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BIODIVERSITY VERSUS NATIONAL DEVELOPMENT: ANALYSIS OF KENYA'S SOCIAL- ECONOMIC TRAJECTORY AS A THREAT TO BIOLOGICAL DIVERSITY

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“Biodiversity is a valuable asset, which if appropriately leveraged, will provide most solutions to impacts of climate change and other social hardships.”

Dr. Eliud Kiplimo Kireger Director General, Kenya Agricultural and Livestock Research Organisation

Abstract

Over the years, human activities have posed the greatest danger to biodiversity that has led to the extinction or near extinction of several species. Across the globe biodiversity loss is becoming a common phenomenon and this is significantly noted in the developing countries where the impact of this trend falls heavily on poor and vulnerable people because their livelihood depends profoundly on natural resources. It is possible that unknown species could as well have been lost through man's interference with biodiversity. Man needs to co-exist with biodiversity for his own good because by destroying this unmatched resource, man is subjecting himself to a slow and painful death. This paper will focus on Kenya and its key contention is that man can lead a dignified life without necessarily destroying or degrading biodiversity and this is possible through sustainable exploitation of terrestrial and marine resources.

The paper will zero in on three of the country's major infrastructure projects whose implementation has had negative impacts on biodiversity. These are the Standard Gauge Railway (SGR), the Lamu Coal Power Plant and sand harvesting in Kwale County for construction of a major oil terminal at the port of Mombasa. Before these projects were initiated, biodiversity was still under threat in Kenya from various other human interventions. But it is the scale of these mega projects that has accelerated the rate of biodiversity degradation and destruction in the country. Other than not implementing projects that harm the environment, the least that could be done is that ventures that

contribute to, or worsen biodiversity loss should be “nature-proofed” as mitigation against loss of biological diversity because when biodiversity is lost, human development cannot take place. Indeed, such loss can lead to the end of man’s life on earth as we know it today.

Only 15% of Kenya’s land area is arable with the remaining portion being arid and semi-arid. Tree cover is less than the internationally recommended 10% of national territory while water bodies are faced with pollution among other threats. To cap it all, Kenya has also been affected by negative impacts of climate change. All these factors have a bearing on the survival of biodiversity and hence measures should be put in place to ensure that anthropogenic factors do not exacerbate an already precarious situation by contributing to biodiversity loss.

Key words: Biodiversity, ecosystem, environment, Kenya, sustainability

Introduction

The Convention on Biological Diversity (CBD) defines biodiversity as “...the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems” (CBD, 1992). It is the sum total of all terrestrial, marine and other aquatic ecosystems, species and genetic diversity (FAO, 2018). It can also be defined as the variability of all forms of life on Planet Earth, i.e numbers of diverse species, genetic distinction between and within species as well as the degree and range of natural habitats and ecosystems (ICMM, 2019; Roe *et al.*, 2019)

Kenya has the dream of becoming a Middle Income Country by the year 2030 and it has adopted several policies to guide it towards this goal. Through blueprints such as Vision 2030 and the Big Four Agenda, the country has initiated large scale infrastructure projects, which in the process of being implemented, have led to the loss or degradation of biodiversity. Vision 2030 was launched in 2007 and it laid down strategies on how to propel Kenya into a Middle Income Country by 2030 while the Big Four Agenda was inaugurated in December 2017 and focused on manufacturing, universal health care, affordable housing and food security, all of were scheduled to be attained by 2022.

The impacts of these projects will be analysed against the background of Kenya’s avowed commitment to protection of all forms of environmental resources through legal, regulatory and policy frameworks. Since the Government of Kenya is the “key destroyer” of biodiversity in this context, it has the moral obligation to ensure that the essentials of human existence are not extinguished in the name of development.

Materials and Methods

Material for this discussion was sourced from official policy documents of the Government of Kenya, United Nations (UN) agencies and other international organisations, Non-Governmental Organisations (NGOs), journals, desk-top research and observation.

Results and Discussion

Importance of Biodiversity to Mankind

Goods and services provided by biodiversity are relied upon by all humans on earth and without them life on Planet Earth would literally come to an end. These critical resources range from food, water, air, energy, among many others. The goods and services are broken down into four broad realms:

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| i. | Provisioning services | food, fresh water, medicines, forest products |
| ii. | Regulating services | surface water purification, carbon storage and sequestration, climate regulation |
| iii. | Cultural services | sacred sites, recreation areas |
| iv. | Supporting services | soil formation, nutrient cycling, pollination |

Mankind depends on biodiversity for everything and therefore it is fundamental to ecosystem health, essential to the sustainable increase of food production and indispensable to building resilient livelihoods (FAO, 2018). Indeed, biodiversity "...is the essential infrastructure that supports all forms of life on Earth..." (Paşca-Palmer, 2019).

Additionally, it plays a significant role in the cultural life of some people who, for example, use forests as shrines and places of worship. This religious-cultural dimension of forests means that the concerned communities are inextricably connected to biodiversity which becomes part of their identity, spirituality and way of life (Billé *et al.*, 2012). The communities consider these places sacred and protect them at all costs and as such governments must always involve the local people whenever they want to initiate projects where such assets are located. When these assets are degraded or destroyed in the name of "development," it literally means that part of the community is "dead."

The most recent example in this regard is the destruction of the 46,000-year-old sacred Aboriginal sites at Pilbara in Western Australia in May 2020 by Rio Tinto, the largest iron mining company in the world. The caves were destroyed so that Rio Tinto could access 8 million tonnes of high-grade iron ore valued at \$104 million that the caves were sitting on. The Juukan Gorge shelters were among the oldest historic sites in Australia, and their callous destruction caused great distress to the Aboriginal community. The caves were flattened despite opposition from Aboriginal community leaders. (*BBC News*, 03/03/2021)



The Juukan Gorge cave sites in Western Australia, before and after the destruction.
Courtesy: AFP

Biodiversity has a critical role in the entire well-being of mankind and indeed its importance features prominently in the Sustainable Development Goals (SDGs) {UNDP, 2016}. Biodiversity is concentrated in tropical forests where 70% of plant and animal species are found and it is in the tropics where biodiversity is facing the greatest threat of extinction (USAID, 2017). The tropical regions offer a conducive environment for diverse species to flourish.

Biodiversity Loss

Biodiversity loss is one of the major environmental threats that humanity is facing today though its impact is felt more among the world's poorest people who cannot easily adjust to its consequences as they have limited access to alternatives than using natural resources for livelihoods (SciDev.Net 19/06/2013). The fact that they rely heavily on natural resources for their existence reinforces the contention that they bear the brunt of biodiversity loss (Billé *et al.*, 2012; World Bank, 2014; UNDP, 2017). The alarming pace of biodiversity loss today

threatens devastating consequences for mankind if it goes on unrestrained. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), up to one million species face extinction, a phenomenon that has never been experienced before in human history (IPBES, 2019). With time, changes to the climate may be reversible but unfortunately extinction of species through biodiversity loss cannot be reversed (FAO, 2018).

Biodiversity loss is considered in terms of species, ecosystems and genes. It is brought about mainly through deforestation that is noted in the tropics, with an annual deforestation rate of 13 million hectares of forestland affecting important animal and plant habitats. Deforestation and subsequent changes in land use contribute to 25% of global greenhouse gas (GHG) emissions – a major contributor to climate change.

Loss of these precious resources can also come about through destruction of habitats, overexploitation of natural resources, the spreading of invasive alien species, climate change and population pressure (UNEP, 2018). The loss of biodiversity is manifested in increasing impacts on the provision of ecosystem goods and services like clean water, food as well as protection from environmental calamities, all of which are significant for human well-being and green growth (World Bank, 2014). Resource exploitation can have long-term negative impacts on the health of the ecosystem and its ability to provide food, timber, energy and other resources.

Over half of the world's population depends on agriculture for their livelihood and continued destruction of agro-biodiversity will have harmful impacts on food security and nutrition (World Bank, 2014; UNDP, 2019). It is because of this that sustainability must be embedded in all human endeavours such as agriculture, forestry, grassland management and the fishing industry (Hay-Edie and Bulus, 2017).

Disruption of water supply, food security and resilience to extreme events are some of the negative consequences of loss of biodiversity (World Bank, 2019). Loss of biodiversity undermines the ability of the ecosystem to function effectively and efficiently, consequently weakening nature's capacity to guarantee mankind a healthy environment (Roe *et al.*, 2019). Biodiversity loss and ecosystem change harm human health and well-being, which may include, among other factors, increased risk of emergence or spread of infectious diseases in animals, plants and humans (UNDP, 2017). Significantly also in the context of the contemporary world, a degraded ecosystem has less resilience to climate change and other disturbances.

The Kenyan Context

Kenya is globally recognised as a country that is rich in biodiversity with over 35,000 species of flora and fauna (IEA, 2011; NEP, 2013). Among other things, Kenya's National Environment Policy (NEP) advocates for "... *sustainable utilization and bioprospecting of biological resources in accordance with international law*". Most of Kenya's population of 47 million people live in the rural areas and 46% of them live below the international poverty line of less than \$ 2 a day and as such they are severely affected by biodiversity degradation (UNICEF, 2018). The reality becomes clearer when reference is made to forest-based indigenous communities that derive their livelihoods from forests and their collective resources which in themselves are among the most threatened with degradation and eventual loss by anthropogenic activities. According to the Government of Kenya, the key drivers of biodiversity loss in the country are "...land degradation, climate change, pollution;

unsustainable harvesting of natural resources, unsustainable patterns of consumption and production, and introduction of invasive and alien species” (NEP, 2013).

Kenya’s Commitment to Conservation of Biodiversity

The country has a number of legal, regulatory and policy frameworks that touch on biodiversity as a sign of its commitment to conservation of this vital resource. It is also a signatory to many international conventions, treaties and agreements that are central to environmental sustainability and sustainable development. The following section will focus on a few of these documents.

National Instruments

1. The Constitution of Kenya, 2010 – The Supreme Law of Kenya declares that “The State shall protect and enhance intellectual property in and indigenous knowledge of, biodiversity and the genetic resources of the communities; protect genetic resources and biological diversity and eliminate processes and activities that are likely to endanger the environment (Part 2, Section 69 I).

2. National Biodiversity Strategy and Action Plan – This was adopted in 1998 and its objectives are to:

- a. Promote the sustainable utilization of biodiversity products.
- b. Create an enabling environment for biodiversity conservation by improving national capacity and strengthening regulatory mechanisms.
- c. Promote awareness in biodiversity conservation.

3. Environmental Management and Coordination Act (EMCA), 1999 – It gives specific measures to be taken in conservation of biodiversity, and especially resources that are facing extinction (Part V, Section 50-52).

4. Vision 2030 – It was inaugurated in 2007 as the social-economic blueprint to propel Kenya to Middle Income Status by 2030. Among other things, it states that “The country will intensify conservation of strategic natural resources (forests, water towers, wildlife sanctuaries and marine ecosystems) in a sustainable manner without compromising economic growth” (Chapter 4, 4.6).

5. Climate Change Act, 2016 – it advocates for incentives to persons “...who encourage and put in place measures for the elimination of climate change including reduction of greenhouse emissions and use of renewable energy” (Part VI, 26, 1 {a}).

6. Energy Act, 2019 – it states that the Government shall promote “...the development and use of renewable energy technologies, including but not limited to biomass, biodiesel, bio-ethanol, charcoal, fuel wood, solar, wind, tidal waves, hydropower, biogas and municipal waste.” Part IV 75 (I).

International Instruments

1. UNESCO World Heritage Convention, 1972 – Calls for states to ensure the “...identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage...” within their territories (Article 4). Such sites must therefore be protected by states and not be subjected to degradation or destruction in the name of development. Kenya ratified this Convention in June 1991.

2. Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region, Nairobi, 1985 – also known as the Nairobi Convention, it demands that “The Contracting Parties shall take all appropriate measures to prevent, reduce and combat **environmental** damage in the Convention area, in particular the destruction of **marine and coastal** ecosystems, caused by engineering activities such as land reclamation and dredging.” (Article 12) As the host to the Convention, Kenya, by default, assented to its provisions.

3. Convention on the Protection and Use of Trans-Boundary Watercourses and International Lakes, 1992 – It calls upon states “To ensure conservation and, where necessary, restoration of ecosystems.” (Part 1, Article 2 (d) Being a country that has transboundary water resources, Kenya was in agreement with provisions of this Convention.

4. The United Nations Framework Convention on Climate Change (UNFCCC) 1992 – Its ultimate objective is “...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system... to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.” (Article 2) Kenya ratified the UNFCCC in 1994.

5. Agenda 21 – it was reached during the United Nations Conference on Environment and Development (UNCED) also known as the Earth Summit in Rio de Janeiro, Brazil in 1992. Kenya endorsed and adopted Agenda 21 during the Earth Summit. It also signed and later ratified the Convention on Biological Diversity that was conceived during the Earth Summit as a demonstration of the country’s commitment to reinforce and consolidate national and international goals for the conservation and sustainable use of biodiversity.

6. Kyoto Protocol, 1998 – It advocates for “Research on, and promotion, development and increased use of, new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies (Article 2, 1(iv). Kenya ratified the Protocol in February 2005.

7. The 2015 Paris Agreement – the Government of Kenya ratified the treaty arguing that its linkage to the SDGs was the beginning of renewed global, transparent, enhanced, ambitious action and support that will address the challenge of climate change in the short and long terms (MEF, 2018). Kenya ratified this Agreement in December 2016.

With these documents it would be expected that Kenya will be at the forefront of protecting biodiversity for the sake of current and future generations.

Kenya’s active participation at the 1972 United Nations Conference on the Human Environment, commonly referred to as the Stockholm Conference, saw the country being honoured with the opportunity to host the United Nations Environment Programme (UNEP).

The Stockholm Conference came up with 23 Principles, two of which are particularly significant to this paper:

Principle 2 – The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.

Principle 13 – In order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and coordinated approach to their development planning so as to ensure that development is compatible with the need to protect and improve environment for the benefit of their population.

Having accented to these Principles, and being the headquarters UNEP, it would be expected, by default, that Kenya will be on the frontline of protecting the environment through word and deed but this has not necessarily been the case. Three of the current mega projects being undertaken by the government negate the expectation that Kenya is a strong bulwark against biodiversity loss. The projects are highlighted in the following section as evidence that Kenya has fallen short of global expectations as a champion of environmental sustainability.

1. The Standard Gauge Railway (SGR)

The Standard Gauge Railway (SGR) is one of the Vision 2030 flagship projects that were initiated by the Government of Kenya and its construction commenced in October 2013. The project is financed by the Chinese government to the tune of \$3.6 billion making it the most expensive infrastructure project in Kenya's history. The railway was originally meant to connect the port of Mombasa on Kenya's Indian Ocean coast all the way to Kisangani in the Democratic Republic of Congo with an extension to Juba in South Sudan. Each country was expected to pay for the portion passing through its territory. To date it is not clear whether the original plan of the new "iron snake" to traverse several African countries will be implemented. In Kenya, the SGR was meant to replace the old meter gauge railway that was built during British colonial times and terminated at the port town of Kisumu on Lake Victoria in Western Kenya. Rehabilitation of the old railway line that runs parallel to the SGR would have made even more economic sense instead of having two lines, with one that is more or less dysfunctional and another that continues to gobble up scarce funds from government coffers.

The first phase of the project (Mombasa to Nairobi – 485 kilometres) was commissioned on 1st June 2017 and the next phase (Nairobi-Malaba) is still under construction. Malaba is a town on the border between Kenya and Uganda. However, the second phase faced opposition from environmentalists and the civil society because part of it was to pass through the Nairobi National Park (NNP), a major tourist attraction in Kenya. The park is the only one in the globe that is within a capital city and this has given Kenya an enviable position in the world of tourism earning it the tag "The world's only wildlife capital." It was argued that to have the railway pass through this natural treasure would interfere with the biodiversity which will eventually affect income from tourism.

Nairobi National Park was established in 1946, making it the oldest in East Africa. It was gazetted in the same year and as such it is a protected area where a project to the magnitude of the SGR is forbidden. For work to the level of the SGR to commence requires de-gazettement as prescribed by the Constitution of Kenya, 2010, but this was not done prior to implementation of the project. The park is home to over 100 species of mammals such as the endangered black rhino, lions, leopards, cheetahs, hyenas, buffaloes and giraffes; over 60 species of reptiles and amphibians and more than 500 species of plants and birds (KWS, 2019; UN Environment, 2019). With savannah, woodlands, gorges, wetlands and forests within its confines, the park is a crucial carbon sink that provides important ecosystem goods and services.

In total disregard to international best practices under Environmental and Social Impact Assessment (ESIA), no consideration was given to alternative routes that completely circumnavigated the NNP allegedly due to high costs. Hence despite opposition, construction work allowing the railway to pass through the park proceeded. Large parts of the park were cleared of vegetation by heavy earth-moving machines to create a 7 kilometre pathway for the railway line that was built 18 meters above ground supported by pillars that were dug deep into the ground to reduce vibrations from trains as they cross the overhead bridge. Internationally acknowledged best practices would be to put biodiversity a head of costs by circumventing the park given that there were alternative routes. The project was approved purely for economic reasons. The economy won over the ecology.

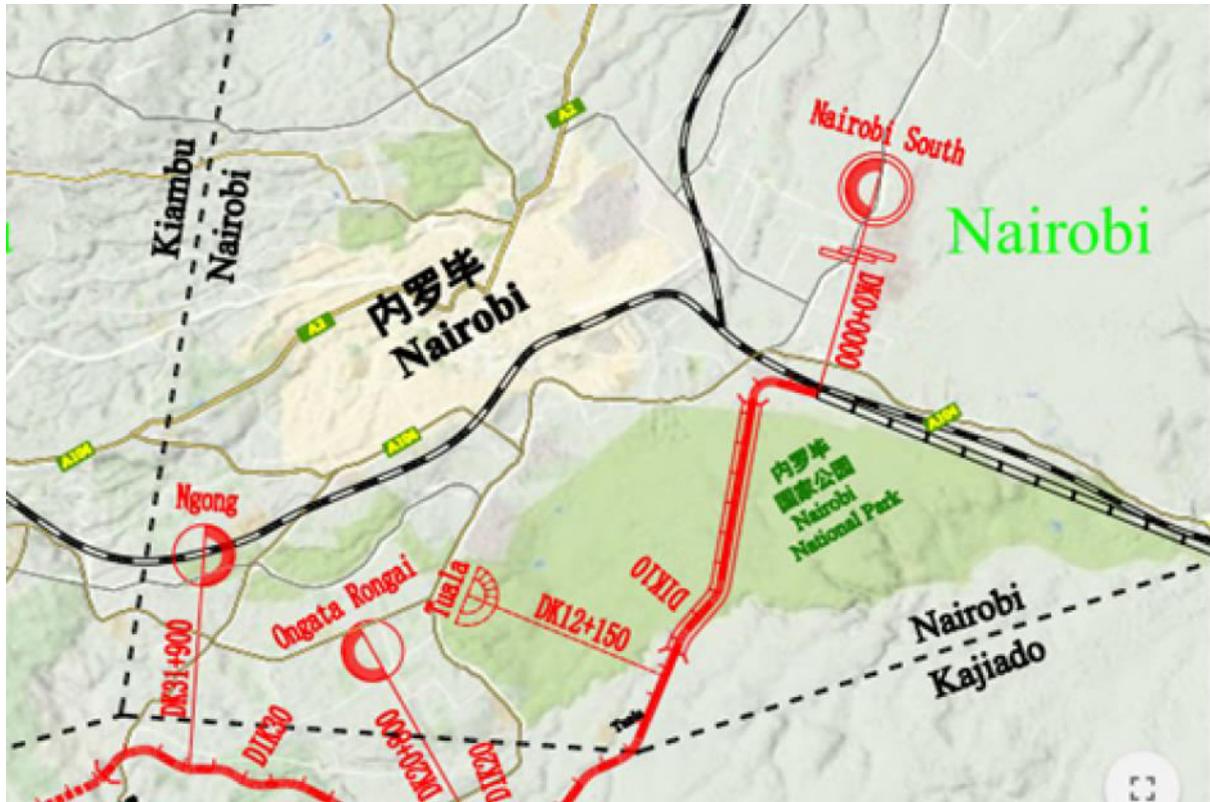
Proponents of the project argued that the SGR would reduce travel time between Mombasa and Nairobi for passengers from over 12 hours to slightly above 4 hours while freight trains would take 8 hours compared to over 20 hours. Using trains for passenger and freight services was also expected to ease pressure on the Mombasa-Nairobi Highway leading to minimal wear and tear on this critical artery that is the gateway to the wider East and Central Africa as well as the Great Lakes Region. Reduced vehicular traffic was also expected to cut down the number of road accidents that were common on this busy route. Similarly, the cost of travelling for passengers and cargo charges were predicted to go down significantly mainly due to economies of scale. However, more than 4 years after the Mombasa-Nairobi stretch became operational, these expectations, particularly the financial ones, have not been met. The cost of passenger tickets and freight are much higher than visualised and the project is not bringing in the much anticipated profits, thereby turning the SGR into yet another grossly expensive “white elephant” project for Kenya (*Daily Nation*, 31/05/2019).

In an attempt to ensure that the SGR is reasonably utilized, the Government of Kenya ordered that all cargo imported into the country via the port of Mombasa must be transported into the interior via the railway. After a protracted legal battle, the High Court sitting in Mombasa overturned the government directive on 11/02/2021, and allowed traders to transport their cargo using the road. If indeed the SGR was a better option compared to the long distance trailers, then there would have been no need for the government directive which many players in the transport sector, and especially the Kenya Transport Association (KTA) viewed to be draconian. The tug of war between the Government of Kenya and transporters regarding the SGR is likely to take much longer to reach an amicable solution.

In the meantime, servicing the loan for the SGR is putting a strain on the struggling Kenyan economy.

Implementation of the project set a bad precedence for protected sites in the country and elsewhere as they now face a similar fate to NNP. Kenya lost the mantle of a country that was

providing leadership in environmental sustainability by approving a project that negatively affected biodiversity. Had one of the alternative routes for the railway line been picked, it would have earned Kenya immeasurable goodwill internationally as a country that can achieve social-economic development while at the same time protecting her biodiversity.



The Standard Gauge Railway crossing through the Nairobi National Park. **Courtesy: Google**

2. Lamu Coal Power Plant

The proposal to construct the Lamu Coal Power Plant was floated by the Government of Kenya in 2013 and was to be the first coal-fired power generation facility in East Africa. Lamu is an archipelago of beautiful islands in the Indian Ocean and the project was informed by the increased demand for electricity in the country against a backdrop of very few Kenyans having been connected to the national grid. As of 2014, only 29% of the Kenyan population was connected to electricity (Hussein, 2014). Under the 20-year Least Cost Power Development Plan (LCPDP) introduced by the Ministry of Energy and Petroleum (MOEP) in 2005, the Government of Kenya had the desire to increase the energy mix in the country instead of relying principally on Hydro Electric Power (HEP) due to its many challenges, notably security of supply.

The government had projected that the nation would require at least 15,000 MW of electricity by 2030 to meet increased demand for domestic and commercial consumption as well as to power various mega projects across the country as envisioned in the Vision 2030 blueprint (MOEP, 2011; Hussein, 2014). With more sources of power generation, the government hoped that this would not only increase access to electricity but also lower the cost of energy to consumers and consequently spur social-economic development.

The contract to put up the coal plant was awarded to Amu Power Company (APC) in September 2014. APC would source coal for the plant from South Africa and Mozambique and later from Kitui in eastern Kenya where large deposits of coal were discovered in 2012 (MOEP Strategic Plan, 2013-2017; UN Environment, 2018).

Being a fossil fuel, coal raises many environmental and health concerns during its entire life cycle from mining, transportation, storage and combustion. Of all fossil fuels, coal is the dirtiest and worst polluter because it generates more CO₂ than any other hydrocarbon (Butler and Basu, 2015). Coal plants are known to emit toxic fumes such as carbon dioxide (CO₂), sulphur dioxide (SO₂), nitrogen oxides (NO_x), mercury (Hg) and particulate matter (PM). Other harmful material released in the process of generating electricity from coal may include lead, uranium, carbon monoxide, volatile organic compounds and cadmium all of which are harmful to human health. Emissions from a coal plant can also cause acid rain that contaminates ground water sources, food crops, vegetation, marine resources, wildlife and other living organisms.

It has been estimated that when operational, the coal plant at Lamu will release 8.8 million tons of CO₂e annually making it the biggest polluter in the country. Up to 1,600 people would possibly die from health complications occasioned by harmful emissions from the plant during its projected 40-year lifetime (UN Environment, 2018). In addition, a lot of dust is generated during mining and transportation of coal. When inhaled, the dust, together with other poisonous fumes emitted during operation of a coal plant, can cause serious ailments such as lung inflammation, cardiopulmonary diseases, chronic obstructive pulmonary diseases, hypertension and kidney failure. Again, cases of miscarriage, premature births, low birth weight and birth deformities are likely to be experienced. Since CO₂ is the greatest contributor to climate change, emissions from the Lamu plant are likely to contribute to a rise in sea levels, which would threaten the Lamu islands' very own existence.

The major marine ecosystems in Lamu are mangrove forests, sea grasses and coral reefs. Approximately 70% of mangrove trees in Kenya are found in Lamu. Thick dust from the coal plant will likely cover leaves of mangrove trees thereby limiting their capacity to absorb carbon dioxide and when it gets into contact with water it can harm aquatic organisms, apart from also polluting ground water resources. Mangrove forests play a key role in the sustainability of the coastal ecosystem. Article 5 (1) of the Paris Agreement calls upon all Parties to "...take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases..." and it is therefore clear the Lamu Coal Power Plant will obviously go against what this Multilateral Environmental Agreement (MEA) advocates for. The project would therefore have adverse effects on human health, air quality and biodiversity apart from also exacerbating harmful impacts of climate change (Myllyvirta and Chuwah, 2017), a phenomenon that has been described as "...a direct existential threat to mankind." (UN Secretary General, 2018)

Lamu has one of the most beautiful coastlines in the world and tourism is the mainstay of the local economy bringing in more than \$ 20 million annually. This sector will be adversely affected by the negative impacts of the coal plant. Lamu's splendid biodiversity and unrivalled ecological infrastructure is likely to be seriously degraded and eventually lost due to the deadly emissions from the coal plant. Other economic activities in the area such as fishing and agriculture will suffer from consequences of coal pollution leading to unemployment, loss of income and a general disruption of livelihoods yet one of the government's key objectives is job creation and economic prosperity as it seeks to join the league of Middle Income States by 2030.

The cooling process of a coal plant requires huge amounts of water which is released back into the ecosystem at high temperatures thereby causing damage to the aquatic environment as is likely to happen in the case of Lamu (Carpenter, 2017). According to the National Energy Technology Laboratory of the United States Department of Defence, the water cooling system of a 520 MW coal-fired power plant requires about 12 million gallons of water per hour (Peltier, 2008). This translates to about 24 million gallons of water per hour for the Lamu plant after commissioning.

Lamu Old Town is a World Heritage Site having been selected to that position by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 2001. It is the oldest and best preserved Swahili settlement in East Africa (UNESCO, 2019). Such sites are legally protected by international treaties due to their cultural, historical, scientific or other importance. They carry a lot of significance for the entire human race and not just for countries where they are located. It is therefore a disservice to such sites for them to be violated in the name of development. As a signatory to the UNESCO World Heritage Convention of 1972, Kenya is morally bound to protect the heritage of Lamu rather than facilitate its degradation.

It has been argued that use of clean coal technology greatly reduces the harmful nature of this form of energy. Clean coal technology refers to a wide range of technologies that are continually developed in efforts to minimize negative impacts brought on man and the environment in the process of generating electricity from coal. One key objective of clean coal technology is to minimize negative impacts of climate change. This technology seeks to minimize dire environmental effects by employing a variety of technologies to clean coal and restrain its emissions.

The Lamu Coal Power Plant will use supercritical technology which considerably lessens harmful emissions like carbon, nitrogen and sulphur oxides that are associated with energy generation from coal. Although this technology is a step ahead of its predecessor (sub-critical), it is not the most advanced and as such will still expose man and the environment to harmful impacts of coal as a source of energy. The trend in the world is to move towards ultra-supercritical technology that promises much lower rates of emissions, but unfortunately this will not be used in Lamu. Plants that use ultra-supercritical technology produce heat of up to 1,400 °C and 5,000 pounds of pressure per square inch (PSI) and are therefore less polluting yet more efficient (Ashraf, 2017). But the bottom line is that as of now, these technologies can only *lessen*, but not *stop* harmful emissions from coal.

Enhanced strictness of emission standards, increased awareness of dangers of fossil fuels and availability of green energy as an alternative to hydrocarbons has forced the coal industry to continue research on newer and cleaner technologies that would allow it to stay in business. In order for Kenya to achieve its development agenda through Foreign Direct Investment (FDI), the government needs to be committed to green energy as this is the focus of many multinational corporations especially those in the manufacturing sector due to their concern for the environment.

The world is slowly moving away from coal and other fossil fuels to green energy and even China has not been left behind. There is a sad paradox to the Lamu Coal Power Plant because whereas China is making efforts to reduce reliance on coal as a source of energy, a

Chinese firm (China Power Global) is involved in construction of the Lamu project (*Daily Nation*, 10/04/2018; Ashraf, 2017; Fei, 2018; Shearer *et al.*, 2019).

On 26/06/2019, the National Environment Tribunal (NET) put a halt to further construction of the Lamu Coal Power Plant because it was argued that the project did not involve public participation and consultation. The NET further noted that the Environmental Impact Assessment (EIA) study and report thereof were never subjected to proper and effective public participation that would have covered most of the grievances that were raised by those opposed to the project. The Tribunal advised that once proper public participation has been conducted, it will make the final ruling regarding the project. In the event that the NET rules in favour of the project's proponents, then the worst fears of those opposed to it will most likely come to pass.

Generating energy from hydrocarbons is against the country's affirmed commitment to promoting green energy and transition to use of clean energy by 2020 as envisaged in Vision 2030, Kenya Green Economy Strategy and Implementation Plan (GESIP), National Climate Change Response Strategy among other key policy pronouncements. Kenya has many green energy resources from which affordable, reliable and sustainable energy can be generated such as solar, geothermal, wind and biogas. The country straddles the equator and enjoys solar radiation for 365 days in a year; has a known geothermal energy potential of 10,000 MW and several zones for setting up wind farms (Sessional Paper Number 4 on Energy, 2004; MOEP Strategic Plan, 2013-2017; Draft National Energy and Petroleum Policy, 2015; Power Sector Medium Term Plan, 2015; Sustainable Energy for All, 2016).

The Lake Turkana Wind Power Project is the largest of its kind in Africa generating 310 MW of clean energy. Electricity can be generated from these renewable sources at a considerably lower cost, and most of all, with no negative impacts on biodiversity compared to the Lamu Coal Power Plant. As stated earlier, the Government of Kenya has made it clear through policy and legal pronouncements that it will put emphasis on renewables as the principal source of its energy requirements and also as one way of its contribution to environmental sustainability.

As a party to the 2015 Paris Agreement, Kenya is bound to adhere to its requirements, one of which is to implement a managed decline of fossil fuel utilisation. While addressing the nation in December 2018, Kenya's President Uhuru Kenyatta emphatically stated that "To be more specific we, as a country, have committed ourselves to attain 100 per cent green energy sufficiency by 2020 and we are on the right path towards realizing that target...We have to use renewable sources of energy to protect our environment, and ensure that we pass down, to our sons and daughters, a country as clean and green as we inherited from our fathers." (<http://www.president.go.ke>).

However, the fact that the Government of Kenya gave the green light for construction of the coal plant at Lamu goes contrary to what it promised the world regarding its commitment of transition to green energy. Perhaps the lack of full government commitment to clean energy matters is what made Kenya miss its 2020 green energy target. It is imperative for the Government of Kenya to stick to its commitment as a major supporter of green energy and avoid investing in energy sources that cause more harm than good to man and the environment.

3. Sand Harvesting in Kwale County

Globally sand is being extracted faster than it is replenished through the natural processes and Kenya is not an exception (UNEP, 2019). Until recently, sand used to be extracted from quarries and river beds but due to a decline from these terrestrial sources, the activity has shifted to marine and coastal zones. In Kenya, the National Environment Management Authority (NEMA) defines sand harvesting as “...the removal, extraction, harvesting or scooping of sand from designated sites” (NEMA, 2007). NEMA came up with guidelines that were meant to contribute to sustainable use of sand as well as appropriate management of the environment. Unfortunately, these guidelines are not usually adhered to and when sand is harvested for mega infrastructure projects, the damage to biodiversity is enormous. A good example in this case is what is going on along a section of Kenya’s coastline at a place called Diani in Kwale County on the country’s south coast.

The sand is scooped to be used in construction of a second oil terminal at the port of Mombasa. Known as the Kipevu Oil Terminal (KOT 2), it is a massive project undertaken by the China Communications Construction Company (CCCC) and will cost \$400 million. The purpose of the project is to enhance the capacity of Mombasa to handle vast amounts of imported oil for local consumption and export to other parts of East and Central Africa as well as the Great Lakes Region thereby contribute to making the coastal city a major regional trading hub. On completion, it is expected that the new terminal will handle 400,000 metric tonnes (MTs) of oil, compared to the current 35,000 MTs (*Construction Review Online*, 18/09/2018). KOT 2 is also expected to stabilise Liquefied Petroleum Gas (LPG) supplies in the country through a line that forms part of the project.

Sand extraction has an impact on biodiversity, water turbidity, water table levels, the landscape and climate through CO₂ emissions from transportation, usually by huge trucks that run on diesel (UNEP, 2014). Because of the huge volume of sand that is being harvested, the following are some of the impacts likely to be experienced in Diani and its surroundings: loss of species – including seabed flora and fauna; destruction of fish-breeding sites; beach erosion; collapse of the tourism sector and deprived livelihoods.

Diani is a major tourist attraction and from 2014-2019 it was voted as the best destination beach in the world but sand excavation activities might alter this scenario. Studies have proved that marine sand mining has an impact on seabed flora and fauna (Krause *et al.*, 2010). Dredging and extraction of aggregates from the benthic zone destroys organisms, habitats and ecosystems and profoundly affects the biodiversity composition (UNEP, 2014).

Tourism is a delicate industry that blends very closely with biodiversity and can be easily affected by loss of key species and beach erosion (Kondolf, 1997). Tourists who flock to the serene environment at Diani have for a long time been attracted by the rich biodiversity within the locality but sand harvesting and all its accompanying activities will degrade the biological diversity and disrupt the tranquillity that has been enjoyed for years, among other disturbances.

The fishing industry can be affected through destruction of benthic fauna that is occasioned by dredging activities (UNEP, 2014) and this is likely to happen in Diani thereby rendering the community destitute as many local people also derive their livelihood from fishing activities.

In 2016 when the SGR was being constructed in Mombasa, sand for the work was dredged from off the beach in Diani and to do the same for the oil terminal will further destroy the fragile ecosystem in the area. Just like in the case of the Lamu Coal Power Plant, sand harvesting in Diani commenced without public participation and consultation as required by, among others, the Constitution of Kenya 2010, Environmental Impact Assessment guidelines and Article 12 of the Paris Agreement. Negative impacts of this activity on man and the environment are likely to be far reaching. Continued harvesting of sand in Diani goes contrary to local and international obligations that Kenya has committed herself to in protection of biodiversity.

These impacts can be minimised through measures such as avoiding unnecessary use of sand in construction, using alternative construction material other than sand, using modern standards and best practices in harvesting, recycling waste from construction and demolition material (UN Environment, 2019).

Conclusion

The complex nexus between biodiversity resources means that when one is degraded the damage trickles down to the rest and as such it is imperative to ensure that the delicate balance between social-economic development and protection as well as sustainable use of biodiversity is maintained for the well-being of mankind. A good starting point could be a paradigm shift focusing on mainstreaming of biodiversity into development planning, mobilization of resources, the governance aspect as well as decision-making processes. Through conservation, restoration and sustainable utilisation of biodiversity, mankind can provide solutions to contemporary and future challenges like climate change, water deficit, food security and nutrition, sustainable development as well as global peace and security (UNEP, 2019).

Conserving biodiversity, maintaining ecosystem services, and sustainably managing natural resources are fundamental to sustainable development. Kenya has the potential of attaining its hoped-for Middle Income Status through implementation of some of its projects which would change for the better livelihoods of many of the country's citizens. However, although this trajectory may be good for the nation, it should not be done at the expense of biodiversity because conservation of these unparalleled resources has been recognised globally as significant to achieving sustainable development. This was the key argument of Principle 13 of the Stockholm Conference of 1972 where Kenya strongly fought for protection of the environment.

Kenya has also committed herself to the protection of biodiversity through local and international instruments, and it is disheartening to see the country going contrary to its avowed commitments. Destruction of biodiversity in the name of economic development will run contrary to the country's desire to lift a significant population of Kenya out of poverty because these people rely on the same biodiversity for their very existence. Kenya's social-economic prosperity should not be achieved at the expense of biodiversity because once lost, it cannot be recovered.

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ABBREVIATIONS AND ACRONYMS

APC	Amu Power Company
CBD	Convention on Biological Diversity
CCCC	China Communications Construction Company
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
FAO	Food and Agriculture Organisation of the United Nations
FDI	Foreign Direct Investment
GESIP	Green Economy Strategy and Implementation Plan
GHGs	Greenhouse Gases
HEP	Hydro Electric Power
ICMM	International Council on Mining and Metals
IEA	Institute of Economic Affairs
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
KOT	Kipevu Oil Terminal
KTA	Kenya Transport Association
KWS	Kenya Wildlife Service
LCPDP	Least Cost Power Development Plan
LPG	Liquefied Petroleum Gas
MEA	Multilateral Environmental Agreement
MEF	Ministry of Environment and Forestry
MOEP	Ministry of Energy and Petroleum
MTs	Metric Tonnes
MW	Mega Watt
NEMA	National Environment Management Authority
NEP	National Environment Policy
NET	National Environmental Tribunal
NGOs	Non-Governmental Organisations
NNP	Nairobi National Park
PM	Particulate Matter
PSI	Per Square Inch
SDGs	Sustainable Development Goals
SGR	Standard Gauge Railway
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations Children's Emergency Fund
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development