RWANDA

State of Environment and Outlook Report 2021

Summary for Policy Makers

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State of Environment and Outlook Report 2021

Summary for Policymakers

This summary for policymakers highlights the findings of the sixth State of Environment and Outlook 2021 Report

Disclaimers

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Background

The constitution of the Republic of Rwanda of 2003 as revised in 2015, provides in its 22nd article, that everyone who lives in Rwanda has the right of living in a clean and healthy environment. In its 53rd article, it obliges everyone residing in Rwanda to protect, safeguard and promote the environment. In the same context, the Law n° 48/2018 of 13/08/2018 on Environment determining the modalities of protection, conservation, and promotion of environment in Rwanda, emphasizes the importance of the right of every person to be informed of the "state of the environment" and to take part in the decisions and strategies aimed at protecting the environment.

To date, Rwanda Environment Management Authority (REMA) has produced five State of Environment and Outlook (SOE) reports. The first report in 2009 provided baseline data on the status and trends of the country's environmental resources. In 2011, the second report took the form of an Atlas depicting environmental change through maps, aerial photographs, and satellite images. The third report in 2013 focused on Kigali City, and in 2015, the fourth report's special theme was greening agriculture, while the fifth focused on achieving sustainable urbanization in Rwanda. This is the sixth report in the series and aims to provide the required information on the current and future state of Rwanda's environment based upon the trends and future impact of development.

This Summary for Policymakers highlights the findings of the sixth State of Environment and Outlook report.

Impalas (Aepyceros melampus) in Akagera National Park.
Photo credit: RDB/ Flickr

The production process

REMA commissioned the Environmental Pulse Institute (EPI), a non-governmental organization in the United States, to provide technical assistance for the preparation of the State of the Environment and Outlook Report for 2021. REMA supported EPI in organizing an inception workshop to launch the reporting process, discuss and approve the content, and towards the end of the process, a validation workshop to peer review the first draft chapters. In addition, EPI organized bilateral stakeholder meetings with REMA, key development partners and civil society stakeholders during which recommendations for a vision of sustainable development and environmental governance was discussed. Extensive research was undertaken to compile and analyze information from various databases, global, regional, and national reports, academic literature, and websites. The publication has undergone an intensive review process to ensure quality control and the scientific validity of the report.

Introduction

The SOE 2021 report presents a comprehensive assessment of Rwanda's environment and examines the potential impacts of COVID-19 on the environment. The analysis is designed to help the government, non-governmental organizations and stakeholders to take informed measures or actions and to monitor progress towards the achievement of environmental goals. The report presents a mixed picture of environmental policy successes and challenges. It also demonstrates that the implementation of environmental and climate policies has brought environmental benefits.

Some of the persistent environmental challenges are intricately linked to economic development, climate change impacts and population growth. Rwanda is committed to addressing these challenges with the aim of achieving long-term sustainability and the ultimate prize of a high-income, green and climate-resilient economy by 2050. However, this will require concerted action, engaging various policy areas in environmental protection, development and actors of society to enable sustainable development.

Farmers harvesting tea leaves at Kitabi Tea Farm.
Photo credit: MINAGRI

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1. Drivers of environmental change

Population and economic growth

The growth in human population, demographic dynamics and economic development are well recognized as some of the biggest drivers of environmental change. Rapid urbanization, human settlements, climate change and socio-economic development and related activities are some of the influencers of this change. The interactions between these drivers are complex in nature and strongly intertwined.

Rwanda's population has grown more than five times in the past 60 years. In July 2021, the population was 12.9 million, a 2.3 percent increase from 2020. With this annual growth rate, Rwanda's population could reach 25.8 million by 2050, with a gross density of around 1,000 p/km², the highest in Africa. The need for social services such as education, health and infrastructural supports will continue to put pressures on the environment.

Rwanda is now the second fastest growing economy in Africa, in its Vision 2050, aspires to reach Middle-Income Country (MIC) status by 2035 and High-Income Country (HIC) status by 2050. The goal of the 2019 National Environment and Climate Change Policy in alignment with Vision 2050, is for "Rwanda to have a clean and healthy environment resilient to climate variability and change that supports a high quality of life for its society". The country's Green Growth and Climate Resilience Strategy (GGCRS) is currently under revision to mainstream priority interventions that are in line with the policy and Vision 2050.

Policy actions and priority interventions as aligned to Vision 2050 are implemented through the National Strategy for Transformation. The first phase of the National Strategy for Transformation (NST1) with a 7-year term 2017-2024 recognizes the environment and climate change as a key cross-cutting driver for inclusive and sustainable national development. In 2019, the country recorded 9.4 percent annual growth in GDP. Despite Rwanda's strong economy and its commitment to sustainable development, economic growth is nevertheless accompanied by disruptions such as the COVID-19 pandemic and impacts on the environment. The main economic sectors in Rwanda are agriculture, mining, industry and tourism.

Agriculture

The agriculture sector is the main economic activity in Rwanda employing 64 percent of the working population. GDP from agriculture grew from 418.14 billion Rwandan francs (Rwf) in 2006 to 570 billion in 2019 and accounted to 26 percent of the overall GDP in 2020. The main agro-environmental problems are closely associated with the country's rapid and intensive agriculture and livestock farming. They include soil erosion and land degradation, water pollution and an increase in greenhouses gases emissions. According to the third National Communication report on climate change, agriculture produced most emissions of greenhouse gases in Rwanda with the sector accounting for 5,345.44 Gg CO_2-eq, 70.4 percent of the total national greenhouse gases (GHG) emissions in 2015.

Terraced Fields
Photo credit: A'Melody Lee/World Bank/Flickr

Industry and mining

The industrial sector in Rwanda is still small but it has been growing steadily with contribution to GDP increasing from 16 percent in 2009 to 19 percent in 2020. Industrialization is part of the Vision 2050 as one of the ways of leading Rwanda into a middle-income country by 2035. The mining sector is also considered a key sector. The mining sector generated around US $412 million from mineral exports in 2019, while, in 2020 due to negative impacts caused by the COVID-19 pandemic, it contributed to 1 percent of the country's GDP. The sector aims to contribute up to 3.6 percent of Rwanda's GDP by 2024, and 4 percent by 2050.

While mining and industrial activities are important economic sectors, they have significant, and in some cases, irreversible impacts on natural assets of the country thus contributing to environmental degradation. Industrial processes have a wide range of negative environmental impacts, associated with pollution and greenhouse gases emissions. In addition, the environmental impacts of mining pose multiple risks to human health.

Tourism

There have been major governmental efforts over the last decade to promote Rwanda as a tourist destination based on its rich flora and fauna around the national parks. The 'Visit Rwanda' campaign by the Rwanda Development Board resulted in tourism revenues of US $498 million in 2019. This was a 17 percent increase from 2018 and constituted 50.1 percent of all service exports. The concentration of tourism activities and developments in protected areas, particularly the national parks, may impact the environment.

Climate change

Climate change is a major driver of environmental change and poses a serious challenge to future economic development. The impacts of climate change are particularly disadvantageous to areas such as sub-Saharan Africa, including Rwanda. For example, Rwanda ranks 185 out of 188 countries in per capita GHG emissions, but despite its low contributions to greenhouse gas emissions, the Global Climate Risk Index ranked it in the top-10 countries most affected by climate change in 2018. The updated Rwanda Nationally Determined Contributions (taking 2015 as a base year total) estimates emissions excluding forestry at 5.33 million tCO_2e. Rwanda was one of the first in Africa to submit a National Adaptation Programme of Action (NAPA-2006) to identify its priority activities to respond to the needs for adaptation to climate change. The Green Growth and Climate Resilience Strategy is under revision to align with the Vision 2050 to ensure it defines a development pathway for Rwanda that is climate resilient and harnesses green economic innovation.

Tea plantations next to Nyungwe Forest. One of the oldest rainforests in Africa, Nyungwe is rich in biodiversity and spectacularly beautiful
Photo credit: Visit Rwanda/Flickr

2. State of the environment

Forests and biodiversity

Rwanda is endowed with a rich diversity of plants, animals and habitats which make the country unique. It is home to 402 mammal species (which accounts for 40 percent of the entire continent's mammalian species); 1,061 bird species, 293 reptile and amphibian species and 5,793 higher plant species. Mountain gorillas (Gorilla beringei beringei) are a very important species in Rwanda because they generate tourism revenue and are found in only two other countries.

Forests now occupy about 724,695 hectares (30.4 percent) of the total land area of which 387,425 hectares (53.5 percent) are plantations and 130,850 hectares (18.1 percent) are natural mountain rainforests, 161,843 hectares are wooded savannah (22.3 percent), 43, 963 hectares are shrubs (6.1 percent) and 614 hectares are Bamboo stands. Figure 1 shows changes in forest cover between 2009 and 2019. In 2020, the forestry sector contributed to 6 percent to the country's GDP and supported the agriculture sector which accounted to 26 percent of the GDP. In addition, forests hold the base for the country's tourism opportunities and provide around 86 percent of the primary energy source mainly as domestic cooking energy.

Soil erosion and land

Rwanda has experienced accelerated soil erosion because of unsustainable human activities and changes in land use. The main factors affecting the amount of soil eroded include land use and vegetation cover, topography, soil and the climate. Around 90 percent of the country lies on slopes with the consequent risk of soil erosion and decreasing fertility. Large swathes of soils are exhausted due to continuous farming, soil degradation and soil erosion and little use of fertilizers that can compensate for the loss of nutrients caused by soil loss or overexploitation. About 11 percent of the country is at extremely high or very high risk of soil erosion (Figure 2). The most risk affected districts in terms of percent area to total area of the district are Ngororero (83 percent), Muhanga (82 percent), Karongi and Gakenke (71 percent) and Rutsiro (69 percent).

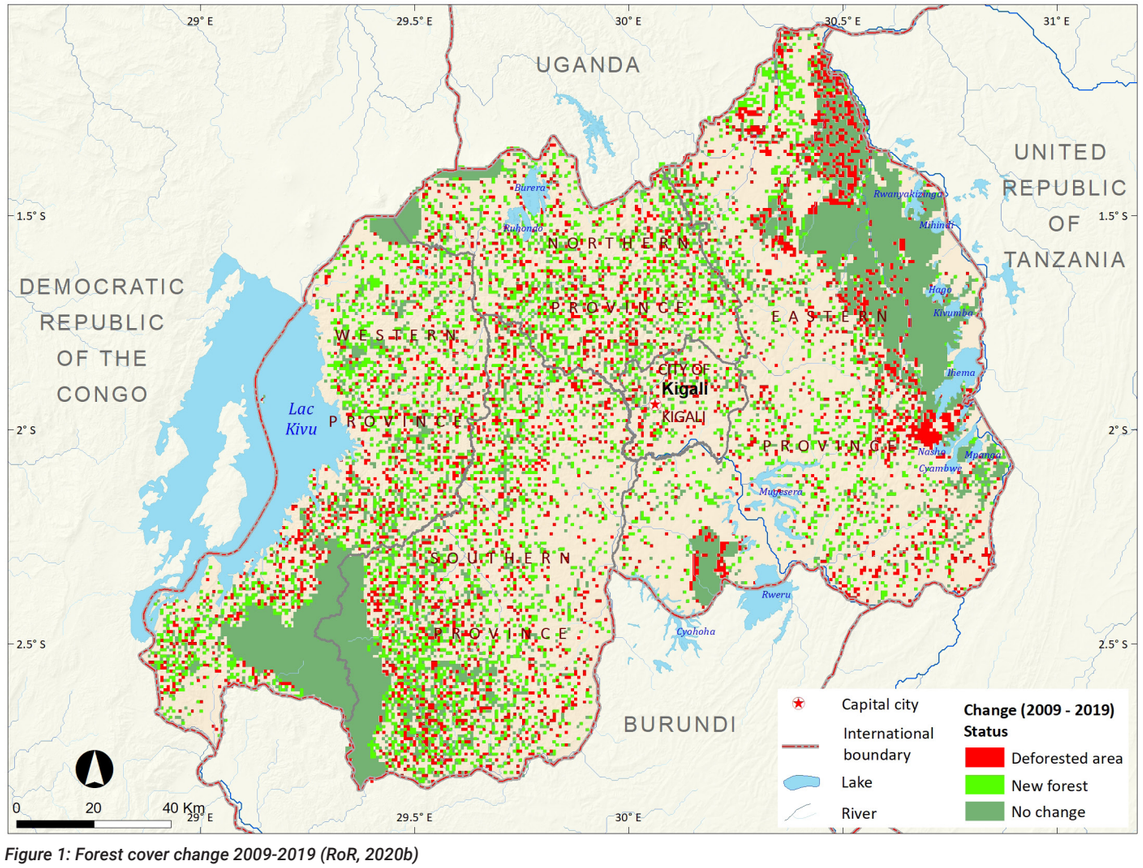


Figure 1: Forest cover change 2009-2019 (RoR, 2020b)

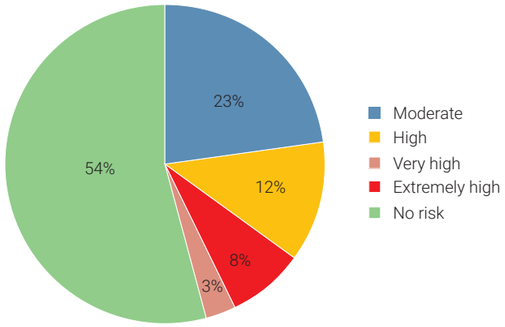


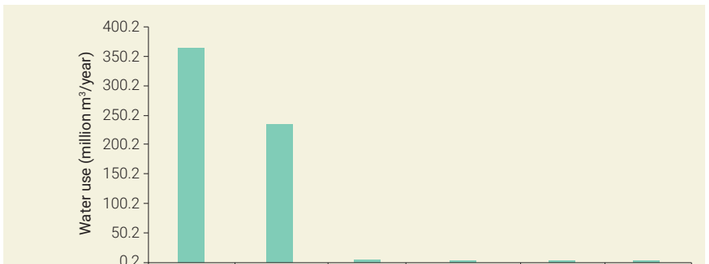
Figure 2: Land area exposed to soil erosion according to risk levels in Rwanda (Source: RWB, 2021)

Water and wetland resources

Surface water in Rwanda occupies a total of 135,295 ha, or 5.3 percent of the country's land area, and includes 101 lakes and 861 rivers. Renewable groundwater is estimated to be 401 million cubic meters. Groundwater is an important source for water supply in rural areas, but information on its quantity is still scarce.

Water and wetland resources are threatened by population growth, the impact of climate change, and the wider competing demands for water. The main water consumers in Rwanda are the domestic and agricultural sectors (Figure 3). Industry, mining, fishponds, coffee washing stations and infrastructure are classified as minor water users. In general, the demand for water resources and competition for water uses between the various economic sectors is increasing. In 2012, the water uses and availability ratio was less than five percent and it increased to nine percent in 2019.

Rwanda has 935 wetlands. In 2016, these were estimated to cover an area of 176,337 ha down from 276,498 ha in 1988 – equating to a 36 percent loss of wetland ecosystem in just 28 years. Three percent of Rwanda's wetlands have Ramsar status, while 53 percent are proposed for Ramsar status. These are mostly located in City of Kigali, Akanyaru, Akagera and Rweru-Mugesera wetland complexes.



	Irrigation	Domestic	Mining	Industries/ manufacturing	Fish ponds	Coffee washing stations
Water use (m³/year)	363,403,960	243,846,975	4,815,625	3,214,625	1,056,250	879,619
Percentage	59.75%	38.61%	0.79%	0.53%	0.17%	0.14%

Figure 3: Consumptive water uses by sector in 2019 (RWB, 2021a).

Waste

High rates of urbanization and economic growth are contributing to the increasing amounts of waste produced. Proper waste management is becoming a priority and should be an integral part of Rwanda's development plans if it is to pursue a green growth pathway towards sustainable development. Currently, less than ten percent of the collected waste is recycled, and an even lower percentage of organic waste is formally composted.

Municipal solid waste

The amount of municipal solid waste produced per capita varies considerably and is estimated at between 0.56 and 0.7 kg per capita per day for urban areas such as the cities of Kigali, Muhanga and Huye. Urban waste in Kigali will increase by 63 percent over the next ten years, from around 600-800 tonnes generated per day in 2019 to 1,300 tonnes per day by 2030.

Liquid waste

With regards to liquid waste, there are about 161 wastewater treatment systems in Rwanda, with most of the systems concentrated in the city of Kigali. These are small, often on-site treatment systems and several of them present environmental or public health concerns to the respective region.

Medical waste

An assessment of health facilities across the country, estimates that a national volume of 5,168 kg per day (60,775,164 kg of waste per year) of medical waste is generated by inpatients and outpatients. According to REMA the state of incinerators and their services regarding the incineration of hazardous waste is poor.

Electronic waste (E-waste)

E-waste covers almost all types of electrical and electronic equipment (EEE) that enters the waste stream. The e-waste collection rate was 15.4 percent in 2018 increasing to 19.3 percent in 2019. Despite the current low collection rate of e-waste, imports of EEE into Rwanda are expected to increase at the rate of 5.95 percent annually and annual e-waste generation may reach around 70,000 tonnes of waste by 2050.

Air and water quality

Air and water pollution are major environmental problems contributing to a significant number of illnesses and deaths in Rwanda.

Outdoor air pollutants (mainly Particulate matter and Nitrogen oxides) are slightly above or within safe limits of national Air Quality Standards, but above indicative WHO levels. The main sources of anthropogenic air pollution are road traffic, domestic fuel combustion and industrial production, while indoor air pollution is mainly due to cooking on fuelwood and charcoal.

The main cause of water pollution is sedimentation and siltation. Activities in the agriculture and mining sectors, as well as land and wastewater mismanagement are the main polluters of waterbodies. The number of households getting water from improved water sources increased from 84.8 percent in 2013 to 87.4 percent in 2017. Households using improved sanitation increased from 83.4 to 86.2 percent in 2013 and 2017 respectively.

Collected electronic waste (laptops) for dismantling at EnviroServe, Kigali
Photo credit: EnviroServe

Muddy river water is an indication of sediment pollution. River Akanyaru along the border with Burundi (left) and Akagera river (right).
Photo credit: Akanyaru - RWFA, Akagera - Amizero N/EPI

Energy

Energy is central to Rwanda's economy and development plans. The government aspires to provide a reliable, efficient and affordable power supply to improve living standards of the population. The country is endowed with natural energy resources including hydro, solar and methane gas.

The main sectors where energy is consumed are households, transport and industry. Households consume 82 percent of all the energy consumed in the country, followed by the transport and industrial sectors at 8 and 6 percent respectively. The installed capacity has increased steadily between 2013 and 2021, the current installed capacity for power generation in Rwanda is at 238.36 Megawatt (MW). The fuel mix for electricity generation is dominated by hydropower, accounting for 52 percent of all electricity generated. Rwanda aims to diversify its energy generation mix by 2024 (Figure 4). This rapid and responsible deployment of clean, renewable energy is crucial to meet the goals of the Paris Climate Change Agreement.

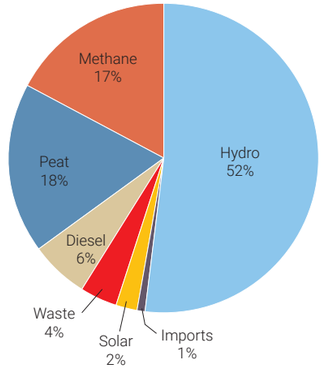
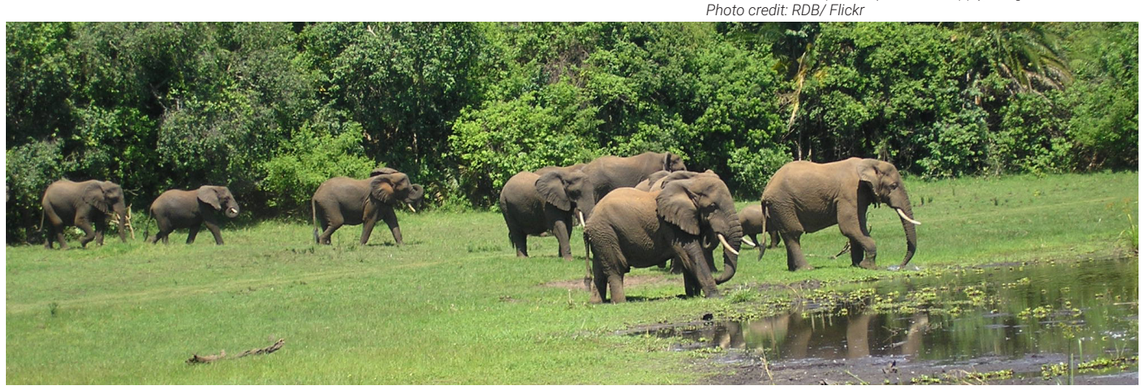


Figure 4: Generation mix target 2024 (REG, 2021).

Herd of African elephants (Loxodonta spp.), Akagera National Park.
Photo credit: RDB/ Flickr



Inclusive wealth and natural capital account

Natural assets and inclusive wealth form the building blocks for achieving the Sustainable Development Goals. Between 1990 and 2015, Rwanda's per capita GDP growth rate was 14.2 percent, and its per capita Inclusive Wealth Index growth rate was 3.3 percent over the same time.

- The total economic value of various ecosystems in Rwanda have been calculated and give a good idea of the value of goods and services obtained from these natural assets. These are indicated below:
- Total Economic Value (TEV) of Nyungwe Afro-montane forest was US $4.80 billion in 2014
- TEV of Rugezi wetland was US $375 million in 2014
- TEV of Mukura Landscape was estimated at US$ 1,468,211 (US$ 817 per hectare per year)
- TEV Akagera Wetland Complex includes a stock value (carbon storage) of US $1.1 billion, and an annual flow value of US $11.9 million
- The Rweru-Mugesera wetland complex provides a multitude of ecosystem services to over 48,000 households or approximately 194,000 individuals with an estimated economic value of over US $52 million
- Kigali City's wetland complexes provide four important provisioning ecosystem services, namely crop framing, papyrus and papyrus products, grass harvesting and brick making with a TEV of just under US $22 million per year.

Nyandungu Urban Wetland Ecotourism Park in 2021
Photo credit: REMA

3. Impact of COVID-19

... on forests and biodiversity

The suspension in human activity due to the pandemic, provides a rare and unplanned experiment to investigate human impacts on the environment, forests and biodiversity. On the one hand, it has enabled wildlife to thrive and extend their territories in some habitats; while on the other hand, it halted the maintenance of parks and natural areas and impeded scientific research and monitoring of wildlife and ecosystem functions. The ecosystem response to this absence of human presence in Rwanda's natural areas may inform how ecosystems can restore themselves if human presence is better managed.

Salient fact

- There is anecdotal evidence that the absence of tourists triggered a rise in forests and biodiversity population numbers or the arrival of new species in areas hitherto frequented by hikers or other visitors.

... on air quality

On the one hand, containment measures to stem the spread of COVID-19 resulted in some dramatic, albeit temporary, improvements in air quality, especially in Kigali city where vehicular traffic was reduced. On the other hand, vulnerable populations sheltering at home during the pandemic were increasingly exposed to indoor air pollution due to the increased burning of poor-quality fuels in homes.

Salient facts

- Exposure to air pollutants is strongly correlated with an increase in mortality (early death) and morbidity (ill health) caused by cardiovascular and respiratory diseases, such as stroke, ischemic heart disease, cancer, acute respiratory infections and chronic obstructive pulmonary disease (COPD).
- According to the Ministry of Health 2020 report, these non-communicable diseases were the second leading cause of mortality in Rwanda, while respiratory diseases were the leading cause of morbidity in Rwanda in 2019.
- Air pollution exacerbates the respiratory and cardiovascular complications associated with COVID-19, aggravating the course of infection.
- Primary pollution dropped during the pandemic: PM2.5 emissions dropped by 33 percent with the imposition of the first lockdown (March 22nd-May 4th) and dropped by 21 percent over baseline levels during the partial lockdown (May 5th-June 3rd).
- However, pollutants emissions bounced back after the relaxation of COVID-19 restrictions.

... on water and sanitation

The government reacted rapidly to the outbreak of COVID-19, putting in place tough measures to stop its spread. In early March, guidelines on handwashing were published and handwashing and hand sanitizers were placed outside all major public buildings and shopping centers in the country. During that period, the water and sanitation sector were among the critical sectors, partly because the sector was important in the fight against the spread of COVID-19, and partly due to the economic consequences of the pandemic which hampered the affordability of water and sanitation services to the public.

Salient facts

- Lockdowns reduced water demand in industrial and commercial sites but increased residential demand.
- The rural residents were more affected than the urban residents. The rural and small-town water suppliers suffered financial and operational challenges during the pandemic, including supply chain difficulties.

... on waste management

Even before the COVID-19 pandemic, Rwanda's waste sector faced various challenges and the current pandemic just exacerbates the situation. Waste generation has shifted from industrial and commercial waste streams to residential and medical waste streams. In accordance with WHO and GoR guidelines to reduce the spread of COVID-19, the use and production of personal protective equipment (PPE), such as gloves, masks and bottles of disinfectant is expected to have increased. In addition, containment measures aimed at slowing the spread of the virus have resulted in interruptions in waste management work and delayed the establishment of waste collection centers across the country such as e-waste.

Salient facts

- The government, in collaboration with UNDP, has developed guidelines and initiatives to ensure that PPE, especially face masks used to combat the spread of the Covid-19 pandemic, are managed safely.
- One of the pilot projects of REMA and stakeholders is the initiation of general collection of PPEs. Local waste collection companies collect and dispose of used masks and gloves at the central collection center in Kabuye where they are kept before incineration.

... on tourism

Protected areas appear to be safe from reduced human activity. In other areas, however, mobility restrictions have prevented scientific monitoring and surveillance of touristic environments that might lead to increased threats from illegal activity, such as deforestation and grazing.

Salient facts

- In 2020, tourism was among the worst hit sectors in Rwanda. Tourism revenue observed a 76 percent decline from US$ 498 million in 2019 to US$ 121 million in 2020 due to the pandemic restrictions.
- The government's support for the sector through the Economic Recovery Fund (ERF) will go a long way in aiding its recovery. About 50 percent of the Rwf 100 billion recovery fund has been dedicated to the tourism and hospitality sector.

... actions to build back better

Table 1 summarizes the pre-pandemic, negative environmental trends compared to the short-term impacts from COVID-19 which are both positive and negative. The main point is that building back better recovery actions such as circular economy approaches and policies that can minimize waste, promotion of greener policies to protect biodiversity, low carbon technologies such as electric vehicles (EVs), EV charging infrastructure that can contribute to reducing air pollutants, etc. would move these environmental trends in a positive direction.

Table 1: A summary of impact of COVID-19 on nature, climate and pollution actions in recovery phase to bend the long-term current trends curve

Issues/Impact	Short-term impacts (2-3 months)	Pre-pandemic long-term trends	Building Back Better recovery actions
Air Pollution	Decreased	Increased	Decreased
Greenhouse Gases (GHGs) Emission	Decreased	Increased	Decreased
Medical Waste	Increased	Increased	Decreased
Single Use Plastic	Increased	Increased	Decreased
Threat to Biodiversity	Decreased	Increased	Decreased
Water for Sanitation and Hygiene Gap	Increased	Increased	Decreased

Positive Impact, Negative Impact

Tree seedlings nursery - Green Amayaga Project
Photo credit: REMA/Flickr

4. How is Rwanda responding?

Environmental governance

Over the years the government has formulated relevant policies and revised them to capture changing national priorities and international commitments (Figure 5). As Rwanda implements Vision 2050 through the National Strategy for Transformation, priorities and targets pertaining to environment and natural resources management are captured in this implementation framework.

Agriculture

Sustainable land use and environmentally friendly farming practices are at the centre of the policies and strategies being implemented to reduce the impacts of agriculture on the environment in Rwanda. Examples include Rwanda's Strategic Plan for Agricultural Transformation 2018-2024, Rwanda Livestock Master Plan 2018-2022, Rwanda National Agricultural Policy 2017 and the National Emergency Plan for Animal and Plant Diseases 2016. There is need for promoting green agriculture in Rwanda and this is embedded into strategy documents such as Vision 2050, Economic Development and Poverty Reduction Strategy (EDPRS), and the National Strategy for Transformation (NST1) 2017-2024.

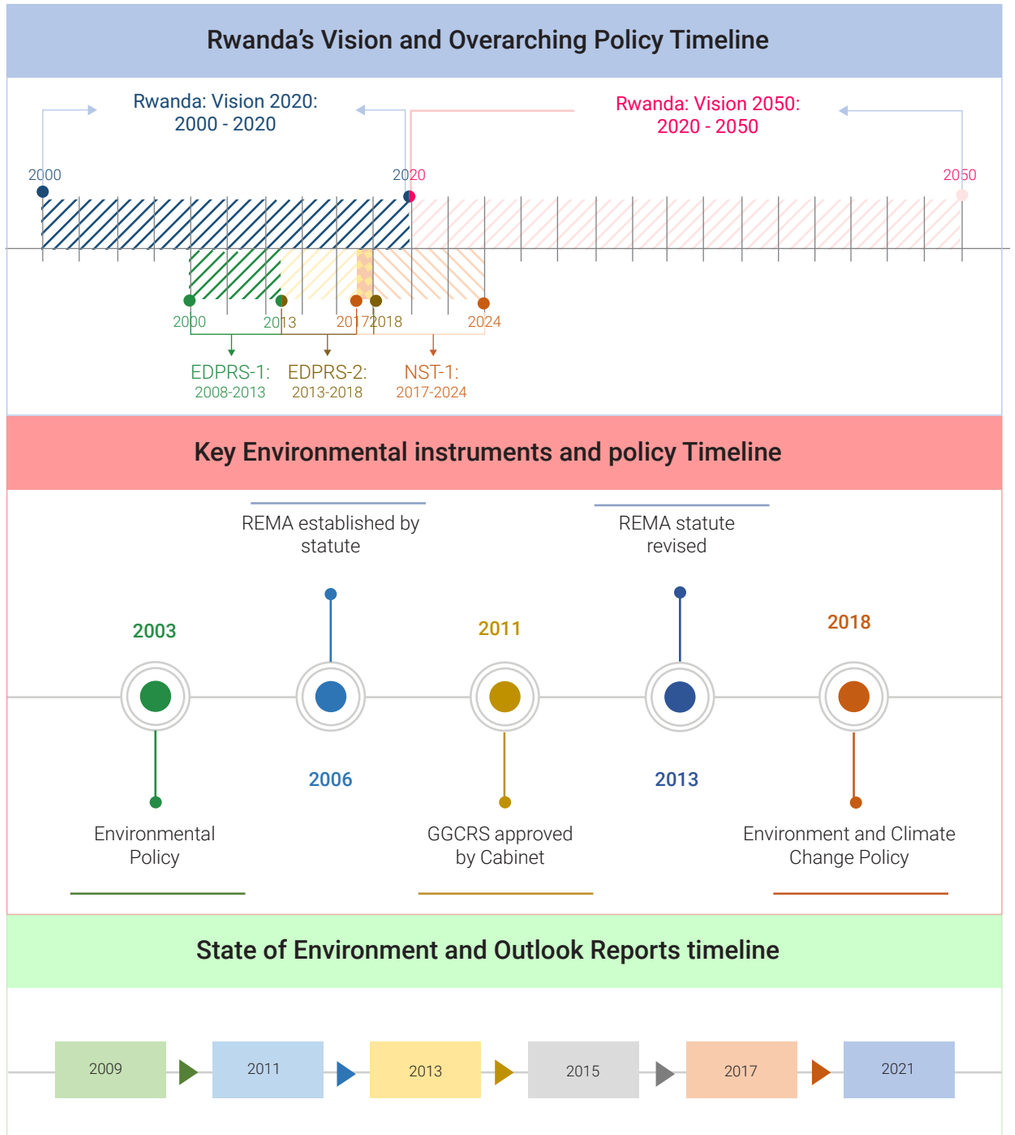


Figure 5: Evolution of environmental governance in Rwanda

Mining and industry

As the mining sector grows, there is an urgent need to reform and promote environment friendly mining. Different instruments have been adopted to support and guide the implementation of the national vision of developing and improving the performance of the mining sub-sector including:

- National Land Use and Development Master Plan (2020)
- Nationally Determined Contributions (2020)
- Prime Minister's Order N° 079/03 of 26/07/2019 determining the structure and functioning of the committee in charge of assessment of applications for licences and disputes related to mining and quarry operations
- Mining Safety Standards (2017)
- Environmental Audit Guidelines for Mining projects (2014)
- EIA Guidelines for Mining Projects in Rwanda (2012)

Tourism

With the tourism sector booming, the GoR has been doing an excellent job in promoting sustainable tourism in the country. Actions include, promoting conservation in Rwanda and increasing the number of protected areas, improvement of eco-friendly facilities and infrastructure, responsive customer care and marketing Rwanda as an international eco-tourism destination through the 'Visit Rwanda' campaign.

Gender

Gender equality is recognized as a critical factor for achieving sustainable development. Rwanda has ratified and adheres to international and regional conventions and declarations, each of which has a gender action plan with commitments for mainstreaming gender, environment and climate change into national strategies and policies. For instance:

- In the Environmental and Climate Change Policy (2019), gender is enshrined in the principles aiming at fostering inclusiveness. This policy urges and encourages effective involvement of women and youth in environment and climate change management, interventions, and decision making.
- The Green Growth and Climate Resilience Strategy states the need to conduct a robust gender analysis assessment for informing gender-responsive approaches in its implementation.
- National Strategy for Transformation (NST1) urges sectors to mainstream gender and family promotion and ensure women and men's equal access, control and equitable benefits in terms of responsibility and sustainable production and consumption.

Coffee washing/drying, Abakundakawa Rushashi Coffee Cooperative, 5 November 2021. Photo credit: MINAGRI/Flickr

Forests and biodiversity

Conservation of Rwanda's primary forest has been key to maximising biodiversity and the provisioning of ecosystem services provided to the wider populations, locally, nationally and internationally. To further improve this, the management of public forests is being transferred to private operators. So far, 36 percent of public forests have been transferred. Further, small private forests are being consolidated into Private Forest Management Units (PFMUs) which are being managed under a simplified forest management plan. To date, a total of 870 ha has been consolidated. Rwanda has also designated two UNESCO Biosphere reserves, the Volcans Biosphere Reserve (1983) and the Gishwati-Mukura Landscape Biosphere Reserve (2020).

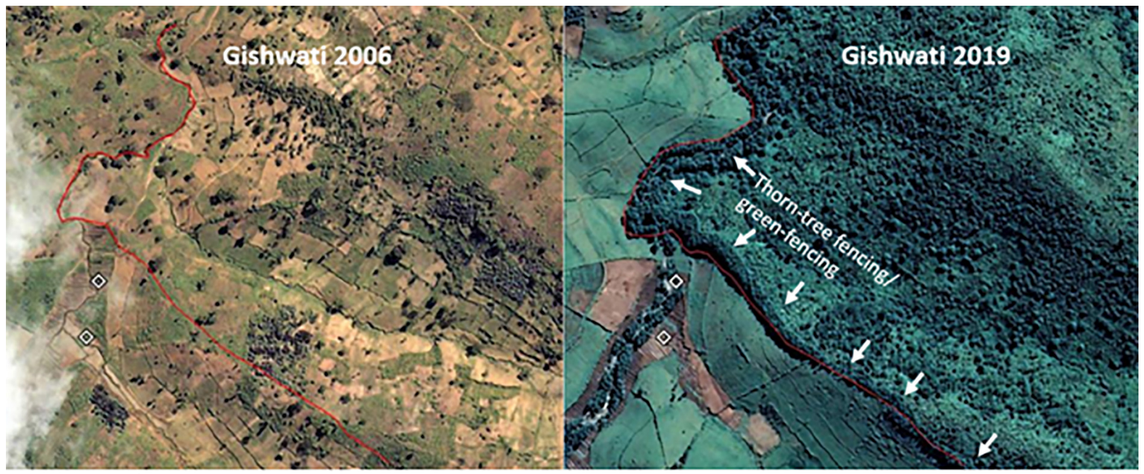
Rwanda developed its first National Biodiversity Strategy and Action Plan (NBSAP) in 2003 as part of meeting its obligations to the Convention on Biological Diversity. The sixth National Report in 2020 presents measures undertaken since 2011 when the CBD Global Strategic Plan for Biodiversity was adopted. An updated NBSAP has been developed to align with this Global Strategic Plan.

Soil erosion and land

The legal framework that provides enabling conditions for addressing negative trends in soil and land are well enshrined in the various laws such as:

- The Constitution of the Republic of Rwanda of 2003 revised in 2015,
- The law N° 48/2018 of 13/08/2018 on Environment,
- The Law N° 43/2013 of 16/06/2013 Governing land in Rwanda, Law Nº 47/2013 determining the Management and Utilizations of Forests in Rwanda,
- The Law N° 13/2014 of 20/05/2014 on Mining and Quarry Operations,
- The Ministerial Order N° 005/16.01 of 15/07/2010 determining the List of prohibited plains to constructions, Ministerial Order N° 007/16.01 of 15/07/2010 determining the Length of Land on Shores of Lakes and Rivers transferred to Public Property,
- The Ministerial Order Nº 002/16.01 of 24/05/2013 Determining the Procedure for Declaration, Authorization and Concession for the Utilization of Water.
- The Ministerial Order N° 003/2008 of 15/08/2008 relating to the requirements and procedure for environmental impact assessment and the Ministerial Order N° 001/ 2019 of 15/04/2019 establishing the list of projects that must undergo environmental impact assessment, instructions, requirements, and procedures to conduct environmental impact assessment.

In addition, the government has set ambitious national voluntary Land Degradation Neutrality (LDN) targets at the national scale with an ambition to reach LDN for the entire country to align to the 2030 Agenda for Sustainable Development (SDG target 15.3) considering all LDN indicators.



Satellite image of Gishwati in 2006 and 2019 showing the major change in landscape in 13 years.

Water and wetland resources

Despite the challenges in the country's water resources and wetlands management, Rwanda has recorded several achievements in these sectors. These include rehabilitation of critical wetlands such as Rugezi, Rweru-Mugesera, Murago and Nyandungu, removal of illegal activities in wetlands especially those in Kigali City and adoption of rainwater harvesting and stormwater management.

Various management responses and policies have also been adopted to ensure sustainable and integrated management of water resources and protection of wetlands. These include:

- The Law N°49/2018 of 13/08/2018 determining the use and management of water resources in Rwanda
- The 2015 National Water Resources Master Plan
- The Green Growth and Climate Resilience Strategy 2011, which includes a program dedicated to integrated water resources management (IWRM)
- The Wetland Master Plan for the City of Kigali. The Ministry of Environment developed the Wetlands Master Plan for the city of Kigali, which provides guidance on wetland use, rehabilitation, management and monitoring

Waste management

The backbone of waste management activities in the country is the law on the environment determining the modalities of protection, conservation, and promotion of the environment in Rwanda. This is complemented by law on water resources and management, as well as national policies on sanitation, e-waste, environment and climate change, and the environmental health policy. Other waste related interventions include the policy on the ban of plastic bags and single use plastics, and the national clean-up day.

Rwanda is also signatory and has ratified several multilateral environmental agreements on transboundary movement of waste. For example:

- At the national level, the overreaching Law n°48/2018 of 13/08/2018 on Environment contains restrictions on export for recovery, import for final disposal, import for recover, and for transit waste. This law is supported by Instruction N° 01/04 of the Rwanda Bureau of Standards related to the issuance of quality certificate for imported goods.
- Since August 2021, REMA has also warned that hazardous waste entering the Rwandan market illegally will be returned to their country of origin, and

Before (top) and after (bottom) images of Gikondo wetland showing the major change in wetland vegetation after industries relocation.
Photo credit: top image - Dan Nsengiyumva; bottom image - N. Amizero/EPI

companies and industries involved in the trade of transboundary movement of hazardous wastes need to have the authorization of the competent authority for the transport of hazardous wastes.

- The Basel Convention on the control of transboundary movements of hazardous wastes and their disposal which was ratified by Rwanda in August 2003; and the National Implementation Plan for the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal 2014-2021 by REMA.
- The Bamako Convention adopted under the auspices of the Organization of Africa Unity (OAU), which bans imports of hazardous waste into Africa.

Air quality

The government's continued efforts to tackle air pollution include the adoption of laws and regulations such as the 2016 Air Quality Law, which sets the framework for the regulation and prevention of air pollution in Rwanda and mandates REMA to regulate air quality in order to improve the health and well-being of its population. REMA has set up an air quality monitoring instruments system that provides data (real-time air quality index) on air quality across the country. In addition, the data is accessible on the 'Rwanda AQI' application so that users can compare ground observation data with satellite data.

Other government responses have included initiatives in the energy and transport sectors including initiatives towards green cities, sustainable services and electric mobility. A car-free day was introduced to reduce air pollution in the city of Kigali and to promote the use of non-motorized transport. This is now held twice a month. In 2018, the first electric motorcycles and cars were introduced onto the Rwandan market. In April 2021, a transport policy was ratified and the Cabinet approved an electric mobility strategy that contains tax incentives for electric mobility inputs, lower electricity tariffs and other incentives.

Water quality

Over the past decade, Rwanda has made progress in improving water quality and access to water and sanitation in rural and urban areas. The country achieved the relevant Millennium Development Goals (MDGs) and going forward is committed to achieving the ambitious SDG targets, not only on access to water and sanitation services but also on the quality of water. Examples of government interventions and plans to improve water quality and increase access to water and sanitation services include the:

- National Water Policy 2016: The Policy provided clear direction for the implementation of activities in the water sector and aimed to achieve adequate coverage of 100 percent water services by 2017/18. A growth of around two percent in the percentage of households having improved drinking water sources was achieved between 2013 and 2017.
- Water Supply Master Plans 2050: Additional efforts are being implemented within the framework of local water supply master plans, for example the water supply master plan of the city of Kigali which will focus on Kigali and seven adjacent municipalities with the objective of providing and maintaining universal access to safe drinking water in the city of Kigali until 2050.

Energy

The National Energy Policy (2015) is the high-level policy document which guides decisions on the extraction, development and use of Rwanda's energy resources in a transparent and sustainable manner. Policies and institutional frameworks play an important role in creating an enabling environment for the clean energy transition. The government has put in place several strategies, policy instruments and projects at the national and sub national levels, in coordination with relevant partners to accelerate the progress on the clean energy targets. Some of these are the:

- Scaling up Renewable Energy Program (SREP) Investment Plan (2015) which supports implementation of the SE4All Action Agenda, with World Bank funding.
- National Electrification Plan (NEP) (2018), detailing the plan of on- and off-grid expansion.
- Rwanda Master Plan & Least Cost Development Plan (LCDP) (2017) which presents a detailed analysis of current power system and future growth.
- Renewable Energy and Energy Efficiency Law (2018) which governs renewable energy sources and energy efficiency in Rwanda with the aim of promoting further development, utilization and sustainability.

Kigali skyline at dusk
Photo credit: Adrien K/Flickr

5. Mainstreaming environment to achieve the Sustainable Development Goals

Rwanda has integrated the Africa Agenda 2063 and the SDGs into its national development agenda through the draft Vision 2050, National Strategy for Transformation (NST1, 2017-2024) and related strategies at different levels. There has been impressive progress on many of the SDG indicators (Table 2). However, lack of up-to-date statistical data remains a major challenge implying the need to strengthen the capacity of the statistical data collection agencies.

Table 2: Progress for Rwanda's applicable SDG indicators 2000-2020 (UNSTATS, 2020)

*** Progress – Green is positive, Red is negative, Yellow is insufficient data, and White is no progress. Value in italic bold is national data.*

Goal	Indicator (Unit)	Base Value (Year)	Latest Value (Year)	Progress	Data Source
3 GOOD HEALTH AND WELL-BEING	**3.9.1** Mortality rate attributed to household and ambient air pollution (Deaths per 100,000 population)		49 (2016)		UNSTATS
6 CLEAN WATER AND SANITATION	**6.1.1** Proportion of population using safely managed drinking water services (Percentage)	***84.8 (2014)***	***87.4 (2017)***	***+3.4***	***NISR***
	6.2.1 Proportion of population using (a) safely managed sanitation services (Unit: % of population), (b) Proportion of population with basic handwashing facilities on premises by urban rural (percent)	***a. 83 (2014)***	***a. 86 (2017)***	***+2.8***	***NISR***
		b.3.3 (2010)	b. 4.6 (2017)	+1.3	UNSTATS
	6.3.2 Proportion of bodies of water with good ambient water quality (*Percentage) *proxy: river bodies		30 (2017) *37.5 (2017)		UNSTATS
			85 (2019)		***RWFA***
	6.4.1 Change in water use efficiency over time (United States value/Volume)	24 (2010)	31.5 (2017)	+7.5	UNSTATS
	6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources (Percentage)	5 (2000)			UNSTATS
		2 (2000)	***8.9 (2019)***	***+6.9***	***NISR***
	6.5.1 Degree of integrated water resources management (Percentage)		35.0 (2018)		UNSTATS
	6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation (Percentage)		***100 (2020)***		***RWFA***
	6.6.1 Change in the extent of water-related ecosystems over time (land area)	6.05(2000)	6.13(2018)	+0.08	UNSTATS
7 AFFORDABLE AND CLEAN ENERGY	**7.1.2** Proportion of population with primary reliance on clean fuels and technology (Percentage)*Proxy: Primary reliance on clean fuels for cooking energy		5(2018)		UNSTATS
		0.9 (2014)	***2.0 (2017)***	***+1.1***	***NISR***
	7.2.1 Renewable energy share in the total final energy consumption (*Percentage)*Proxy: Renewable energy share in the total final electricity generation		****53(2018)***		***MININFRA***
		90.7(2010)	86.7(2017)	-4	UNSTATS
	7.3.1 Energy intensity measured in terms of primary energy and GDP (MJ/constant purchasing power parity GDP)	8.44(2000)	4.38(2017)	-4.06	UNSTATS
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	**12.** Joined international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement (% average)				Yes
	12.4.2. Electronic waste generated per capita (Kg)	0.215(2010)	0.567(2019)	+0.352	UNSTATS
	12.5.1. Electronic waste recycling rate (percent)		11.1(2018)		UNSTATS
13 CLIMATE ACTION	**13.1.1** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population (Number)	***Deaths:183. Affected:16,645 (2016)***	***Deaths: 273 Affected:80,164 (2017)***	***+90 +63,519***	***MINEMA***
	13.1.2 Adopted and implemented national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030				Yes
	13.1.3 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies. *Proxy: number of districts	***22/30 (2017)***	***29/30 (2020)***	***+7***	***MINEMA***
	13.2.1 Developed nationally determined contributions, long-term strategies, national adaptation plans, strategies as reported in adaptation communications and national communications				Yes
15 LIFE ON LAND	**15.1.1** Forest area as a proportion of total land area (Unit: % of land area)	10.7(2010)	11.2(2020)	+0.5	UNSTATS
		11.6(2000)	***30.4(2019)***	***+18.8***	***RWFA***
	15.1.2. Proportion of important sites for Terrestrial and Freshwater Biodiversity Areas covered by protected areas (percent)	a.29.2(2010) b.51.7(2010)	a.29.2(2019) b. 51.7 (2019)		UNSTATS
	15.2.1. a. Progress towards sustainable forest management (Unit: Percentage)	0(2000)	9.8(2020)	+9.8	UNSTATS
	15.2.1.b. Above-ground biomass stock in forest (tonnes per hectare)	145.5(2010)	146.1(2020)	+0.6	UNSTATS
	15.2.1.c. Forest area under an independently verified forest management certification scheme ('000 of hectares)	0(2010)	9.78(2019)	+9.78	UNSTATS
	15.2.1.d. Forest area annual net change rate (percent)	-0.79(2010)	0.4(2020)	+0.39	UNSTATS
	15.2.1. e. Proportion of forest area within legally established protected areas (percent)		78.2(2020)		UNSTATS
	15.3.1. Proportion of land that is degraded over total land area (Percentage)		12(2015)		UNSTATS
	15.4.1 Coverage by protected areas of important sites for mountain biodiversity (Percentage)	33.3(2010)	33.3(2020)		UNSTATS
			11.9(2018)		***RWFA***
	15.5.1 Red List Index (Index)		0.9(2020)		UNSTATS
	15.6.1.a. Total reported number of Standard Material Transfer Agreements (SMTAs) transferring plant genetic resources for food and agriculture to the country (number)	62(2012)	113(2020)	+51	UNSTATS
	15.6.1.b. Rwanda has adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits				Yes
	15.8.1 Rwanda adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species				Yes
	15.9.1 (a) Progress towards national targets established towards Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020 in their national biodiversity strategy and action plans and the progress reported towards these targets				Yes
	15.a.1 and **15.b.1 (a)** Official development assistance on conservation and sustainable use of biodiversity; and **(b)** revenue generated and finance mobilized from biodiversity-relevant economic instruments (millions of constant 2016 US dollars)	a. 0.4(2002)	a. 16.2(2018)	+15.8	UNSTATS

Key facts and messages

- The government's efforts to promote environmentally sustainable development are demonstrated by an increase in public participation. For instance, the Compendium of Environmental Statistics notes that since 2007, there has been a growing number of national level Non-Government Organizations (NGOs) active in environmental matters. By 2017, these numbered 69.
- The Green Growth and Climate Resilience Strategy (GGCRS) is the government's centerpiece for mainstreaming environment in sectors impacting the environment.
- Although there are still gaps to be addressed, there is a robust iterative targets-to-policy actions-to-reporting process that is updated as new goals are set.
- The institutional configuration including structures, management, and procedures to implement the GGCRS objectives is functioning.
- An assessment of financial resources allocated to environmental management in Rwanda is conditioned by available information on budget decisions, a general finding is that combined funding from both national and international resources has not met targets.

6. An outlook for the future

Rwanda´s future state of the environment will largely be shaped by the country´s aspirations to achieve higher income country status by 2050 while being food and energy secure. Other important factors that define Rwanda´s future is its youthful population, rapid economic development, regional integration through the East African Community and African Union, and good governance and strong institutions.

Forests and biodiversity

Business as usual scenario

Rwanda's forests remain protected in national parks and forest reserves, while pockets continue to be scattered throughout the country. Deforestation will continue to be compounded by the huge demand on biofuels for energy, estimated at 85 percent of the current energy mix. The negative gap between supply and demand for firewood will continue to narrow slowly from the current 2 M tonnes per year. However, this is not expected to reach a net positive or even zero by 2050. No significant impact on ecosystems and biodiversity is expected in the near future.

Rwanda continues to place its forest resources under private management, with the area of such privately managed forests increasing from 14.1 percent in 2017 to 80 percent by 2024. The country aims to reduce household dependency on the use of firewood for energy from as high as 79.9 percent in 2016/17 to 42 percent by 2024. As such the forest cover of 30.4 percent is hard to maintain even though use of liquid petroleum gas will be greatly increased.

Policy options

The privatisation of management of parts of its forest sector, as well as the promotion of value addition to the forest industry, does not result in a comprehensive improvement of the country's forests, and neither will this result in better conservation as business interests take precedence over protection. Going into 2050, economic diversification results in fast paced urbanization, taking significant pressure off the land and rural areas. At the same time affordable electricity supply reduces the reliance on firewood for energy and this allows forests to be restored to their levels of 40 years ago, while other targets for forests, biodiversity and protected areas can be met, founded in inclusive land administration and tenure security. There is sustained effort to ensure that total value is obtained from forests, especially from nontimber forest products.

Soil erosion and land degradation

Business as usual scenario

The likelihood of landslides is further worsened by the country's exposure to flooding. Despite such vulnerability, the country's land assets are the most valued for food production and personal wealth. Household land ownership for agriculture is small at 0.76 ha and getting even smaller and fragmented. At current levels of food production per unit area and an expanding population, the country needs land that is four times the country size to meet its food demands by 2050. As this option is not realistic, the other option is to increase food production by 15 times on the same piece of land. Such intensive farming is not only impracticable, but also exposes the land to various forms of land degradation, including soil erosion and soil acidification.

Policy options

Through the refined Crop Intensification Program, Rwanda is focused on smart farming through better use of knowledge of local agro-ecological conditions so that the most appropriate crops are grown in specific regions. The same will apply for livestock farming whereby the correct livestock units are adhered to for purposes of avoiding land degradation. Smart farming results in optimum farm production while the environment is protected.

Water and wetland resources

Business as usual scenario

The pollution from wastewater and agro-chemicals, among other sources, is greatly reduced by 2050 through better and more organic farming methods, improved wastewater treatment, and the restoration of watersheds to stop soil erosion and siltation of wetlands. The institutionalisation of water, sanitation, and hygiene (WASH) master plans at national, city and district levels, as well as the adoption of smart water supply approaches in cities and industries, result in safe drinking water reaching universal access by 2050. Similarly, resilient faecal sludge management results in safely managed sanitation services for all by 2035. A key challenge that Rwanda will continue to face is in water supply to meet both the country's WASH needs, as well as the demands for industry and agriculture, as well as a growing population.

Policy options

Increasing water supply is the main strategy that will be employed to enhance access to safe drinking water and improve sanitation services. This will be done by building water capture infrastructure such as dams and weirs and deploying water harvesting techniques. In agriculture, water conservation measures will be applied. Integrated water resources management and catchment-based water management approaches will bring the management of water closer to the users, with significant benefits for water availability and access. Integrated land management will protect the land and forests, and watersheds with additional benefits for water management.

Energy resources

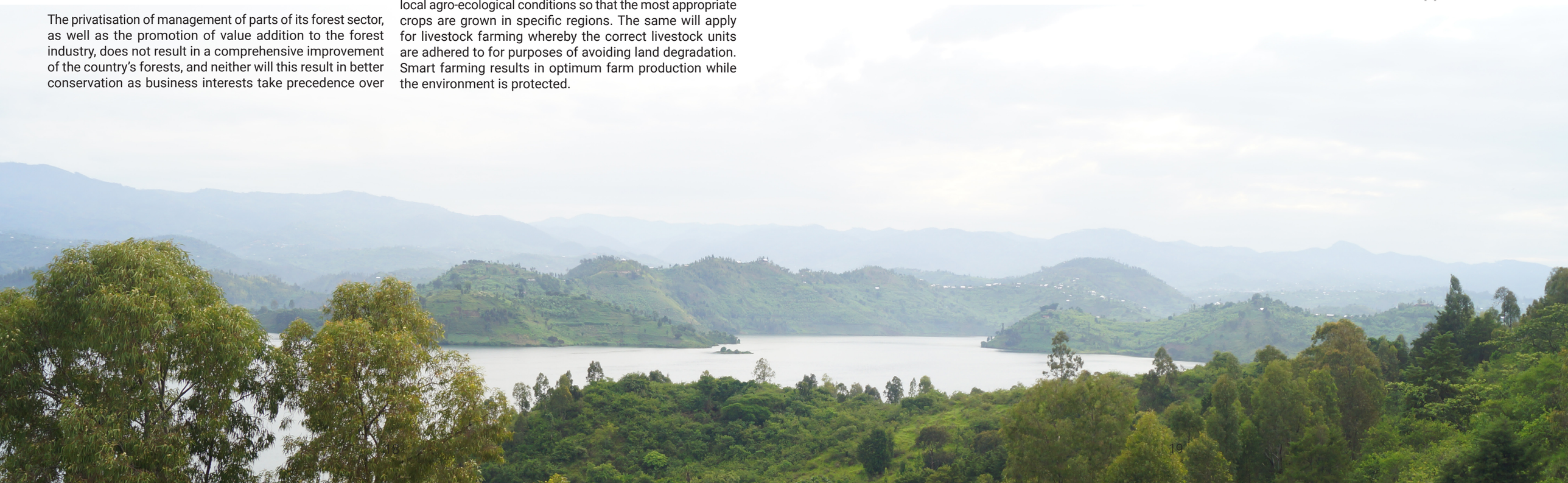
Business as usual scenario

With biomass making up 85 percent, while electricity makes up two percent only, the huge demand for biofuels has meant an annual shortfall of two million metric tonnes in biomass fuel. A gap that is too wide to close by 2050. While there are significant efforts to generate more electricity from renewable sources such as hydropower and solar, much of the new generation is enough to close the electricity importation gap, as well as to transition the electricity mix from non-renewable thermal sources to fully renewable, including hydro- and solar power. As the investment in energy is hindered by Rwanda's low energy potential, the country fails to meet its Vision 2050 energy targets, resulting in continued deforestation and other consequences such as land degradation and the risk of landslides.

Policy options

The country maintains its drive to attract both foreign and domestic investors, and this benefits both the energy and other sectors of the economy. There are multiple benefits that accrue from the use of clean energy, including good health as people are not exposed to indoor air pollution from the use of biofuels for cooking. This results in the country prioritising the energy sector. However, the country remains challenged by the limited potential for electricity generation, which is not adequate for its needs. The only area where opportunities seem abundant is solar power, and the country´s policies must promote both small-scale and large-scale solar investments.

Scenic site on Lake Kivu Karongi 11 Nov 2021.
Photo credit: Denis Rugege



Air and water quality

Business as usual scenario

Increased industrial activity and urban growth in Rwanda results in higher levels of outdoor air pollution. Urbanisation rates that are not matched with the development of infrastructure such as paved roads result in the country failing to reduce outdoor air pollution in towns and cities. The high dependency on fossil fuels for cooking and lighting across the country result in high incidences of indoor air pollution and cases of acute respiratory illnesses.

Wastewater and agro-chemicals are major sources of surface water pollution. With a growing and urbanising population, and through the unintended consequences of large-scale use of inorganic fertilizers under the Crop Intensification Programme, the risk of water pollution is high. As such the cost of treating water for drinking is high, while water weeds such as the Water hyacinth thrive in some of the country´s water bodies.

Policy options

The drive to improve Rwanda's air quality should include an improved design in the rural homestead for better ventilation, while use of clean cooking stoves should be encouraged. In urban areas, roads need to be paved to limit the amount of dust pollution. Together, with universal access to electricity and a public transport system that runs on electricity, the country should be able to meet its Vision 2050 targets for modern housing and settlements with environmentally friendly and climate resilient surroundings.

Continuous improvement is needed in urban planning, including proper channeling of storm water and wastewater treatment, as well as farming methods that do not result in the erosion of agro-chemicals into water bodies, so that there are lower levels of water pollution.

Waste management

Business as usual scenario

All towns in the country are equipped with and serviced by infrastructure for solid waste management, initially to close the 35 percent gap in waste collection coverage, and later to cover the increased waste generation of 14 percent by 2035.

The drive to decarbonise the transport sector result in Rwanda using more electric public and private vehicles, new types of car batteries are added to the electronic waste stream, while the country is challenged by how best to manage such waste. Although the country has a ban on single use plastics in place, there is still wide use of plastic in packaging, a situation that remains into 2050.

Policy options

Rwanda's future policy options and approaches to waste management need to be centred around the household and business levels. This will result in local level cleanliness, which then gets reflected across much of the country. With high levels of awareness in waste separation significant success can be scored in the reduction of waste generation. The infrastructure for wastewater management needs continuous modernisation and upgrading to meet the needs of growing urban populations. Although new laws are enacted and old ones modernised, much of Rwanda's success in waste management will continue to arise from proper enforcement, including the current ban and control on the use of non-biodegradable single-use plastic products.

Climate change and natural disasters

Business as usual scenario

Given the global nature of climate change, some solutions are crafted at the global stage and Rwanda continues to be a significant actor at that level. The country follows suit in decarbonising the transport sector, but the huge demands on clean electricity that come with such transformation result in the country failing to catch up with the developed world.

Rwanda experiences landslides owing to its terrain and deforestation. The migration to universal access to electricity results in a significant reduction in levels of deforestation, which together with forest restoration efforts and terracing, result in reduced levels of exposure to landslides. The restoration of forests and protection of wetlands also results in reduced frequencies of flooding.

Policy options

Climate smart solutions need upscaling in Rwanda, including mass public transport systems driven by clean energy from renewable sources. The smart public transport system will be favoured by the public if it is efficient and on time, while huge tariffs on the use of personal fossil fuel driven cars can deter the public from owning and using fossil fuel driven cars. The incremental investment in clean forms of energy will make Rwanda a low-carbon economy by 2050 if the current efforts are sustained.

While forest restoration efforts will result in a significant reduction in the frequency and severity of disasters such as floods and landslides, the country will also need to invest in early warning capacity so that there is little to no loss of human and animal life due to these disasters.

Rwanda has established institutions and is implementing policy initiatives that aim to promote sustainable development through minimizing the pressure from economic activities

Conclusion and policy recommendations

on the environment and by supporting the implementation of the SDGs. However, there is still a lot to do in terms of managing and protecting the natural resources. Like other countries in the region, Rwanda has been, and continues to be impacted by the COVID-19 pandemic. While vaccination has been embarked on as one way forward there is still the gargantuan task of building back better and propelling the economy and environment into post-pandemic growth trajectory.

Many of the assets that are critical for maintaining the productive base for the economy of Rwanda are either not priced or are priced at much lower levels than they should rightly be. This is especially true for natural capital. Natural capital assets such as forests and water bodies have only been valued for the products they provide for the market. These include timber and aquatic products such as fish. However, these ecosystems offer a much larger suite of services such as water purification, water regulation, climate regulation, habitat provisioning for species among many others. To that end, **it is recommended that the Inclusive Wealth Index be adopted as a more dynamic means of natural resources accounting and assessment**.

A major target set by the government of 30 percent area under forest cover to be achieved by year 2020, has been already achieved. However, Rwanda needs to promote alternative sources of energy for cooking and modern fuel cooking technologies to reduce the consumption of biomass energy for domestic purposes which is still estimated to be around 86 percent.

Rwanda's effort towards achieving Land Degradation Neutrality targets would move the country forward by meeting multiple SDGs. There should be a switch of emphasis to focus on the promotion of a high-quality, integrated soil management system rather than stand-alone erosion control measures in agricultural land. **High quality soil management could be achieved through an integrated conservation agriculture approach that provides profitable agricultural yields, while minimizing environmental damage**.

The government of Rwanda aims for a balance between maintaining water and wetlands ecosystems and their full use as engines of development. **Some of the recommended interventions for water resources and wetland management in Rwanda are to accelerate the process of rehabilitation of Rugenge (Gikondo) wetland and others in the City of Kigali wetland network.** This process is an impressive and important example of environmental law enforcement for wetland protection, the acceleration and success of the process will encourage future wetland rehabilitation plans. **It is also recommended that management plans be developed for the important Rweru Mugesera and Akagera wetlands.**

The current COVID-19 pandemic has highlighted the importance of a sustainable waste management system, including collection, recycling, and waste management. **To build an effective waste management system in Rwanda, it is recommended that a national integrated and sustainable waste management strategy be developed. This will guide waste management practices, integrate waste minimization complementary to other technologies for unlocking opportunities in the waste sector.**

Water pollution in Rwanda is not a critical issue now, but improvement is necessary since the pressure of water pollution may increase in the future. To that end, **the efforts to conduct assessments of the quality of waterbodies throughout the country should consist of repetitive monitoring at the same sites and sampling locations to detect water quality trends**.

Despite the government's efforts in adopting and implementing policies and measures aimed at reducing air pollution, most of the population continues to be exposed to high levels of air pollution. The impact of air pollution on health continues to be of great concern. **The most effective, efficient approach to protect public health from the adverse effects of outdoor air pollution is to reduce ambient concentrations through emission controls.**

Current efforts towards smart transport systems need to be enhanced through electrification of both road and rail transport systems. As one of the few countries assembling electric cars, Rwanda is a leading player in Africa in clean transportation. An enabling policy environment that promotes electric vehicles while discouraging fossil fuel powered vehicles is necessary. The policy environment must also allow for the development of the infrastructure for use of electric vehicles, including working with local authorities and power utility companies to facilitate the construction of electric car charging points.

The suggested policy options in the scenario section noted the adjustments needed if Rwanda is to achieve its vision aspirations, with most of the adjustments centered on smart and green growth. While the aspirations under the country´s Green Growth and Climate Resilient Strategy are generally ambitious, **Rwanda has the potential to successfully achieve most of the goals under the Business-as-Usual scenario. Much more will be achieved if the suggested policy options are implemented**, but this is only possible in the absence of sideswipes as is the current case with COVID-19. The achievements in integrating the environment into its development planning through green growth mainstreaming are impressive. The coming decade will therefore be crucial, and this is not the time to lose momentum, as the impacts of climate change are increasingly evident, and the importance of the environment can no longer be questioned.

Acronyms

AQI	Air Quality Index
AU	African Union
CBD	Convention on Biological Diversity
COPD	Chronic Obstructive Pulmonary Disease
COVID-19	Coronavirus Disease 2019
GDP	Gross Domestic Product
EDPRS	Economic Development and Poverty Reduction Strategy
EIA	Environmental Impact Assessment
EEE	Electrical and Electronic Equipment
EPI	Environmental Pulse Institute
ERF	Economic Recovery Fund
EV	Electric Vehicle
GGCRS	Green Growth and Climate Resilience Strategy
GGGI	Global Green Growth Institute
GHG	greenhouse gas
GoR	Government of Rwanda
Ha	Hectare
HIC	High-Income Country
IWRM	Integrated Water Resources Management
LCDP	Least Cost Development Plan
LDN	Land Degradation Neutrality
MDGs	Millennium Development Goals
MIC	Middle Income Country
MINEMA	Ministry in Charge of Emergency Management
MINFRA	Ministry of Infrastructure
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action Plan
NDCs	Nationally Determined Contributions
NEP	National Electrification Plan
NGOs	Non-Government Organizations
NISR	National Institute of Statistics of Rwanda
NST	National Strategy for Transformation
OAU	Organization of Africa Unity
PFMUs	Private Forest Management Units
PPE	Personal Protective Equipment
RDB	Rwanda Development Board
REG	Rwanda Energy Group
REMA	Rwanda Environment Management Authority
RWB	Rwanda Water Resources Board
RWFA	Rwanda Water and Forestry Authority
RWf	Rwandan Francs
SDGs	Sustainable Development Goals
SE4All	Sustainable Energy for All
SOE	State of Environment and Outlook
SOER	State of Environment and Outlook Report
SMTA	Standard Material Transfer Agreements
SREP	Scaling up Renewable Energy Program
TEV	Total Economic Value
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNSTAT	United Nations Statistical Division
WASH	Water, Sanitation, and Hygiene

The hills roll on in Nyungwe National Park.
Photo credit: travelmag.com/Flickr

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