Kenya: Food Security and Ecosystem Resilience

Introduction

Kenya's Agriculture Rural and Urban Development (ARUD) Sector comprises of five sub-sectors namely: agriculture, livestock, fisheries and the blue economy, lands and physical planning, and the National Land Commission. The combination of rural development and agriculture - crops, livestock, forestry, fisheries, aquaculture and related services - are powerful tools to end hunger, improve livelihood opportunities and bring about sustainable development. The overall goal of the sector is to attain national food security and sustainable management of land and the blue economy, making it a key player in driving the achievement of the Sustainable Development Goals (SDGs).

Table 1: Key indicators for Kenya (World Bank, 2017) (UNDESA, 2018)

KENYA	2018
Total population (million)	50.96
Total area (km^2)	591 958
Population density (persons/km^2)	89.5
Per capita income, 2015 (US $)	1,340

Agriculture in the Kenyan Economy

About 75 per cent of the Kenyan population lives in the rural countryside (Table 1). Agriculture contributed 34.5 per cent of GDP in 2018. Most of those employed in agriculture are subsistence farmers; and the proportion of people employed in agriculture has been slowly declining - from 41.4 per cent in 2005 to 37.2 per cent in 2018. Women make up 75 per cent of the labour force in the agricultural sector (World Bank, 2017) (UNDESA, 2018).

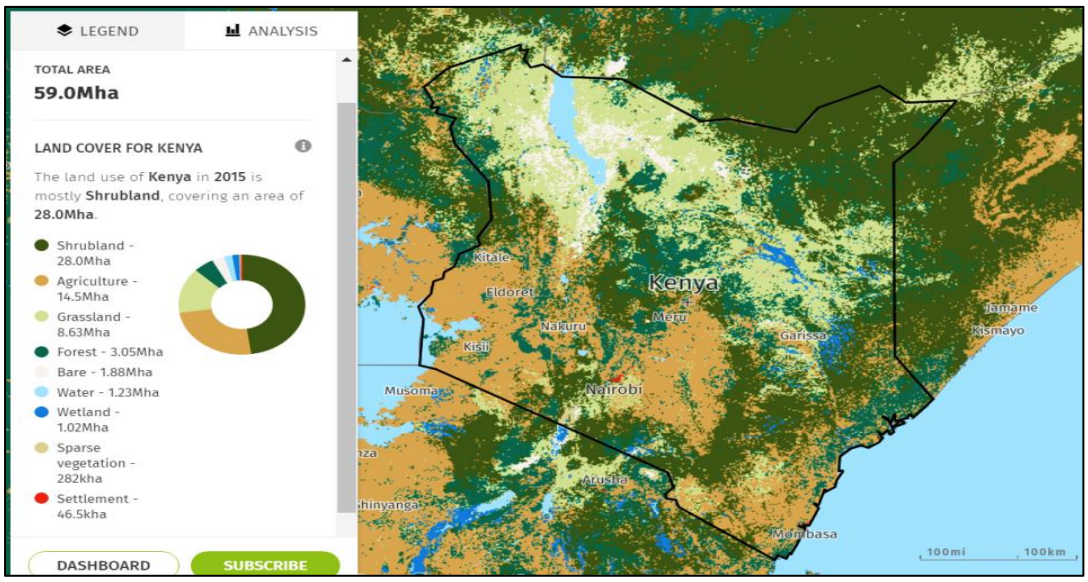

Figure 1: Land cover Kenya (2015) Data source: Global Forest Watch

Total land area of Kenya is 569,000 km^2 and 49 per cent of this is agricultural land. It is a dry country with 80 per cent of the total land area classified as arid and semi-arid, leaving 20 per cent of the land as arable Figure 1 and 2 (FAO, 2014) (World Bank, 2017).

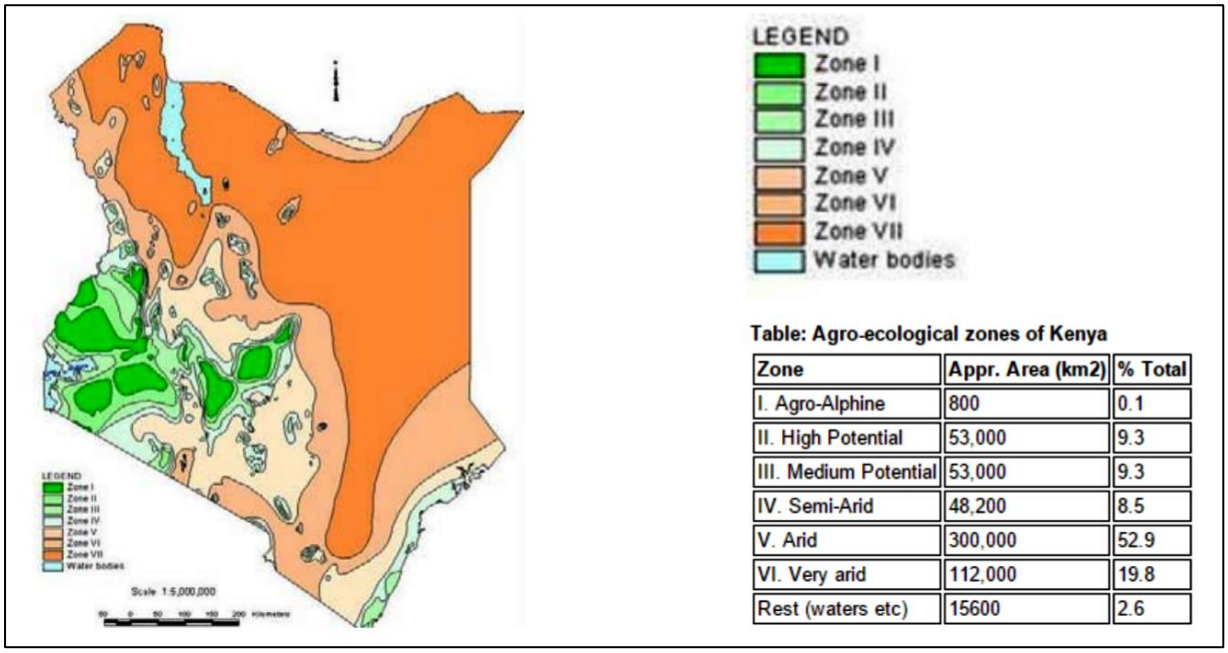

Table: Agro-ecological zones of Kenya

Zone	Appr. Area (km2)	% Total
I. Agro-Alphine	800	0.1
II. High Potential	53,000	9.3
III. Medium Potential	53,000	9.3
IV. Semi-Arid	48,200	8.5
V. Arid	300,000	52.9
VI. Very arid	112,000	19.8
Rest (waters etc)	15600	2.6

Figure 2: Kenya Agro-ecological zones (FAO/GEF, 2016)

Food Security Situation

Food insecurity is a chronic problem in Kenya aggravated by consecutive poor rainy seasons. Between 2015 and 2017, 17 million people or 35.6 per cent of the population was severely food insecure as shown in Table 2 (UN Stats, 2019). More recent data indicates about 2 million people in the north and northeastern areas were subject to food insecurity due to the poor rains between 2018-2019 season (FAO, 2019). Food insecurity contributes to undernutrition and children who are undernourished are at a higher risk of mortality, poor health, growth and development. Figure 3 highlights the livelihood zones in Kenya.

Relevant SDG 2 indicators

2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)

2.4.1 Proportion of agricultural area under productive and sustainable agriculture

Table 2: Food insecurity trends in Kenya (FAO, IFAD, UNICEF, WFP and WHO, 2018)

Location	Prevalence of undernourishment in the total population (%)		Prevalence of severe food insecurity in the total population (2015-2017)	Prevalence of wasting in children under 5 (2017)	Prevalence of stunting in children under 5 years of age (%)		Prevalence of overweight in children under 5 years of age (%)	
	2004-2006	2015-2017	%	%	2012	2017	2012	2017
Kenya	28.2	24.2	35.6	4.0	35.2	26.0	5.0	4.1

Location	Prevalence of undernourishment in the total population (%)		Prevalence of severe food insecurity in the total population (2015-2017)	Prevalence of wasting in children under 5 (2017)	Prevalence of stunting in children under 5 years of age (%)		Prevalence of overweight in children under 5 years of age (%)	
	2004-2006	2015-2017	%	%	2012	2017	2012	2017
Eastern Africa	34.4	31.2	29.2	6.0	38.5	35.6	4.5	4.4
Africa	21.3	19.6	25.9	7.1	32.6	30.3	5.0	5.0

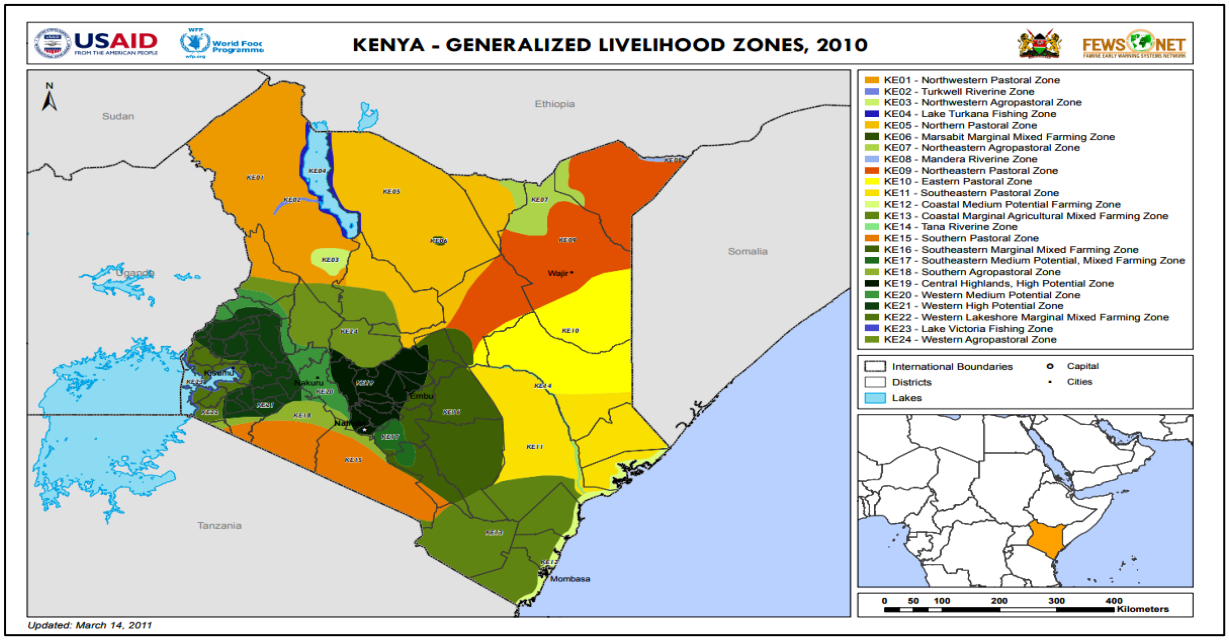

Figure 3: Kenya Livelihood zones fews.net

Relevant SDG 2 indicators

2.5.1 Number of plant and animal genetic resources for food and agriculture secured in either medium- or long-term conservation facilities

2.5.2 Proportion of local breeds classified as being at risk, not at risk or at unknown level of risk of extinction

Ending Hunger

Genetic Diversity

Genetic, species and ecosystem diversity are key ingredients upon which food production largely depends. By 2018, there were 27 local breeds kept in the country. The number of plant breeds in Kenya with sufficiently stored genetic resources in 2017 was 50,325, an increase from 44,790 in 2000 (UN Stats, 2019). The number of local breeds at an unknown level of extinction has stagnated at 25 since 2010 to date; while only 2 local breeds are known to be 'not at risk'. Of the local breeds, 92.59 per cent are at an unknown level of risk of extinction, while those that are known not to be at risk are estimated at 7.4 per cent (UN Stats, 2019).

Renewable Energy

Relevant SDG 7 indicators
7.2.1 Renewable energy share in the total final energy consumption

Kenya's renewable energy share in 2016 was estimated at 71.85 per cent of the total final energy consumption down from 79.04 per cent in 2000. The highest renewable energy share was recorded in 2003 at 83.25 per cent as shown in Figure 4 (UN Stats, 2019). The renewable energy mix in Kenya includes geothermal, wind and solar energy among others. The use of clean energy protects the environment from degradation, such as that associated with deforestation for fuelwood. It is well documented that deforestation and related soil erosion can lead to increased siltation of water reservoirs and loss of topsoil required for farming thus negatively impacting food security.

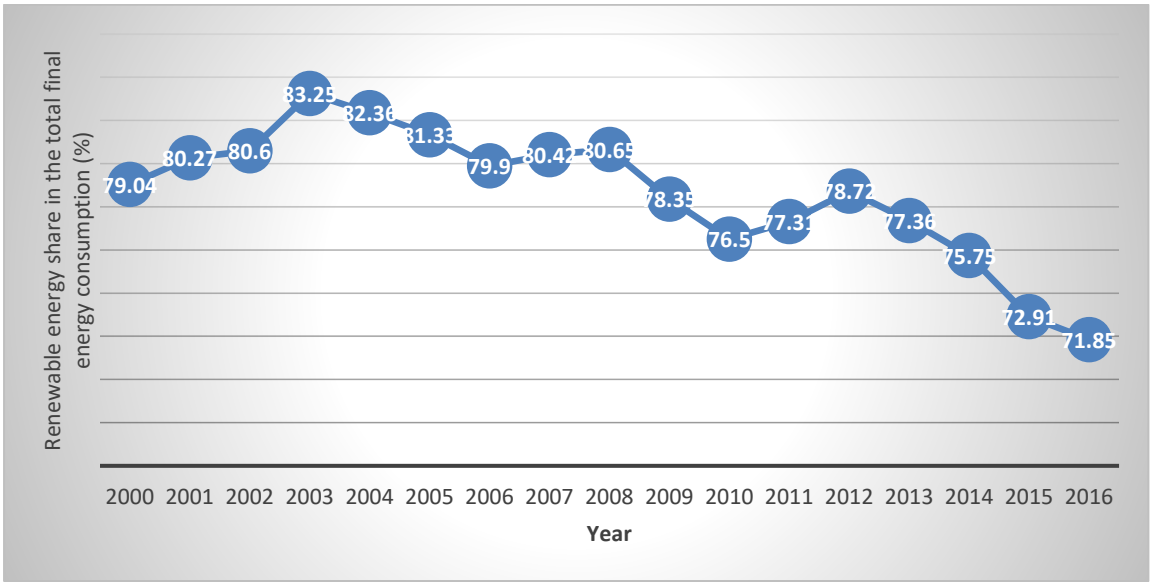

Figure 4: Trends in renewable energy share in the total final energy consumption (%) 2000-2016 (UN Stats, 2019)

Clean Water and the Marine Environment

Water Quality

Relevant SDG 6 indicators
6.3.1 Proportion of wastewater safely treated
6.3.2 Proportion of bodies of water with good ambient water quality
6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources.
6.6.1 Change in the extent of water-related ecosystems over time

Kenya is a water scarce country with permanent water bodies covering 2.03 per cent of the total land area. The extent of rivers and open water bodies in Kenya in 2017 was estimated at 306,091 and 75,729 km^2 respectively. Water withdrawals as a proportion of available freshwater resources was estimated at 33.2 per cent in 2015 (above 25 per cent which is considered the threshold of initial water stress) (UN Stats, 2019).

Water scarcity, water quality and poor sanitation are combining to affect food security in this country. Only 0.5 per cent of wastewater effluent is treated, meaning that water quality is an emerging issue (SDGCA and SDSN, 2018). The proportion of water bodies and groundwater bodies estimated with raw water of good quality in 2017 was 35.5 and 42.18 per cent respectively. Water quality is affected by poor sanitation and where scarce, the public look for creative ways to bridge the water supply gap to meet industrial, domestic and agricultural water needs. For instance, it is common for people to use

wastewater to irrigate urban farms, despite the associated environmental health risks and regardless of the fact that it is against the law. There is high potential for waste water to be contaminated with faecal waste; and as the data shows that at the national level the proportion of open defecation in 2015 was 12.03 per cent and the proportion of households that do not use at least basic sanitation service was 29.3 per cent in the same year (SDGCA and SDSN, 2018) (UN Stats, 2019). **Error! Reference source not found.** 5 shows the trends in open defecation in Kenya between 2000 and 2015.

There have been calls for a national policy on wastewater reuse to provide guidelines for the maximum allowable levels of pesticides, herbicides, heavy metals and nutrients such as nitrogen and phosphorus in wastewater and suggest the required water quality monitoring frequency for faecal indicators including *Escherichia coli*, faecal coliforms and enterococci among others (Kaluli, Githuku, Home, & Mwangi, 2011).

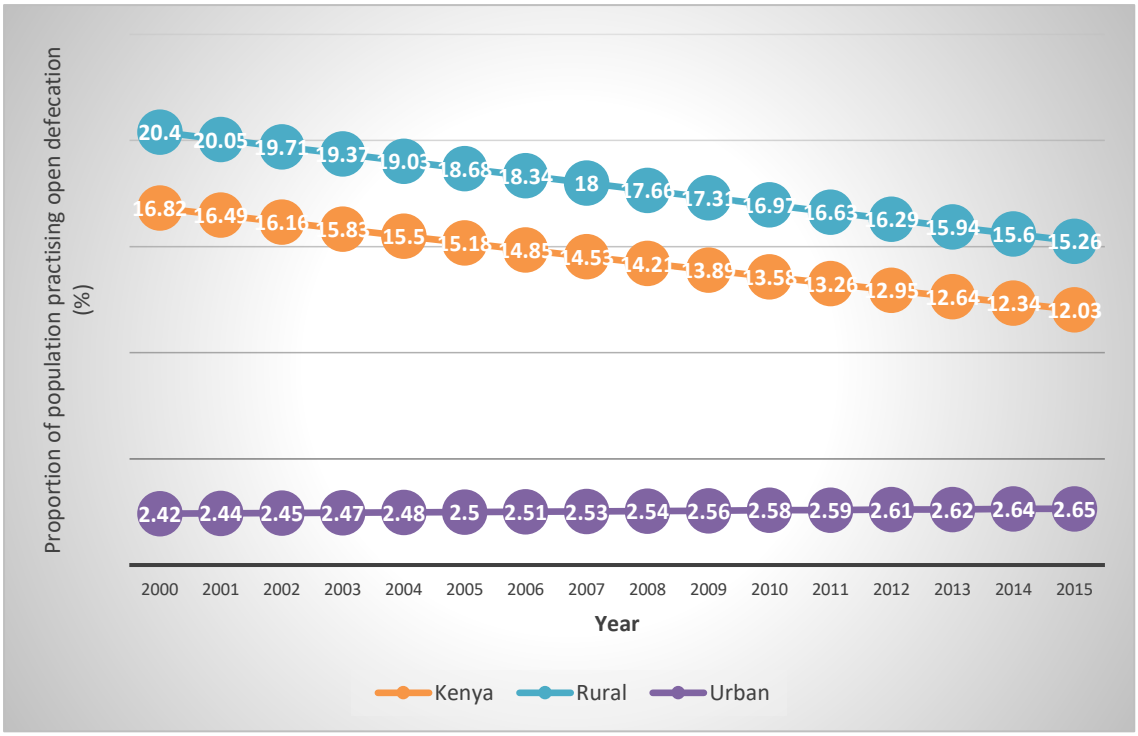

Figure 5: Trends in open defecation in Kenya 2000-2015 (UN Stats, 2019)

Sustainable Management of Coastal Zones and Fisheries

The value of fishing and aquaculture in 2017 was about 0.8 per cent of GDP and total fisheries production in the same year was 184,000 metric tonnes. Between 2000 and 2015, capture fisheries sector shrunk by 1.8% while the growth in aquaculture averaged 27.1 per cent over the same time period (KMFRI, 2017) (World Bank, 2017).

Given the importance of fisheries to food supply and the economy, it is important that fish stocks and their ecosystem habitats are maintained and used wisely. Fishing activity in Kenya is mainly artisanal, however over fishing is an issue. It is estimated that within the Exclusive Economic Zone (EEZ), fish exploitation is as high as 32.4 per cent with about 8 per cent of the fish being caught using trawling methods (SDGCA and SDSN, 2018). The National Oceans and Fisheries Policy 2008 recognizes artisanal fishers and aims to invest in and develop the sector as a means of improving food security and the livelihood support of these small-scale fishermen.

Relevant SDG 14 indicators

14.2.1: Proportion of national exclusive economic zones managed using ecosystem-based approaches

14.4.1: Proportion of fish stocks within biologically sustainable levels

14.5.1: Coverage of protected areas in relation to marine areas.

14.6.1: Progress by countries in the degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing.

14.b.1: Progress by countries in the degree of application of a legal/regulatory/policy/institutional framework which recognizes and protects access rights for small-scale fisheries

There have been a number of interventions to address these issues including the development and implementation of the first Integrated Coastal Zone Management (ICZM) action plan 2011- 2015; and the ICZM Policy 2014. Other related legal provisions include the Forest Conservation and Management Act 2016, the Fisheries Management and Development Act 2016, and the Wildlife Conservation and Management Act 2013.

Regarding protection of marine areas, only 0.8 per cent of marine protected areas are under protection across the Kenyan exclusive economic zone translating into an area of 903 km^2. The average proportion of marine Key Biodiversity Areas covered by protected areas was 60.23 per cent as of 2018. This is a 15.9 per cent increase from 2000 (UN Stats, 2019).

Illegal Fishing

Kenya is one of the countries in the forefront of building global consensus around best approaches to promote sustainable blue economy development. Kenya's Vision 2030 Agenda for Sustainable Development recognizes the blue economy as central in advancing sustainable development. This is in tandem with SDG 14 to "*conserve and sustainably use the oceans, seas and marine resources for sustainable development*". Kenya signed the Agreement on Ports States Measures (PSMA) to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (the Agreement) on 19th November 2010. The agreement seeks to discourage and abolish illegal, unreported and unregulated (IUU) fishing. The value and quantity of fish landed (Table 3) in Kenya has been on the decline and this is partly thought to be due to illegal fishing. Kenya is also a member of other regional bodies such as the South West Indian Ocean Fisheries Commission (SWIOFC) and the Indian Ocean Tuna Fisheries Commission (IOTC) which also have in place frameworks to address this issue.

Table 3: Quantity and value of fish landed 2013-2017 (KNBS, 2018)

Attribute	2013	2014	2015	2016	2017
Quantity of fish (metric tonnes)	154,253	159,340	141,698	123,513	111,814
Value of fish (Kes '000)	19,984,330	20,940,907	20,749,959	19,735,384	18,581,000

Terrestrial Ecosystems: Land, Biodiversity and Forests

Tree and Forest Cover

Forests in Kenya in 2015 covered an estimated 7.8 per cent of total land cover or an area of 4,413,000 hectares. Apart from contributing to the economy, forests are key in providing environmental, social and cultural benefits. These include food security and shelter, forests are key water catchments recharging rivers and lakes which supply water for domestic, industrial and agricultural use. By protecting forests, the country is able to increase land productivity through improved land management. Indeed, the government has been keen to increase land under forests with tree cover increasing by 25 per cent between 2000 and 2015 from 6.2 per cent in 2000 to 7.8 per cent in 2015. The forest net area change was 0.88 per cent in 2010 and 0.85 per cent in 2015 see **Figure 6**~~**Figure 1**~~ and **Figure 7** (UN Stats, 2019).

Relevant SDG 15 indicators

15.1.1 Forest area as a proportion of total land area

15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type

15.2.1 Progress towards sustainable forest management

15.3.1 Proportion of land that is degraded over total land area

15.5.1 Red List Index

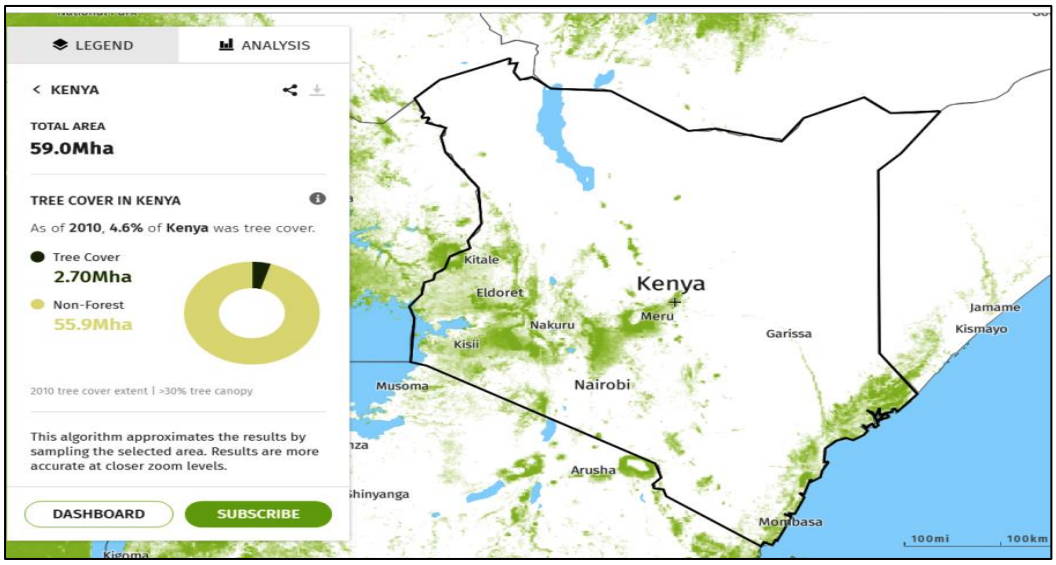

Figure 6: Kenya with a 30%+ tree canopy (2010). Data source: Global Forest Watch

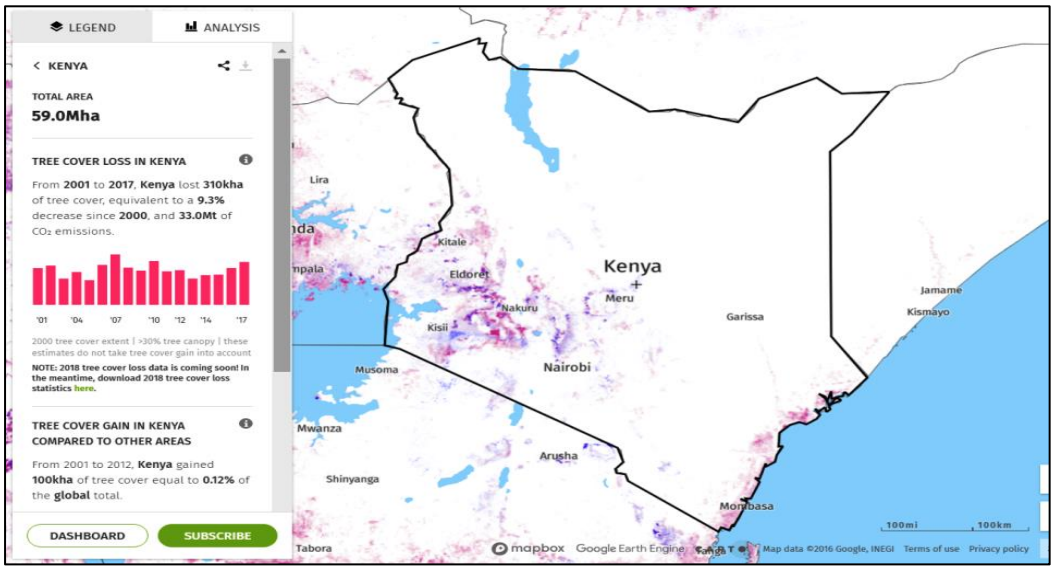

Figure 7: Tree cover loss in Kenya 2001-2017. Data source: Global Forest Watch

Encouraging Sustainable Forest Management

The environmental value of forests as measured by above-ground biomass is growing increasing from 233 tonnes/ha in 2005 to 246 tonnes/ha in 2015 (UN Stats, 2019). This is partly a result of dedicated attention to forest protection. The proportion of forest within legally established protected zones increased from 7.13 to 13.21 per cent in 2000 and 2015 respectively (UN Stats, 2019).

The Forest Conservation and Management Act, 2016 provides for the sustainable and wise use of forest resources including public, community and private forests. It also considers, areas of forest land that require special protection. The government has been undertaking tree planting activities to restore and increase tree cover on the major water catchment areas and drylands. For example, about 600,000 ha of major water towers were restored and a total of 50,000 ha dryland areas have been reclaimed around the country including in Garissa, Turkana and West Pokot regions. These tree planting activities along with water conservation and harvesting infrastructure have helped in the reclamation of degraded land. (MDP, 2017).

Under the Vision 2030 Greening Kenya initiative, the government developed the Bamboo Development and Commercialization Strategy (2014-2017), National Bamboo Policy 2019, and the Green Schools and Commercial Tree Growing for a Green Economy programme. Encouraging a tree-growing culture amongst children from a young age is a major aim of this programme. Forestry Research and Development has also contributed six high value on-farm tree species which are being distributed for planting at county level (MDP, 2017).

Protected Areas

The number of threatened species among the mammals, birds, fish and higher plants in Kenya stands at 30, 39, 71 and 222 respectively (World Bank, 2017). Kenya's Red List Index, a measure of extinction risk, has been on a downward spiral and in 2019 was estimated at 0.79 (down from 0.85 in 2001) (UN Stats, 2019). This highlights a steady erosion of biodiversity over the years and is cause for concern.

The proportion of freshwater biodiversity covered by protected areas was estimated at 34.39 per cent in 2018. This marked an increase from 24.06 in 2000. On the other hand, the proportion of terrestrial biodiversity covered by protected areas was estimated at 35.07 in 2018, which was an increase from 30.46 in 2000 (UN Stats, 2019). Figure 8 and Figure 9 highlight these trends.

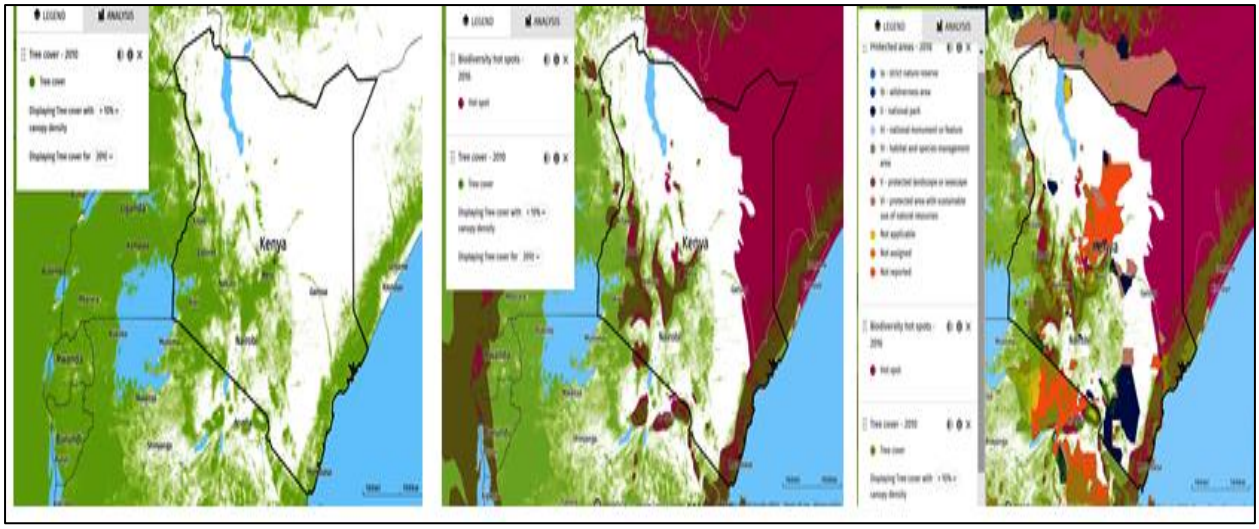

Figure 8: From left to right – Kenya with a 10%+ tree canopy cover (2010), then with hotspots (2016) and then protected areas (2018) Data source: Global Forest Watch

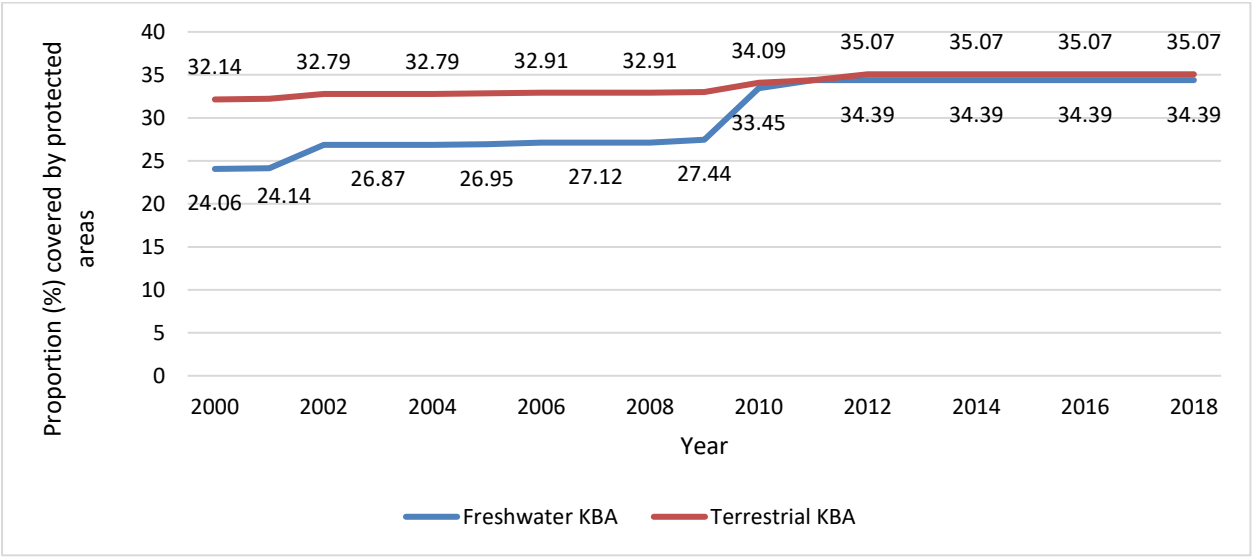

Figure 9: Average proportion (%) of freshwater and terrestrial Key Biodiversity Areas (KBA) covered by protected areas 2000-2018 (UN Stats, 2019)

Emerging Environmental Challenges

Waste Production and Management

About 93 per cent of the 2,400 tons of waste Nairobi produces daily is reusable; and only 5 per cent is recycled or processed into compost (MoENR, 2016). Collection rates are also very low. For instance, in 2015, only 32.5 per cent of the municipal solid waste produced was collected (UN Stats, 2019). Solid waste and other land-based pollutants can pose a threat to air, water and soil with impacts on ecosystem and human health. Poor waste management at the Dandora dumpsite has over the years led to contamination of soils and ground water with chemicals such as lead that can have serious health impacts. For instance, average concentrations of lead in the waste dump and industrial soils in the

Relevant SDG 12 indicators

12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment

12.5.1 National recycling rate, tons of material recycled

Dandora, Kariobangi and Mukuru slums in 2015 were 2,630.5 mg/kg (Ondayo, Simiyu, Raburu, & Were, 2016). This is higher than the US Environment Protection Agency guideline of 1,200 mg/kg for lead in waste dumps and industrial soils. The Nairobi River traverses the dumpsite and its polluted waters are used further downstream for domestic use and irrigation of urban agriculture (Soezer, n.d).

There is also much potential to support food security through the production of compost. This is also supported by the EMCA (Waste Management) Regulations of 2006 which specifies that solid waste should be sorted and reduced at the source where it is used or produced. Measures proposed include treatment of waste, reclamation and recycling.

The legal and policy framework includes the Environmental Management and Co-ordination (Waste Management) Regulations 2006 which outline the requirements for handling, storing, transporting, and treatment/disposal of all waste categories. Disposal of waste is done by NEMA-licensed entities. The waste management regulations place emphasis on waste minimization (reducing, re-using, recycling and recovering), cleaner production, and segregation of waste at source. The regulations also provide an opportunity for investment in various aspects of waste management by the private sector. Other more recent regulations include the National Waste Management Strategy 2015 and the National Sustainable Waste Management Policy 2018.

Climate Change

Kenya is among the countries that have ratified and signed the United Nation Framework Convention on Climate Change and the Kyoto Protocol. The country has also localized these protocols by adopted the following strategies: National Climate Change Response Strategy, 2010; National Climate Change Action Plan, 2013-2017; Kenya Independent Nationally Determined Contribution (INDC) 2015; Kenya National Adaptation Plan 2015-2030; The Climate Change Act, 2016; and National Climate Change Framework Policy, 2016.

Relevant SDG 13 indicators

13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other

13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula

13.3.2 Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions

Other opportunities to address climate change include creating awareness through formal and informal education opportunities. The Kenya Institute of Education has not yet integrated climate change in the curriculum at primary, secondary and tertiary institutions. However, some universities already offer climate change courses. For instance, Kenyatta University, the University of Nairobi and a few other tertiary institutions offer courses and degrees incorporating climate change issues. There are also plans to improve knowledge management at county level by engaging stakeholders in climate change learning, information and resource sharing activities.

Financing Natural Resources Management

Kenya's national budget, has over the years, recognized the interlinkages between the economy and the natural resources sectors such as agriculture, tourism, water and energy and this has been factored

Relevant SDG 15 indicators

15.a.1 and **15.b.1** Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems.

15.c.1 and **15.7.1** Proportion of traded wildlife that was poached or illicitly trafficked

into the national budget over the years. Official development assistance has been fluctuating as shown in Table 13 ranging from a low of US $1.02 million in 2005 to a high of US $190.17 million in 2015 (UN Stats, 2019).

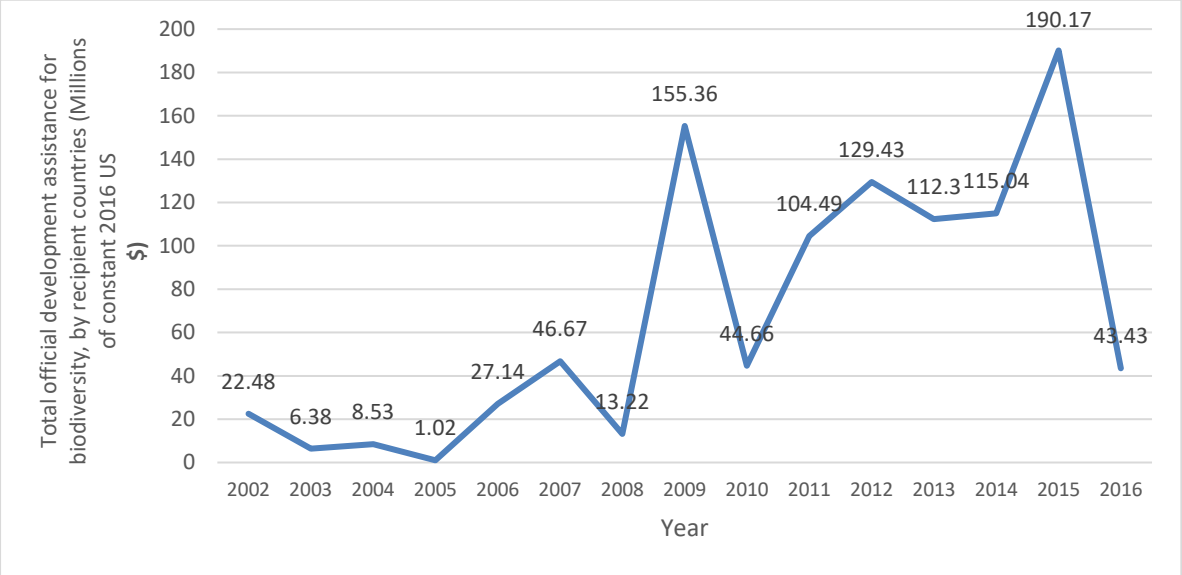

Figure 10: Total official development assistance for biodiversity (millions of constant 2016 US $) 2002-2016 (UN Stats, 2019)

Supporting Actions to End Hunger

Sustainable Fisheries Management

The Fisheries Management and Development Act No. 35 of 2016 is a forward-looking law that aims to manage the fisheries resource sustainably in line with international obligations while allowing for community livelihoods support. It also sets out the institutional framework for fisheries management including the Kenya Fisheries Advisory Council, The Kenya Fisheries Service, The Fish Marketing Authority, the Fisheries Research and Development Fund and the Fish Levy Trust Fund.

The State Department of Fisheries and Blue Economy has put together an Inter-Agency committee to spearhead the process of ratifying PSMA in accordance with the National Oceans and Fisheries Policy, the Fisheries Act and the Fisheries Management and Development Bill, 2015 legal instrument and Ministry of Agriculture, Livestock and Fisheries. Also, countries within the Western Indian Ocean region have established the FISH-i Africa Task Force to help in combating IUU in the shared waters.

Relevant SDG 15 indicators
15.4.1 Coverage by protected areas of important sites for mountain biodiversity

Sustainable management of mountain ecosystems

The coverage by protected of mountainous biodiversity has been increasing over the years. In 2000 the proportion of mountain key biodiversity areas covered by protected areas was estimated at 36 per cent. In 2018 the proportion of protected was recorded at 38 per cent (UN Stats, 2019).

Relevant SDG 15 indicators

15.6.1 Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits

15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species

15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020.

Sustainable Management of Biodiversity

The National Biodiversity Strategy and Action Plan 1999, is under review and the country intends to address the issue of national target-setting through national consultations and also create awareness of the Aichi Biodiversity Targets. Other policies to support conservation and wise use of biodiversity include the Forestry Master Plan (1995-2020) and the National Forest Programme 2016–2030 among others. However, there is need for a supportive legal and institutional framework to support biodiversity management in the country.

Kenya is a party to the International Treaty on Plant and Genetic Resources for Food and Agriculture and the Convention on Biodiversity-Nagoya Protocol. In 2012 Kenya reported its legislative, administrative and policy measures to the Access and Benefit Sharing Clearing House. A national law on the prevision and control of alien invasive species has been adopted. For instance, there have been major initiatives to efforts to address the water hyacinth (*Eichornia crassipes*) including the Lake Victoria Environment Management Program.

The invasive aquatic weed - the Water hyacinth (*Eichornia crassipes*). Photo credit: Ecoloop 360.

Conserving Agricultural Biodiversity

The government established the Kenya Agricultural and Livestock Research Organization (KALRO) under the Kenya Agricultural and Livestock Research Act of 2013. This brought together all

agriculture and livestock related research institutes. The mandate of KALRO is to promote research and innovation in genetic resources, cultivated plants and domesticated livestock and their wild relatives, and biotechnology; and to apply these for the wellbeing of the people.

Sustainable Coastal Zone Management

Relevant SDG 6 indicators
6.5.1 Degree of integrated water resources management implementation (0-100)
6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation

On a scale of 0-100, the degree at which Integrated Water Resources Management (IWRM) is undertaken is 53 (MWI, n.d). There is a legal and policy framework which guides the sector. IWRM plans have been developed for each of the six water catchment basins and sub-catchment plans have been developed and operationalized. Water Resources Rules 2007 are used for equitable water allocation. Also developed is the Integrated Water Resources Management and Water Efficiency Plan for Kenya 2009, National Water Resources Management Strategy and Plan (2012-2016), the National Water Master Plan 2030, Water Policy 2016 and the Water Act 2016 which recognizes water resources regulation. At lower levels County Water Bills also include principles of IWRM. The Water Resources Authority is the sector regulator and public participation is encouraged through Water Resources Users Associations (WRUA) and Catchment Area Advisory Committees.

Transboundary Water Resources Management

Kenya has a number of transboundary water basins (rivers, lakes and aquifers) including the Merti Aquifer, Kilimanjaro Aquifer, Lake Victoria-Nile Basin, Daua River basin, Mara River basin, Sio-Malaba-Malakisi River basin, Athi, Tana, Rift Valley, and the Ewaso Ng'iro North basins (MWI, n.d).

The percentage of transboundary basin (rivers, lakes and aquifers) area with an operational arrangement for water cooperation is estimated at 26.8 per cent while that for rivers and lake basins was 35.9 per cent (UN Stats, 2019).The policy framework to support this collaboration includes the Kenya Transboundary Water Resources Policy and related legal context to operationalize the policy. There are varying levels of cooperation ranging from joint Memoranda of Understanding, projects, agreements and technical working teams. For instance, there is a 2015 Memorandum of Understanding for the Joint Water Resources Management of the Transboundary Mara River Basin between Kenya and Tanzania.

Bibliography

FAO. (2014). *Country Programming Framework for Kenya 2014-2017.* Rome: Food and Agriculture Organisation of the United Nations (FAO). Retrieved from http://www.fao.org/3/a-bp634e.pdf

FAO. (2019). *Crop Prospects and Food Situation.* Global Information and Early Warning System on Food and Agriculture (GIEWS). Rome: Food and Agriculture Organization of the United Natins (FAO). Retrieved July 7, 2019, from http://www.fao.org/3/ca5327en/ca5327en.pdf

FAO, IFAD, UNICEF, WFP and WHO. (2018). *The State of Food Security and Nutrition in the World 2018. Building climate resilience for food security and nutrition.* Rome: Food and Agriculture Organisation of the United Nations (FAO), IFAD, UNICEF, WFP and WHO. Retrieved from http://www.fao.org/3/I9553EN/i9553en.pdf

FAO/GEF. (2016). *Participatory assessment of land degradation and sustainable land management in grassland and pastoral systems.* Rome: Food and Agriculture Organization of the United Nations (FAO) and Global Environment Faciltiy. Retrieved July 7, 2019, from https://www.thegef.org/sites/default/files/project_documents/r_GCP_GLO_562_GTF_Prodoc_15032016__002_1.pdf

Kaluli, J. W., Githuku, C., Home, P., & Mwangi, B. M. (2011). Towards a National Policy on Wastewater Reuse in Kenya. *JAGST, 13*(1). Retrieved from https://ir-library.ku.ac.ke/bitstream/handle/123456789/7899/Towards%20a%20national%20policy%20on%20wastewater%20reuse%20in%20Kenya....pdf?sequence=3

KMFRI. (2017). *Kenya's Aquaculture Brief 2017: Status, Trends, Challenges and Future Outlook.* Mombasa: Kenya Marine and Fisheries Research Institute (KMFRI).

KNBS. (2018). *Statistical Abstract 2018.* Nairobi: Kenya National Bureau of Statistics (KNBS).

MDP. (2017). *Implementation of the Agenda 2030 for Sustainable Development in Kenya.* Nairobi: Ministry of Devolution and Planning (MDP). Retrieved from http://planning.go.ke/wp-content/uploads/2018/04/SDG-Implementation-plan-2030.pdf

MoENR. (2016). *Nationally Approrpriate Mitigation Action on a Circular Economy Solid Waste Management Approach for Urban Areas in Kenya.* Nairobi: Ministry of Environment and Natural Resources (MoENR). Retrieved July 1, 2019, from https://www.undp.org/content/dam/LECB/docs/pubs-namas/undp-lecb-Kenya-Waste-NAMA-2016.pdf

MWI. (n.d). *Kenya filled questionnaire for indicator 6.5.1: Degree of integrated water resources management implementation (0-100).* GEMI Initiative, UN-Water. Retrieved from http://iwrmdataportal.unepdhi.org/IWRMDataJsonService/Service1.svc/getNationalSubmissionFile/Kenya

Ondayo, M. A., Simiyu, G. M., Raburu, P. O., & Were, F. H. (2016). Child Exposure to Lead in the Vicinities of Informal Used Lead-Acid Battery Recycling Operations in Nairobi Slums, Kenya. *J Health Pollut, 6*(12), 15-25. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6221501/

SDGCA and SDSN. (2018). *Africa SDG Index and Dashboards Report 2018. Kigali and.* Kigali and New York: The Sustainable Development Goals Center for Africa)SDGCA) and Sustainable Development Solutions Network (SDSN). Retrieved from http://unsdsn.org/wp-content/uploads/2018/07/AFRICA-SDGS-2018-Complete-Report-WEB.pdf

Soezer, A. (n.d). *National Appropriate Mitigation Action on A Circular Economy Solid Waste Management Approach for Urban Areas in Kenya.* Nairobi: Ministry of Environment and Natural Resources (MENR) and United Nations Development Programme (UNDP).

UN Stats. (2019). *Sustainable Development Goals*. Retrieved from SDG Indicators: UN Global SDG Indicator Database: https://unstats.un.org/sdgs/indicators/database/

UNDESA. (2018). *World Statistics Pocketbook 2018 Edition.* New York: United Nations Department of Economic and Social Affairs (UNDESA).

World Bank. (2017). *The little green data book 2017 (English). World development indicators.* Washington, D.C.: World Bank. Retrieved from http://documents.worldbank.org/curated/en/239271500275879803/The-little-green-data-book-2017