of workers at the work place has long been ignored.

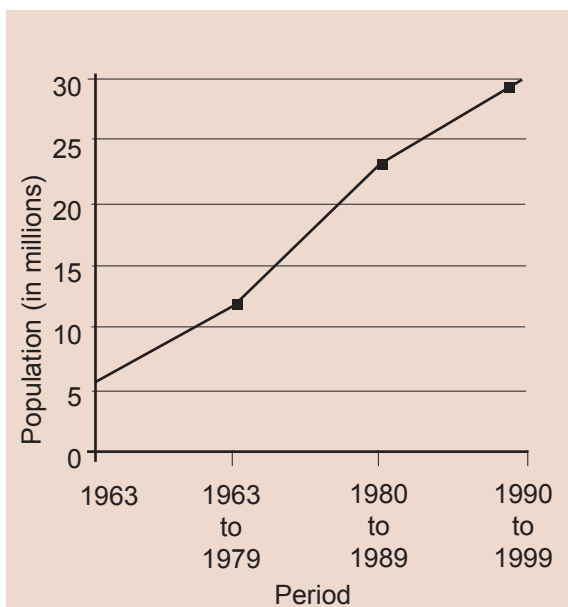
2.5 The driving forces behind unsustainable land use

a) Population increase

At independence, Kenya had a total population of about 7 million people. By 1979 the population had risen to 15.5 million people. In 1989, it shot to almost 21.5 million people. By 1999 the population had reached 29 million (see figure 9). Over the same period, the Kenyan economy performed poorly with no remarkable industrialization to cope with the demands of the population. The population trend has inevitably resulted in intense pressure on the available natural resources.

The pressure in many parts of Kenya has triggered the cycle of degradation of forests, wildlife, water and mineral resources. The

Figure 10. Trend of population increase in Kenya, 1963–1999.



increased number of people searching for economic security has led to intensification of cultivation, expansion of cultivated land, overgrazing of the range, and harvesting of trees for fuelwood leading to deforestation and an acute water crisis as well as loss of biological diversity and soil erosion.

b) Misapplication of modern technological innovations

Technological innovations have had positive and negative impacts on the management of natural resources in Kenya. A good example is the National Soil and Water Conservation Programme that was started in 1974 to conserve soils in cultivated and grazing land within permanent settlements. By 1987, the project had 51 tree nurseries with an output of 200,000 fruit tree seedlings and 2.5 million forest and fodder tree seedlings annually. These conservation efforts raised crop yields by between 50% and 70%. In 1982, the programme had put in place 2,912 km of cut-off-drains, 3,090 km of bench terraces, 556 hectares of narrow-base terrace, 2000 km of grass strips, 283 km of stone terraces, 1,107 km of trash lines, 81 km of artificial waterways. In addition, 714 hectares of grass were planted, 1964 gullies rehabilitated and 1,247 gabbions constructed. These efforts are estimated to have conserved millions of tonnes of topsoil and soil moisture thereby expanding crop agriculture into areas then not utilized.

The second commendable effort in technological innovations has been the blending of modern and traditional practices—a practice called agroforestry—in the last 10–15 years. Within the humid

and semi-humid zones of Kenya, there has been tremendous increase of tree cover (open-canopy forest) in the cultivated lands through an extension campaign based on re-vegetation of lost forests with trees that have direct economic benefits to the household. Some areas in central Kenya, eastern (Machakos, Meru, Embu) and western Kenya (Maseno) have incorporated traditional knowledge and skills with new farming technologies propagated by the Kenya Forestry Research Institute, Kenya Agricultural Research Institute and the International Centre for Research in Agroforestry, that have resulted in amazing increases in yields.

Cases of abuse of technology have also been reported. The irrigation technologies adopted in places like the Kimligo–Kamleza irrigation scheme have over time deposited salt materials on the surface rendering the soils unproductive. If not checked, the entire scheme will experience serious soil degradation and soon end up as a wasteland. A similar fate may befall the hundreds of hectares under small-scale and large-scale irrigation schemes especially in the dry areas at the Coast and along the Tana and Ewaso Nyiro Rivers.

c) Stifling indigenous skills, technologies, knowledge and practices

Indigenous knowledge and techniques abound in Kenya. The Turkana pastoralists protect and conserve trees through ownership of the trees by individuals and families. Pasture land near settlements is guarded by migrant herders who cannot use the pasture

The pressure in many parts of Kenya has triggered the cycle of degradation of forests, wildlife, water and mineral resources.

The increased number of people searching for economic security has led to intensification of cultivation, expansion of cultivated land and overgrazing of the range

without prior permission from elders. Amongst the Suba of Nyanza, their traditional belief and respect for founder clan shrines has guarded against human activity. These shrines are now thick forests alternating with farms and homesteads. The Endo of Elgeyo Marakwet use an ancient irrigation technology that has helped them produce bumper fruit harvests over years.

Experience shows that disregarding indigenous traditional skills has led to destruction of natural resources. When the government through the Ministry of Livestock Development introduced the "North America" model of range management by demarcating the drylands in Turkana, Marsabit, Isiolo, Garissa, Wajir and Mandera into "Grazing Blocks", the traditional transhumant system of seasonal migration in search of water, pasture and the opportunistic spread of grazing pressure was ignored. Age old systems developed by the Rendille, Borana, Somali and Turkana herdsmen were regulated into designated territories in which the government undertook to develop water sources and also develop social services such as schools to transform the nomads into sedentary populations that could be easy to govern and plan for. About 40 years down the line,

this model failed and cases of severe de-vegetation and soil loss were reported over the period. The centres for water and social services instead degenerated into epicentres of desertification and sanitation problems associated with urbanization.

By de-emphasizing the links and relationships between people, their culture and resources, previous and on-going development programmes have unwittingly contributed to the prevalent insensitivity and apathy of communities towards 'sound' environmental and natural resources management. Furthermore, they have exacerbated the colonial legacy of separating people from nature.

d) Natural and man-made disasters

Kenya experiences minor droughts every 2 to 3 years, and major droughts after 8 to 10 years. Drought decimates 30–40% of the wildlife and livestock, 30–40% of crop yields, destroys riparian and gallery forests. It decimates the natural germination capacity of grasslands by 50%. Livestock and wildlife concentration around a few water points leads to serious vegetation and soil degradation. Millions of hectares of forest are lost due to forest fires, which more often are caused by lightening. After fierce forest fires, as much as 20% of the plant and animal species are lost and never recur during the regeneration period that follows.

Lack of alternative sources of goods and services force people to exploit vulnerable environmental resources in order to meet livelihood needs as seen in the new

settlements for conflict victims in Naivasha and Nakuru suburbs, and in refugee camps such as Kakuma. Poor people use natural resources in an unsustainable manner when survival strategies are necessary. Moreover, while many communities are aware of environmental concerns, they lack the capacity to practice sound management.

Subsistence farmers and pastoralists who rank among the poorest in the country are extremely vulnerable in times of prolonged drought and/or floods. For example, during the prolonged drought in 2000, hundreds of pastoralists invaded commercial ranches in Laikipia District and Mount Kenya forest in search of pasture, and a number of Maasai herdsmen from Kajiado moved their cattle into Nairobi also in search of pasture. Arguably the drought was the result of a natural disaster rather than human-induced environmental degradation. Nevertheless, it forced people into re-activating a long-standing tradition of moving into the drought escape areas that are now private ranches and urban centres forcing pastoralists to resort to unsustainable survival mechanisms.

e) Poor environment regulation

A concise policy framework from which to generate holistic and integrated strategies and actions does not exist. Sectoral policies—the technocrat's view of forests, soils, wildlife and water—have not been effective on the ground. The absence of a concise national land-use policy has had a direct impact on the way natural resources have been conserved.

The enactment of the Environmental Management and Coordination Act is an attempt to address the need for a framework legislation on the management of the environment. It is too early to judge the efficacy of this legislation. Indeed the institutional framework envisaged by the legislation is yet to be put in place even though the legislation is now in force. Nevertheless, the legislation has been passed in itself and the role of the government and other stakeholders is to ensure that the benefit of the legislation are realized for the sustainable management of the environment.

2.6 The impact of unsustainable land-use practices

a) Health hazard and diseases

Almost a quarter of all diseases in Kenya can be attributed to environmental factors. The poor, particularly women and children, are most affected. Water-related diseases, such as cholera and diarrhea arise from polluted water. Burning biomass fuels for cooking and heating causes indoor air pollution in turn contributing to acute respiratory infections and related illnesses. Malaria arises from poor management of water sources where malaria-carrying mosquitoes breed. Agrochemicals affect poor farmers who use pesticides without training on how to handle them or without protective clothing.

Water pollution leads to environmental health effects in the form of water-borne diseases, such as, cholera and typhoid and chemical poisoning in human beings and animals. For example, in Mwea area, there is a higher than normal incidence of water-borne diseases among paddy

rice farmers—31% of residents show signs of bilharzia, 15% of hookworms, and up to 50% of the sampled population regularly have malaria parasites in their bodies (GoK/UNEP, 2001).

A survey in major horticultural areas found that most farmers experience occasional poisoning symptoms after applying agrochemicals. It estimated that pesticides poison 7% of the people in Kenya's agricultural sector every year and that a quarter of the farmers in major horticultural areas regularly suffer from pesticide-related ill health. Organophosphates pose an acute danger because of their relative high toxicity.

About 80% of treated cases between 1987 and 1990 at Kiambu District Hospital had suffered agrochemical poisoning from organophosphates used in coffee, vegetables and flower production (GoK/UNEP, 2001). One tenth of all illnesses treated at Lake North Clinic near Lake Naivasha were attributed to pesticide poisoning of flower farm workers who complained mainly of rashes, sores and gastro-intestinal problems. High organo-chlorine residues, especially DDT and Dieldrin, have been found in human milk samples taken from mothers in horticultural and coffee-growing areas.

Further, health risks arise from the ingestion of agrochemicals in contaminated containers used to carry water, or in airborne transfer. Infections can cause skin, eye, and gastro-intestinal and respiratory complications. Long-term health effects include pathogenesis of childhood anaemic anemia, chronic mercury poisoning and possibility of impotence. The impacts of pollution are shown in table 25.

Table 25. Impact of industries on air, water and land pollution in Kenya.

Type of industry	Air	Water	Land
Chemicals	Emissions of sulfur oxide, nitrogen and chlorofluoro-carbons	organic chemicals, heavy metals, suspended solids and PCBs	Sludge
Paper and pulp	Emissions of sulfur oxide, methane, carbon dioxide, hydrogen sulfides, mercaptans, dioxins	Suspended solids, organic matter, chlorinated organic substances, dioxins	
Cement, glass and ceramics	Dust containing nitrogen and carbon oxides, chromium and lead. Emission of lead, arsenic, carbon dioxide, hydrofluoric acid, silica and fluorine compounds	Oils and heavy metals contamination	Soils contaminated with metals and solid wastes
Mineral mining	Dust and heavy metals such as mercury	Discharge of acids (arsenic, lead and cadmium)	Degradation by slag heaps and soil erosion
Refineries/ petroleum products	Emission of sulfur, nitrogen and hydrogen fumes, toxic compounds and odours. Risks of explosion high	HCs, mercaptans, caustics, effluent from gas scrubbers	Harzadous waste, sludges, spent catalysts.
Leather and tanning	Leather dust, hydrogen sulfide and chromium compounds	Toxic solutions containing suspended solids, sulphates and chromium	Chromium sludges

Source: GoK/UNDP 1997.

b) Biodiversity loss

Organic pollution, chemical discharges from industries and urban waste have degraded fresh water bodies and their biodiversity. Waste also impacts on water quality and are manifest through deterioration of the quality of the aquatic environment, deoxygenating, eutrophication, siltation, habitat modification and toxicity among others. In some places some plant and animal species introduced into some water bodies have caused disastrous environmental impacts. The hyacinth has interfered with the hydrological cycle of the lakes and the breeding points of the key lake fishes. The introduction of the Nile perch, a predator, has eliminated indigenous species.

Sediment deposited into the major river systems coupled with discharge of industrial waste has reduced the volume of sea water, interfered with fish species and the wetland life forms including riparian forests and marshlands. Pollution of inland fisheries has far reaching implications. There is a possibility that some of the health disorders suffered by humans could be linked to eating contaminated fish.

Where pesticides are reasonably safe for humans, they may be acutely toxic to fish, birds, bees and other beneficial non-target species. Uncontrolled development, existing pollution and sedimentation from agricultural areas upstream increasingly threaten marine life.



De-vegetation of the semi arid savannah through charcoal burning in Mweiga, Nyeri.

Pollution reduces the capacity of soils to produce crops and leads to food insecurity as is the case around the Webuye paper factory. The liquid effluent has reduced the habitats of aquatic life forms such as fish. The fishermen's catch on Lake Victoria for instance has reduced tremendously in the last 10 years. According to the 1997–2001 National Development Plan, the “... current fish-catch levels in Lake Victoria are unsustainable and the potential collapse

of the Nile perch fishery is imminent” (table 26). Some fish species have been reported to be now extinct as a result of pollution of the lake and river waters.

Sewage sludge is a concentration of heavy metals and water-soluble synthetic organic compounds. It also contains grease, oils and bacteria. When such sludge is mixed with irrigation water or agricultural manure, it leads to soil poisoning.

Table 26. Status of species of fish, reptiles and amphibians in Kenya

Category	Fish	Amphibians	Reptiles
Total species	683	101	24
Endemic in Kenya	54	13	17
Known extinction	7	-	-
Endangered	60	2	11
Vulnerable	7	-	-
Rare	16	1	3
Introduced	13	-	-

Source: GoK, 1992

c) Economic loss

In Kenya there are quantitative estimates of economic costs of environmental degradation but analysis of cross-sectoral, multi-resource or multi-species values of our natural resources are inadequate. However, R.F. Meadows (2001) has attempted an analysis of the relationship between the environment, incomes and livelihoods both at macro and micro levels with regard to economic costs of environmental degradation. The results indicate substantive losses shown in table 27 below.

d) Aesthetical/cultural site loss

Aesthetic losses include interfering with the scenic beauty that renders water and

recreation sites unsuitable for recreation. For example, the water hyacinth at the Nairobi Dam has derived the sailing club use of the facility. This reflects an economic loss. Siltation, which changes vegetation for example, in the coastal areas of Malindi and Mamburi, has rendered settlements and beach plots for recreation unsuitable.

Litter is an eyesore and spoils the scenic and aesthetic quality of beaches and other tourist centres. The Nairobi Central Business District is one such eyesore as it is littered with waste from hawking activities of the previous night, so is litter from residential estates strewn all over exuding a pungent smell.

Table 27. Selected economic costs of environmental degradation in Kenya.

Service	Estimated loss annually (in US\$ millions)
Loss of ecological services, including watershed catchment protection function alone	26
Loss of support to rural household livelihoods, including income and subsistence	94
Loss of the national economy income	4
Loss of foreign exchange earnings	0.22
Loss to commercial and industrial consumers earnings	2
Loss of global wildlife tourism values	350
Loss of total government earnings from wildlife tourism	29
Loss of global tourist consumer surpluses	450–700
Loss per forest adjacent to household;	100–350
Loss of tourism from Mount Kenya forests	0.3
Loss of farm income (agroforestry, livestock and soil conservation)	330 million/ha
loss of elephant populations	75–97
Loss of flamingos	3–6
Loss of Amboseli lions	30
Loss of Masai Mara gross revenue	31
Loss on Masai Mara wildebeest	187–225

Source: Data synthesized from Meadows (2001)

The Kaya forests form a natural habitat for fauna and flora, and are important for the traditional, cultural and medical requirements of the local communities (from the Digo's in the South Coast to the Giriama in the North Coast). The Kayas are used by the elders (Wanatsi) to lead the communities in search of their gods for forgiveness or thanksgiving after success. They are also used to appease or pacify gods when there is evidence of declining harvest, reduced rainfall, absence of peace and harmony, rampant diseases...

These cultural groves now face challenges including heavy encroachment due to declining respect for traditional values and customs, rising demand for agricultural land and wood fuel, mining to meet the needs of local and international markets. Demand for construction materials, sand, timber, and coral blocks and the occurrence of forest fires especially in dry seasons exacerbate the problem.

e) Land-use conflicts

The department of livestock production in Laikipia District estimates that on average, the grazing capacity varies from 5.2 ha per tropical livestock unit (TLU) in agro-ecological zone (AEZ) IV and 6.5 ha/TLU in AEZ V. Estimates by Flurry (1986) show more localized variations from 2.8 to 5.2 around Ngobit, 2.8 to 4.3 along the Naro Moru Nanyuki Sirimon area and 6.5 ha to the north of Timau. Central division consisting of most of the plateau was estimated to have an average grazing capacity of 4.2 ha /TLU (Mwichabe, 1997).

Studies by the department in West Laikipia show that the average household of 7 persons who are agro-pastoralists in AEZ IV need at least 2 cows, 1 heifer, 9 sheep and 5 goats to survive. This works out to about 3.5 TLU/household or a per capita demand of 0.5 TLU. If the grazing capacity is at best 4.3 ha/TLU then it follows that could be the minimum land holding size that can enable a family to survive above the food security line and probably market some surplus. In order to meet other cultural obligations for example dowry, fines, gifts, etc, the family in AEZ IV would require 14.5 ha/family (Mwichabe, 1997).

The optimal farm size based on its ability to provide self-sufficiency for the Central Division in Laikipia is an average of 13.2 ha per household for an average family to achieve food self-sufficiency—based on the assumption of substantial contribution from farm crop and livestock products.

It is therefore not surprising that on small scale ranches, the livestock population far exceeds the available grazing by a factor of 4.5–7. The problem is however mitigated by the high numbers of absentee landowners whose land is subject to pasture poaching. Were these absentees to settle, the current stocking rates will have to be destocked by 70–90%.

Irrigation schemes on smallholder farms upstream use over 90% of the river water reducing the flow to similar small irrigation schemes downstream resulting in conflicts in the recent past. This situation prevails particularly along the rivers Engare Ngobit,

Suguroi, Salama, Pesi, Lamuria and Kanagoi within the Kieni West area (Ngobit areas).

The pastoralist Maasai move with their livestock during dry spells over a large area without any regard to private property. This has resulted in conflicts with large-scale ranchers who despite fencing the ranches, the Maasai still move their cattle onto the ranches in search of pasture and water.

f) Increase in poverty

Degradation of the environment leads to lower fertility and productivity of a natural resource (such as soils) resulting in food insecurity. This leads to a decline in household nutritional status, with children particularly being affected. Shortages of food coupled with lack of access to water and poor sanitation are amongst the factors, which cause malnutrition.

One coping mechanism adopted by poor people when food is scarce is to find alternative land for grazing and cultivation. Often this involves the use of "unsuitable" or marginal land, such as wetlands or vulnerable forests, which, in the longer term, cannot sustain such usage. For many Kenyans, hopes of building or even accessing shelter are rapidly diminishing owing to the increasing cost of building materials and inappropriate shelter policies, technologies, standards and strategies.

Catchment destruction that resulted in lowered flow of water into streams led not only to water rationing in major towns in Kenya but also to rationing of electricity. Two

hydropower generation plants closed reducing the power supply by over 70%. The country undertook expensive emergency measures to supply power that cost billions of shillings in importing equipment and personnel. Power consumption bills went up by at least 200%. Almost 40% of jobs were lost in this period. To address the shortfall, a 305 megawatt thermal generator that utilizes 20,000 litres of diesel a day was commissioned. The side effects of this generator included health threats to nearby residents and increased release of hydrocarbons into the atmosphere. This time, an ecological mistake nearly grounded the national economy as industries operated at less than half the capacity.

Households with few assets are most vulnerable to all kinds of shocks. Resilience of households is dependent on financial and social capital or rights to exploit natural capital. External shocks are an important cause of asset loss. Households and communities are often poor because crucial livelihood assets, such as livestock or land, have been affected by disease, floods, or conflicts/ethnic clashes. Natural and man-made disasters have a greater impact upon the poor who may have no choice but to live and work in locations that are unsuitable and at risk or more prone to disaster.

g) Disjointed policies, laws and institutions

There is no policy framework from which holistic and integrated strategies for wise use of land can be generated. Instead, there are numerous sectoral policies laden with

sectoral interests. The translation of the policies into practice has not been successful. The absence of a concise, national land-use policy has had a direct impact on the way natural resources are conserved.

Since the late 1970s, ad hoc reviews of the sectoral policies have attempted to graft an integrated national outlook. The reviews are usually parliamentary sessional papers, national development plans or sectoral action plans. The first effort at formulating a macro land-use policy was Sessional Paper No. 1 of 1986 on Economic Management for Renewed Growth, which targeted limiting misuse of land in the country. Through this, the government expressed the intention to establish a National Land Commission to review land tenure, land-use practices, and legislation to conform with current development needs.

The best attempt to put in place an integrated, national policy on land use was contained in the National Environmental Action plan (NEAP) which culminated in the enactment of the Environmental Management and Coordination Act of 1999 which has been operationalised, but its full institutional framework is yet to be put in place.

The development policies for towns in Kenya are still modeled along the colonial line, where conservation of natural resources within peri-urban areas is considered a temporary use of the land as opposed to urban activities associated with industrial activities. The main thrust of the policy on commerce and industry is the promotion of

import substitution to attract external investors into the country. The policy encourages extractive use of natural resource base with minimal investment in its conservation and sustainable management.

As early as 1930, the colonial government in Kenya established laws and institutions such as the African Land Development Board to reduce soil erosion within the "native reserves". The post-independence government elaborated on these and established laws to stem land (natural resources) degradation mainly as sectoral efforts. The Kenya Constitution itself does not have direct provisions protecting the environment and natural resources other than under sections dealing with the broad issue of human rights. The laws have been entrusted within various ministries, parastatals and commissions that have been, and are still instrumental in the management of natural resources.

Fortunately an umbrella law was enacted in 1999 to rationalize the sectoral acts. These include more than 50 separate statutes that relate to the protection of natural resources and the environment in general. Those that regulate land-use activities include the Agricultural Act (CAP 318), Land Control (CAP 302), The Chief's Authority Act (CAP 128), the Mining Act (CAP 306), the Local Government Act (CAP 268), the Trust Land Act (CAP 208), the Land Planning Act (CAP 303) and the Government Lands Act (CAP 280).

There are separate ministries, departments, corporations, technical institutions, agencies and organizations for every known

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biophysical component of the environment. Each of these institutions has its own set of policies, regulations and even laws governing its operations. Quite often, these institutions have no relationship with one another. Hence the department dealing with soil and water conservation is in the Ministry of Agriculture but hardly has any links with the Ministry of Water nor that of Lands at the policy and technical levels. At the policy level the Ministry of Environment does not have any powers over how land is alienated and used in the country.

Despite the absence of policies and laws, and despite the conflicts, overlaps and overlooks in the sectoral policies, laws and

institutions, there is some possibility that were the government and its agencies to implement the framework the way it is, some significant benefits would accrue in the area of natural resources management. Indeed, the period between 1963 and 1980 saw a show of goodwill on the part of civil servants who applied the same framework and went out of their way to implement programmes that did less damage to the natural resources. The political establishment was committed to conserving natural resources to the point where the world rewarded them by locating a key natural resources management institution—the United Nations Environment Programme (UNEP)—in Kenya!

The technocrats in government had well-placed zeal in internalizing the concerns and agreements from the global fraternity as were emerging from the various international protocols. When corruption took root and became some kind of national pastime, all the policies, laws and institutions were rendered irrelevant. Forests have been destroyed everywhere. Wildlife poaching and deforestation have reached alarming levels. Individuals can invade wetlands and water catchment areas without retribution despite the existing laws. Individuals who are "politically correct" will pollute the environment and damage the water and terrestrial resources without restraint.

Chapter Three

Emerging trends



CNRM

Fighting desertification in Migwani division of Mwingi district.

3.0 The emerging trends

Shifts in policy, legislation and institutional land-use practices have over the years brought about changes in the way land-based resources have been used in space and time. Such changes can roughly be grouped in three periods each with unique landmark changes.

3.1 The genesis of sectoral policies, laws and institutions

This period covers the decades between 1898 and 1963 when the country was under colonial rule. Generally the authorities made policies and laws that not only

enhanced production but also preserved forests, wildlife and soils and enforced them without persuading the indigenous people. The colonial administration applied principles of conservation according to the letter. Settlers who had the habit of destroying natural resources in their bid to expand their agricultural activities ceased to do so.

Everybody feared the consequences of breaking the law and the destruction of forests, wildlife, wetlands, soil loss was at a minor scale. The indigenous Africans, were subjected to punitive laws. Indeed this was an era when the laws stated in the various statutes were applied and followed to the letter. It was an age of mechanical application of scientific principles without

regard to the needs, responsibilities and capacities of the local communities in managing natural resources.

This age could be called the “golden era” for natural resource conservation in Kenya because there was little destruction of the resources. Clearing of indigenous forests was minimal. Wildlife protection was probably at its best. There was no economic pressure to reclaim wetlands. But, soil loss within the areas reserved for Africans was significant.

3.2 The benevolence age

This period spans from 1963 to about 1983. These decades were the “competence test” for the new government after independence. The new government introduced a human face in the application/enforcement of the sectoral policies and laws on conservation of the natural resources, which had been put in place prior to independence. But the government did not attempt to improve on them. For instance the forced use of bench terracing for soil erosion was stopped. Forest reserves such as Marmanet, Mt. Elgon, Mt Kenya, Lamu were de-gazetted and converted into settlement schemes for the poor and landless who had been displaced by the white settlers. The punitive fines for fishing and poaching wildlife were discarded.

Although the politicians were reluctant to stress the colonial conservation policies for fear of being associated with the draconian conduct of the colonial government, the new government established a central policy position in Sessional Paper No. 10 of 1965,

which recognized the need to conserve natural resources for future generations. The concern to balance conservation of the resources with the need to exploit was incorporated in the national development plan. Subsequently the government established the National Environment Secretariat which spurred this policy into development planning. Subsequently, the United Nations Conference on Human Environment (UNCHE) facilitated the location of the United Nations Environment Programme in Kenya in 1973.

In the 20-year period, natural resources management and environmental protection enjoyed unprecedented political goodwill and support from the highest office in the land. Resource conservation was part of the political agenda. This enabled technocrats to introduce some meaningful changes within the sectoral policies and international protocols. This was reflected in an upsurge in the development of environment and natural resources institutions, and schools of wildlife management and environmental studies. The question of appropriate technology took center stage in the development process.

Overall, excision of forests was slower. However, wildlife went through the most dramatic loss especially between 1975 and 1983 when ‘politically correct poachers’ nearly decimated the large herbivores in the country. The wildlife saga was actually the first impact of high-level corruption. Soil erosion worsened until about 1975 when economic realities and good extension packages in NSWCP reversed the trend.

3.3 The dark age

The period between 1983 and 2001 could be considered in this country as the age of ironies and contradictions. Sectoral policies, legal and institutional reforms were at an advanced stage. The application of appropriate technology was brought within the policy environment to influence sustainable utilization of the natural resources.

In addition, rational programmes emerged in response to international protocols and cooperation. In 1996, six East African countries decided to pool resources under the auspices of IGADD to fight natural resource degradation. In 1987 the government took practical steps to integrate development and environment on a sustainable basis following the provisions of the report "Our Common Future" by the Brundtland Commission. In 1989, the government in response to the UNEP General Assembly and the United Nations Conference of Environment and Development (UNCED) placed high priority on integrating financial, scientific and technological resources in the national programmes to reduce the degradation of natural resources.

Despite all the gains at technical and policy level, there was no political will to support conservation of natural resources. Some individuals and private citizens destroyed forests, wildlife and wetland areas with impunity because of the short-term political survival interests, and high-level corruption in the power structures and government

system. All the policies, laws and institutions charged with sustainable utilization of the natural resources were ignored. Forests were excised and converted into private land without regard of their role as a public good. The international community has pumped billions of shillings into the Kenya Wildlife Service (KWS) to protect wildlife resources. Although the Ramsar sites have been officially declared, there still are cases of individuals acquiring beach plots along Lake Naivasha as evidenced by the spirited resistance of the Naivasha Riparian Owners Association. The Export Promotion Zones in the industrial area of Nakuru also discharge waste into Lake Nakuru.

Water and wetland resources, however, have borne the brunt of decline during this period. Despite significant awareness creation in the development and conservation of water resources, pollution steadily increased.

Shifts in policy, legislation and institutional land-use practices have over the years brought about changes in the way land-based resources have been used in space and time. Such changes can roughly be grouped in three periods each with unique landmark changes. These periods include the age of hegemony during the colonial period; the benevolence age immediately after independence and the dark ages today.

Chapter Four

Towards a national land-use policy

4.1 Justification

It is clear from the above that the current trend of using land will lead to a gloomy future if the status quo is maintained. Pollution will continue; destruction of water catchments will increase leading to cessation of flow of major rivers and limiting water and power supplies; land-use conflicts over arable land; water and pastures will escalate; the savannahs and grasslands will be subjected to severe desertification due to expanding agricultural activity, overgrazing and the search for fuelwood. Loss of biodiversity will accelerate the collapse of the life-supporting ecosystems.

The Kenya Land Alliance (KLA) formed in 1999 is advocating for formulation and implementation of a National Land Policy and a review of land laws. The initiative to create an institutional framework for land laws and land policy advocacy in Kenya was necessitated by the realization that the policy, legal and institutional framework created in 1950s is inappropriate because of the many changes in the social, political, economic and cultural fronts in the country today. The increase in population has resulted into a heightened competition for access to land and natural resources. In addition the changes in the global environment have combined to create a significantly different reality. It is in the face of this reality that KLA has consolidated all

efforts towards effective advocacy for land policy and land law reforms in Kenya, as a contribution to the constitutional review process.

4.2 The choices to be made

The possible future scenarios regarding the natural resources available for use in Kenya revolve around three key areas: i) The national land-use patterns; ii) the evolving policies and legislation with respect to natural resources in particular; iii) the related sectoral policies and how they affect the entire economy, and the effects of technological innovations and other global changes.

Scenario 1 Maintaining the status quo

This scenario involves maintaining the status quo characterized by an increasing population, and the projected trends of the current land-use practices worsening following the search for additional land. The situation could accelerate migration into ASAL areas as a large proportion of the growing labour force find affordable settlements but to the detriment of forests and rangelands. Pollution and technology abuse will continue unchecked. There will be little improvement in governance because of little political goodwill in enforcing

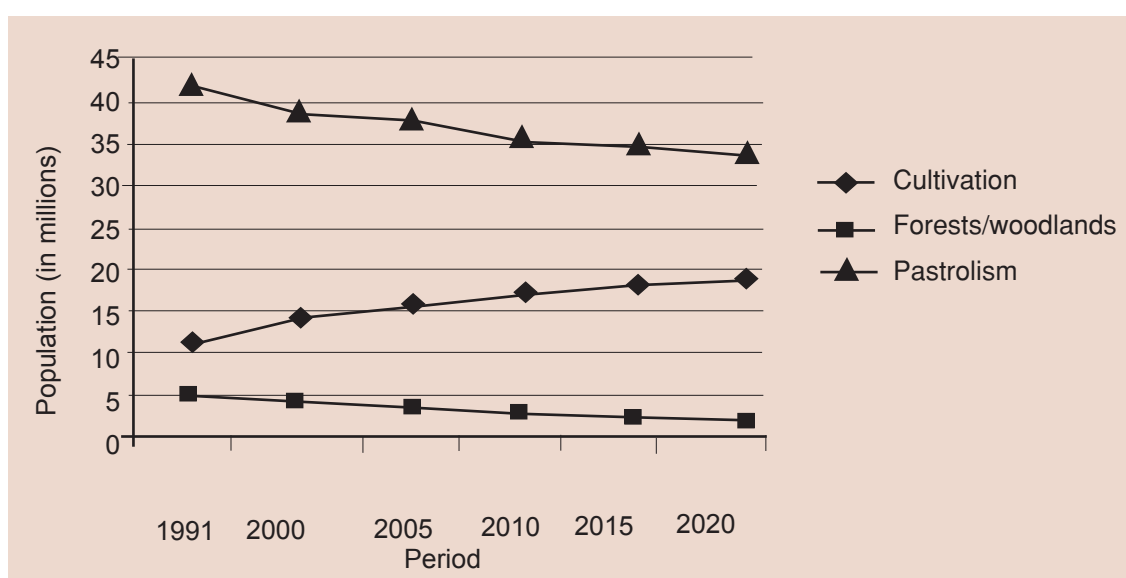
policies and legislation. Corruption in every sector of the economy continues.

The consequences of this scenario will be severe particularly in the area of wildlife conservation and the environmental protection. Continuation of the current trends in land use implies that the area under crop production is likely to increase to approximately 15.0 million ha by the year 2005, with a corresponding decrease in forest and woodlands. There will be more encroachment on forests and rangelands, increased settlements and cultivation in ASAL that would lead to environmental degradation and destruction of water catchments. Agricultural expansion into the ASAL will be uneconomic in the long run due to the ecologically fragile state of the region. Expansion of large scale agriculture into wildlife and pastoral areas and commercial ranching, and smallholder agriculture will increase. The expected land-use changes are shown in figure 11.

Continued land-use conflicts are expected among such activities as smallholder irrigated agriculture, rainfed agriculture, pastoralism and wildlife, coastal tourism and exploitation of the wetlands in districts such as Tana River.

There will continue to be less room for roaming wildlife. The stock of wildlife in both reserves and national parks will reduce leading to possible decline in the volume of both local and international tourists. There will be increased pressure on wildlife conservation and protected areas to be opened up for settlement and agriculture. The pressure to allow access to parks for dry-season grazing is already on the increase especially in Narok and Taita Taveta districts. The communities claim that the parks were their ancestral lands and therefore have grazing rights, as they never receive any tangible gains from tourism.

Figure 11. Projected land-use trends



Source: Institute of Economic Affairs, 1999

There will be increased loss of biodiversity to unplanned human activities leading to a breakdown in the life supporting systems. Destruction of catchment areas will lead to cessation of river flow and affect the water sources and supply systems, loss of scenic beauty and irrigation potential. Unchecked increase in pollution and destruction of the natural resources will inevitably occur without good political will, sound policies and laws.

Scenario 2

Instituting a rational national land-use program by chance

This scenario assumes that the goodwill of individual citizens and donors and sectoral reform will at some foreseeable future lead to rational use of land in the country.

Under this scenario the land resources may undergo positive gains. Such gains may be in the form of increased open-canopy forests on private lands and the reduced rate at which land is converted for cultivation. Land-use intensification will continue (as emphasized in Sessional Paper No. 2 of 1994 on National Food Policy). A draw

back to this scenario is the high costs involved and lack of political will. This will slow down the implementation process. High capital investment for the development of agricultural innovations, building farmer capacity through training, and creating public awareness will remain a dream. There will be no strict land-use control system to ensure that proper land-use practices are established in all places in accordance with appropriate zoning ideals.

The best that one can expect from reliance on a goodwill scenario is the intensification in use which lessens the pressure on land. Forest destruction may be reduced by about 1.5% annually. It also implies that a total of 11.5 million ha will be saved from conversion to agriculture by the year 2020 (table 28).

If implemented, intensification of agricultural land will have tremendous positive effects on the overall status of natural resources particularly availing more land for other land uses such as pastoralism, water catchment, conservation, wildlife and settlement.

Table 28. Changes in land use and projected requirement

Land use	Land requirement (million ha)					
	1995	2000	2005	2010	2015	2020
Status quo (current agriculture)	10.6	11.8	13.1	14.3	15.5	16.7
Intensification of agriculture	10.6	11.8	10.5	11.5	12.4	13.4
Land made available by intensification	0		2.6	2.8	3.1	3.3
Remaining forest and rangelands						
i) Status quo	42.9	41.4	40.0	38.6	37.1	35.6
ii) With agriculture intensification	42.9	41.4	42.6	41.4	40.2	38.8

Source: Institute of Economic Affairs, 1999

To attain the scenario, high capital investment to develop appropriate technology and manpower will be necessary to sustain the changes. It will also require a strong government input, strategy reinforcement and goodwill for promotion of productive practices, especially the wider use of improved seeds, fertilizer and disease and pest control; promotion of increased intercropping and multicropping; provision of efficient support services including extension, research and storage and handling services in the agricultural sector; restructuring various institutions charged with the management of all the sets of natural resources in question; transformation of most of the policies and legislation related to sets of natural resources to levels that are compatible with the socio-economic, political, environmental and ecological realities.

The worst occurrence would be negative loss through de-gazettment of the remaining important forest areas, grabbing of plots by some unscrupulous people, minor level of poaching, minor forest losses through fire and wood poaching, and loss of soils through soil erosion.

Scenario 3 Instituting rational land-use by choice

Scenario three will depend on the following assumptions.

- Population pressure is minimized as a result of the economic realities of the time. Policies and laws would have been strengthened and the institutions harmonized.

- That corruption will be eliminated when government embraces the principles of good governance and the entire population's ethics change against corruption. In addition, increased economic burden would rise to the level that people reject the status quo.
- It is further assumed that new economic opportunities would emerge alongside innovation and use of technologies that utilize natural resources at optimal levels.
- Introduction of multiple land use will depend on formulation of a national land-use policy enacted and enforced to guide and harmonize land-use planning activities. Though majority of the population will continue to depend on land for their economic welfare, they will be supported to practice the best economic and environmentally least harmful land-use practices based on land potential and local level land-use management plans with the active participation of local communities in setting out areas for specific and appropriate uses. The local people will be encouraged and supported to participate in land-use decisions and in the conservation of wildlife and biodiversity in the wider sense. Local communities would gain more from wildlife conservation than from alternative land uses.

The possible impacts of this scenario include more efficient use of the available natural resources, and an increase in the overall balance of natural resources. There will be an increase in biodiversity, wildlife population, rational use of ASAL and increased land equivalent ratio.

Introduction of multiple land-use systems alongside agricultural intensification therefore has tremendous impact on Kenya's natural resources conservation and environments. More land will be availed for use. There will be reduced destruction of natural resources and environment degradation. The welfare of landowners will be guaranteed through diversification of their economic base and production strategy especially in the ASAL where climatic conditions are unpredictable.

Two major conclusions can be drawn from the three scenarios.

The best option is Scenario 3: Instituting rational land-use by choice, where a deliberate effort is made by all sections of the Kenyan society to institute a rational land-use programme. This requires commitment, goodwill and a change in attitude amongst the peoples of Kenya. It will require a facilitative environment (technological innovations including use of traditional skills and indigenous knowledge, rational policy, legal and institutional framework as well as collective bargaining).

Scenario 1 is probably the worst option. Unfortunately it is the easiest to achieve since one ends there by doing nothing. Scenario 2 will introduce half-hearted measures through reforms driven by international protocols and donor pressure. The desired results will most likely happen by chance as the process relies on external initiatives and the goodwill of the populace. The current externally-driven reforms will perhaps lead to a rational land use by chance but over a long period of time. It is therefore

reasonable to suppose that everybody, not government alone, is responsible for instituting a rational land-use plan nationally and each person should play their part in putting in place the transformation required for the realization of scenario 3.

4.3 The key elements of a national land-use policy

To review and put in place an appropriate national land-use policy, principles to guide the process should be enforced.

a) The guiding principles

The principles are aimed at guiding the manner and conditions under which appropriate use of land can be achieved. The appropriate land-use system must involve making decisions, choosing between options, accommodating diverse interests and presenting them as guidelines whose implementation must cater for the best interests of people individually, communally and as a nation. To achieve this, the system must be based on some mutually agreeable rationale that guides the decision-making process and the institutions in charge of the administration of land resources. The following are core guiding principles:

- The cultural integrity of the various peoples in Kenya relating to perceptions, rights, tenure systems, community institutions, conflict resolution among other value systems, must be respected and recognized as the basis for making decisions on land use and therefore superseding short-term

political interests. People resident in a given area should have first priority in determining access to land resources and providing time-tested conflict resolution mechanisms.

- Whereas it is important to meet the objectives of the people and those for national development when zoning land use, an equilibrium must be maintained for a suitable environment. Satisfying human needs should be balanced with the needs of other organisms in order to maintain the ecological linkages that sustain life.
- The State must ensure equity amongst the various categories of resource users, their production systems and ecosystem protection. The land-user rights and access by all citizens must be treated equally. The rights of access by future generations must not be compromised by the present generation.
- Access to, use and conservation of land resources must be based on a national system of resource allocation where various stakeholders, including the general public, participate in decision-making and administration through a forum where consensus is reached after compromises and concessions are voluntarily made.
- The 'Abuser Pays' principle needs to be embraced as a preventive measure. Liability for resource abuse should never be passed on but rather, the abuser of natural resources should be forced to meet the costs of rehabilitation.

b) The National Land-use Plan

For a national land-use plan to provide coherent, rational and coordinated guidance on the use of land resources in Kenya, it must be comprehensive and integrated and should aim to:

- Rationalize the use of land resources in line with the principles of appropriate use and sustainable development.
- Harmonize initiatives in the use of land resources so as to achieve an integrated and sustainable strategy for managing natural resources.
- Consolidate the inventory of land resources, and create a platform of strategic information for national land-use planning, resource allocation and resource management programmes.
- Provide a suitable institutional arrangement for a national early warning system that would alert the relevant policy and implementing agencies of the current and emerging threats to ecological and economic sustainability of the resources.
- Establish the guidelines that control and direct land-use and production systems, and technological choices for different ecological and social differences.

A national land-use plan can be developed using a national land-use planning process that entails the following.

c) Continuous land-use planning process

Since land is used for different purposes, it is important to select the appropriate purpose for a particular area that best serves the interests of all those involved. Different land uses such as pastoralism and sedentary farming in ASALs compete. The people living in a specific area usually consist of different groups with divergent interests in land and its resources.

Land-use planning therefore is a process of mitigating competing land uses and the diverse interests of people. The process balances three objectives:

- to maximize the use of scarce natural resources to meet socio-economic, political and cultural obligations of people.
- to ensure equity or fairness in the distribution of costs and benefits from the use of the resources among groups regardless of social background.
- to add value to natural resources. Land-use planning is therefore directed at the "best" use of the land.

The end result of the land-use planning process is a national land-use plan in which the country is zoned into areas suitable for various uses such as agriculture, conservation, cultural groves, industry etc. The development of the national land-use plan will spell out the responsibilities at the national, meso and local levels.

Land-use planning is a continuous process necessitated by the need for change; or arising from the development of national

objectives. The process can also be triggered by national development plans such as the current focus on poverty eradication. Two processes should be undertaken simultaneously. Land evaluation to re-examine the suitability of land for the use and undertake what is commonly referred to as farming systems analysis to gauge the socio-economic constraints. In Kenya, such data exist in national institutes such as the Kenya Agricultural Research Institute and Kenya Forestry Research Institute, and with international non-government organizations such as The African Medical and Research Foundation and OXFAM.

Land evaluation is a critical step when carrying out a land-use planning process. It is the process of assessing the suitability of land for alternative uses. The process includes the identification, selection and description of land-use types relevant to the area. A suitability analysis is then conducted to determine the best use by matching the various land potentials and the positive as well as negative consequences of each land-use type. One of the key considerations is the level of current and future investment in terms of technology, which will alter the suitability ratings. The land evaluation process supplies the land-use planning process with alternatives for land resource use.

d) Environmental impact assessment

Environmental Impact Assessment (EIA) is the integration of the science of environmental analysis with the politics of resource management. It is a process of environmental planning and monitoring that ensures resource management is

sustainable. It is an action-oriented policy statement providing for a mandatory and public environmental impact statement over any development activity.

Environmental impact assessment focuses on the unpredicted costs of development programmes. For example water reservoirs may lead to diseases, weed problems, eutrophication and seismic effects. Health programmes may lead to drug resistance, water pollution or population increase. Irrigation projects may trigger diseases, water pollution, salinization or water logging. Increased agricultural production can pollute the soil, acidify it or lead to genetic loss.

It is therefore mandatory that land earmarked as suitable for one form of land use undergo thorough environmental impact assessment before implementing the programme and projects.

The newly enacted Environment Management and Coordination Act provides for Environment Impact Assessment before any major developments are undertaken that have a bearing on natural resources and the environment. Once the legislation is fully in force and the institutional framework for its enforcement is fully operational it should be possible for the environmental impact of major environment projects to be established and corrective and mitigation actions taken. However, as with every legislation, the greatest challenge is in the enforcement.

e) Incentives and penalties

Incentives and penalties need to be well defined to protect the natural resources and also the welfare of the people who depend on these resources for their livelihoods. Sanctions are best developed through a participatory process with stakeholders so that a compromise is reached between different parties.

Such sanctions will involve clearly defining the values to be protected. For example: human health safety and life support media such as water, soils, flora, fauna; use of a mixture of criminal, civic and administrative statutes to allow flexibility in administering incentives and penalties; a clear statement and an un-ambiguous list of crimes perceived as land resource abuse. They may include:

- Damage and permanent injury to the ecosystem
- Pollution which injures another human being
- Contributing to risk of injury to the environment
- Contributing to the risk of death or injury to human beings and other animals

The crime list would include:

- Released pollutant into the environment
- Operated a hazardous installation
- Handled toxic materials
- Contributed to damage of ecosystems
- Supplied false information on monitoring or
- Tampered with monitoring equipment

Incentives could involve a wide range of awards and tax exemptions for industrialists and other land users who use technology to preserve resources; the individuals who contribute immensely to knowledge on appropriate use of the land resources; clubs and groups who volunteer time, knowledge and resources to lobby for specific land-use issues need to be recognized by society and listed in the national heroes medal awards scheme.

f) A rational land-tenure system

Arable land in Kenya comprises 19.2% of total land, of which 2.2% is covered by forest. The remaining 82% is arid or semi-arid. About 24 million Kenyans live off 17% of the country's arable land majority of whom own tiny pieces of land or are landless. In Nyanza, Western and Central Provinces, the average land size dropped from 2 to 1.6 ha between 1982 and 1992 (Ogendo and Kosura, 1995). Over the same period 15–25% of the 5 million households in Kenya were virtually landless with no guaranteed access to land.

This situation has resulted from the suitable but scarce land being hoarded by the middle class in the high-value highlands and municipalities. There are also problems of gender where widows and youth have been dispossessed especially in trustlands inheritance process. This skewed access and distribution of land inevitably translates into sharp social differences leading to increased poverty, political marginalization of citizens because some are squatters.

The National Land-use Plan therefore needs to be supported by a national land-tenure policy which ensures fairness and equity in access and control of land and its resources; facilitates just and fast administration; has fair conflict-resolution mechanisms; spells out fair compensation mechanisms; and facilitates and protects informal leaseholds especially the landless who have farming skills but no purchasing power to own land.

g) Institutional re-arrangement

A national land-use policy with a well-articulated national land-use plan will require an apex, umbrella organization to integrate all the concerns in land resources and take the responsibility of implementing and enforcing the provisions of the policy.

A suitable institution would be a permanent national land-use commission. The commission would enforce the national land-use policy and implement the national land-use plan. It will stipulate the manner under which land resources can be accessed and used. The commission will take into account what cannot be compromised, the rights of the people, and the principles of conservation.

4.4 The assets to build on

a) The National Environment Action Plan (NEAP)

The NEAP was adopted in June 1994. The NEAP Report addresses environmental issues in an integrated cross-sectoral manner. The NEAP provides not only a strategy for achieving sustainable development in Kenya, but is a basis for translating

Agenda 21—the Global Programme of Action on Environment and Development—into an action plan. It shows the government's continued commitment to conservation and sustainable use of natural resources, as stated in the national development plans and policies. The enactment of an umbrella law for the management of environment (EMCA) in 1999, and the development of the National Poverty Reduction Strategy are key achievements of the NEAP.

b) The National Environmental Management and Coordination Act (EMCA) (1999)

This is an Act of Parliament that establishes an appropriate legal and institutional framework for the management of the environment in Kenya. The Act stipulates that there is need to improve the legal and administrative coordination of diverse initiatives in order to improve the national capacity for the management of the environment. The Act also provides that the environment constitutes the foundation in the national economic, social, cultural and spiritual advancement.

The general principle of the Act is that every person in Kenya is entitled to a clean and healthy environment and has a duty to safeguard and enhance the environment. The Act enforces the principles of sustainable development, namely;

- The principle of public participation
- The cultural and social principles traditionally applied by any community in Kenya for the management of the environment or natural resources

- The principle of international cooperation in the management of environmental resources shared by two or more States
- Intergenerational and intergenerational equity
- The polluter-pays principle
- The precautionary principle
- An effective administrative structure that consist of the following organs—

c) The National Environmental Management Authority (NEMA)

NEMA's main object and purpose is to exercise general supervision and coordination of all matters relating to the environment and to be the principle instrument of government in the implementation of all policies relating to the environment. The main responsibility is monitoring the state of the environment; advising the Government on issues of environment policy legislation; coordinating and harmonizing integration of environmental concerns during development planning; overseeing compliance with environmental laws, regulations, impact assessments and standards; and promoting environmental education and awareness.

d) The external goodwill

Over the last three decades there have been concerted efforts globally to direct attention to the management of the environment and natural resources and its linkages with social and economic development. International attention on natural resource management in Kenya picked up in 1972 after the United National Conference on Human Environment (UNCHE) which attempted

to integrate development and environment conservation as a way of stemming natural resource degradation.

According to the register of international treaties and agreements, Kenya ratified 36 out of the 152 instruments before independence in 1963. Most of the treaties date back to 1921. Between 1963 and 1973—Kenya's first decade of independence—the country adopted 35 conventions. Between 1973 and 1983 forceful articulation and development of policies on environment and natural resource management was evident in Kenya particularly following the UNCHE and the Brutland Commission that generated the political will by locating UNEP in the country.

In 1977, UNEP initiated an action plan "Global system for combating desertification" which triggered Kenya to start preparing a national action plan of natural resource management. In 1980, the World Conservation Strategy was launched in Kenya with support from The International Union for conservation (IUCN), the Food and Agriculture Organization of the United Nations (FAO), and UNEP specifically to initiate a national approach to stop the environmental problems and diminishing natural resources. This was the precursor to the much-publicized National Conservation Strategy that yielded the National Environment Action Plan (NEAP).

In 1986, six East African countries resolved to pool resources to fight natural resources degradation under the auspices of the Inter-

Governmental Authority on Drought and Desertification (IGADD). In 1987 the government started practical steps to integrate development and environment on a sustainable basis following the provisions of the report "Our Common Future" by the Brutland Commission. In 1989, the government in response to UNEP General Assembly and the United Nations Conference on Environment and Development (UNCED) started putting high priority on financial, scientific and technological resources into its national programmes to reduce the degradation of natural resources.

After the Rio Summit in 1992, virtually all the government programmes within the public investment programmes were based on the provision of Agenda 21. The immediate products have been the NEAP and the Environment and Management Act of 1999 that proposed the National Environment Management Authority [NEMA]).

The protocols come with financial and technical provisions that countries from the developing world could use to effectively manage their environment. Overall, Kenya has accepted 29 out of 54 conventions on environmental management. Trends between 1993–2003 show poor implementation of principles enshrined within the international protocols. It appears the political establishment does not support some specific provisions in the agreements. Also, the competence of professionals to manage such conventions has drastically been compromised. In addition, parliament has never been a key party to the treaty

provisions and therefore broad-based politics may be uncertain.

e) Traditional laws, skills, practices and institutions

The Loita Maasai, a sub group of the Masai pastoralists, inhabit the southern part of Narok District. Under the guidance of the cultural and spiritual leaders known as O'Loibon they have since colonial times, consistently and successfully resisted modern land tenure systems and natural resources management. Their cousins, the Purko Maasai inhabiting the northern part of the same district rapidly embraced modern land tenure systems and resource management. This, unfortunately, has resulted in a rapidly degrading environment. Conflicts arising from landlessness and lack of pasture emerged as large chunks of the grazing land were sold off to the wealthy who then converted them into wheat farms.

The Loita Maasai on the other hand enjoyed a healthy and well-managed environment. Their indigenous resource management systems continuously shielded them from drought.

Lpinguan Ranch has changed hands severally. First the Laikipia Maasai wrestled it from the Samburu. Later the Whiteman appropriated it after the 1911 Maasai Agreement and developed it into a livestock-breeding ranch under the name P&D Ranch.

Fifteen years after independence, the ownership reverted to the government under the Department of Settlements in the Ministry of Lands. The Samburu who had been squatting on the land made a claim to the ranch to which government verbally acceded. Taking the promise seriously, Samburu pastoralists from the larger Samburu District, together with a few Pokot and Turkana herdsmen, started occupying the ranch bringing with them large herds of livestock.

In four years, the productivity of the pastures declined from 6 t to 0.3 t per hectare due to overgrazing. The exposure of the topsoil accelerated soil erosion reaching losses of about 50 t per hectare per year. The water dams shrunk in volume or dried up. With the help of the Laikipia Wildlife Forum the old men sought security of tenure from the government so that they could invest their money, time and labour.

They worked on a management plan that would revive the productivity of their pastures. An immediate step in the plan was to secure tenure but to use the land to get the highest returns, through tourism. The ranch was not subdivided but individual plots would be issued to form the basis for buying shares from the limited company that would run the tourism facility. A small enclosed part of the ranch would host critical infrastructure that would include a veterinary diagnostic laboratory, a livestock auction yard, a small stock-fattening facility, and grounds for grazing during drought.

Conclusion

The land-use problems facing Kenya today are due to the lack of an appropriate national land-use policy. The air is increasingly being polluted; water systems are diminishing in volume and deteriorating in quality. The land is threatened by desertification. The soils are being eroded and deposited in the ocean and lakes. The forests are being cut with impunity thus destroying the water catchments and the savannahs and grasslands are undergoing de-vegetation through overgrazing, charcoal burning and other inappropriate land-use practices.

The underlying causes of the deterioration of the life support systems (air, water and land) is a result of unsustainable land-use activities notably deforestation, bad irrigation techniques, overgrazing, fuelwood harvesting and charcoal burning. Others are pollution from industries, harmful agricultural practices and improper management of solid and liquid urban wastes. The ever-increasing population exerts pressure on the natural resources and drives the misuse of the resources; it is worsened by the cyclic occurrence of natural disasters such as droughts and floods.

The impacts of unsustainable land use are many. The decline in the supply of pastures and potable water fuels conflicts among pastoralists and between small and large-scale irrigation farmers. Poor quality of air and water increases disease risks in human beings and extinction of other life forms. Destruction of water catchments causes shortage of water and electricity supply necessitating rationing. Desertification reduces the productivity of land leading to food insecurity, reduced income and non-accumulation of economic assets. Eventually millions of families end up living below the poverty line. Currently, over 5 million households are unable to access basic needs such as food, medical care, and education and to meet other social obligations.

The current trend of deterioration will lead to a gloomy future for Kenya if the status quo is maintained. However, the entire Kenyan society can opt for rational land use through the application of wise-use principles. Striking a balance between satisfying the human livelihood needs and wise use of resources to ensure conservation for future generations is the biggest challenge.

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