Effects of Climate Change, e.g. Droughts, Flooding and Strategies to Govern these Effects with Special Reference to Kenya

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Key words: 1. Flooding 2, Drought 3, Integrated Disaster Risk Management , strategies; Famine; Inter-community conflicts; Man-made Water canals; Rainwater harvesting; Reservoirs; Soil Erosion; Sweat Equity;

1. SUMMARY

The last day of October 2019 arrived, with rains throughout Kenya. Kenya has a phenomenon of heavy rains, that brings chaos throughout the land. Lost Lives of both people and livestock, many rendered homeless and foodless. The challenges are so dire that we need to declare a state of emergency. Prior to that, we had a long spell of drought, leading to the same types of suffering and losses. I see a trend and patterns here. In both scenarios (floods and drought) we are helplessly hopeless. The nominal GDP has grown at 6%, yet we are at crisis point. In a certain language I know, crisis means danger, but it also means opportunity.... These losses adversely impact our GDP. It is estimated that easily between 2% and 4%, goes down the drain, because of the resources applied to restoration and recovery. Technically these are sunk costs, because they are replacing what infrastructure and capital was already in place. Moreover the lives of our fellow citizens and their livestock, crops, farm produce cannot be replaced. The worst hit are usually the poorest citizenry. People living on less than One Dollar per day. *They have no social safety net. See the GINI Coefficient below*. It shows that the poor are getting poorer, and their numbers increasing, some years back the extreme poverty levelwas 47% now statistics show 53%.

Being smart surveyors the opportunity is now for us to conduct studies on the environmental, economic, social and technological fronts and establish counter-measures to prevent the deaths and loss of investments. The greatest challenges for us as a developing nation are food, shelter, security and safety. Kenya's economy is agricultural. Majority of the people live in the rural areas. Of late, more and more rural folk are moving to cities and urban areas. This causes a strain on the infrastructure and public spaces, while at the same time rural areas are deprived of able-bodied people that could make a difference in agricultural productivity and production.

Strategies are needed to take measures to protect our environment, the land on which we depend for food and investments while we explore ways and means of preparing ourselves for these inevitable climate change phenomena. Schools, colleges and universities ought to collaborate with government and private sector to devise evidence based solutions that will address the following:

1. Food insecurity
2. Shelter needs as per the constitution
3. Forest cover to international standards of 10%

4. Arid and Semi Arid lands (ASAL) form 80% of our land, we need to reclaim and reforest our land.
5. Climate Change phenomenon that leads to floods, then droughts.

I seek to analyze the Cause and Effect of this strange paradox. *This conference is taking place in the Netherlands, a country that has a third of its land at 22 feet (about 6.70 metres) below Sea level.*.I am aware that during the colonial period the Mau Mau political Detainees were engaged to dig a canal from just outside Thika City to convey water to the Kitui area, it is called the Yatta Farrow, Kitui County is part of the ASAL (Arid and Semi Arid Lands) area that forms 80% of our land. Why was this just a one off, yet the need persists? With the benefit of technology and knowhow from ourselves, in collaboration with the people of Holland, and perhaps Israel and Egypt, we can have several canals constructed crisscrossing the country to harvest rainwater, store it in reservoirs or underground, and deliver it where and when it is most needed.

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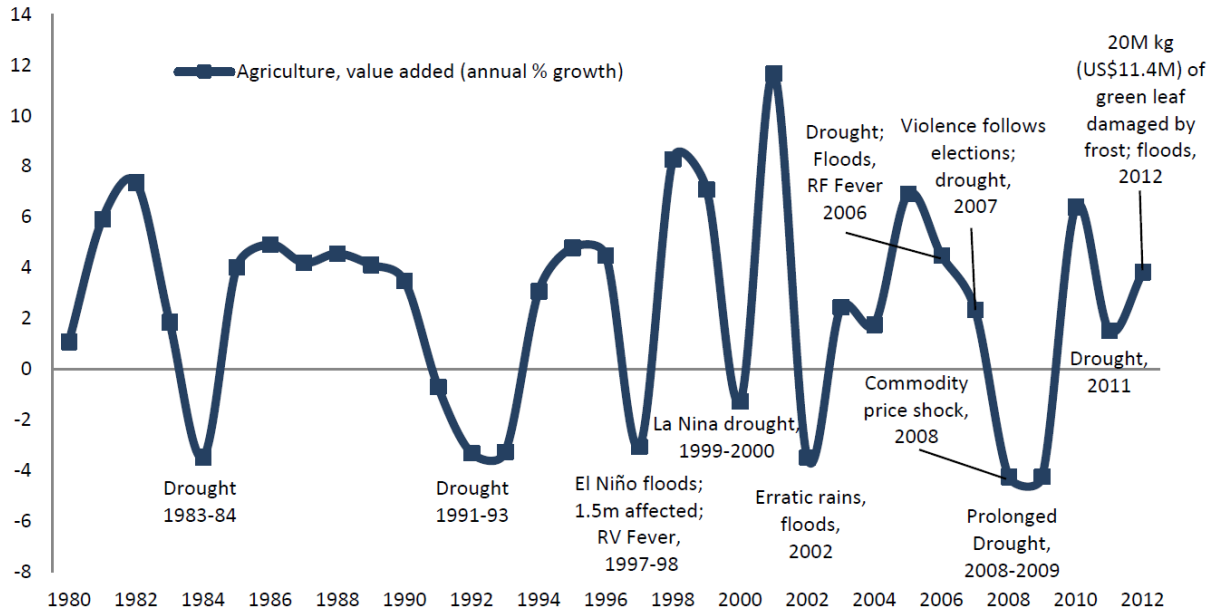
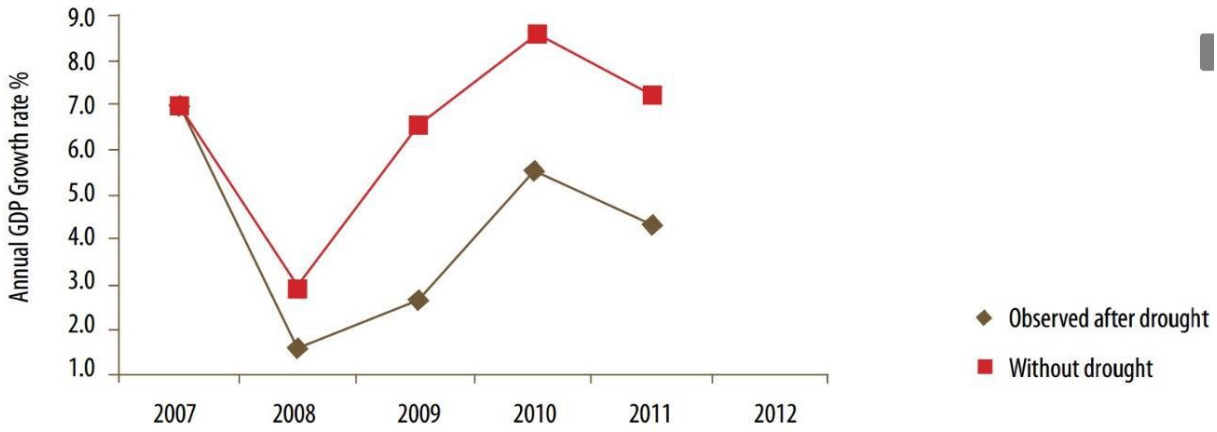
2. INTRODUCTION: BACKGROUND INFORMATION:

When we have floods or droughts, our economy behaves like this here map. Since our economy is basically agricultural we end up with negative growth and adverse economic development.

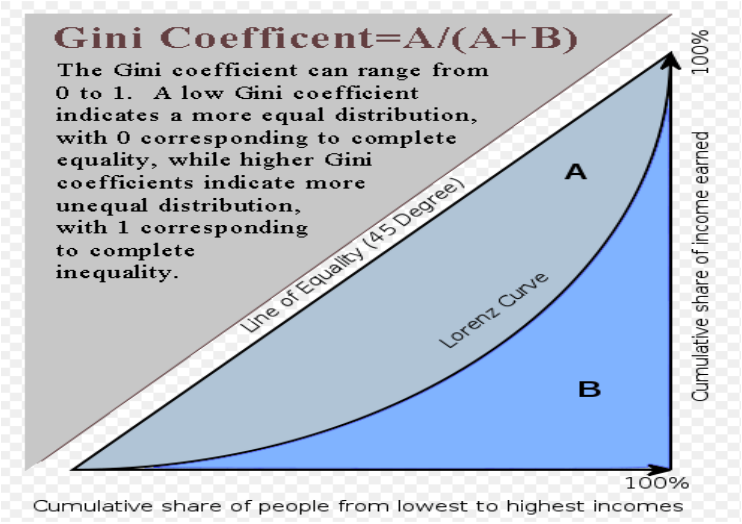


Source: The Kenya National Climate Change Action Plan 2018- 20202



Source: The Kenya National Climate Change Action Plan 2018- 20202

This same scenario obtains when there are floods, the economy suffers during recovery and restoration. It does not start from zero, but from below zero., In some cases human lives are lost. To give some perpective and context, last year, 2019 alone Kenya lost 132 people. Earlier, in May 2018, the Patel Milmet Dam, a privately owned dam located near the township of Solai, Nakuru County, in Kenya's Rift Valley, burst amid heavy rains on 9 May 2018, killing at least 48 people. This was just one incident. This matter is in court.



3. SOME EXPLANATORY NOTES

Mitigation means human interventions that seek to prevent or slow down the increase of atmospheric greenhouse gas concentrations by limiting current or future emissions and enhancing potential sinks for greenhouse gases.
Adaptation means adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities.

Adaptive capacity refers to the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences (*IPCC, 2014, Fifth Assessment Report (AR5) Glossary).*
The **carbon market** is a market that is created from the trading of units of GHG emissions. A carbon credit or offset is a financial unit of measurement that represents the removal of one tonne of carbon dioxide equivalent from the atmosphere. Carbon credits are generated by projects that deliver measurable reductions in Green House Gas (GHG) emissions. The main **greenhouse gases** that are measured in a GHG inventory are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).
Climate change means a change in the climate system which is caused by significant changes in the concentration of greenhouse gases as a consequence of human activities and which is in addition to natural climate change that has been observed during a considerable period.
Global warming refers to the gradual increase, observed or projected, in global surface temperature, as one of the consequences of climate change.
Resilience refers to the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation (*IPCC, 2014, AR5 Glossary).*
Vulnerability refers to the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. (*IPCC, 2014, AR5 Glossary).*
Republic of Kenya **Ministry Of Environment And Forestry: National Climate Change Action Plan 2018-2022; Volume I**

4. Kenya's National Climate Change Action Plan 2018-2022

Aim: To further Kenya's sustainable development by providing mechanisms and measures to achieve low carbon climate resilient development in a manner that prioritises adaptation.

Disaster (Drought and Floods) Risk Management	**Food and Nutrition Security**	**Water and the Blue Economy**	**Forestry, Wildlife and Tourism**
Reduce risks to communities and infrastructure resulting from climate-related disasters such as droughts and floods. ▪ Increase number of households and entities benefiting from devolved adaptive services ▪ Improve ability of people to cope with drought ▪ Improve ability of people to cope with floods and increase resilience of infrastructure ▪ Improve coordination and delivery of disaster risk management activities to effectively deal with drought, floods, landslides, disease outbreaks and other disasters	Increase food and nutrition security through enhanced productivity and resilience of the agricultural sector in as low-carbon manner as possible. ▪ Improve crop productivity through the implementation of climate-smart actions ▪ Improve crop productivity by increasing the acreage under irrigation ▪ Increase productivity in the livestock sector through implementation of priority climate-smart actions ▪ Enhance productivity in the fisheries sector through implementation of priority climate-smart actions ▪ Diversify livelihoods to adjust	Enhance resilience of the Blue Economy and water sector by ensuring access to and efficient use of water for agriculture, manufacturing, domestic, wildlife and other uses ▪ Increase annual per capita water availability through the development of water infrastructure ▪ Climate proof water harvesting and water storage infrastructure and improve flood control ▪ Promote water efficiency (monitor, reduce, re-use, and recycle) ▪ Improve climate resilience of coastal communities • Improve climate resilience of coastal communities	Increase forest cover to 10% of total land area; rehabilitate degraded lands, including rangelands; increase resilience of the wildlife and tourism sector ▪ Afforest and reforest degraded and deforested areas in Counties ▪ Implement initiatives to reduce deforestation and forest degradation ▪ Restore degraded landscapes (ASALs and rangelands) ▪ Promote sustainable timber production on privately-owned land ▪ Conserve land areas for wildlife

to a changing climate

Health, Sanitation and Human Settlements	**Manufacturing**	**Energy and Transport**
Mainstream climate change adaptation into the health sector; and increase the resilience of human settlements, including improved solid waste management in urban areas ▪ Reduce incidence of malaria and other vector-borne disease ▪ Promote recycling to divert collected waste away from disposal sites. Promote recycling to divert collected waste away from disposal sites. Promote recycling to divert collected waste away from disposal sites. ▪ Control flooding in human settlements Promote green buildings	Improve energy and resource efficiency in the manufacturing sector Increase energy efficiency ▪ Improve water use and resource efficiency ▪ Improve water use and resource efficiency ▪ Optimise industrial and manufacturing processes ▪ Promote industrial symbiosis in industrial zones	Climate-proof energy and transport infrastructure; encourage electricity supply based on renewable energy; encourage the transition to clean cooking; and develop sustainable transport systems ▪ Promote the transition to clean cooking with alternative clean fuels such as LPG in urban areas, and clean biomass (charcoal and wood) cook-stoves and alternatives in rural areas ▪ Increase renewable energy for electricity generation ▪ Climate proof energy and transport infrastructure ▪ Develop an affordable, safe and efficient public transport system, including a Bus Rapid Transit System in Nairobi ▪ Reduce fuel consumption and fuel overhead costs, including electrification of the Standard Gauge Railway ▪ Promote low-carbon action in the aviation and maritime sectors

Table 1: Climate risks and sources of vulnerability **Climate risks** Rising temperatures Uncertain changes in rainfall patterns Rising sea levels and stronger storm surges • Greater risk of extreme weather events (droughts, floods and landslides) • Melting glaciers • Ocean acidification		**Key sources of vulnerability** • High levels of multi-dimensional poverty, particularly in the ASALs • Gender inequality • Environmental degradation, including loss of forest cover High reliance of the national economy and local livelihoods on rain-fed agriculture • High level of water scarcity and mismanagement of water resources • Insecure land tenure and land fragmentation • Population growth and migration to urban areas • Heavy disease burden and limited access to quality health care, particularly in rural and remote areas	

Effects of climate change, e.g. droughts, flooding and strategies to govern these effects with special reference to Kenya (10499)

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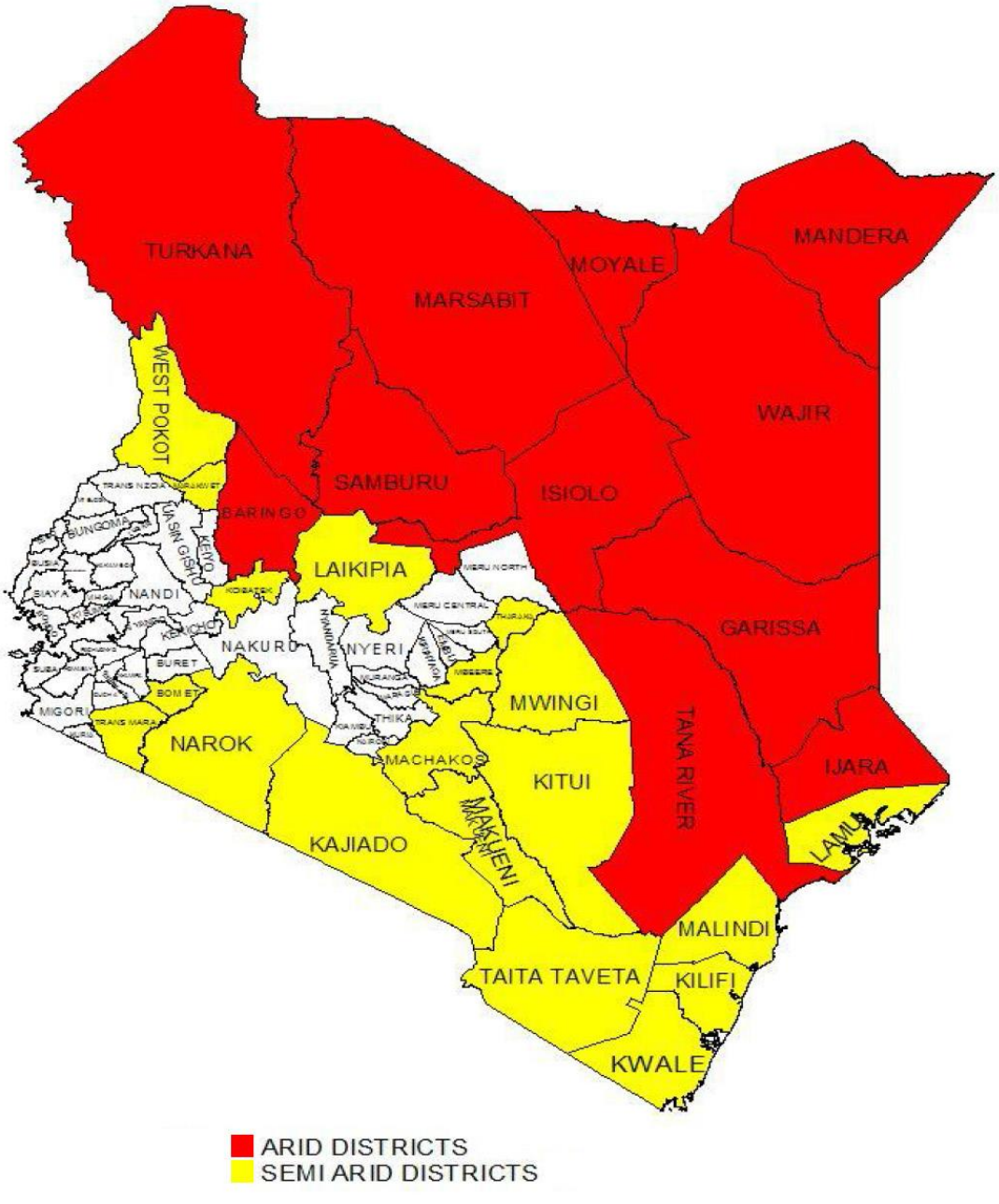
Flood-prone areas of Kenya

Source: Government of Kenya (2015). El Niño Response Plan, October 2015 to January 2016

5. METHODOLOGY – APPROACH

Desk top research: This discourse is given impetus by the various policy documents crafted by the Government of Kenya's various Ministries, Departments and Agencies. I have borrowed liberally from these documents, and I have acknowledged as such, where I have not shown it is by inadvertence, not by choice. Many parties, including the media, have written publications, albeit as news items like the Solai Dam tragedy. Government policy briefs on Climate Change are in plenty.

First hand experiences: I have spoken to many people on this matter, and they have been forthcoming and forthright in sharing their own views on the various aspects of the Climate Change phenomenon and how it impacts the Kenyan society. In December 2019 and January 2020 I had discussion at length, with an expert geographer, who also happens to be a former long serving director at the premier tobacco company, and, by coincidence, is a farmer along the Yatta Farrow. His rich knowledge and understanding of Kenya's terrain, affirms the possibilities of designing and constructing canals from the various points of plenty like rivers, lakes and dams on the one hand, to the points of scarcity, like the 80% of Kenya's North Eastern Region, which arid and at best semi –arid.



6. FINDINGS – RESULTS

Income distribution in Kenya is adverse against the poor, the rural folk and the women.

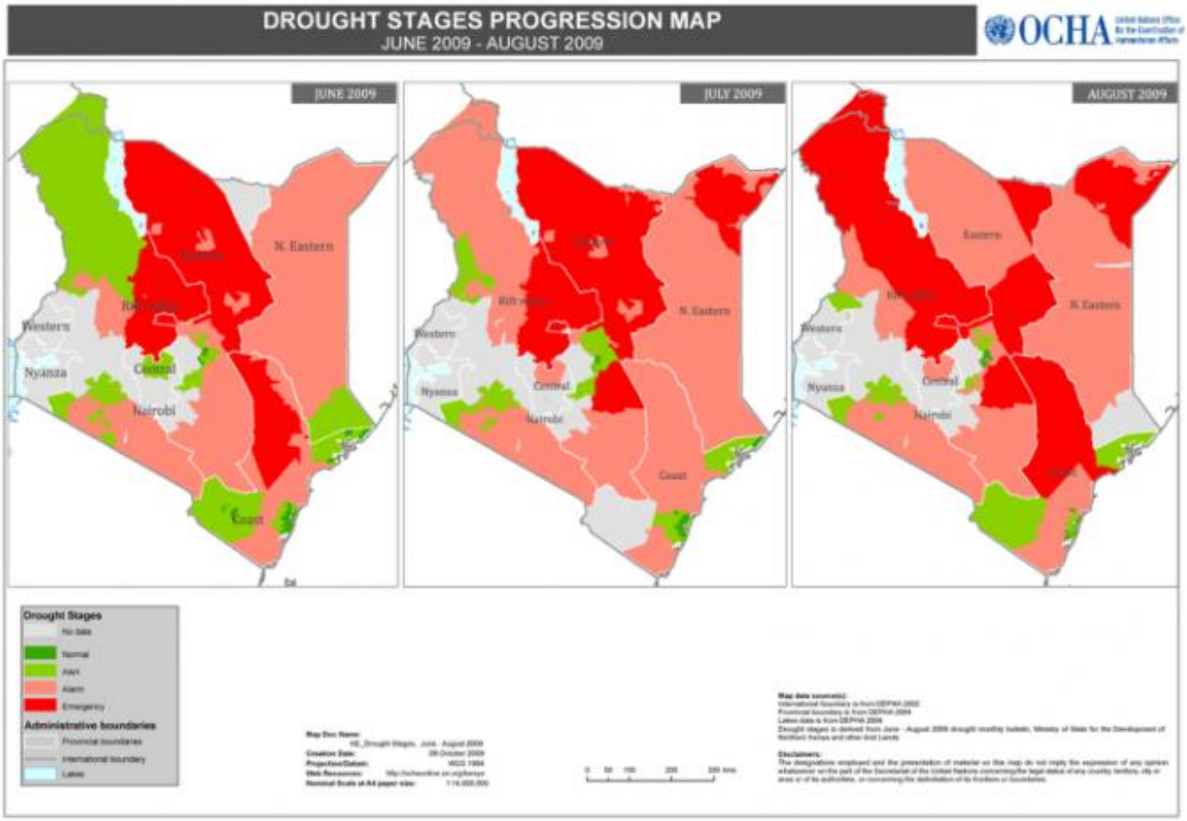
7. Strategic Objective 1**: Reduce risks to communities and infrastructure resulting from climate-related disasters such as droughts and floods.**

Issue/problem: Floods and drought have national economic consequences and extensive socio-economic effects at the household and community levels, especially for vulnerable groups, such as women, older members of society, persons with disabilities, children, youth, and members of marginalised and minority communities. Current responses are reactive rather than proactive, and impeded by inadequate early warning systems, lack of disaster management coordination, and limited support to build disaster preparedness.

Big 4 Pillars: Linked to Food Security, Health, Manufacturing, Housing
Sustainable Development Goals (SDGs): 1 – No poverty; 2 – Zero hunger; 3 – Healthy lives; 4 – Education; 5 – Gender equality; 6 – Sustainable water management; 8 – Sustained economic growth; 9 – Resilient Infrastructure; 10 – Reduced inequalities; 11 – Sustainable communities; 13 – Climate action

National-level Indicators:

- Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population
- Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national strategies
- Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national strategies
- Number of households receiving food aid and cash transfers



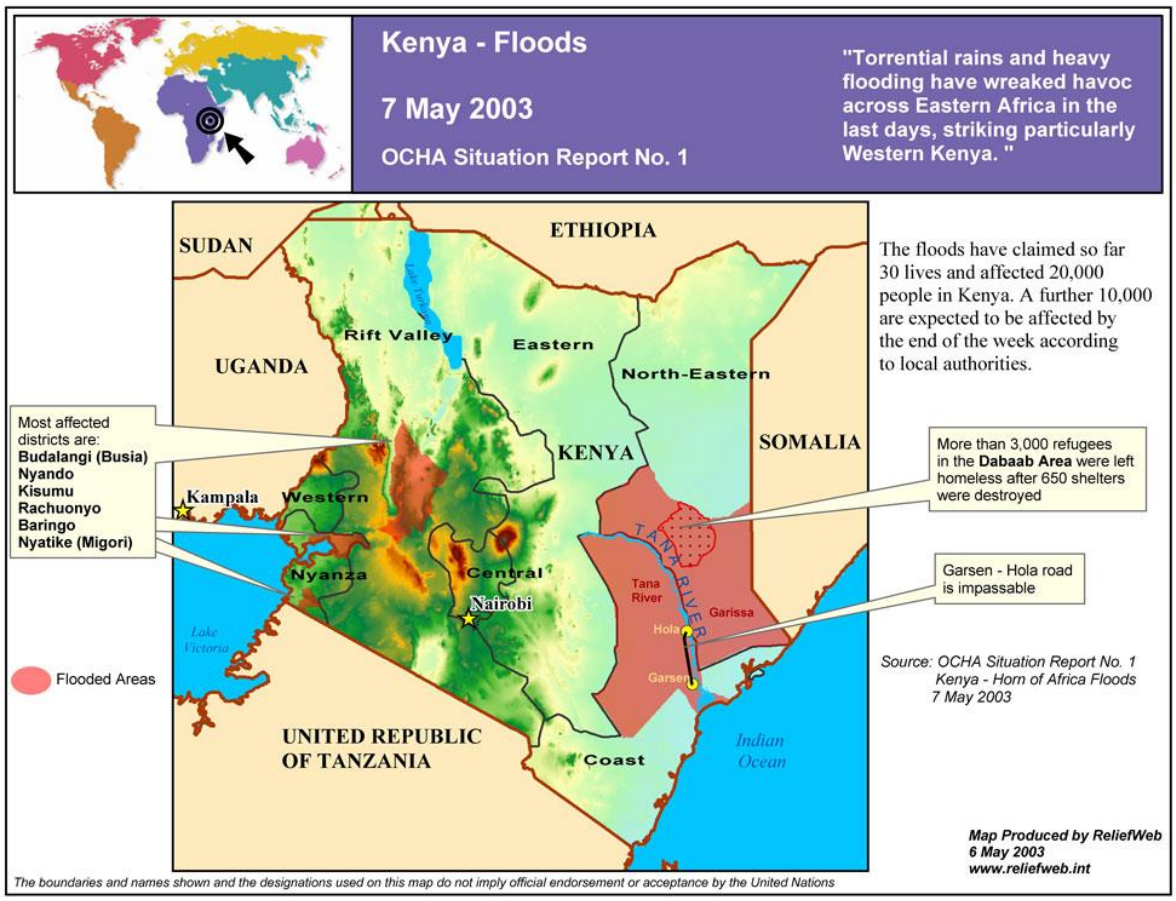
8. **Strategic Objective 2: Increase food and nutrition security by enhancing productivity and resilience of the agricultural sector in as low carbon manner as possible**

Issue/Problem: Climate change is negatively impacting agricultural productivity and resilience of value chain actors, including households. An increase in the severity and frequency of climate change-related disasters such as droughts and floods poses threats to food security and negatively impacts small-scale and large-scale farmers, pastoralists and fisher communities.

Big 4 Pillar: Food Security
Sustainable Development Goals (SDGs) : 2 – Zero hunger; 1 – No poverty; 5 – Gender equality; 10 – Inequality reduction; 12 – Sustainable consumption and production; 13 – Climate action; 15 – Life on land

National-level Indicators:

- Gross Domestic Product (GDP) growth of agricultural sector
- Livestock deaths from drought / number of livestock slaughtered attributable to drought
- Agricultural land under irrigation (acreage)
- Green House Gas emissions in the agriculture, forestry and other land use sectors



9. Strategic Objective 3: Enhance resilience of the blue economy and water sector by ensuring adequate access to and efficient use of water for agriculture, manufacturing, domestic, wildlife, and other uses.

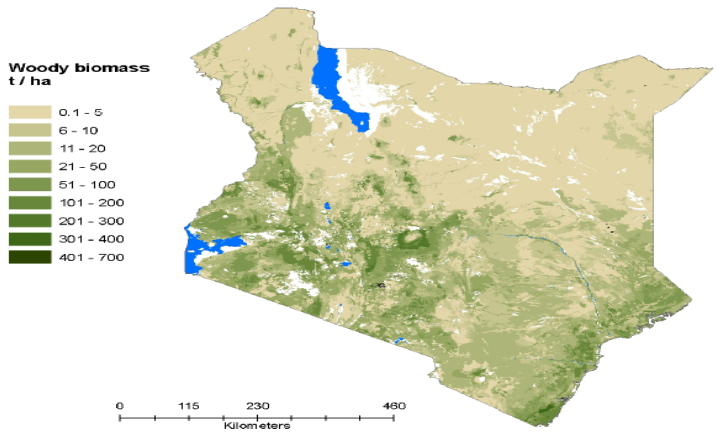
Issue/problem: Access to and quality of water is expected to decline because of climate change (such as drought and reduction of glaciers). Coastal areas are impacted by sea level rise, storm surges, increasing ocean temperatures, and ocean acidification.

Big 4 Pillars: Food Security, Health, Affordable and Decent Housing, and Manufacturing

Sustainable Development Goals (SDG 6): Clean water and sanitation; 14 – Life below water; 1 – No poverty; 2 – Food security and nutrition; 3 – Good health; 9 – Sustainable Infrastructure; 10 – Inequality reduction; 12 – Sustainable consumption and production

National-level Indicators:

- Water storage per capita
- Water coverage
- Per capita water availability
- Coverage of protected areas in relation to marine area



10. Strategic Objective 4: **Increase forest/tree cover to 10% of total land area; rehabilitate degraded lands, including rangelands; increase resilience of wildlife.**

Issue/Problem: Unplanned development (such as agricultural expansion, settlement, and infrastructure development) and reliance on biomass for cooking leads to deforestation

and forest degradation, with negative impacts on wildlife and increased Green House Gas emissions.

Big 4 Pillar: Food Security

Sustainable Development Goals (SDG) 15 – Life on land; 5 – Gender Equality; 6 – Sustainable Water; 7 – Sustainable Energy; 13 – Climate Action
National-level Indicators

- Forest cover as a % of total land area
- Area of land used for private forestry
- Proportion of land that is degraded over total land area
- Elephant and other wildlife deaths as a result of drought

11. Strategic Objective 5: **Mainstream climate change adaptation into the health sector; and increase the resilience of human settlements, including improved solid waste management in urban areas**

Issue/problem: Kenya's improvements in malarial control, water-borne diseases, respiratory diseases, infant mortality and malnutrition are vulnerable to set backs from climate change. Inappropriate waste management can have negative health impacts and contribute to Green House Gas emissions.

Big 4 Pillars: Linked to Health and Housing

Sustainable Development Goals (SDG) 3 – Good Health; 5 – Gender Equality; 6 – Clean water and sanitation; 9 – Sustainable Infrastructure; 11- Sustainable Cities; 12 – Sustainable consumption and production; 13 – Climate Action

12. Strategic Objective 6: **Promote energy and resource efficiency in the manufacturing sector**

Issue/Problem: Resource (including water, electricity, and other inputs) scarcity because of climate change; and inefficient energy use in the manufacturing sector (such as charcoal production and cement production) increases Green House Gas emissions
Big 4 Pillar: Manufacturing

Sustainable Development Goals (SDG) 9 – Industry, innovation and infrastructure; 1 – Zero poverty; 3 – Good health; 5 – Gender equality; 6 – Clean water and sanitation; 7 – Affordable and clean energy; 10 – Reduce inequalities; 12 - Responsible consumption and production; 13 – Climate action; 15 – Life on land
National-level indicators
Big 4 Pillar: Manufacturing
Sustainable Development Goals (SDG) 9 – Industry, innovation and

infrastructure; 1 – Zero poverty; 3 – Good health; 5 – Gender equality; 6 – Clean water and sanitation; 7 – Affordable and clean energy; 10 – Reduce inequalities; 12 - Responsible consumption and production; 13 – Climate action; 15 – Life on land

National-level indicators

Big 4 Pillar: Manufacturing
Sustainable Development Goals (SDG) 9 – Industry, innovation and infrastructure; 1 – Zero poverty; 3 – Good health; 5 – Gender equality; 6 – Clean water and sanitation; 7 – Affordable and clean energy; 10 – Reduce inequalities; 12 - Responsible consumption and production; 13 – Climate action; 15 – Life on land

National-level indicators

- Green House Gas emission reduction by adoption of energy efficiency and energy conservation practices
- Number of industrial parks adopting waste diversion practices

13. Strategic Objective 7 a**: Ensure an electricity supply mix based mainly on renewable energy that is resilient to climate change and promotes energy efficiency; encourage the transition to clean cooking that reduces the demand for biomass.**

Issue/Problem: Renewable and affordable electricity supply with low Green House Gas emissions needs to increase to meet the demands of a growing population and industrialising nation. 70% of Kenyans depend on biomass for primary energy most of which is non-renewable. This leads to indoor air pollution, deforestation, and Green House Gas (GHG) emissions.

Big 4 Pillar: *linked to Food and Nutrition Security, Manufacturing, Health and Affordable Housing*
Sustainable Development Goals (SDG) 7 – Affordable and clean energy, 1 – End poverty; 2 – Food security; 3 – Health; 5 – Gender equality; 8 – Sustainable growth; 9 – Resilient infrastructure; 11 – Sustainable cities; 13 – Climate action, 15 – Sustainable forests

National-level Indicators:

Renewable energy share in the total electricity generation mix - %
▪ Households using biomass for energy - %
▪ Proportion of households using LPG - %
▪ Freight moved by rail - %

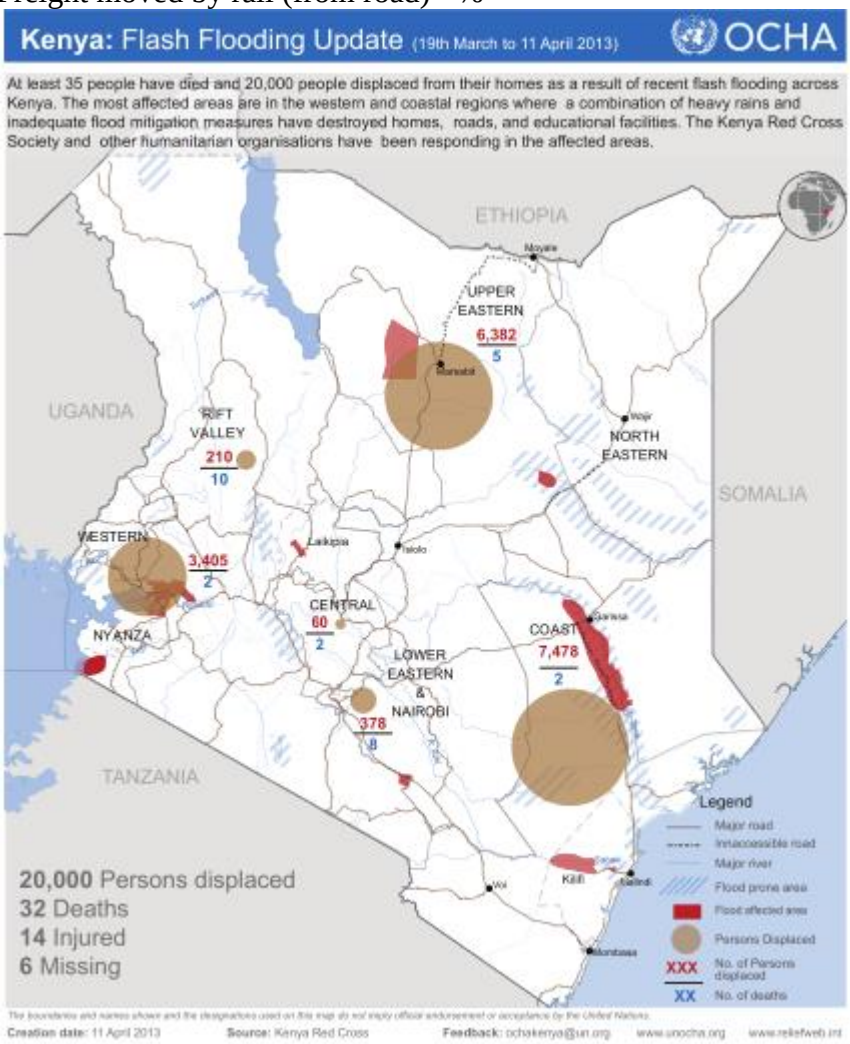
Strategic Objective 7 b:

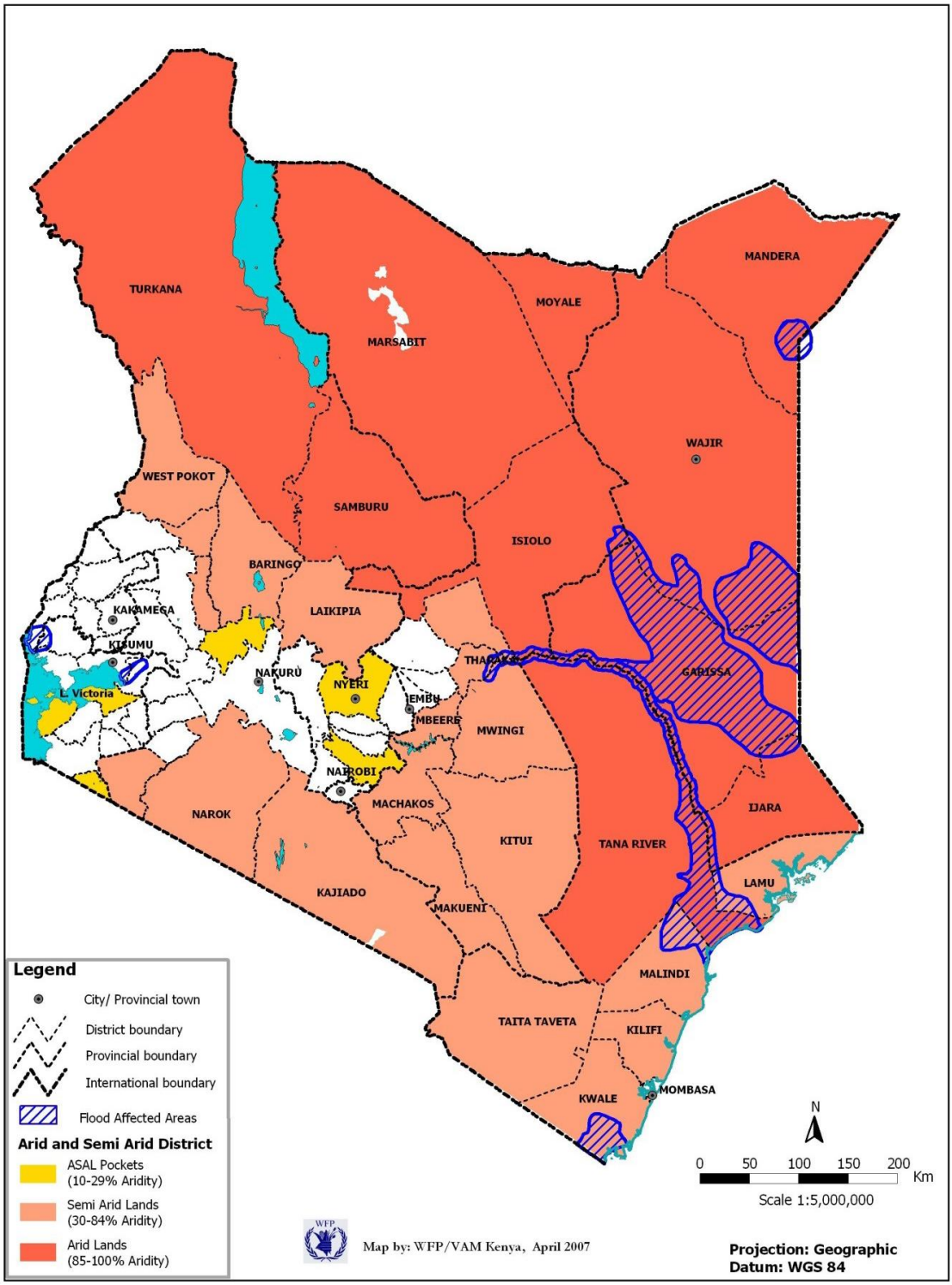
Establish efficient, sustainable world-class transport systems and logistic services that can withstand the expected impacts of climate change

Issue/Problem: Operational inefficiency, heavy traffic congestion, heavy fuels, and high fuel consumption lead to high levels of Green House Gas Emissions.
Big 4 Pillar: Manufacturing, Food and Nutrition Security, Health
Sustainable Development Goals (SDG) 9 – Industry, innovation and infrastructure, 1 – Zero poverty; 3 – Health, 7 – Sustainable cities and communities, 10 – Reduced inequality; 12 – Sustainable consumption and production; 13 – Climate action

National-level Indicator:

Freight moved by rail (from road) - %





Source: World Food Programme/VAM Kenya, 2007 as seen on the Logistics Capacity Assessment homepage

14. CONCLUSION – IMPLICATIONS

The Government of Kenya is alive to the climate change phenomenon. She crafted the National Climate Change Response Strategy in 2010. She then followed up with the creation of a National Climate Change Task Force, which led to the Climate Change Act of May 2016, this led to the National Climate Change Action Plan 2018-2022. The Legislation led to the formation of the Climate Change Council chaired by His Excellency the President and Commander in Chief of the Kenya Defence Forces; The Deputy President deputizes; under the Council is the Directorate of Climate Change, which is expected to craft the Regulations so as to operationalize the Climate Change Act 2016, and this is in process.

While there is every effort to prepare for the inevitable Climate Change, with the best will in the whole world, the intent could be swallowed into the bureaucratic red tape. There is the Council headed by our President himself, then there is the Directorate headed by the Director, but answerable to the Principal Secretary responsible for the Environment, all this makes it top heavy. This scenario renders it to be slow

There is growing discontent among the population especially the youth and their parents due to unemployment. In many instances, parents or guardians sell their assets, be it land or livestock or any other valuables so that they can pay for their children's or charges' schooling. So when they graduate from college and have no jobs, they should be encouraged to start their own business but this requires incubation.

With such a low forest tree cover there lies the potential for youth employment, with their abundant energy and imaginative creativity they could apply these attributes towards nation building, by planting trees. The corollary is that they get idle, watch television and/or meet at the market place, come across some very radical ideas, which can lead to undesirable and dangerous activities of insecurity. Radicalization does not grow on trees. In our case, radicalization is mainly society made.

15. RECOMMENDATIONS

1. Plant more trees, not just on special occasions but make a programme for the many young men and women who are idle to plant trees and adopt them as a matter of national urgency, importance and national ethos.
2. Desist from constructing huge dams which serve only the surrounding community, and cost so much money most of which is diverted. Examples – Arror, Kamwerer, Itare, each of these was estimated to cost upwards of 20 Billion Kenya Shillings. None of the three has been completed but the

budget has been exhausted. Even the Turkwel Gorge Dam though completed its financing was questionable.

3. More awareness and education on sustainable development principles and best practices in environmental conservation. Some specific adaptation actions include:

• producing and promoting of drought tolerant, diseases and pest resistant as well as early maturing crop varieties,

• promoting orphan crops, e.g. sorghum, cassava, pigeon pea, sweet potato,

• promoting agricultural produce post-harvest processing, storage and value-added,

• breeding of animals from various agroecological zones that adapt well to climatic variances.

• providing special livestock insurance schemes to spread and transfer risks arising from climate change.

Surveyors to map out the whole country's terrain, in order to determine and establish all the valleys and mountains that can be excavated or back-filled to create canals and water catchment areas, and to create reservoirs.

- Engineers to collaborate with Surveyors to conduct a land surface survey of the whole country, perhaps done in blocks and phases, so as to determine the terrain and then design the canals. If it was done then, when we had our colonials masters, why not now when we are more educated, and technology is at our finger tips, and we are masters of our own destiny.

  All households to practise rainwater harvesting. It becomes a requirement of building plans approvals that they must include rain water goods and tanks
  Surveyors and Engineers to scout, design and develop more water reservoirs, especially in the arid and semi arid areas and channel all the water that always runs away into the Indian Ocean or flows to Lake Victoria and onwards to the River Nile

16. ACKNOWLEDGEMENTS

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d. Ministry of Agriculture
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