**DEVELOPMENT OF KENYA NATIONAL ENVIRONMENTAL PERFORMANCE INDEX**

**WORKING PAPER 6: INDICATOR PROFILES AND DATA SOURCE**

## 1.0 Summary of Revised Draft KEPI Framework

**Table 1: Draft EPI Framework**

| **Index** | **Objectives** | **Policy** | **Indicators** | **Data Source** |
| --- | --- | --- | --- | --- |
| **EPI** | **Environmental Health** | Environmental Burden of Disease | Environmental Risk Exposure | KHDS – Kenya Health & Demographic Survey (2016), MOH |
| Air Quality | Indoor Air Pollution (COX,NOX, particulate matter) | NEMA, DOSH |
| Outdoor Air Pollution (COX,NOX, dust) | NEMA, DOSH |
| Water and Sanitation | Access to clean and safe drinking water | MOH (Public Health) |
| Access[[1]](#footnote-1) to Sanitation | MOH, Ministry of Water and Irrigation (State Department of Water Services) |
| Environmental Nuisance | Access to solid waste services | NEMA, County Municipalities |
| Noise Pollution | NEMA |
| **Ecosystem Vitality** | Sustainable Water Resources Management | Water Stress Index | Water Resource Authority (WRA) |
| River Water Quality Index | Water Resource Authority (WRA) |
| Marine Water Quality Index |
| Agriculture, Livestock and Fisheries | Nitrogen Use Efficiency | Ministry of Agriculture, Livestock and Fisheries, FAO |
| Nitrogen Balance | Ministry of Agriculture, Livestock and Fisheries, FAO |
| Fish stocks | Kenya Marine and Fisheries Research Institute (KMFRI) |
| Forests and woodlands | Forest Cover | KFS |
| Forest Protection | KFS |
| Air Pollution | Sulphide oxides concentration | NEMA, Kenya Meteorological Department |
| Nitrogen oxides concentration | NEMA, Kenya Meteorological Department, Ministry of Environment and Natural Resource |
| Biodiversity and Habitat | Species Protection (Marine and Terrestrial) | KWS, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) |
| Habitats Protection (Marine and Terrestrial) | KWS, National Museums of Kenya |
| Invasive species | KWS, KEPHIS, KMFRI |
| Climate Change | Green House Gases (GHG) emission per capita | MENR, KAM, Kenya Climate Innovation Centre  UoN (Institute for Climate Change) |
| Industrial Green House Gases emission | MENR, KAM  UoN (Institute for Climate Change) |
| Green House Gases emission from Solid Waste | MENR, Municipal Council  UoN (Institute for Climate Change) |
| GHG Emissions from Transportation | State Department for Transport, Research Institutions  UoN (Institute for Climate Change) |
| Energy Efficiency | Renewable Energy | Ministry of Energy and Petroleum |
| CO2 emission per KWH | Ministry of Energy and Petroleum |
| Sustainable Land Resource Use | Extent with alkalinity/ acidity risks | KALRO, Department of Resource Surveys and Remote Sensing (DRSRS) |
| Land degradation / Erosion | DRSRS,  Regional Centre for Mapping of Resources for Development (RCMRD) |
| **Socio Economic Sustainability** | Environmental Behaviour and Awareness | Environmental Education | NEMA |
| Poverty and Environment | Population below poverty line dependent on natural resource for livelihood | NEMA, Ministry of Devolution and Planning |
| Gender and Environment | Environment Gender Index | Survey, Expert Opinions and  National Gender and Equality Commission (NGEC) |
| Public Private Partnership | Support of environmental projects through PPP arrangement | Ministry of Devolution and Planning |
| Governance, Compliance and Enforcement | Environmental related policies formulated and legislations enacted | Ministry of Environ and Natural resources, CECs |
| Complains and prosecution on environmental pollution | National Environment Complaints Committee (NECC), Department of Compliance and Enforcement and the Environmental Inspectors and Prosecutors Office, NEMA, CECs |

## 2.0 Material Thresholds for Certain Indicators “Is a particular issue relevant to a County’s’ environmental performance?”

Differences in natural resource endowments, physical characteristics, and geography between Counties will be accounted for by introducing material thresholds for certain indicators. Only the indicators that meet the criteria for being relevant in a certain County will be included in calculating the County’s score. For Counties that will not meet the material threshold (e.g. minimum area of land that is forested), the indicator or issue category will not be included in calculating the score. For these Counties, other indicators

in the relevant category or categories will receive proportionally greater weight. This approach is widely accepted and has been adopted in the computation of global EPI scores. Table 2 presents the material thresholds that will apply for various policy categories /indicators for all Counties.

Table 2: Material Thresholds

| Indicator / Policy Issue | Not evaluated if… |
| --- | --- |
| Biodiversity and Habitat | Landlocked or ratio of coastline to land area less than 0.01. |
| Fish Stocks | Landlocked or ratio of coastline to land area less than 0.01. |
| Forests and Woodlands | Total forested area less than 200 sq. km or less than 3 percent of total land area is covered with greater than 30 percent tree canopy. |
| Energy | Least developed Counties |

## 3.0 Indicator Profiles and Data Source

### 3.1 Environmental Risk Exposure

**Objective:** Environmental Health

**Policy Category:** Environmental Burden of Disease

**Description**: The Environmental Risk Exposure (ERE) indicator assesses hazards to human health posed by five environmental risk factors: unsafe water, unsafe sanitation, ambient particulate matter pollution, household air pollution from solid fuels, and ambient ozone pollution. The indicator describes the dangers these environmental factors pose to human health, weighting each risk factor’s contribution to a nation’s burden of disease[[2]](#footnote-2).

The Environmental Risk Exposure summarizes the health risk that poor air and water quality pose to populations, weighted by how much the particular risk factor contributes to a country’s overall burden of disease (i.e., Disability-Adjusted Life Year or DALY). The disability adjusted life year (DALY), developed by World Health Organisation (WHO), calculates the sum of the number of life years lost due to premature mortality or years of life lost due to disability caused by an environmentally related disease.

**Rationale**: About a quarter of the total global burden of disease is attributable to remediable environmental causes[[3]](#footnote-3). Approximately 13 million deaths could be prevented every year by addressing environmental problems, such as air and water pollution, and through public health measures, such as improved access to water and sanitation and the use of cleaner fuels (WHO, 2008). It is estimated that about 25% of the diseases we face today are occurring due to prolonged exposure to environmental pollution (WHO, 1997). Interventions geared towards the improvement of hygiene, water supply and sanitation can reduce water & sanitation and respiratory related deaths by up to 35% (NEMA, 2011).

**Data Source**: KHDS – Kenya Health & Demographic Survey (2016), WHO, Institute for Health Metrics.

**Unit of Measurement**: Unitless Scale from 0 to 1, with 0 indicating no risk and 1 corresponding to maximum risk

**Variables**: No of deaths as a result of cholera, diarrhoea among under 5s, dysentery, incidences of malaria among under 5s and pregnant women, bilharzia, typhoid, respiratory infections (pneumonia) and occupational injuries.

**Indicator computation method**: A health exposure risk factor score attributed to each environmental characteristic i.e deaths, years of life lost, years lived with disability, and disability-adjusted life years (DALYs), which, taken together, constitute the “burden of disease.”

### 3.2 Indoor Air Quality

**Objective**: Environmental Health

**Policy**: Air quality

**Description**: Indoor air refers to the air quality within and around building and structures, especially as it relates to the health and comfort of building occupants. Some of the gases that cause health hazard within a building are: carbon monoxide, radon (a radioactive, colourless, odourless and tasteless gas in smoke) and particulates. Some of the diseases caused are: chronic acute respiratory infections, lung cancer, blindness, TB and miscarriages. Solid fuels such as (coal, wood, charcoal, dung, and crop residues) has much effect, liquid fuels (kerosene), gaseous fuels (LPG, natural gas, biogas) has moderate effect and electricity has slightly low human health effect.

Most of this happens when biomass is used for cooking. Electricity and gas has a less or no indoor air pollution experienced. Average exposure is PM2.5 Exceedance (an average of the percentage of the population exposed to PM2.5 levels at 10 μg/m3, 15 μg/m3, 25 μg/m3, and 35 μg/m3 – World Health Organization’s (WHO) air quality guidelines and interim I, II, and III targets; Household Air Quality – Indoor Solid Fuel Usage; and Average Concentration of NO2 (in parts per billion).

**Rationale**: According to the world development indicators, indoor air pollution is the world’s fourth leading cause of ill health in humans. There is seven (7) premature deaths due to air pollution in the world annually (WHO, 2015). Most of Kenyan citizen use biomass for cooking hence most of them are exposed to indoor air pollution. There is a significant rise in diseases associated with indoor air. The diseases include lung cancer, acute respiratory infections, blindness, TB and also miscarriages.

**Computation**: air pollutant concentration over a specified averaging period. Data from an air monitor.

**Unit of Measurement**: PPM (Parts per million)

Data Source: NEMA, DOSH

### 3.3 Outdoor Air Quality

**Objective**: Environmental Health

**Policy**: Air quality

**Description**: Outdoor air is the air polluted outside a premise. Some sources of the outdoor air include: dust, burning of trash, vehicles and industrial emissions. Some of the outdoor air include: sulphur dioxide, hydrogen sulphides, CO2, CO, Nitrogen Oxide, Nitrous Oxide.

Average exposure is PM2.5 Exceedance (an average of the percentage of the population exposed to PM2.5 levels at 10 μg/m3, 15 μg/m3, 25 μg/m3, and 35 μg/m3 – World Health Organization’s (WHO) air quality guidelines and interim I, II, and III targets; Household Air Quality – Indoor Solid Fuel Usage; and Average Concentration of NO2 (in parts per billion).

Rationale: Outdoor air also affects human health. There are seven (7) million premature deaths due to air pollution in the world annually (WHO, 2015). The air pollutants are mostly produced by vehicles, industries, any outside burning, dust etc. Human health has been at a great risk from the polluted air from outside. According to WHO, outdoor air pollution killed at least 5.5 million people in 2013, while another 141.5 million individuals lost a portion of healthy years from their lives. This is a clear indication that outdoor air has an effect to the human health and preventative measures should be taken into consideration while designing machines and work environment.

**Computation**: air pollutant concentration over a specified averaging period. Data from an air monitor.

**Unit of Measurement**: PPM (Parts per million)

**Data Source**: NEMA, DOSH

### 3.4 Access to Clean and Safe Drinking Water

**Objective:** Environmental Health

**Policy Category**: Water and Sanitation

**Definition**: Access to connected water supply measures the percentage of the population that has access to clean water supplied through proper piping system managed by the water operators under the supervision of state governments. The WHO defines an improved drinking water source as piped water into dwelling, plot or yard; public tap/standpipe; tubewell/borehole; protected dug well; protected spring; and rainwater collection (Source: WHO, 2008).

**Rationale:** As the nation becomes more developed and urbanised, efficient supply of clean water to homes and industry is an important factor to the quality of life and the environment. Access to clean and safe water in the right quantities by every Kenyan citizen is guaranteed in the constitution. According to the national to water masterplan 2030, the domestic demand for water is expected to increase from the estimated 1186 MCM/yr in 2010 to 2561 MCM/yr in 2030 and to 3657 MCM/yr in 2050. This presents enormous challenge in provision of adequate water and sanitation services. Failure to ensure adequate supply clean water supply will risk the population to be exposed to water borne diseases such as diarrhoea which may lead to sickness or even death.

**Computation/Indicator creation:** The computation of this indicator involves direct transformation from the reported figures at the ministry of water and irrigation (% access to water supply), department of water services. The indicator is a type A indicator where high values indicate good performance.

**Data Source**: Ministry of Water and Irrigation, State department of Water Services

### 3.5 Access to Sanitation

**Objective:** Environmental Health

**Policy Category**: Water and Sanitation

**Indicator Description**: Access to Sanitation describes the portion of a country’s population that has access to toilets that provide the safe disposal of human waste. Improved sanitation sources include connection to a public sewer, septic system, pour-flush latrine, simple pit latrine, or ventilated pit latrine. The system is considered “improved” if it hygienically separates waste from human contact and is not a public or shared facility. (Source: Global EPI Report, 2016).

**Rationale:** According to the Joint Monitoring Programme (WHO, UNICEF), only 32 percent of the rural population has access to improved sanitation of which 72 percent predominantly consisted of simple pit latrines providing varied degrees of safety, hygiene and privacy. Open defecation is still practiced in Kenya despite the government’s ambitious Open Defecation Free (ODF) Rural Kenya 2013 Campaign Roadmap. Overall, the national open defecation rate is about 14 percent, which masks massive regional disparities (KESHP 2016-2030). Similarly, an estimated 27% of urban population have access to improved sanitation. According to KESHP policy 2016-2020 only 60% of the wastewater in the sewer network reaches the treatment plants. In economic terms, Kenya loses KES 27 billion annually due to poor sanitation (National ODF Framework 2016-2020). For instance, feacal contamination of the environment is the root cause of an annual average of 3500 cases of cholera affecting Kenyans, especially the young children (SOE 2014).

**Computation/Indicator creation method:** The estimation of the country’s performance with respect to this indicator will involve direct transformation of the access to sanitation services using proximity to target. We envisage getting data for the access to sanitation (%) for the different counties from department of public health at county level. This is because health was devolved through the Kenya’s constitution of 2010, thus sanitation mandate lies with the counties. The indicator is a type A indicator where high values indicate good performance.

**Data Source**: MOH, Department of public health

### 3.6 Access to solid waste disposal services

**Objective:** Environmental Health

**Policy Category**: Environmental Nuisance

**Definition/Description**: The indicator provides a measure of the number of households with access to solid waste disposal services with the aim of ensuring safe and adequate disposal of the waste materials.

**Rationale**: A key concern in Kenya’s waste management is the rapid urbanization that has occurred over the past few decades. This is confounded by the improved economic status of the country which is accompanied by increased production of domestic waste. Solid waste management is a major environmental hazard in Kenya. The per capita waste generated was expected to be 1 kg/day by 2012; 61 percent of this waste being residential and hence, non-hazardous (KESHP 2016-2030). Environmental management and coordination (waste management) regulations, 2006 in section 2 requires all the waste generators to collect segregate and dispose or cause to be disposed of the waste generated as per the provisions of the regulations. Failure to observe these regulations often attract rodents and insects which tend to harbour gastrointestinal parasites, yellow fever, worms, the plague and other unhealthy conditions for humans. Exposure to hazardous wastes, particularly when they are burned, can cause various diseases including cancers. Additionally, waste can contaminate the ecosystem, including surface water, groundwater, soil, and air which cause more problems not only to humans but other species as well. Similarly, lack of access to adequate waste management services also affects the aesthetic value due to illegal disposal of waste in roads and other open areas.

**Computation/Indicator creation method:** The indicator will involve direct transformation to PTT. The indicator is a type A indicator where high values indicate good performance.

**Data Source**: Municipalities

### 3.7 Noise Pollution

**Objective:** Environmental Health

**Policy Category**: Environmental Nuisance

**Description**: Noise pollution means the *emission of uncontrolled noise that is likely to cause danger to human health or damage to the environment* as per the Environmental Management and coordination (Noise and excessive vibrations) regulations 2009. The Regulations elevate the standards of living of the people by prescribing acceptable noise levels for different facilities and activities. Different zones have different permissible noise levels for day and night.

**Rationale**. A person’s psychological wellbeing is influenced by the tranquility of the surrounding. It is thus prudent that the noise and excessive vibrations regulations in Kenya are enforced to ensure the maintenance of a healthy environment for all people in Kenya (NEMA)[[4]](#footnote-4).

**Computation/Indicator creation method:** Computation of an overall noise pollution index for the country will depend on the available data both spatialy and temporal. However, most noise emitters are not only stationary but also temporary posing a major challenge in aggregating the noise level spatially to obtain a country index. Whereas Environmental Management and coordination (Noise and excessive vibrations) regulations 2009 mandates government bodies (listed in regulation 22) to generate maps of noise levels, availability of this data is subject to field investigation to verify the quality of the datasets their availability. Should these datasets be made available in acceptable quality, the levels will be measured against the allowable levels as set in 1st-3rd schedules of the regulations. The injuries due to exceedance of allowable noise levels will be obtained from Directorate of Occupational Safety and health. The number of injuries per year will also be used to inform on the environmental health status through setting targets for the county/country.

**Data Source**: NEMA, DOSH, KeNHA, KAA, Mines and Geology Department, Kenya Railways, Kenya Meteorological department, County governments

**National Target**: Within allowable maximum levels and zero deaths/injuries due to noise and excessive vibrations.

### 3.8 Water Stress Index

**Objective:** Sustainable Water Resources Management

**Policy Category**: Sustainable Water Resource Management

**Description**: Water Stress is calculated as the percentage of a country’s or County’s territory affected by oversubscription of renewable water resources. Water use is represented by local demands summed by domestic, industrial, and agricultural water withdrawals, and then divided by available water supply to yield an index of local relative water use. A high degree of oversubscription is indicated when the water use is more than 40% of available supply (WMO, 1997). The Water Stress Index helps to capture national / county’s variation in water use vs. availability.

**Relevance/Rationale**: Protection of water systems and the provision of adequate quantities of water for various types of water uses are critical for sustainable development. Growing population has led to increasing demand to supply water for domestic, agricultural, and/or industrial use leading to habitat and biodiversity loss, pollution, the introduction of invasive species, and the construction of dams (UNEP GEMS/Water, 2006). Public policy should monitor the balance of demand to supply of critical water resources to protect populations from both short and long term needs.

**Variables:** Available renewable water resources (rainfall, ground water) – millions of cubic (meters)

* Total Water demand for domestic, agriculture, industrial and other uses
* Change in water quantity /Long term trends of river flow levels, lake levels and ground water levels
* Amount of rain water and runoff water harvested
* Number of water monitoring stations

**Indicator computation method**: The formula used for calculation of water stress index is:

WSI = (Total water use / Renewable water supply) x 100 (%)

Where:

Water use = domestic demand + agricultural demand + commercial demand + industrial demand

Renewable water supply = rainfall + renewable groundwater + desalination + reuse of treated wastewater

**Target:** Water use is considered sustainable if this ratio is equal to or less than 100%.

**Data Source:** Water Resource Authority (WRA)

### 3.9 Water Quality Index

**Objective:** Sustainable Water Resources Management

**Policy Category**: Sustainable Water Resource Management

**Definition:** Water quality index (WQI) is valuable and unique rating to depict the overall water quality status in a single term that is helpful for the selection of appropriate treatment technique to meet the concerned issues. The Water Quality Index (WQI) uses six parameters measuring nutrient levels (dissolved Oxygen, total Nitrogen, and total Phosphorus) and three parameters measuring water chemistry (pH, trace elements and conductivity). These parameters have been selected because they cover issues of national and global relevance (eutrophication, nutrient pollution, acidification, and salinization) and because they are the most consistently reported.

**Rationale**: Water quality is a critical indicator for measuring ecosystem health. Pressure on global freshwater resources is growing due to factors such as population growth, air pollution deposition, climate change, land management, and economic development (Vorosmarty et al. 2010). This makes adequate water resource monitoring, management, and protection particularly urgent.

For the nutrient measurements, dissolved oxygen is the measure of free (i.e., not chemically combined) oxygen dissolved in water. It is essential to the metabolism of all aerobic aquatic organisms and at reduced levels has been shown to cause both lethal and sub-lethal effects. Nitrogen and phosphorus are naturally occurring elements essential for all living organisms, and are often found in growth-limiting concentrations in aquatic environments. Increases in nitrogen and/or phosphorus in natural waters, which result largely from agricultural runoff and synthetic fertilizers or from municipal and industrial wastewater discharge, can result in significant water quality problems, including harmful algal blooms, hypoxia and declines in wildlife and wildlife habitat. Excesses have also been linked to higher amounts of chemicals that that are harmful for humans (EPA, 2010).

The last two parameters, acidity and alkalinity, are measured by *pH* – an important indicator of water quality in inland waters because it can affect aquatic organisms, both directly through impairing respiration, growth and development of fish, and indirectly through increasing the bioavailability of certain metals such as aluminium and nickel. Electrical *conductivity* is a measure of the ability of water to carry an electric current, which is dependent on the presence of ions. Increases in conductivity can lead to ecosystem changes that reduce biodiversity and alter community composition (Weber- Scannell and Duffy, 2007).

**Data Source:** Water Resource Authority (WRA)

**Indicator creation method:** River water quality index (WQI) is computed based WQI is computed based on 6 main parameters: pH, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), trace elements and fecal coliforms. For the purpose of EPI PTT computation, total WQI of rivers within a County/ Kenya will be divided by the number of stations in order to obtain the Average WQI for the County / Kenya.

The mathematical expression for WQI is given by

http://pubs.sciepub.com/ajwr/1/3/3/image/equ1.png

Where,

*Qi* = sub-index for ith water quality parameter;

*Wi* = weight associated with ith water quality parameter;

n = number of water quality parameters.

### 3.10 Marine Water Quality Index

**Objective:** Sustainable Water Resources Management

**Policy Category**: Sustainable Water Resource Management

**Description:** This indicator evaluates the number of coastal and estuary water samples that comply with the Kenya’s Marine Water Quality Parameters guidelines.

**Rationale:** Maintaining a thriving and diverse marine ecosystem requires a high water quality level and specific characteristics. This indicator monitors several parameters critical to sustaining habitats and diversity of marine species. Marine water quality monitoring plays an important role in evaluating the degree of pollution from land based sources as well as sea based sources that can pose threats to the marine resources which contribute to the stability and diversity of the marine ecosystem. The results will reflect the degree of the health status of marine water.

**Unit of measurement:** index

**Indicator creation method:** The computation of MWQI takes into consideration nine parameters (Total suspended solid (TSS), Oil& Grease, E.Coli, Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb) and Mercury (Hg)) which can directly relate to the degree of marine water quality in a specified area. The percentage of samples that comply with the MWQI Guidelines is computed for each County by subtracting number of samples that exceed the standard guidelines from the total samples in each County.

### 3.11 Nitrogen Use Efficiency

**Objective**: Ecosystem Vitality

**Policy**: Agriculture, Livestock and Fisheries

**Indicator**: Nitrogen Use Efficiency

**Description**: Nitrogen Use Efficiency (NUE) is examined by taking into account both plant N uptake efficiency, focusing on the recovery of fertilizer-N, and the utilization efficiency of the absorbed N or measures appropriate management of nitrogen resources for agricultural production. Also it measures the ratio of nitrogen inputs to outputs and is expressed as a percentage, with 100 percent representing maximum efficiency.

Increasing nitrogen use efficiency (NUE) directly enhances crop productivity while decreasing nitrogen runoff and associated environmental degradation. Nitrogen (N) application is a universal method for intensifying agricultural production – thereby reducing the pressure to convert other landcover types, like forests and wetlands, into croplands. But too much N can be harmful. N not taken up by crops enters the environment through nitrogen leaching, ammonia volatilization, and nitrous oxide emissions.

Rationale: Applying nitrogen (N) to cropland is a critical method of increasing crop production without furthering land conversions. Excessive applications, however, can have significant environmental impacts. N not taken up by crops is often lost to the environment through nitrogen leaching, ammonia volatilization, and nitrous oxide emissions. This can negatively affect air and water quality, lead to ozone layer depletion, and exacerbate climate change Monitoring the appropriate use of these agricultural inputs acts as a proxy for their potential to do environmental harm, and encourages countries to be more judicious in their applications.

**Computation**: NUE = ((N in crops+N in fertilizer)) / ((N in fertilizer+N in imported feedstaff+N fixation+N deposition))

Where N is nitrogen

**Unit of Measurement**: metric tonnes (Percentage)

**Data Source**: Ministry of Agriculture, Livestock and Fisheries, FAOSTAT

### 3.12 Nitrogen Balance

**Objective**: Ecosystem Vitality

**Policy**: Agriculture, Livestock and Fisheries

**Indicator**: Nitrogen Balance

**Description**: nitrogen balance (NBALANCE), measures excess nitrogen released to the environment as a result of an overuse of fertilizer application. NBALANCE lies between 39 – 79 kg/N/year.

**Rationale**: Fertilizer production and excessive application, however, create a host of environmental and human health problems. Nitrogen runoff leads to eutrophication – the chemical enrichment of an aquatic ecosystem often leading to oxygen depletion and species die-off – habitat destruction, and biodiversity loss in freshwater and marine ecosystems. Nitrogen compound emissions contribute to acid rain, ground level ozone, atmospheric ozone depletion, and ultimately to climate change.

**Computation**: NBALANCE = (N in fertilizer + N in feed staffs + N fixation + N deposition – (N in crops + N in livestock))

**Unit of Measurement**: Metric tonnes

**Data Source**: Ministry of Agriculture, Livestock and Fisheries

### 3.13 Fish Stocks

**Objective**: Ecosystem Vitality

**Policy**: Agriculture, Livestock and Fisheries

**Indicator**: Fish stocks

**Description**: The Fish Stocks indicator is a measure of the proportion of a country’s total catch – within its exclusive economic zone (EEZ) – that comes from overexploited or collapsed fish stocks. Overexploitation occurs when a fish stock is harvested at levels that exceed the species’ capacity for reproduction and replacement. As a proxy for fisheries management, the Fish Stocks indicator may not adequately capture historically exploited fish stocks that are on the path to rebuilding. The target is to have Zero percent of fish stocks overexploited or collapsed.

Kenya is endowed with both marine and inland water resources that contribute to the overall fish production; the coastal marine resource includes the EEZ. The inland water resources include lakes, dams, and rivers of varying sizes. Fisheries contribute a significant proportion to Kenya’s GDP. Fish stocks is a subpopulation of a particular species of fish, for which intrinsic parameters (growth, recruitment, mortality and fishing mortality) are traditionally regarded as the significant factors determining the stock's population dynamics, while extrinsic factors (immigration and emigration) are ignored.

**Rationale**: Fish in Kenya is governed by the fisheries Act of 2012 and fisheries management and development Act of 2016. Fish can be in sea, lakes, rivers and ponds. These habitats have different species of fish. The stocks in Kenya change due to unsustainable fishing practices, habitat destruction, pollution and weak management structures. The effect of fish stock reduction is an ecosystem problem that affects the species. Fish stock is guided by the Sustainable Development Goal (SDG) 14 to “Conserve and sustainably use oceans, seas and marine resources. Proper management of fisheries requires limitation of the number of persons or of vessels, nets or areas or other means employed in a fishery. (Fisheries Act, 2012).

**Computation**: Catch Data for selected species(taxon).

**Unit of Measurement**: Metric tonnes (MT) (% catch relative to the maximum catch over a time series)

**Data Source**: Kenya Marine and Fisheries Research Institute (KMFRI), Ministry of Agriculture Livestock and Fisheries, State Department of Fisheries.

**Target**: Zero percent of fish stocks overexploited or collapsed

### 3.14 Forest Cover

**Definition**: In Kenya, Forests implies *land which is declared or registered as a forest, or woody vegetation growing in close proximity in an area of over 0.5 of a hectare including a forest in the process of establishment, woodlands, thickets* (Forest Conservation and Management Act, 2016) This indicator provides the total area under forest for the whole country measured against the country desired target.

**Rationale**. Kenya is endowed with a wide range of forest ecosystems ranging from montane rainforests, savannah woodlands; dry forests and coastal forests and mangroves. The current forest cover of 6.99% of the land area of the country is still below the constitutional requirement of 10%. Forests play critical ecological, social, cultural, and economic functions. They contribute directly and indirectly to the national and local economies through revenue generation and wealth creation, and it is estimated that forestry contributes to 3.6% of Kenya's GDP, excluding charcoal and direct subsistence uses. Forests also support most productive and service sectors in the country, particularly agriculture, fisheries, livestock, energy, wildlife, water, tourism, trade and industry that contributes between 33% to 39 % of the country's GDP. Biomass comprises about 80% of all energy used in the country, while they also provide a variety of goods, which support subsistence livelihoods of many communities (Forest Policy 2014).

**Computation/Indicator Creation Method:** The forest cover will be computed using satellite data Known forest areas will be used as training datasets for satellite mapping. However, primary data will be obtained from Kenya Forest Service and Kenya Forest Research institute on the current forest cover in the country. The status will be measured against the set target to allow computation of proximity to target and to provide the overall indicator score.

**Units of measurement**: Hectares

**Data Source**: Kenya Forest Service (KFS), Kenya Forest Research Institute(KEFRI)

**National Target**: 10% forest cover

### 3.15 Forest Protection

**Definition**: Forest protection indictor measures the total forest area (ha) in the country that is currently protected against the forests under threat of destruction by virtue of not being protected by the relevant institution. Globally, forest cover loss is used to measure loss of forests based on an established benchmark.

**Rationale**. Forests comprise the country’s water towers and catchments, where over 75% of the country's renewable surface water originate, and therefore serve critical water regulation roles which are important for human livelihoods, irrigated agriculture, and production of hydroelectric power. At the same time, deforestation in Kenya is estimated at 50,000 hectares annually, with a consequent yearly loss to the economy of over USD 19 million (Forest Policy 2014).

**Computation/Indicator Creation Method:** The forest protection will be measured using forest cover loss/deforestation due to illegal logging estimated from satellites together with primary data obtained from Kenya Forest Service and Kenya Forest Research institute. We envisage that KFS will have information on the current forest cover in the country and on including average tree cover loss through illegal logging, agricultural expansion, urbanisation and licensed tree harvesting. The status will be measured against afforested areas over the same period to allow computation of proximity to target where the country aims to move from the current 6.99% to 10% tree cover.

*Fo*

**Units of measurement**: Hectares

**Data Source**: Kenya Forest Service (KFS), Kenya Forest Research Institute(KEFRI)

**National Target**: Target should be greater than 1

### 3.16 Sulphide Oxide (SO2) concentration

**Objective**: Ecosystem Vitality

**Policy**: Air Pollution

**Indicator**: Sulphide oxide (SO2) concentration

**Description**: Sulphur dioxide is produced mainly from the combustion of fossil fuels that contain sulphur, such as coal and oil (e.g., coal being burnt in a home fireplace for heating and diesel-powered vehicles). Sulphur dioxide is also produced from some industrial processes (e.g. fertiliser manufacturing, aluminium smelting and steel making). Natural sources of sulphur dioxide include geothermal activity.

**Rationale**: SO2 is one of the primary contributors to acid rain, which can diminish fish stocks, decrease biological diversity in sensitive ecosystems, degrade forests and soils, and diminish agricultural productivity. SO2 can also form hazardous aerosols under certain atmospheric conditions. However, sulphur dioxide deposition can affect vegetation around industrial discharges and in cities. Lichens are good bio-indicators of pollution as they do not like to grow where there is sulphur dioxide in the air. The average concentrations of sulphur dioxide should not exceed the 350 µg/m3 standards more than nine times a year and should not exceed the 570 µg/m3 standards at all.

**Computation**: air pollutant concentration over a specified averaging period. Data from an air monitor.

**Unit of Measurement**: PPM (Parts per million)

**Data Source**: NEMA, DOSH

### 3.17 Nitrogen oxide concentration

**Objective**: Ecosystem Vitality

**Policy**: Air Pollution

**Indicator**: Nitrogen oxide concentration

**Description**: Two of the most common nitrogen oxides are nitric oxide and nitrogen dioxide. The main source of nitrogen dioxide resulting from human activities is the combustion of fossil fuels (coal, gas and oil) especially fuel used in cars. It is also produced from making nitric acid, welding and using explosives, refining of petrol and metals, commercial manufacturing, and food manufacturing. Natural sources of other nitrogen oxides include volcanoes and bacteria.

**Rationale**: Nitrogen oxides are a group of highly reactive gases. They contribute to the formation of ground-level ozone, fine particulates, and acid rain. The damages associated with NOX overlap heavily with those listed for SO2 and acid rain. Additionally, nitrogen from NOX emissions can dissolve in water and lead to eutrophication.

Nitrogen dioxide is toxic to plants in short-term concentrations of 120 µg/m3. It reduces plant growth. When sulphur dioxide and ozone are also present, the effects on vegetation are worse. Along with sulphur dioxide, nitrogen dioxide can cause acid rain. The national environmental standard for nitrogen dioxide is 200 µg/m3 as a 1-hour average.

Computation: air pollutant concentration over a specified averaging period. Data from an air monitor.

**Unit of Measurement**: PPM (Parts per million)

**Data Source**: NEMA, DOSH

### 3.18 Habitat Protection

**Definition**: This indicator measures the total area of protected habitats that against the total land that is not protected. The protected habitats include both marine and terrestrial habitats. This indicator assesses the nation’s area of protected biomes in proportion to the territory that each biome occupies. This indicator appraises a country’s contribution to protecting habitats that are rare or threatened at the national/global level.

**Rationale**. Of the nine Planetary Boundaries popularized by Johan Rockström at the Stockholm Resilience Institute, the global limits of biodiversity loss have been exceeded by the widest margin. Biological diversity provides grounds for ecosystem functioning and the provision of ecosystem services which are paramount for human well-being. The terrestrial and marine protected habitats host rich biodiversity that provides services essential for food security, human health, the provision of clean air and water; contribution to local livelihoods, and economic development. However, about 70% of the Kenya’s National biodiversity treasure are found outside protected areas, hence exhibit an increased pressure of destruction and loss of species and habitats (SOE 2014).

**Computation/Indicator Creation Method:** The computation of this indicator will involve calculating the ratio of the habitats that are protected to non-protected areas. The indicator borrows from the global EPI.

**Units of measurement**: Hectares

**Data Source**: KWS, KEMFRI

**National Target**: 10% forest cover

### 3.19 Species Protection

**Definition**: The Species Protection indicator report on countries’ efforts to protect species (in the mammals, birds, and amphibians taxonomic classes) in their actual as opposed to estimated ranges. The indicator strives to assess the policy effectiveness towards protection of endangered species in the country.

**Rationale**: Convention on International Trade in Endangered Species of wild fauna and flora also known as CITES which Kenya is a signatory prohibits any trade or traffic of threatened species of flora and fauna. Kenya has approximately 159 species of plants considered threatened (38%), 71 species of birds threatened (27%), 9 of the threatened mammals 55% are all found in the Coast Region (SOE 2014). The country has also recorded 18 extinctions including the Rocky River frog and the Kenyan Oribi. One of the targets of the Convention on Biological Diversity to which Kenya is a party is to prevent the extinction of known threatened species by 2020 and that by then their conservation status, particularly of those most in decline, has been improved and sustained. In Kenya poaching of Elephants and Rhino for tusk and horn continue to be a major challenge with an average loss of over 200 elephants per year outside the KWS protected areas and up to 50 per year within KWS protected areas (SOE, 2014).

**Computation/Indicator Creation Method:** This indicator focuses on the actual number of endangered species. The indicator will measure the population of threatened species that are within protected areas against the population of endangered species outside protected areas both marine and terrestrial.

**Units of measurement**: No of Species Protected

**Data Source**: KWS, KMFRI

### 3.20 Invasive Species

**Definition**: Invasive species are organisms that cause ecological or economic harm in a new environment where it is not native. The species invade forests/woodlands, agricultural areas, rivers and lakes such as the water hyacinth in Lake Victoria and in Lake Naivasha and the rapidly spreading ‘Mathenge shrub in arid and semi-arid areas.

**Rationale**: Kenya has also had several invasions of alien species that have had negative impacts on biodiversity, agriculture and human development. Studies show that Kenya has been invaded by 34 species: 11 arthropods, ten microorganisms, nine plant species and four vertebrates (SOE,2014). The SOE 2014 indicates Nairobi National Park and the Maasai Mara National Reserve are among many wildlife areas that have been adversely affected by invasive species in the country. In agriculture for instance, the recent (march 2017) invasion of fall army worm in North Rift has threatened food security in the country. The pest *Spodoptera Frugiperda* has a potential of destroying 100% of crops that include maize, sorghum rice and some vegetable crops.

**Computation/Indicator Creation Method:** The computation of this indicator will involve quantifying the area invaded by alien species. We however recognize that the effect varies for instance on water bodies compared to agriculture or on arid and semi-arid areas. Whereas for agriculture, the loss can be quantified economically, the invasion of hyacinth or Mathenge shrub can be easily quantified on spatial scale(area). Overall, areal measurements will be used for uniformity across counties as the invasion affect economic activities ranging from pastoralism, fishing, navigation and agricultural production.

**Units of measurement**: Area in Hectares to be given in % area of land invaded by alien species relative to the total agricultural land/water body area/shrubland in a given county. The proximity to target calculation will depend on the targets set at different county regarding the alien species of interest to a given county. For instance, in North rift we envisage that the counties will target minimizing the crop destruction by fighting fall army warms. On the other hand, the counties affected by invasion of hyacinth/Mathenge will target harvesting the to reduce the area affected.

**Data Source**: KWS, KALRO, KEPHIS, KFS

### 3.21 Greenhouse gases (GHG) emission per capita

**Objective**: Ecosystem Vitality

**Policy Category**: Climate Change

**Definition**: This indicator seeks to measure the annual equivalence of CO2 emission per person.

**Relevance/Rationale**: Greenhouse gas emissions contribute to climate change. The impacts of climate change are already being felt nationally and are projected to accelerate in severity globally. These impacts affect human health, water resources, agriculture, and ecosystems. While most greenhouse gas emissions (GHG) to date have originated in developed nations, developing countries are, and will continue to be, the most affected by climate change impacts (Stern 2006). GHGs are emitted from a variety of human activities including electricity generation, transportation, industrial agriculture, forestry, and waste management (IPCC 2007). Monitoring greenhouse gas emissions is critical for targeting effective climate change policy.

**Unit of measurement:** kg per capita

**Indicator creation method**: Total amount of CO2 equivalent of electricity consumption, transportation and solid waste are weighted by total population

**Data Source:** Kenya Meteorological Department

### 3.22 Industrial Green House Gases (GHG) emissions

**Objective**: Ecosystem Vitality

**Policy Category**: Climate Change

**Description**: This indicator seeks to measure the annual equivalence of CO2 emission by the industrial sector.

**Rationale:** Monitoring greenhouse gas emissions is critical for targeting effective climate change policy. This requires information for the public sector as well as the private sector. With oil and gas production a major driving factor for the economy, careful monitoring of all sectors is required.

**Data sources**: KAM

**Variable**: Electricity Consumption, Emission rate, Industrial (Manufacturing) GDP

**Trend Data**: 2011 and 2016

**Unit of measurement**: Tonnes/Industrial GDP

**Indicator computation method**: The industrial GHG emission for each count is computed based on the industrial electricity consumption, converted into CO2 equivalent emission using the emission rate from electricity generation: CO2 emission = Elec \* Eco2/. The CO2 emission is then weighted against the industrial (manufacturing) GDP.

### 3.23 Greenhouse Gases Emissions (GHG) from Solid Waste

**Objective**: Ecosystem Vitality

**Policy Category**: Climate Change

**Description**: Municipal solid waste is a type of waste consisting of everyday items that are discarded by the public every day. Generally, municipal solid waste may consist of garbage (food waste and other degradable organic wastes), rubbish (combustible and non-combustible solid waste), refuse and litter. The indicator is a measure of the total waste generated per capita in a country. It is used to measure the policies put in place by municipalities to reduce the waste generated at source. It in turn promotes a negative trend in generation and concerted efforts on recycling to reduce the general cost of disposal to the economy.

**Rationale**. Greenhouse gas emissions from waste contribute to the household carbon footprint. In urban centres, whereas the waste may be disposed and transported to a landfill/solid waste disposal site, the waste continues to generate greenhouse gases for up to 15 years. One of its effects is the foul smell that causes environmental nuisance to the residents living near the site. Additionally, the gases contribute to the overall footprint of the greenhouse gases that over a long time bring about climate change.

**Computation/Indicator creation method:** In order to estimate emissions from solid waste, the first step will involve estimating the average solid waste disposed from households. The carbon footprint for the waste can then be estimated depending on the type of waste. The study will consider municipal solid waste in major towns spread across the country. We envisage obtaining the average solid waste disposed per household per year from the respective municipalities at county level. The amount will be used to calculate average tonnes of CO2 equivalent generated from waste per person per year. A model developed by US Environmental protection Agency (EPA) for estimating CO2 equivalent from waste will be used.

**Emissions = number of people in household \* average tonnes of CO2 equivalent generated from waste per person per year**

**Data Source**: Municipalities

**Unit of measurement**: Tonnes of CO2 equivalent per person per year

### 3.24 GHG Emission from Road Transportation

**Objective/Policy**: Ecosystem Vitality/Climate Change

**Description**: This indicator seeks to measure the sum of GHG emissions (in CO2 equivalents) from road transportation. The majority of GHG emissions from transportation are CO2 emissions resulting from the combustion of petroleum-based products like gasoline, in internal combustion engines.

**Rationale**: Green House Gases (GHG) emissions from road transportation (passenger cars, light duty vehicles, heavy duty vehicles, buses and motorcycles) contribute to global warming. High GHG emission from the transport sector indicates the inefficiency of public transport and/or low/medium level environmental awareness among the public.

**Data Sources**: State Department for Transport, Research Institutions

**Trend Data**: Time series data for 3 to 5 years

**Unit of measurement**: Ktonnes CO2 Equivalent (kg CO2 eq)

**Indicator creation method**: A COPERT 4 (Computer Programme to estimate Emission from Road Traffic) model will be used to calculate emission of road transport in Kenya. COPERT 4 is a software tool coordinated by the European Environment Agency (EEA) that has been used world-wide to compute greenhouse gas emission from road transportation.

The model utilises the following data:

* Monthly minimum temperature and maximum temperature
* Monthly relative humidity
* Annual fuel consumption specification per fuel type by each state
* Number of vehicles per vehicle category
* Distribution of the vehicle fleet into different vehicle categories
* Mileage per vehicle category
* Average speed per vehicle type in different road
* Driving Share
* Mean trip distance
* Emission factors per vehicle category

### 3.25 Renewable Energy

**Objective**: Ecosystem Vitality

**Policy Category**: Energy

**Definition**: Percentage of total net generation of renewable electricity over the total net electricity generation

**Rationale**: Since the energy sector contributes most of the anthropogenic GHG emissions globally, the percentage of all energy from renewable sources indicates the performance of each country in this critical sector. Renewable energy is derived from naturally occurring resources, principally the movement of wind and water, the heat and light of the sun, plant material and animal waste, and geothermal (the heat in the earth’s crust). All these resources can supply our needs and those of future generations in a sustainable way. Effectively harnessing these renewable resources requires careful planning and advanced technology. Renewable energy has the potential to enhance energy security and reliability; generate income and create employment; enable the country to make substantial foreign exchange savings by reducing dependence on imported fuels and its attendant price volatility, and mitigate climate change as it has minimal adverse effects on the environment. According to the Economic Survey 2013, biomass provides 69% of the country’s overall energy requirements while petroleum accounts for about 22% and electricity 9%. 74.5% of the electricity component is generated using renewable energy sources with fossil fuels providing the balance of 25.5% (SOE 2014).

**Indicator creation method:** This indicator is calculated by dividing the renewable electricity production by total electricity production. The renewable electricity production includes biodiesel, biogasoline, other biogas, charcoal, geothermal, hydro, other liquid biofuels, sludge gas, solar energy and wind.

**Unit of measurement**: Percentage

**Data Source**: Ministry of Energy and Petroleum

**Target**: 100%

### 3.26 CO2 emission per KWH

**Objective**: Ecosystem Vitality

**Policy Category**: Energy

**Description**: This indicator refers to the ratio of CO2 emissions to electricity generated by power plants.

**Rationale**: CO2 emissions contribute to climate change. Three denominators (population, GDP and electricity generation) are used to assess the relative carbon efficiency of economies in these three aspects.

**Unit of measurement**: kg CO2 per person

**Indicator creation method**: This indicator is created using a sectoral approach that contains total CO2 emissions from fuel combustion as calculated using the IPCC Tier 1 sectoral approach divided by the total population in a County.

**Data Source**: Ministry of Energy and Petroleum, International Energy Agency (IEA)

**Target**: The nominal policy target is 0 emissions per kWh.

### 3.27 Extent with alkalinity/ acidity risks

**Objective**: Ecosystem Vitality

**Policy**: Sustainable Land Resource Use

**Indicator:** Extent with alkalinity/ acidity risks

**Description**: Acidity or pH is a measure of the concentration of hydrogen ions (H+) in the soil. In general, water for irrigation should have a pH between 5.0 and 7.0. Water with pH below 7.0 is termed "acidic" and water with pH above 7.0 is termed "basic"; pH 7.0 is "neutral". Alkalinity is a measure of the water's ability to neutralize acidity. An alkalinity test measures the level of bicarbonates, carbonates, and hydroxides in water and test results are generally expressed as "ppm of calcium carbonate (CaCO3)".

**Rationale**: Irrigation water and fertilizer changes the soil PH with time. The hot and dry climates of requires that the irrigation water does not contain soluble salts in amounts that are harmful to the plants or have an adverse effect on the soil properties. Water of such quality is usually not available in sufficient quantities to satisfy the water requirements of all the crops grown.

The PH changes affects the soils and the ground water. The changes are caused by high evaporation on the surface living the soil with salts of higher or low PH. The extensive demand and use of groundwater can induce salt-water intrusion while high evaporation can increase salinity in shallow aquifers. This indicator detects changes and can alert policy makers to threats of deteriorating quality. It measures the total area where an increment of concentration in EC is detected. The target is no further increase of saline, brackish and brine water. It is possible to identify the anthropogenic source contamination of water from agricultural activity by closely analysing the change in the electrical conductivity of groundwater within areas cover by irrigation.

**Computation:** Sampling method of the available data. Non-available data PH- meter used in soil samples.

**Unit of Measurement:** ECe (μS/cm)

TDS (ppm) = 0.64 X EC (μS/cm) = 640 X EC (dS/m)

**Data Source:** KALRO, DRSRS

### 3.28 Land Degradation/ Erosion

**Objective**: Ecosystem Vitality

**Policy**: Agriculture, Livestock and Fisheries

**Description**: Land degradation is a process in which the value of the biophysical environment is affected by a combination of human-induced processes acting upon the land. It means Loss of natural fertility of soil because of loss of nutrients, less vegetation cover, Changes in the characteristic of soil, Pollution of water resources from the contamination of soil through which water sweeps into ground or runoff to the water bodies and Changes in climatic conditions because of unbalanced created in the environment. The different causes of land degradation include the following: deforestation, overgrazing, agricultural practices, industrialization and urbanization.

**Rationale**: Arable land is more susceptible to erosion and degradation because of soil disturbance every now and then during ploughing hence making it easy to be washed away. Most of the arable land in Kenya are in highlands because of its fertility. The percentage of these lands is low hence protection against erosion of any kind should be done both at the national and county level. If it is not done then the soil and land is affected. The data of this arable lands under protection can be found in the ministry of agriculture and lands.

**Computation:** Time series data of maps on land use will give the change in percentage of land used in different areas i.e. agriculture, forestry, residential etc.

**Unit of Measurement:** Square Kilometres (Km2)

**Data Source:** Department of remote survey and remote sensing (DRSRS)

**NB: Principal component analysis (PCA)** is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.

### 3.29 Environmental Education

**Objective / Policy Category**: Socio Economic Sustainability / Environmental Behaviour and Awareness

**Definition**: Environmental Education is multidisciplinary approach that encompasses effort to understand and appreciate the environment while teaching how natural environment function in relation to human behavior towards ecosystems for sustainable livelihoods (SOE 2014).

**Relevance / Rationale**: Environmental education is a crucial component for achieving sustainable development goals and an essential tool for informed decision-making and constructive community engagement. Raising awareness and changing behavior are key tools for environmental protection. The increasing population rate, rapid development and increased urbanisation is accompanied by increased demand for natural resources which increases pressure on limited natural resources. Comprehensive education programs in both formal education institutions and non formal ones are key in transforming environmental goals into realities. The programs may include topics on sustainable use of natural resources and impact of global climate change. The main goal of the programs is to raising awareness to changing personal behavior. These programs can take the form of general media broadcasts and school curriculum development, to major awareness-building and behavior change campaigns.

NEMA acknowledges that broad public participation in decision making processes is one of the fundamental preconditions for sustainable development and aims to promote environmental education and public awareness at all levels (SOE 2014). Public awareness during world environment days is carried out in the country using various methods which include media outreach, public barazas, exhibitions, agriculture shows among others. This is geared towards reaching a critical mass of citizens.

Environmental awareness is highly correlated with behavior. The goal is to achieve a close ratio of awareness to behaviour and hence there is need to continually assess this ratio in order to capture positive or negative changes in awareness levels.

**Indicator computation method**: This indicator relies on survey data from a sample of a statistically balanced population of various target groups. A questionnaire capturing issues of water, waste/energy, waste, biodiversity, pollution etc is filled by the respondents and the responses to each question are collated and rated as per the following Awareness and Behavior

Scales/levels –indicating what proportion of respondents are falling under each level.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Ratings** | 5 | 4 | 3 | 2 | 1 | 0 |
| **Awareness Levels** | Excellent | Good | Average | Fair | Poor | Poor |
| **Behaviour level** | Always | Most of the time | Sometime | Rarely / | Not Sure / Don’t Know | Never |

**Data Source**: NEMA (Education and Information Department)

### 3.30 Population below Poverty Line Dependent on Natural Resource for Livelihood

**Objective / Policy Category**: Socio Economic Sustainability/ Poverty and Environment

**Definition**: Population below poverty line dependent on natural resource for livelihood

**Relevance / Rationale**: As the world population continues to grow, so does the demand on world resources continue to rise. Poverty often causes people to put pressure on the environment. Environmental pressure on resources is largely affected by populations poverty levels. Poor people tend to rely more directly on their environment for survival than the wealthy. The poor experience difficulties in meeting various needs and this leads to pressure on land, overexploitation of soils and deforestation. The poor also lack access to training on how to protect the environment.

**Indicator computation method**: Percentage of the total population in a County living below poverty line (less than 1 dollar a day) that is dependent on natural resource for livelihood.

**Data Source**: Survey Data

**Unit of Measurement**: Percentage

### 3.31 Environment Gender Index

**Objective / Policy Category**: Socio Economic Sustainability / Gender and Environment

**Definition**: A survey based index reflecting inequality in achievement between women and men in three dimensions: livelihood, empowerment and the natural resource management.

**Relevance / Rationale**: Different roles men and women have in the family, community and work-force are likely to have different responses, priorities and power over resources when it comes to environmental protection. Men and women will therefore interact with the environment differently, and therefore an opportunity for them to protect it.

Gender roles in most communities in Kenya dictate that women and children are daily exposed to environmental risks, because of their dominance in agricultural labour, and their responsibility in carrying out domestic chores of fetching fuel wood, water and grazing livestock. In most households, women are also responsible for water and waste management. Such roles have made women in some communities to become effective managers of environmental resources. Various women groups have also spearheaded re-afforestation programmes as best illustrated by the Green Belt Movement in many areas of Kenya highlands.

Several governments have come together to establish international mandates ensuring that gender equality and women’s empowerment are central to environmental decision-making and sustainable development. However, the lack of a mechanism to monitor and measure government progress has contributed to little or no implementation of these agreements. Scientific measurements are and should be part of gender mainstreaming policies and programs in all spheres. Measuring and collecting gender data in the realm of environment and sustainable development would significantly bolster monitoring and evaluation efforts, promote efficiency and effectiveness, and contribute to enhanced decision-making and performance, and accountability. The quality of gender mainstreaming efforts should also be addressed, as environmental programs and policies often include gender in a token manner or as an afterthought, limited to reporting on women’s participation, listing them as beneficiaries, or focusing on women as victims.

**Indicator computation method**: The environment gender index is computed based on geometric mean across the three dimensions; these means, calculated separately for women and men are then aggregated using a harmonic mean across genders.

**Data Source**: Survey Data

### 3.32 Environmental related policies formulated and legislations enacted

**Objective / Policy Category**: Socio Economic Sustainability / Governance, Compliance and Enforcement

**Definition**: This indicator seeks to measure status of formulation of relevant County environmental policies since devolution.

**Relevance / Rationale**: Environmental governance comprises of policies, legislations and institutions that shape how man interact with the environment (Nagi, 2009). This incorporates the processes of decision-making involved in controlling and managing the environment and natural resources.

Good environmental governance takes into account the role of all actors that impact on the environment. Effective environmental management is key in ensuring formulation and implementation of national environmental policies and legislation as well as domestication of Multilateral Environmental Agreements at all levels. In Kenya, many sectoral policies and laws still remain un-harmonized with the Constitution. These include policies and laws concerning agriculture, land, water, forests, trade and industry, which have significant implications on the environment.

**Indicator computation method**: Total number of environmental related policies formulated and environmental strategies developed at County level

**Data Source**: CECs

**Unit of measurement**: Number

### 3.33 Complains and Prosecution on Environmental Pollution

**Objective / Policy Category**: Socio Economic Sustainability / Governance, Compliance and Enforcement

**Definition**: This indicator seeks to measure effectiveness in enforcement of environmental regulations and standards

**Relevance / Rationale**: Enforcement is a set of actions that the government or others take to compel or encourage compliance. Enforcement generally includes inspection to find information needed to determine compliance status and to identify violations and legal actions to impose some consequences for violating the law. Enforcement therefore acts as a tool for compliance. Enforcement tools provided within the Kenyan environmental law include: issuance of orders, notices, seizures, sanctions, easements, prosecutions, conditional approvals, cessation orders, and improvement orders.

**Indicator computation method**: Percentage of annual (2016) reported complaints on environmental pollution that have been prosecuted and closed.

**Data Source**: Department of Compliance and Enforcement and the Environmental Inspectors and Prosecutors Office, NEMA

**Unit of measurement**: Percentage

### 3.34 Support of environmental projects through PPP arrangement

**Objective / Policy Category**: Socio Economic Sustainability /Public Private Partnership

**Definition**: This indicator seeks to measure the extent of support, good will and engagement in environmental projects by the private sector.

**Relevance / Rationale**:

**Variables**: Number of PPP platforms by sector e.g. forest, water, agriculture, waste etc, Number of private organizations in PPP, Number of environment projects supported by PPP arrangement and Number of TORs or MOUs developed for partnerships.

**Indicator computation method**: XXX

**Data Source**: Ministry of Devolution and Planning, CECs

1. Access is defined as at least 20 litres per person per day from an “improved” source within 1 kilometre of the user’s dwelling. (WHO 2000). [↑](#footnote-ref-1)
2. Yale EPI 2016 [↑](#footnote-ref-2)
3. World Health Organization. (2006) Preventing disease through healthy environments: towards an estimate of environmental burden of disease. Available: <http://www.who.int/quantifying_ehimpacts/publications/preventingdisease>. pdf. Last accessed: January 14, 2014. [↑](#footnote-ref-3)
4. http://www.nema.go.ke/index.php?option=com\_content&view=article&id=25&Itemid=165 [↑](#footnote-ref-4)