Kenya

Impact of macro and policies on non point pollution

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Foreword

The Nile Basin Initiative (NBI) is a partnership between riparian countries of the Nile; namely Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. The NBI's shared vision is to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from the common Nile Basin water resources". To translate this shared vision into action, there are two complimentary programmes: the Shared Vision Program (SVP) which creates a basin wide enabling environment for sustainable development; and the Subsidiary Action Programmes (SAPs) engaged in concrete activities for long term sustainable development, economic growth and regional integration of the Nile Basin countries.

The Nile Transboundary Environmental Action Project (NTEAP), one of the seven projects under the Nile Basin Initiative's (NBI) Shared Vision Programme, is mandated to provide a strategic environmental framework for the management of the trans-boundary waters and environmental challenges in the Nile River Basin.

As part of a broader plan of raising environmental awareness, NTEAP seeks to enhance the understanding of common and high priority policy issues that affect the environment of the Nile Basin. This will be done through policy studies of the patterns of economic development and priority transboundary environmental issues. The Nile Transboundary Environmental Analysis which was developed by the riparian countries in collaboration with the World Bank, UNDP and GEF identified priority environmental issues and threats in the Nile Basin. Better understanding of how these environmental threats are influenced by macro and sectoral policies and identifying the root causes is essential to explore possibilities of jointly addressing the threats.

In August 2006 the NTEAP held a planning workshop in Tanzania on the impact of macro-sectoral policies on the Nile Basin environment. The workshop discussed the concept note on macro policies prepared by NTEAP, reviewed country papers and decided on the kind of studies that could be carried out in line with macro and sectoral policies. Topics were selected on the basis of their relevance to the Nile Basin, significance of trans-boundary aspect and where policy intervention/policy reforms will be required. Four research themes/topics emerged. These focused on the macro/sectoral policies: on soil erosion; non point pollution/pesticide pollution; exploration and development of oil projects; and deforestation in the Nile Basin.

This report aims to open a debate that will enhance understanding of the relationship between water resources development and the environment in the Kenyan part of the basin. Thus it provides a forum to discuss paths for the Nile Basin with a wide range of stakeholders. This in turn will provide a strategic environmental framework for the management of the Nile Basin and the impending environmental challenges and threats existing in the Basin. Further it will contribute to the achievement of sustainable and equitable socio-economic communities in the basin. Specifically, this report provides a synthesis of the impact of macro-sectoral policies on the non point pollution/pesticide pollution in Kenya. It also suggests the necessary interventions and reforms required to influence policy change.

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Executive Summary

Environmental threats facing the Nile Basin in Kenya include deforestation, which affects wetlands and water sources that feed the Nile river; soil erosion causing serious levels of siltation which negatively affects the river flow and impacts negatively on the quantity of water available especially in the downstream countries. Other threats include invasive water weeds infestation which impact on the river ecosystem causing loss of some fish species such as tilapia; floods; droughts; wetlands degradation. Pollution is a key threat that faces the Basin. Most of these threats except for droughts and floods are human related.

Impact of Point and Non-point Sources of Pollution on the Nile Basin Environment

Non-point source pollution accounts for majority of contaminations in streams, rivers and lakes of Lake Victoria and the Nile Basin. Non-point source pollution occurs as water moves across the land or through the ground and picks up natural and human-made pollutants, which are eventually deposited in streams, rivers, lakes, wetlands and groundwater. The most common non-point-source pollutants are sediments, nutrients, pathogenic microorganisms from dairy or beef industries and toxic chemicals from various industries. Sedimentation impacts on water quality and quantity, affecting potable water supply and fisheries. In Kenya more than ¾ of waters have for a long time not been meeting water quality standards.

Absence of sound policies and regulations leading to dumping of toxic waste by industries frequently leads to contamination of soil and water bodies with adverse effects on human health and the environment. In the urban and peri-urban environments where lack of sound policies have allowed human settlements without proper sanitation, human waste has contributed to non-point-source pollution of surface and underground water systems.

In the farmlands where safe pesticide utilization and management policies are not adhered to and proper audits are wanting, non-point-source pollution from various agro-chemicals via storm water runoff is rampant. Pollutants transported by run-off water from the sugar belt accounts for a good portion of pollutants transported to streams and rivers in the Nile Basin

Soil Erosion and siltation

Soil erosion in the highland catchments in Kenya is a major cause of siltation in the Nile Basin wetlands which negatively affects the river flow and impacting negatively on the quantity of water available especially in the downstream countries. Siltation reduces lake levels and changes fish habitat. This alters feeding and breeding areas of fish. Most of the fish species such as *Protopterus aethiopicus* inhabit the littoral zones and use them for spawning. The loss of such habitats and critical zones compels the fish to relocate or they may perish.

Impact of Eutrophication on Lake Fisheries

Fish of the families Coregonidae and Salmonidae are eliminated from the fish communities due to eutrophication, with the subsequence of other families such as Cyprinidae and Percidae starting to predominate (Reshetnikov, 1988). This and similar phenomena could possibly explain the disappearance of native fish species such as *Labeo victorianus* (Ningu) from the market in the Lake Victoria Basin.

However, the major threat to *L. victorianus* would probably be habitat destruction occasioned by damming, and building of causeways, that prevent their migration for the purpose of breeding. This has an impact on the livelihood of the local communities that predominantly rely on fisheries. An example of such habitat change is seen in the building of the Mbita-Rusinga Island causeway, which the local communities claim has, together with the water hyacinth, reduced the fish diversity and biomass per capita.

It has been noted that due to eutrophication and the subsequent proliferation of waterweeds, especially water hyacinth (*Eichhornia crassipes*), there has been a drastic reduction in the catch of Lake Victoria Ngege (*Oreochromis esculentus*). This has a negative impact on the economy and nutrition of the lakeside communities.

Health effects of Non-Point Pollution

Domestic use of water in the lake basin includes direct washing of utensils, laundry as well as drinking of raw and untreated water from wells, rivers and lakes. At the beaches of Lake Victoria, these activities are often performed at the same site where recreational activities such as swimming and bathing take place. The waters are often heavily impacted by nonpoint-source pollution resulting in prevalence of disease causing microorganisms such as *Vibrio cholerae* (causing cholera), *Salmonella tiphy* (the organism that causes typhoid), *Entamoeba histolytica* (the organism that causes amoebiasis), *Escherichia coli* (that cause urinary tract infections), just to mention a few of the most common.

Deforestation

It is estimated that between 1990 and 2005, Kenya lost 5% of its forest cover - around 186,000 hectares. This loss could be attributed to a number of factors, most significant of which is deforestation for access to agricultural land and settlement.

To some extent there is logging for utilization of the resources as a source of livelihood. It should be clearly noted that these forests are a source of rainfall, medicinal herbs, soil-cover to protect against soil erosion, hardwood timber for economic security and habitat for our rich biodiversity. The loss of forests is a loss of a great heritage. One case study that demonstrates the danger being created by deforestation in Kenya is the Mau Forest, which is presented in this report.

Policy Causes of Impact

Several statute laws have been legislated in Kenya to control ground and water pollution, deforestation and soil erosion among others. Notable among these are the Water Act of 2002 and the Environmental Management and Coordination Act of 1999. These together with the Ramsar Convention have endeavoured to protect the basin from undue pollutants. Law enforcement mechanisms are however still wanting and heavy loads of pollutants are still released to the environment.

The existing policies on solid waste management are not effective in controlling generation, collection, storage, transportation, incineration and final disposal. The Local Government Act (cap 265) of 1977 vests the powers to contract out services in the Local Authorities (LAs). The licensing of the waste operators is done by NEMA subject to Environmental Management and Coordination Act (1999). The licensed waste operators often do not have the capacity to manage the waste. Open lorries are used to transport the waste and at the end of the day a good fraction of the waste is carried away by the wind before it reaches the dumpsite for disposal. Taxes paid to the LAs are enough to buy and maintain appropriate waste management equipment and constructing engineered landfills.

The public Health Act (Cap 242) of 1972 requires the cleansing department to facilitate provision of services. However, there are no standards to be followed in providing cleansing services and there is no involvement of the mass of the people to practice waste minimization, cleaner production and proper waste handling. Unfortunately, the general population is ignorant of their rights and would not raise an alarm when not served properly. They would rather pay extra taxes to the mushrooming waste operators to have their waste collected. To the common man in most parts of the country, especially those traveling, littering seems to be a culture.

Impact of Macro Sectoral Policies

Kenya does not have a National Environmental Policy hence environmental management is guided by disparate sectoral legislations and decrees. Lack of a comprehensive policy on environment has weakened the policy and political resolve of the government, to ensure a coordinated and effective implementation of policies and legislation relating to the management of the environment.

Currently there are 77 Acts of Parliament related to various sectors that deal with environmental management in Kenya. Most of these Acts proceeded NEMA and some have mandates that contradict NEMA's mandate and yet NEMA has no legal control over them as the Act that established NEMA is not organic hence not entrenched in the constitution and cannot supersede the rest of the Acts in matters related to environmental protection. Most of these Acts are sectoral and have been purely couched to fulfill sectoral mandates which sometimes are in a collision with international environmental laws and conventions.

Although the mother ministry that is the repository of environmental policies is the Natural Resources and Environment through the National Environmental Authority (NEMA), other ministries such as Water, Agriculture, Local Government, Trade and Industry, private sector amongst others also play key roles in environmental management in the country. As mentioned above these institutions have developed their own environmental protection and management statutes. Most of these statutes were couched either by their nature such as fisheries, forestry, wildlife or by function thus; agriculture, public health, industry or mining hence too specific and narrow in scope. An assessment of these institution policies on management of major issues such as solid waste disposal, water and air pollution, pesticides, and agro chemicals usage revealed major tensions in approach due to competing mandates. Some of the statutes in question include; land use, water resources, public health, disposal of hazardous waste, solid waste disposal, fisheries, forests, radiation, among others.

Recommended policy interventions

- Macro and sectoral policies that affect environmental management be reviewed in order to tease out tensions, contradictions and duplications;
- The Kenyan government should exploit the opportunity provided by the proposed review of the constitution to entrench the environmental concerns and the law into the nation's constitution. This would imbue law governing the environment with supremacy over other laws and policies on matters pertaining to the environment;
- The Kenyan government should make concerted effort to ensure implementation of existing policies and laws by the relevant implementing agencies such as NEMA and local authorities with the requisite policy and political support;
- Public awareness and Environmental Education at all levels of the community should be promoted;
- Every local authority should be required by law to build and maintain environmentally sound solid and hazardous waste disposal facilities based on set standards.

Although with a relatively small quantity of major inland drainage systems, Kenyan rivers draining into Lake Victoria as part of the Nile Basin System are significant. Permanent rivers occupy approximately 3,998 km in length. Although the country has other river basins including, Tana, Athi, Ewaso Nyiro, the largest one is the Lake Victoria basin which is part of the Nile River basin. While Kenya shares the smallest part of the lake, it is argued that its contribution through rivers; Yala, Nzioa, Sondu, Nyando, Mara, Serengeti etc to waters of the lake (hence the Nile River Basin) is the highest in the East Africa region. The Nile river catchments in Kenya covers an expansive area in Western part of the Rift Valley which includes Nyanza, Western, North and South Rift Valley and accounts for almost half of the country's land surface. Despite this Kenya remains a water stressed country with an overall limitation of water surface and a high population growth rate that has put a very high premium on proper management and development of river basins.

Like many areas in Eastern Africa and beyond, the surface water resources of Kenya are the result of the interaction between the physical relief and climate. Historically it has been recorded that geophysical activities in East Africa were turbulent and this led to the formation of the Great Rift Valley System that is more pronounced in Kenya than other Eastern Africa countries. This feature makes Kenya a country of marked physical contrasts, with a wide range of climatic conditions. The Rift Valley divides Kenya into two distinct and almost equal sections thus the Eastern and the Western Rift Valley with totally different and varying climatic conditions. Rainfall in Kenya is characteristically low and erratic with an uneven geographical and temporal distribution. This low rainfall coupled with high rates of evaporation and seepage into groundwater reservoirs, reduces significantly the water available for run-off to less than 5 percent of precipitation with a range from 1 to 12 percent in the Rift Valley Basin and the Lake Victoria Basin, respectively.

Largely, the western part of Kenya drainage systems comprised of major rivers as Yala, Nzioa, Nyando, Sondu, Mara etc form the Nile Basin System part of Kenya. Lake Victoria is the repository of most of the river drainage systems where most of the Nile tributaries from Kenya empty their waters before joining the Nile River. Consequently socio-economic and human activities undertaken on these river systems have a direct effect on the quality and quantity of water of the Nile Basin. The environment of this area is characterized by a very high density of population, high intensity on agricultural activities, fishing, cattle keeping, commercial cane and tea farming and logging.

The Nile Basin is very rich in biodiversity with about 129 species of fish;129 fish endemics;137 species of amphibians; 3 Ramsar sites; 69 wetland dependent IBAs; 5 endemic bird areas and yet only 4.5% of protected area.

Environmental threats facing the Nile Basin in Kenya include deforestation, which affects the wetlands and exposes the water sources that feed the Nile River, soil erosion causing serious levels of siltation which negatively affects the river flow and impacting negatively on the quantity of water available especially in the downstream countries. Other threats include invasive water weeds infestation which impact on the river ecosystem causing loss of some fish species such as tilapia, floods, droughts, wetlands degradation. Pollution is a key threat that the basin faces. Most of these threats except for droughts and floods are human related.

Environmental Issues

A number of environmental determinants are considered to be key to sustainable development. Policies touching on these determinants require political will to be able to make meaning in addressing the positive as well as negative impacts of the determinants. Appendix 1 highlights key environmental issues in Kenya and their environmental impacts.

Point and Non Point Sources of Pollution

Point sources of pollution occur when pollutants are discharged or emitted directly into a water body, while non point source pollution delivers pollutants indirectly through natural as well as human-made environmental changes. An example of point pollution is when there is an oil spill following capsizing of a ship transporting oil. Washing of fertilizer from agricultural lands by storm water run-off into streams, rivers and lakes represents non point pollution. The natural system may not have any of the pollutants present until it is introduced to the environment by human activity.

Non point source pollution accounts for majority of contaminations in streams, rivers and lakes. This is the case with the situation in the water catchments of Lake Victoria and the Nile Basin. Non point source pollution occurs as water moves across the land or through the ground and picks up natural and human-made pollutants, which are eventually deposited in streams, rivers, lakes, wetlands and ground-waters. The most common non point-source pollutants are sediments, nutrients, pathogenic microorganisms from dairy or beef industries and toxic chemicals from various industries. Sedimentation impacts on water quality and quantity, affecting potable water supply and fisheries. In Kenya more than ¾ of waters have for a long time not been meeting water quality standards. Examples can be cited of Kisumu city, which sits on top of the largest inland water body but most houses in the city have no running taps of potable water. Similar experience is experienced by towns around Lake Victoria.

EXTENT AND SEVERITY OF NON POINT POLLUTION

Anthropogenic (man-made) and natural environmental conditions are frequently direct and/or indirect determinants of ecosystem health. This includes inferior health conditions and misery due to the confounding factors that come into play to worsen otherwise mild

inherited disorders. Poverty can exacerbate the spread and severity of infectious diseases, while, on the other hand, affluence and industrialization can have negative impacts relating to pollution and affluence diseases such as leukemia and lymphomas. Absence of sound policies and regulations leading to dumping of toxic waste materials frequently lead to leakages into the soil and water bodies that humans interact with, leading to adverse conditions in man and the environment. In the urban and peri-urban environments where lack of sound policies have allowed human settlements without proper sanitation, human waste has contributed to non point-source pollution of surface and underground water systems.

In the farmlands where pesticide policies have not been implemented and proper audits are wanting, non point-source pollution has resulted from various agro-chemicals via storm water runoff system during rainy seasons or through irrigation. Run-off water from the sugar belt accounts for a good portion of pollutants transported to streams and rivers in the Nile Basin, often resulting in eutrophication. Non point-source pollution also occurs due to improper management of wastewater, sewerage and septic systems that often take long before they are maintained or repaired. It is difficult to precisely measure the contribution of each component sector to pollution.

Eutrophication in Rivers and Lakes

Phosphorus enrichment can promote excessive growth of aquatic plants (eutrophication), and cause undesirable changes in the structure and function of the ecosystem. It has been argued that point pollution from sewage/industrial effluents contribute more to phosphorus enrichment in water bodies than do agricultural activities (non-point pollution) (Jarvie et al., 2006), but it is not easy to quantify the contribution of non point sources and their effect can be enormous.

Fish of the families Coregonidae and Salmonidae are eliminated from the fish communities due to eutrophication, with the subsequence of other families such as Cyprinidae and Percidae starting to predominate (Reshetnikov, 1988). This and similar phenomena could possibly explain the disappearance of native fish species such as Labeo victorianus (Ningu) from the market in the Lake Victoria Basin. However, the major threat to L. victorianus would probably be habitat destruction occasioned by damming, and building of causeways, that prevent their migration for the purpose of breeding. This has an impact on the livelihood of the local communities that predominantly rely on fisheries. An example of such habitat change is seen in the building of the Mbita-Rusinga Island causeway, which the local communities claim has, together with the water hyacinth, reduced the fish diversity and biomass per capita.

It has been noted that due to eutrophication and the subsequent proliferation of waterweeds, especially water hyacinth (Eichhornia crassipes), there has been a drastic reduction in the catch of Lake Victoria Ngege (Oreochromis esculentus). This has a negative impact on the economy and nutrition of the lakeside communities.

Epidemics Resulting from Non-Point Pollution Effects

Domestic use of water in the Lake Basin includes direct washing of utensils, laundry as well as drinking of raw and untreated water from wells, rivers and lakes. At the beaches of Lake Victoria, these activities on water use are often performed at the same site where recreational activities such as swimming and bathing take place. The waters are often heavily impacted by non point-source pollution resulting in prevalence of disease causing microorganisms such as Vibrio cholerae (causing cholera), Salmonella tiphy (the organism that causes typhoid), Entamoeba histolytica (the organism that causes amoebiasis), Escherichia coli (that cause urinary tract infections), just to mention a few of the most common.

Many unplanned or poorly planned settlements operate without sanitary facilities, and when people leave their wastes uncovered, the same is swept to the water bodies when it rains and increases the microbial loads in the waters, often with the consequence of disease epidemics.

Deforestation

Decline in forest cover

It is estimated that between 1990 and 2005, Kenya lost 5.0% of its forest cover, or around 186,000 hectares. This loss could be attributed to a number of factors, most significant of which is deforestation for access to agricultural land and settlement. To some extent there is logging for utilization of the resources as a source of livelihood. It should be clearly noted that these forests are a source of rainfall, medicinal herbs, soil-cover to protect against soil erosion, hardwood timber for economic security and habitat for our rich biodiversity. The loss of forests is a loss of a great heritage. One case study that demonstrates the danger being created by deforestation in Kenya is the Mau Forest. Box 1 below is a case study of the Mau Forest showing real non point pollution in Kenya

Decline in, or changing rainfall patterns

Local communities around the lake have noted a great change in the water levels over the years, and they blame it on the changing rainfall patterns. They can prove by recession of the waters to points they could not reach twenty or so years ago. They say this has affected the fisheries because there are certain fish species that were abundant, being transported by flooding rivers that are nowadays hard to come by.

Soil erosion and siltation in water bodies

Land use activities expose the soil to degradation and possible erosion. When the soil is eroded and carried by runoff water most of it ends up in rivers causing siltation. Siltation

Box 1:The Story of the Mau Forest in Kenya

Found in the great Rift Valley the Mau ranges, on which the Mau Forest is nested, lies in the western part of the rift. There are five main forest reserves: Eastern, Western and South-western Mau covering 66,000, 22,700 and 84,000 hectares, Trans-Mara (34,400ha) and Ol Pusimoru (17,200ha). A sixth large block, the Maasai Mau, covering 46,000 hectares, is not a gazetted forest. The Mau has deep, fertile, volcanic soils, and enjoys one of the highest rainfall levels in Kenya. Annual rainfall ranges between 1,000mm to a high of 2,000 as you move towards the west.

The forest is habited by a rare mix of animals, birds and flora and it forms the largest water catchments in the country. The forest forms sophisticated ecological system which is the source of over 12 rivers, most of which drain into Lake Victoria. Numerous streams drain the forests west of the sharp crest, forming part of the Sondu and Mara river systems, which flow into Lake Victoria, and the Southern Ewaso Nyiro system, which flows into Lake Natron. The Mau ecosystem is largest single forest jungle in East Africa with closed canopy of indigenous trees. Vegetation patterns are complex with lower montane forest below 2,300m and westwards to thickets of bamboo, which consists of forest and grassland. An aerial view depicts tight and intertwined greenery with brown patches where illegal logging, settlements and charcoal burning are taking place without the notice of forest guards or by corrupt arrangements. It is estimated that 45 bird species or more and 2,000 families live here. Mau Forest's asset base is estimated to be worth $300 million or Shs 20 billion. The current rate of forest destruction therefore has put to risk this resource. If current rate were to continue then all the water catchments, tea production and tourism are in danger of demise (Njuguna 2006).

According to the United Nations Environment Programme, Mau is an asset of national and regional importance that supports crucial sectors such as energy, tourism, agriculture and water supply. It is also the single most important water catchments in the Rift Valley and Western Kenya and the Nile basin. As some rivers drain into the Lake Victoria, there is likely to be implications beyond Kenya's borders all the way into the River Nile basin if they dry up. Domestic water supply will also be severely aggravated, spelling doom for thousands of people who depend on it. The largest inhabitants of the forest are the Ogiek or Dorobo, who have traditionally been hunter-gatherers and keepers of bees. These activities are now unregulated, thereby directly contradicting forestry and conservation policies. It is estimated by conservationists that up to a quarter of the Mau has been destroyed through encroachment, excisions, illegal logging and other human activities.

Corrupt deals in excision and allocation of forest land to political correct individuals and settlement of the landless and squatter through political patronage have seen huge chunks being awarded to individuals. There is very high pressure now from all quarters for settling human population in Kenya which has added to the problem. One of the major political excuses to illegally acquire land was the so called Nyayo Tea zones a pre text of excising forest land in the name of providing protection. Lots of tea was planted, to extend the area under this crop beyond traditional locations.

The surrounding areas are intensively farmed, with human population about twice as high on the western side of the forest compared to the East. The southwestern zone is the most affected by illegal logging. The forest is under trust land, managed by the County Council of Narok, one of the richest local authorities in the country. Most of the problems begun in 1999 when the local authority allowed group ranches, owned by the locals, to be subdivided and sold to members.

The main conservation problem in the Mau is that facing many Kenyan forests: increasing pressure on productive land from an expanding population. A particular complication in this case is the presence of the forest-dwelling Ogiek people, several thousand of whom have been evicted from the forest since the mid-1980s and are awaiting resettlement. The Ogiek may have used the forest's resources sustainably in the past, but their hunter-gatherer lifestyle was in direct conflict with forestry policy.

Moreover, immigration of other ethnic groups to the eastern edge of the forest (particularly from the densely populated western borders) has added to the number of people expecting to be resettled, and increased the pressure on forest resources. In this stalemate have come opportunistic politicians who present themselves as advocates of the landless only to acquire land for themselves, relatives and their political cronies.

Current use of the forest by local people includes (illegal) hunting (*Tragelaphus euryceros* are often pursued using dogs, and this has had a severe impact on their population), honey-gathering (forest trees are cut and debarked to construct hives), fuelwood collection and grazing. These activities, which might be carried out sustainably, are largely unregulated at present, causing further degradation and preventing degraded areas from recovering. Over 30% of forest cover in the eastern sector was lost between 1967 and 1989, and this process is continuing. The western boundary comprised of mainly small holdings or large tea estates has been more stable. Unfortunately, a number of recent excisions have, for unclear reasons, targeted areas in the west, which contain the most valuable and intact tracts of closed-canopy forest.

reduces the available water for aquatic fauna and flora, thus affecting fisheries and other uses of water. Many a times siltation has affected production of hydroelectricity, causing heavy losses.

Effect of siltation and reduction of lake levels on fish production

In addition to the effects of climate change, siltation reduces lake levels and changes fish habitat. This alters feeding and breeding areas of fish. According to Guchuki et al., (2006), most of the fish species such as Protopterus aethiopicus inhabit the littoral zones and use them for spawning. The loss of such habitats and critical zones compels the fish to relocate or they may perish. Heavy loads of silt, aggravated by deforestation, affect fisheries.

The main conservation problem in the Mau is that facing many Kenyan forests: increasing pressure on productive land from an expanding population. A particular complication in this case is the presence of the forest-dwelling Ogiek people, several thousand of whom have been evicted from the forest since the mid-1980s and are awaiting resettlement. The Ogiek may have used the forest's resources sustainably in the past, but their hunter-gatherer lifestyle was in direct conflict with forestry policy. Immigration of other ethnic groups to the eastern edge of the forest (particularly from the densely populated western borders) has added to the number of people expecting to be resettled, and increased the pressure on forest resources. Current use of the forest by local people includes (illegal) hunting (Tragelaphus euryceros are often pursued using dogs, and this has had a severe impact on their population), honey-gathering (forest trees are cut and debarked to construct hives), fuelwood collection and grazing. These activities, which might be carried out sustainably, are largely unregulated at present, causing further degradation and preventing degraded areas from recovering. It is estimated that 28% of forest cover in the eastern sector was lost between 1967 and 1989, and clearly this process is continuing. The western boundary (flanked by well-established smallholdings or large tea estates) has been more stable. Unfortunately, a number of recent excisions have, for unclear reasons, targeted areas in the west, which contain the most valuable and intact tracts of closed-canopy forest. In the Eastern Mau, forest plots were allocated in the late 1990s to a reported 28,000 settlers. This may have destroyed much of the watershed for Lake Nakuru (IBA KE049). This and other illegal encroachments are formalized in

Heavy loads of silt into a stream in the Nile Basin, leading to Lake Victoria

Destruction caused by deforestation in Rift Valley area of the Nile Basin

degazettement proposals published in February 2001 and affecting more than a quarter of the current gazetted area. The degazettement notice covers some tracts of relatively intact forest as well as recently settled areas; it will have a permanent and serious negative effect on water catchments.

Legislation and Mitigation

Several statute laws have been legislated in Kenya to try and control water pollution. Notable among these are the Water Act of 2002 and the Environmental Management and Coordination Act of 1999. These together with the Ramsar Convention have endeavoured to protect the basin from undue pollutants. Law enforcement mechanisms are however still wanting and heavy loads of pollutants are still released to the environment. Under the Water Act of 2002, every water resource belongs to the state. The government has the duty to control the use, but involves various stakeholders in the management of the resources. Water supply and sewerage is enshrined in the National Policy on Water Resources Development.

One way to mitigate non point-source pollution is to involve local communities and law enforcement personnel in implementing joint Local Agenda 21 in order to ensure sustainable development. Drainage waste water from the sugar belt can be collected in special drainage canals before they reach stream and rivers, and pumped back to an elevated point for re-use for irrigation and nutrient application to augment or supplement commercial fertilizer. Mitigation may also include filtration of storm water in street detention ponds (Han et al., 1999).

The story of Love canal (See Box 2) is a clear evidence of what happens in cases where there are no clear policies on waste management and subsequent land reclamation and land-use practices. In many countries, waste management (also referred to as cleansing) is vested in the local authorities, and every town or city is required by law to have an engineered landfill for ultimate disposal of solid and hazardous waste. As it is, there is open burning of wastes in the damp sites. It is well known that combustion of waste containing polyvinyl chloride (e.g. certain plastics) produce toxic substances in the form of dioxins, furans and polychlorinated bicarbons (PCBs). These toxins are persistent, do not break down easily in the environment and can easily be accumulated in the food chain. In most damp sites in Kenya one would always encounter mixed wastes including medical wastes. These wastes are handled by unprotected handlers and "scavengers" who risk infections.

Solid waste management

Solid waste management has not been given the attention it deserves in most parts of Kenya. With the establishment of the Ministry of Environment in Kenya, there have been changes, with some attention being given to waste collection albeit using very crude methods of collection and transportation. Solid waste poses high risks to the health of the nation and is a good contributor to non point-source pollution. In Kenya, for example, the local government authorities are not compelled by any statute or policy as a mandatory rule to have and operate landfills for solid waste management. In effect the dumping sites used are a source of high risk to the environment. The leachate from these dump sites cause pollution to the nearby rivers and lakes.

Impact of solid waste policy in reducing undesired outcome

The existing solid waste management laws are not effective in controlling generation, collection, storage, transportation, incineration and final disposal. The Local Government Act (cap 265) of 1977 vests the powers to contract out services in the Local Authorities (LAs). The licensing of the waste operators is done by National Environmental Management Agency (NEMA) subject to Environmental Management and Coordination Act of 1999. The licensed waste operators often do not have the capacity to manage the waste. Open lorries are used to transport the wastes and at the end of the day a good fraction of the waste is carried away by the wind before it reaches the dumpsite for disposal. Taxes paid to the LAs are enough to buy and maintain appropriate waste management equipment and constructing engineered landfills.

The public Health Act (Cap 242) of 1972 requires the cleansing department to facilitate provision of services. However, there are no standards to be followed in providing cleansing services and there is no involvement of the mass of the people to practice waste minimization, cleaner production and proper waste handling. Unfortunately, the general population is ignorant of their rights and would not raise an alarm when not served properly. They would rather pay extra taxes to the mushrooming waste operators to have their waste collected. To the common man in most parts of the country, especially those traveling, littering seems to be a culture.

Mitigating waste management and health delivery impacts

Even before considering the legal framework for waste management, there should be concerted efforts in promoting Environmental Education and Awareness, and the promotion of the hierarchy of solid waste management (waste minimization at source, separation, processing and/or recycling, land filling).

Several impacts of agricultural practices, dairy farming, urbanization and industrial activities on the environment have been realized in the Lake Victoria Basin. Some of these impacts stem from non-point pollution following indiscriminate application of toxic materials in the environment. Additional pollution comes as a result of run-off water system washing away agro-chemicals to rivers, lakes and subsequently the oceans, with deleterious effects on wetland habitats and biodiversity. Paragraph 1, Article 5 of the Ramsar Convention on Wetlands (Ramsar Convention, 1971) commits the signatories to the convention to coordinate and support policies and regulations concerning the conservation of wetlands and their fauna and flora. This would, in effect, also improve the general ecosystem and public health.

A solution to these and many other environmental problems lies primarily on Environmental Education at all levels, and in embracing the principles of Agenda 21 (Agenda 21, 1992) at local, national and global levels. This entails precautions as we endeavour to meet the present needs of society without compromising the ability of future generations to meet their own needs. The following points are recommended:

- A landfill for every local authority, or combined landfill for several small local authorities that can share costs;
- Classification of waste generators and operators;
- Waste separation at source;
- Improved incineration standards;
- Public awareness and periodic training of operators;
- Compliance with the Basel Convention (1989) on hazardous waste;
- Compliance with the Stockholm Convention on Persistent Organic Pollutants (POPs)

Small and medium enterprises take advantage of non existence and/or poorly enforced solid waste management policies to pollute the environment. Eventually these mixed plastic wastes are burned, releasing dioxins to the environment.

The main conservation problem in the Mau is that facing many Kenyan forests: increasing pressure on productive land from an expanding population. A particular complication in this case is the presence of the forest-dwelling Ogiek people, several thousand of whom have been evicted from the forest since the mid-1980s and are

Box 2: A Shocking Environmental Tragedy
The Love Canal Environmental Tragedy

The story of Love Canal is one of a shocking environmental tragedy. William T. Love, after whom the tragedy was later named, had a dream of creating a state-of-the-art model community on a three-block tract of land on the eastern edge of Niagara Falls in New York. Love felt that by digging a short canal between the upper and lower Niagara Rivers, power could be generated cheaply to fuel the industry and homes of his would-be model city. The construction of the canal flopped due to economic reasons after a massive ditch had been dug. Slightly over a decade later, the canal was turned into a municipal and industrial chemical **dumpsite**. Almost 50 years down the line, the Hooker Chemical Company, then the owners and operators of the property, covered the canal with earth and sold it to the city for one dollar. Soon after, there were sprawling posh homes in an exclusive community with a school, shopping, as well as recreation facilities.

Disaster was triggered by a record amount of rainfall. Corroding hazardous waste-disposal drums popped up from the ground. There was leachate everywhere: schools, homes, shops, everywhere! Vegetation was kind of chocked by chemicals. Swimming pools were filled with toxic chemicals. Everywhere in the neighbourhood the air had a choking smell. Children returned from play with burns on their hands and faces.

Later followed high rates of miscarriages and terrifying birth defects. A large percentage of people in Love Canal are being closely observed because of detected high white-blood-cell counts, a possible precursor of leukemia. The inhabitants of Love Canal were finally evacuated from their homes and their neighbourhood with the consequences of starting a new life in a strange environment.

To avoid repeats of similar stories, stringent hazardous wastes control from point of generation to their ultimate disposal, and dangerous practices resulting in serious threats to health and environment should be put in place and religiously observed.

awaiting resettlement. The Okiek may have used the forest's resources sustainably in the past, but their hunter-gatherer lifestyle was in direct conflict with forestry policy. Immigration of other ethnic groups to the eastern edge of the forest (particularly from the densely populated western borders) has added to the number of people expecting to be resettled, and increased the pressure on forest resources. Current use of the forest by local people includes (illegal) hunting (Tragelaphus euryceros are often pursued using dogs, and this has had a severe impact on their population), honey-gathering (forest trees are cut and debarked to construct hives), fuelwood collection and grazing. These activities, which might be carried out sustainably, are largely unregulated at present, causing further degradation and preventing degraded areas from recovering. It is estimated that 28% of forest cover in the eastern sector was lost between 1967 and 1989, and clearly this process is continuing. The western boundary (flanked by well-established smallholdings or large tea estates) has been more stable. Unfortunately, a number of recent excisions have, for unclear reasons, targeted areas in the west, which contain the most valuable and intact tracts of closed-canopy forest. In the Eastern Mau, forest plots were allocated in the late 1990s to a reported 28,000 settlers. This may have destroyed much of the watershed for Lake Nakuru (IBA KE049). This and other illegal encroachments are formalized in degazettement proposals published in February 2001 and affecting more than a quarter of the current gazetted area. The degazettement notice covers some tracts of relatively intact forest as well as recently settled areas; it will have a permanent and serious negative effect on water catchment.

Mitigating Agro-chemical Pollution Effects in the Nile Basin Ecosystems

Agriculture is the backbone of the Kenyan economy. The use of agro-chemicals in large-scale commercial farming for maximum profits is therefore inevitable. This should however be planned to avoid undesirable impacts on public health and the ecosystem, especially where irrigation is practiced. The negative impacts are related to nutrients (i.e. fertilizers) and biocides (generic term for pesticides and other chemicals used for killing unwanted biological organisms), with consequences on eutrophication and eco-poisoning, respectively (Pearce, 1998).

It is noteworthy that there has been a sharp decline in agricultural extension services in many parts of Kenya. For example, in Nyanza, which is the most vulnerable province as far as non-point pollution effects are concerned, there are hardly any practicing extension officers (the kind that were uniformed and interacted with farmers almost on daily basis). This scenario pre-disposes non-experts to misuse of agro-chemicals, leading to increased risks to Public Health and Ecosystems Health. Consequently, an urgent need arises for training of users, extension workers and regulators to mitigate negative impacts of agrochemicals in agriculture and livestock production. This needs to be done in collaboration with the Environment counterparts in the form of joint training workshops.

Pursuant to the established legal and operational framework comprising Best Practices, Legislation, Monitoring and Compliance, Kenya has put in place structures that only need updating with the demands of changing times and technology, coupled with political will, to ensure success.

Problems in the Livestock Sector

Law and policy in Kenya have not put in place stringent restrictions to control non point source pollution resulting from activities in the livestock sector. There are no properly designed abattoirs in most parts of the country and public health regulations concerning meat and meat processing are hardly followed. In the rural areas, for example, it is not uncommon to see a sick cow carried on an ox-cart being taken to the slaughterhouse. This is in spite of the fact that the law requires that meat must be inspected before being sold to the public. In the dairy farms there are no proper drainage systems to collect waste water for treatment. The spread of zoonotic diseases is therefore rampant.

MACRO/SECTORAL POLICIES

International Conventions on Environmental Management

Kenya is a signatory to many international and multilateral environmental agreements. However, coordination of implementation and synergy in terms of promoting conservation and national development is disparate and weak. Further the institutional arrangements in managing environmental issues are also uncoordinated. Consequently, synergy and linkages in implementation of these conventions at national and local level has been difficult. There is no common strategy for awareness raising and this leads to conflicting messages and actions by key stakeholders to the public (**Angwenyi, A.** 2006).

Macro policies at National level

Despite the fact that the UN World Headquarters of Environment-UNEP is located in Kenya, the country does not have a National Environmental Policy hence environmental management is guided by disparate sectoral legislations and degrees. The biggest oversight/omission is perhaps the lack of any direct mention of environmental protection by the supreme law of the country- the Constitution of Kenya. Section 71 of the constitution is the only section that can be vaguely associated with environmental protection. It deals with the right to life which encompasses in a farfetched manner the right to clean and healthy environment. The lack of visibility of environmental management and protection in the constitution cascades down to lack of national policy on environment (GOK (Government of Kenya) (1992). Currently the National Environment Authority is in the process of consultation with

stakeholders to formulate a national policy on environmental protection and management. Whether this will be anchored in the new constitution in order to give environment the necessary visibility and legal strength required is too early to judge but nevertheless an advocacy issue.

The custodian of Environmental Management in the country is the Ministry of Natural Resources, Environment and Mines through the National Environment Management Authority (NEMA). Currently there are 77 Acts of Parliament related to various sectors that deal with environmental management in Kenya. Most of these Acts proceeded NEMA and some have mandates that contradict NEMA's mandate and yet NEMA has no legal control over them as the Act that established NEMA is not organic hence not entrenched in the constitution and cannot supersede the rest of the Acts in matters related to environmental protection. Most of these Acts are sectoral and have been purely couched to fulfill sectoral mandates which sometimes are in a collision with international environmental laws and conventions.

Although the mother ministry that is the repository of environmental policies is the Natural Resources and Environment through the National Environmental Authority (NEMA), other Ministries such as Water, Agriculture, Local Government, Trade and Industry, private sector amongst others, also play key roles in environmental management in the country. As mentioned above these institutions have developed their own environmental protection and management statutes. Most of these statutes were couched either by their nature such as fisheries, forestry, wildlife or by function thus; agriculture, public health, industry or mining hence too specific and narrow in scope. An assessment of these institution policies on management of major issues such as solid waste disposal, water and air pollution, pesticides, and agro chemicals usage revealed major tensions in approach due to competing mandates. Some of the statutes in question include; land use, water resources, public health, disposal of hazardous waste, solid waste disposal, fisheries, forests, and radiation.

Tensions in Sectoral Policies

The Ministry Agriculture in their effort to increase yields promotes increased use of agro chemicals including fertilizers and pesticides. Being in the main agricultural zone of the country i.e. Kericho, Nandi, Kisii and Western Province tea plantations; Chemelil, Muhoroni, Awendo, Mumias and Nzioa Sugarcane plantations and Bungoma Coffee, and Trans Nzioa and Uasin Gishu coffee estates, the Lake Victoria/Nile basin has borne the brunt of non point pollution of its waters from these agro-chemicals and fertilizers through eutrophication. This has impacted on the quality of water in the basin.

Another key tension observed in this study between these Ministries on settlement of people. While the Ministry of Natural Resources and Environment has a clear mandate to conserve and reserve forests in order to purify and protect the environment, the Ministry of Agriculture is continuously under pressure (especially political pressure) to settle the increasing population. This has led to unplanned de-gazzetement and settlements in forest areas such as the Mau Ranges, Mt Elgon, Kaimosi, Kakamega forests, among others, opening up and exposing water catchments. Consequently a marked increase in soil erosion has occurred with direct effect on siltation and

Remedial measures

Table 1. Suggested remedial measure

Issue	Intervention	Responsibility
Lack of legal visibility of Environmental protection and management in Kenya's supreme law	NBI to support Environmental groups to Lobby/Advocate for the entrenchment of Environmental protection and management in the new constitution NBI to support NEMA to prepare a position paper proposing the process and procedure to entrench environment in the constitution	NEMA, NBI and Civil Society. NBI to provide financial support
Lack of harmony in statutes supporting environment	A comprehensive study be conducted to analyze all environment statutes to harmonize them	NEMA within the support of NBI and UNEP
No national environmental Policy	Work on the establishment of a national environmental policy should be accelerated and completed before the new constitution is finalized to ensure environment issues are captured	NEMA with the support of NBI and
Inadequate funding to local authorities to manage solid waste and other pollutants	The new policy and laws to provide a clear framework for funding environmental management	Ministry of Local Government and Natural Resources and Environment
NEMA is weak and poorly funded	The NEMA Act to be entrenched in the constitution and the law be amended for NEMA to raise funds by charging an environmental management levy from users thus public sector, private sector, etc.	Minister of Natural Resources and Environment
Investors do not always conduct environmental assessments and those who do are not sufficient	Penalties for not conducting and environmental assessment be made stiff in the new law	NEMA and Ministry of Trade and Industry, Agriculture and Water Resources, NBI to support this initiative too
Environmental monitoring on water quality is not sufficient and rigorous	Regularize water quality monitoring in the basin and publish results to create awareness Identify environmental threats at sub basin and district levels with participation of beneficiary communities Identify sections of the river system that do not meet the desired water quality standards and any contamination and black spots along the river system and further estimate pollution load carried by the main river streams and tributaries regularly. Generate data for general research on water and provide information to advice on the effectiveness of pollution control measures in place, and for decision making at operational and policy levels	NEMA, Ministry of Water and NBI
Lack of awareness on non point pollution and pesticide pollution	Conduct symposia at local basin level, and national level to raise awareness	NBI, Civil society and NEMA

non point pollution in the basin waters.

Solid waste disposal which is major cause of non point pollution in the country has been left for city, municipal and county councils to handle. With increasing urban populations in towns and industrial development around the lake region, the councils have been unable to dispose this waste in a sustainable manner hence resorted to dumping it in rivers or the lakes with a direct effect on water quality in the basin. Again NEMA had no legal mandate to enforce compliance to environmental standards by these institutions. The major reason why councils have failed to dispose solid waste in accordance to international standards is limited financing. Most councils are bankrupt due to underfunding or mismanagement hence are unable to invest in modern facilities for solid waste disposal.

Summary and Conclusions

There are well meaning sectoral policies which if implemented can mitigate environmental degradation and subsequent negative impacts. Those implementing the policies seem not to have the capacity to do so, either because of lack of technical knowledge or in some cases lack of funds. For example, it is common knowledge that uncharacterized commingled solid waste could have hazardous substances and cause danger to the environment when disposed of in the damp sites. In spite of this knowledge, there seem to be no effort to introduce and practice safer waste management methods. Policies on forestation have not been spared the blame either. Loss of forest cover continues unabated leading to massive soil erosion. Encroachment of the forests for human settlement and agricultural activities has continued, sometimes with the support of politicians.

Recommendations

We recommend that the macro and sectoral policies that affect environmental management be reviewed in order to tease out tensions, contradictions and duplications to make them effective. Currently the four main sectoral policies covering agriculture, lands, local government and environment have major contradictions which have allowed loopholes to be exploited by opportunists and destroyers of the environment. This review should entrench the environmental law in the constitution as an organic law which should override any other law/policy that may be in conflict. One opportunity to do this is the impending constitutional review. The bill to review the constitution is already being discussed in Parliament.

The specific policies/laws should also be revisited with an aim of stringent but civilized implementation. Involvement of stakeholders and intersectoral collaboration in formulation and implementation of policies gives them a sense of ownership and commitment to them. Public awareness and Environmental Education at all levels of the community should be encouraged. Every local authority (or a group of small but close local authorities) should be required by law to have and operate an engineered landfill for final disposal of solid and hazardous wastes. If waste management will continue to be contracted to private operators, then there should be standards to be adhered to so as to limit further littering and mitigate adverse effects on the scavenger communities.

Furthermore, policy makers and implementers could be taken on study tours to selected model authorities that have in a way succeeded. For example, certain southern African countries have managed to establish and run successful cleansing services that could be emulated and even improved on. Their policies formulations and implementation could serve as an example. Zimbabwe, in spite of economic hardships has established engineered landfills in all main cities. Unfortunately, due to the political quagmire some of the systems cannot be maintained. Botswana has maintained some of the best managed systems to date, and Tanzania is currently studying ways of improvements.

Table 2 provides more recommendations for policy interventions, highlighting the issue, intervention and who is responsible for implementation.

Acronyms

IBAs - Important Bird Areas

LA - Local Authority

NB - Nile Basin

NBI - Nile Basin Initiative

NEMA - National Environmental Management Authority

NTEAP - Nile Basin Trans-boundary Environment Action Plan

PCBs - Polychlorinated bicarbons

POPs - Persistent Organic Pollutants

UN - United Nations

UNEP - United Nations Environment Programme

References

Agenda 21, Earth Summit (1992) Rio Declaration on Environment and Development, Rio de Janeiro, Brazil, 3 to 14 June 1992, United Nations.

Angwenyi, A. (2006) National Legislation and Domestication of International Environmental Law

Gichuki, J., C. Ezekiel and F.M. Wanda (2006) Implication of a fisheries management plan for Lake Victoria: Status of the Lake Victoria Environment Trends and impact to fish stocks Project No. 8ACP ROR 029

GOK (Government of Kenya) (1992) The constitution of Kenya, (revised edition), Nairobi, Govt Printers, available at: http://kenya.rcbowen.com/constitution/ (accessed 13 August 2006)

GOK (Government of Kenya) (1999) Environmental Management and Coordination Act, Nairobi, Govt. Printers.

GOK (Government of Kenya) (1977) Local Government Act. Nairobi, Govt. Printers.

GOK (Government of Kenya) (1972) Public Health Act. Nairobi, Govt. Printers.

GOK (Government of Kenya) (2003), Environmental Impact Assessment and Auditing Regulation 2002, Nairobi, Government Printers..

GOK (Government of Kenya) (2004), Investment Programme for the Economic Recovery Strategy for Wealth and Employment Creation 2003-2007, Nairobi, revised March 2004), GOK.

Han, J.S., E.S.MiyashitaY-y. Lin and A. Rao (1999) Storm water filtration of a municipal detention pond. In: Kenaf Properties, Processing, and Products; Mississippi State University, Ag & Bio Engineering, 1999, pp471-484.

Jarvie, H.P, C. Neal and P.J.A. Withers (2006) Sewage-effluent phosphorus: A great risk to river eutrophication than agricultural phosphorus? Science of the total Environment 360(1-3): 246-253.

National Environment Management Authority (NEMA) (2002), Environmental Impact Assessment and Audit Administration and Review Manual, 2002, NEMA web site, available at: www.nema.go.ke (accessed January 2006),

National Environment Management Authority (NEMA) (2006), Draft Environmental Impact Assessment and Audit Administration and Review Manual, NEMA, Nairobi, February

Njuguna, M. (2006), A great lake on its death bed", The Daily Nation, 11 October, available at: www.nationmedia.com/dailynation/printpage.aspnewsid=85224, Vol. 2006.

Pearce, G.R. (1998) Agrochemical pollution risks associated with irrigation in Developing Countries: A Guide. Report OD 141, HR Walliford/DFID

Ramsar Convention on Wetlands (1971) Ramsar Convention Secretariat, Switzerland

The Constitution of Kenya (2008) Section 71; The right of life and clean healthy environment.

The Environmental Management and Coordination Act (1999) The Kenya Gazette, Environmental Management Act, 2000.

The Water`Act (2002) Kenya Gazette, Water Act, 2002.

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