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NATIONAL ENVIRONMENTAL
MANAGEMENT AUTHORITY

EFFECT OF CLIMATE CHANGE IN KENYA:



ADAPTATION AND MITIGATION MEASURES

"Together We Can Tackle Climate Change"

INTRODUCTION

Kenya lies within East Africa region of the African Continent and almost bisected horizontally by the Equator. Kenya covers a total territorial area of 587,000 Km² of which 11,000 Km² is covered by water. Kenya borders to the west, Ethiopia and Sudan to the north, Somalia to the east and Tanzania to the south. The country is rich in biological diversity with 35,000 known and documented species of animals, plants and micro-organisms.

1.1 Physical Features

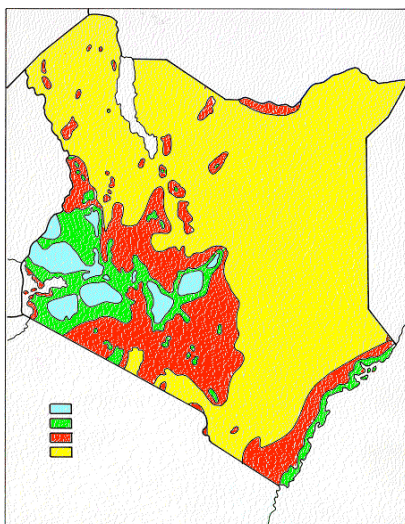
Among the important features found in the country include Mt. Kenya which is the second highest mountain in Africa rising to about 5,230m above sea level and the Great Rift Valley approximately 60km long and up to 330m deep in some areas. Although Mt. Kenya had a complete ice cap several decades ago, the ice has melted due to increasing temperatures as a result of climate change leaving only traces of glacier at present.

Other mountains include Mt. Elgon to the western and Aberdare Mountain Ranges to the eastern part of the country respectively. To the extreme left lies the Lake Victoria which is the largest fresh water lake in Africa. The country has five major water towers namely; Mau forest, Mt. Elgon forest, Aberdare ranges, Mt. Kenya forest and Cherangany forest providing a source to major rivers and drainage systems spanning the country. These basins include; Lake Victoria, Tana River, Ewaso Nyiro, Athi and the Rift Valley Basins.

2.0 VULNERABILITY TO CLIMATE CHANGE

Kenya like other countries in the world is highly vulnerable to climate change. This is because only 20% of the territorial surface area in Kenya is classified as highly potential area receiving high amounts of rainfall to support agricultural productivity. The largest part of the country comprising of over 88% of the total territorial area is arid and semi-arid lands (ASALs) with minimal annual rainfall ranging from 200-850mm. However, over 80% of the total population occurs within the potential areas while only 20% of the population occurs in the vast ASALs comprising of ecological zones III-VII as illustrated in figure 1 below. In addition, the ASALs are dominated by pastoralists supporting over 70% of the livestock in the country.

Figure 1: Ecological Zones of Kenya



Source: Pratt & Gwynne, 1977; GoK, 1992. Legend explanation:

Zone I: Afro-alpine moorland and grassland or barren land above forest line.

Zone II: Forests and derived grasslands and bush lands.

Zone III: Land of high agricultural value (intensive livestock and crop production), low forest potential.

Zone IV: Semi-humid, annual rainfall: 700 – 850 mm.

Zone V: Semi-arid, annual rainfall: 550 – 700 mm.

Zone VI: Arid, annual rainfall: 300 – 500 mm.

Zone VII: Very arid, annual rainfall: 200 – 300 mm.

The Kenyan economy is based on agricultural activities which directly employ 64% of the total population. As such, natural resources comprise major source of livelihoods for majority of the population often leading to over-exploitation, unsustainable use and environmental degradation. However, Kenya is currently facing high rate of desertification processes and environmental degradation as a result of climate change.

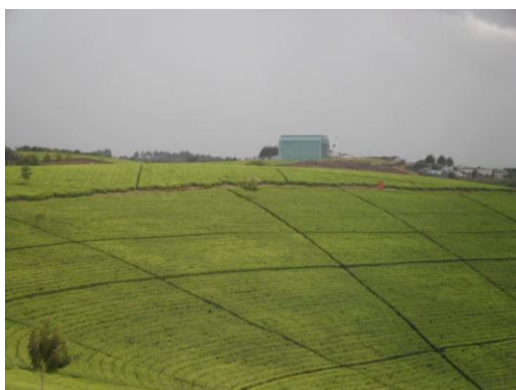
2.1 Global Warming and Climate Change

Climate change is the significant variation of expected weather patterns of an area over a long period of time. Climate change is caused by emissions of greenhouse gases into the atmosphere mainly through human activities disrupting atmospheric balance and global warming and heating of the earth's surface.

The increase in atmospheric temperatures due to emissions of greenhouse gases (GHGs) has led to global warming. The GHGs form an invisible film over the

atmosphere which traps heat leading to increasing atmospheric temperatures and global warming. This has triggered change in climate which has become a major challenge to human existence and survival. The largest contributors of GHGs include carbon dioxide and water vapour. Other GHGs include methane, nitrous oxide and other chlorofluorocarbons also exist in the atmosphere.

Climate change is caused predominantly through human induced activities especially the combustion of fossils fuels, deforestation to support both agriculture and settlements and other land use changes. It is estimated that the concentration of carbon dioxide has increased in the atmosphere from 270 ppm to 370 ppm over the past several decades. Climate is arguably one of the greatest challenges to human existence and survival. The situation has been aggravated by limited mitigation and adaptation measures thus threatening livelihoods and survival.



*Part of Kiptangat Tea farm within Mau Forest Catchment
A tea factory building can be seen from the far end.*

2.2 Effects of Climate Change in Kenya

Kenya like other countries in the world is experiencing adverse effects of climate change. Climate change has caused negative socio-economic effects across most sectors with the most vulnerable being agriculture and livestock, forestry, water, health, fisheries, energy, tourism as well as physical and social infrastructure. Some of the general adverse effects of climate change experienced in Kenya include;

- Variations in weather patterns (reduced rainfall and failed seasons)
- Frequent and prolonged droughts and diminishing water resources,
- Floods/flash floods and landslides
- Environmental degradation and habitat destruction
- Resurgence of pests and diseases
- Loss of biodiversity
- Severe famine and hunger causing food insecurity
- Resource use conflicts

Although climate change may occasionally result in positive and beneficial consequences such as high crop yield during El Nino rains, majority of the effects have an overall net negative effect likely to cause irreversible and detrimental changes to the various sectors.



Drought resistant maize crop



Dead livestock



Encroachment of forest land by human settlements



Deforestation in the Mau Forest is threatening our Water Catchment areas

3.0 ADAPTATION TO CLIMATE CHANGE

Kenya must adapt to climate change through making the necessary adjustments while putting in place the relevant mitigation measures to avert the magnitude of the effects. There is need for the country to seize the opportunities offered through Clean Development Mechanisms (CDM) and carbon trade. This will promote green economy through the use of alternative approaches in all sectors. It is on this basis that the rallying call, “***Together We Can tackle Climate Change in Kenya***” has been developed and adopted to mobilize stakeholders to address climate change at all levels.

3.1 What We Can Do to Mitigate Effects of Climate Change

Some of the recommended actions across sectors aimed at mitigating climate change are discussed:

Agriculture sector is extremely important to the economy of this country and livelihoods of its people. There is need to develop technologies and innovations that are geared towards increased food production. These include development of fast growing crops, drought tolerant crops, early maturing crops such as Katumani maize composite.

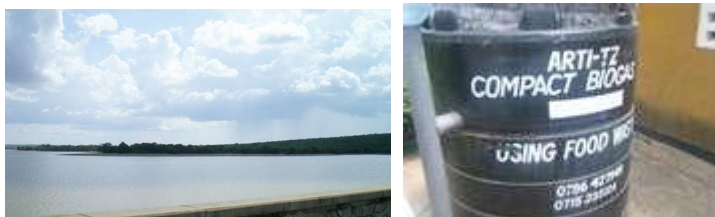
Other areas of focus include; irrigation, conservation agriculture and sustainable land management practices.

Forestry sector must upscale afforestation and re-forestation efforts in order to increase our tree cover and subsequently enhance carbon sinks.

The government has developed and gazetted farm forestry rules that require every farm to have 10% tree cover.(*Agric Act cap 318 on farm forestry rules, 2009*). This will enable the country to achieve the anticipated 10% tree cover which is the minimum requirement by the United Nation (UN) standards and also in the vision 2030.



Water sector must embrace water conservation technologies such as drip irrigation, construct water harvesting technologies such as water pans to trap storm water, recycling of waste water while reducing water wastage through leakages of burst pipes and unsustainable uses such as current car washing techniques which uses clean water from taps as opposed to recycled water.



Technologies in Renewable Energy

Health sector has equally suffered from the effects of climate change through resurgence of diseases in areas they did not occur before due to global warming. For instance, highland malaria is now common in previously cooler highlands where they could not survive before.

Increase in temperatures through global warming has created new warmer habitats that are conducive to the survival of pests and diseases.

The sector should embark on research to develop methods and strategies of prevention and cure of various diseases in such areas

Energy sector should adapt to climate change through enhanced use of alternative energies to minimize Green House Gases (GHGs) emissions and subsequently reduce global warming. The hydro-electric power generation provides the major source of energy in the country.

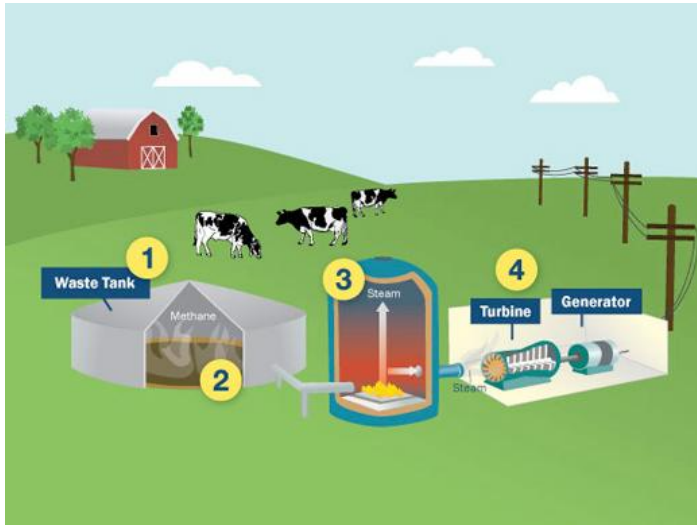
However, climate change has led to reduced amounts of rainfall and its reliability often resulting in failed seasons. The level of hydro-electric power generation in existing facilities has fallen far below the national requirements.



Solar & Geothermal renewable energy sources

Therefore, there is need for diversification in power supply and use of renewable energy sources to satisfy the national needs. These include use of alternative energy sources such as biogas, solar, wind, bagasse, geothermal, coal, improved stoves, bio-fuels as well as up-scaling the use of other renewable energy sources.

The sector should enhance public awareness campaigns on the use of alternative renewable energy sources and modern energy saving technologies.



Processes in Biogas digestion

Industrial sector is dependent on the availability of raw materials and energy for sustained production to support economic growth. However, the sector is among the leading in emissions of GHGs to the atmosphere contributing to global warming and climate change. Industries must adopt cleaner production and energy efficient technologies in industrial production. This will ensure maximum use of raw materials for production while minimizing waste generation at the end of the pipe.

There is need to promote environmentally friendly technologies and practices such as recycling and enhanced compliance to environmental regulations and standards.



Promotion of Green Energy technologies



Waste segregation & recycling in Kenya

Early warning data and information should be availed and disseminated in order to enhance disaster preparedness. The application of weather data and information is very critical in mitigation of climate change. This information guides farmers on the expected time and quantities of rainfall as well as the recommended type of crops to be planted.



Environmental disasters have escalated with occurrence of climate change which has resulted to severe effects such as flooding due to *El Nino* rains, prolonged droughts, and disease outbreaks among others. Disasters require concerted efforts of various relevant agencies in order to bring about the necessary response actions. In addition, disease outbreaks such as malaria and cholera have in the past stretched available health facilities leading to deaths. In this regard, there is need to improve the capacity and facilities to handle disasters.

The National Disaster Management Agency must enhance its coordination of other agencies during disasters in order to reduce casualties and increase survival rates. Further, there is need to enhance use of information and communication technologies in disseminating information related to any disaster in order to enhance mobilization of relevant stakeholders and actors during a disaster occurrence. Disaster preparedness must be embraced across sectors in order to ensure the availability of relevant and functional facilities. The Disaster management Centre must embrace use of early warning information in order to avert risks and minimize magnitude of the disasters.



Flooding as an effect of Climate Change in Kenya

4.0 Implementation of the National climate Change Response Strategy

The Government and other stakeholders are implementing many interventions that have direct and/or indirect relevance to climate change adaptation and mitigation. The interventions cover a wide range of sectors including: agriculture, water, energy and infrastructure. Examples include:

Agriculture: promoting irrigated agriculture, promoting conservation agriculture, value addition to agricultural products, developing weather indexed crop insurance schemes, support for community-based adaptation including provision of climate information to farmers, enhanced financial and technical support to drought resistant crops.

Livestock and Pastoralism: Breeding animals tolerant to local climatic conditions, weather indexed livestock insurance, establishment of fodder banks, documenting indigenous knowledge, provision of water for livestock and humans, early warning systems for droughts and floods, and vaccination campaigns.

Water Resources: Enforcement and/or enactment of laws for efficient water resource management, increasing capture and retention of rainwater, water quality monitoring, de-silting rivers and dams, protecting and conserving water catchment areas, investing in decentralized municipal water recycling facilities, campaigns on water harvesting, developing hydrometric network to monitor river flows and flood warning.

Forestry: Intensified afforestation, promoting agro forestry-based alternative livelihood systems, promoting alternative energy sources, community forest management, REDD+ initiatives and reduced monospecies plantation stands.

Energy: promoting the use of alternative energy including geothermal, wind, solar and mini hydro power generation; and the promotion of improved cook stoves.



5.0 Conclusion

Climate change is a cross-cutting development issue that requires high level political goodwill and support to effectively address the risks and maximise the opportunities it presents. For Kenya, adaptation to climate change remains the top priority to reduce vulnerability and enhance resilience of the social and bio-physical systems, especially the vulnerable communities and groups.

Similarly, mitigation actions that deliver sustainable development benefits are of importance as the country strives to remain a low emitter in the context of the national economic development as set out in Vision 2030. Climate smart strategies should be embraced in order to promote use of clean energy technologies for improved and sustainable livelihoods. Stakeholders should be encouraged to mainstream climate proofing and climate change responsive activities in their daily activities.

This booklet therefore informs the public on issues of climate change in the country and efforts being put in place to mitigate as well as adapt to effects of climate change.

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A truck off loads carcasses at the Kenya Meat Commission holding ground near Athi River.
PHOTO/FACE

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