Future Pathways for Climate Change Adaptation, Mitigation and Environmental Sustainability

Policy Brief

October 2022

Key Policy Messages

⇒ *In Rwanda, there is a growing pattern of major climate hazards affecting the country. Soil erosion and landslides are becoming greater problems, major floods happen almost annually, and there have been several major droughts over the last decade.*

⇒ *Rwanda people are highly vulnerable to climate change because the bulk of their livelihoods depend on climate sensitive natural resources. Climate change is therefore an important development problem that requires urgent attention.*

⇒ *Even if the Paris Goals are achieved, the economic costs of climate change in Rwanda are projected to be large.*

⇒ *Climate change will affect medium-term development and poverty reduction, as well as long-term growth and Vision 2050 goals.*

⇒ *Climate change is a major macroeconomic risk and is likely to affect the public finances of Rwanda.*

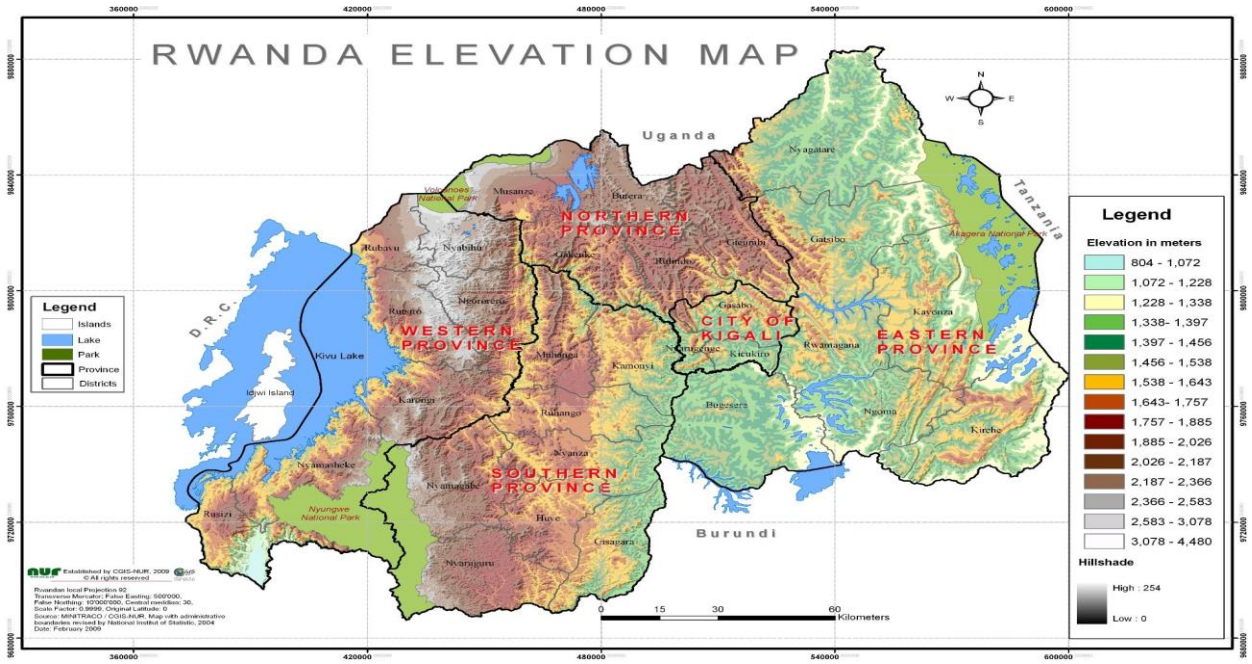
⇒ *Through collaboration between local communities, government agencies and development partners, a range of actions can be taken at different levels to address climate change in Rwanda.*

⇒ *These include, among others: (i) strengthening institutional and technical capacity among sectors involved in adaptations strategies (government, private sector, and Civil Society Organizations), particularly for developing bankable projects for domestic and external funds mobilization; (ii) setting institutional and regulatory framework for sector coordination.*

Introduction

Rwanda is a small land locked country in Central Africa located between 1°4' and 2°51' south latitude and 28°45' and 31°15' east longitude. The country has a total land area of 26,338 km2 and shares borders with Uganda to the north, Tanzania to the east, Burundi to the south, and the Democratic Republic of Congo to the west and northwest (MoE 2. , Updated Nationally Determined Contribution, 2020). The country is divided into four main climatic regions: eastern plains, central plateau, highlands, and regions around Lake Kivu along the western border. Rwanda enjoys a tropical climate with hilly topography stretching from east to west. The Rwandan territory is covered with diverse ecosystems which includes mountain rainforests, gallery forests, savannah woodland, wetlands and aquatic forests and agroecosystems. Approximately 52% of the country's total land area is arable and the total cultivated area equates to 66% of the national territory, with over 93,000 hectares of marshland under cultivation.

Figure 1: Rwanda Elevation Map



With much small plot cultivation occurring on hills or mountain areas, increased runoff and landslides have been experienced, increasing the country's vulnerability to climate change impacts (REMA 2., 2018). Rwanda is a low-income country, but still ranks as one of the top 30 places in the world to do business (2019) and one of the fastest-growing economies in Africa[1].

Rwanda has a population of 12.9 million people (2020) with an annual population growth rate of 2.5%. Approximately 17.4% of the population currently live in urban areas and this is projected to increase to 20% and 29.6% of the population by 2030 and 2050, respectively[2]. The country has a Gross Domestic Product (GDP) of $10.4 billion in 2019 and $10.3 billion in 2020 and an annual growth rate of 9.5% in 2019 and −3.4% in 2020[3].

Rwanda's strong economic growth has been accompanied by substantial improvements in living standards (Table 1), with a 2/3 drop in child mortality and near-universal primary school enrollment. A strong focus on development-orientated policies and initiatives has contributed to significant improvement in access to services and human development indicators. Rwanda's poverty rate dropped from 39.1% in 2014 to 38.1% in 2017 and Rwanda experienced robust economic growth and social performance following the implementation of two, five-year Economic Development and Poverty Reduction Strategies—EDPRS (2008–12) and EDPRS-2 (2013–18). Over the last decade, growth averaged 7.2 % and per capita GDP grew at 5% annually[4]. Rwanda's Vision 2050, a blueprint to transform Rwanda into an upper middle-income country by 2035 and a high-income country by 2050 requires an annual average GDP growth rate of at least 12% during 2018-2035 and 10% from 2035 to 2050[5]. However, the lockdown and social distancing measures, which were critical to control the COVID-19 pandemic, sharply curtailed economic activities in 2020. The

[1] Nzohabonimana, D. (2019). What makes Rwanda one of Africa's fastest growing economies? TRT World [17 January 2019]

[2] World Bank Data Bank (2021). Population estimates and projections, Rwanda

[3] World Bank Data Bank (2021). World Development Indicators, Rwanda. [data accessed 13 September, 2021].

[4] World Bank (2021). Rwanda – Overview.

[5] Ministry of Finance and Economic Planning (2015). Vision 2050. Republic of Rwanda

government expects GDP to drop by 0.2% in 2020, compared to a projected expansion of 8% before the COVID-19 outbreak[6].

Despite the country's overall positive growth and development over the past 25 years, Rwanda is still highly vulnerable to impacts from climate change through its high dependence on rain-fed agriculture, as well as need to improve its road networks, health sector and water resource management[7]. In Rwanda, the high levels of poverty and low degree of development limits capacity of poor households and communities to manage climate risk, increasing their vulnerability to climate-related shocks[8].

Table 1. Key Development Indicators[9]

Indicator	
Life Expectancy at Birth, Total (Years) (2019)	69.0
Population Density (People per sq. km land area) (2018)	498.7
% of Population with Access to Electricity (2019)	37.8%
GDP per Capita (Current US$) (2020)	$797.90

Key Environmental Problems, Their Causes and Opportunities

Environmental problems in Rwanda include climate change, land degradation, forest degradation, biodiversity loss, water degradation and poor waste management and pollution.

Climate variability and change: Rwanda has experienced a temperature increase of 1.4°C since 1970, higher than the global average, and can expect an increase in temperature of up to 2.5°C by the 2050s from 1970. Rainfall is highly variable in Rwanda, but average annual rainfall may increase by up to 20% by the 2050s from 1970. Projections for East Africa over Rwanda and Burundi show an increasing trend in rainfall intensity for both rainy seasons (MXOLISI E. SHONGWE, 2010) which is likely to cause floods and storms which can result in landslides, crop losses, health risks and damage to infrastructure (MoE, 2011). Temperature rise may increase the spread of vector-borne diseases, air-borne and water-borne diseases, impacting on animal and human health, and could negatively affect crop yields, impacting food security and export earnings. Higher temperatures result in higher altitudes at which tea and coffee can be grown, which may significantly impact the land available for tea and coffee and may result in land use conflict. Extreme weather already negatively impacts the economy and climate change could result in annual economic costs of just under 1% GDP by 2030 (SEI, 2009).

As like many other countries, Rwanda is increasingly experiencing the impacts of climate change. Rainfall has become increasingly intense, and the variability is predicted to increase by 5% to 10% (GoR, 2018). Changes in temperature and precipitation and their distributions are the key drivers of climate and weather-related disasters that negatively affect Rwandans and the country's economy, including

[6] World Bank (2021). Rwanda – Overview
[7] Netherlands Commission for Environmental Sustainability (2015). Climate Change Profile – Rwanda
[8] Climate Risk Country Profile - Rwanda
[9] World Bank (2021). Data Bank – World Development Indicators. URL: https://databank.worldbank.org/source/world-developmentindicators

through droughts, floods, and landslides which results in damage to infrastructure, loss of lives and property (including crops) and contribute to soil erosion and water pollution. Data from the Emergency Event Database: EM-Dat[10], presented in Table 2, shows the country has endured various natural hazards, including droughts, floods, landslides, epidemics, and storms.

Table 2: Natural Disasters in Rwanda, 1900 – 2020

Natural Hazard 1900–2020	*Subtype*	*Events Count*	*Total Deaths*	*Total Affected*	*Total Damage ('000 USD)*
Drought	Drought	6	237	415,6545	00
Epidemic	Bacterial Disease	11	317	7,259	0
Earthquake	Ground Movement	2	81	2,286	0
	Flash Flood	4	34	26,051	0
Flood	Riverine Flood	10	170	85,739	0
Storm	Convective Storm	2	3	6,553	0
Landslide	Landslide	5	117	11,949	28,000

Rwanda is highly reliant on rain-fed agriculture both for rural livelihoods and exports of tea and coffee, in addition to depending on hydropower for half of its electricity generation. The country's ongoing economic growth is therefore highly threatened by climate change (MoE-2020).

Land degradation: Rwanda's soils are highly erodible, in the highlands due to excessive rainfall, steep topography and insufficient soil and water conservation practices, and in the drylands due to occasional floods. It has large negative impacts on crop yields. Rwanda's steep terrain and small farm size create serious constraints on agricultural development. More than 70% of the cultivated land surface has slopes greater than 10% which when combined with high and often intense rainfall, results in high levels of erosion and surface run off into waterways equivalent to an annual economic loss of almost 2% of GDP equivalent (REMA, 2009). The soil erosion rate in cropland, which occupies 56% of the national land area, is estimated to be 421 t/ha accounting for 95% of the national soil loss (Fidele Karamage, 2016). 26% of crop land is located on slopes higher than 30% and accounts for 60% of the total soil erosion in Rwanda. There is also a very high dependence on biomass for household fuel (80% of the population) which contributes to erosion through deforestation of Rwanda's hills. Soils in Rwanda also tend to have low levels of organic matter and around 75% of soils are acidic, with a pH below 5.5 and deficient in nitrogen and phosphorus – these are also constraining factors for plant growth.

Forest depletion: The country has identified the crucial role forests have to play in its development agenda. Forests provide primary energy source, mainly as domestic cooking energy and provide the base for the country's tourism opportunities, which were targeted to generate over US$ 600 million by 2020. Rwanda's forests also protect watersheds, downstream wetlands and support agriculture. However, due to dense and rapidly increasing population on a fragile land resource, forests have been threatened by deforestation and continuous degradation of forest resources (Ministry of Lands and Forestry, 2018). Deforestation occurs as a result of agricultural expansion, livestock farming, unsustainable

[10] EM-DAT: The Emergency Events Database – Universite catholique de Louvain (UCL) – CRED, D. Guha-Sapir, Brussels, Belgium. URL: http://emdat.be/emdat_db/

fuelwood extraction, encroachment into forest lands, settlements, forest fires and overgrazing, all of which subject the land to degradation, erosion and landslides (REMA, 2009). Natural forest areas have declined by 65% during the period from 1960 to 2007 (MINIFOM, 2010).

Biodiversity loss: Rwanda has diverse habitats and ecosystems that range from humid montane forests to savannahs, lakes, rivers and wetlands which support a wide range of biodiversity. However, the Country's biodiversity faces various threats which has led to loss of species, shrinkage in population sizes and ecosystem degradation. Rwanda's development agenda recognizes the important and central role that biodiversity and natural resources play in terms of supporting the country's economic growth, livelihoods as well as in the provision of critical ecosystem services such as water, soil erosion and flood control as well as climate change mitigation (BIOFIN, 2018). Tourism in Rwanda, largely attracted to the country's biodiversity in protected forests, generated USD390 million that accounted to 29% of total exports and 4.6% of GDP (USAID, 2019). However, it continues to lose biodiversity at alarming rates due to e.g., land use change and human population pressure, habitat destruction, overgrazing, deforestation, pollution, unsustainable harvesting, introduction of invasive species as well as effects of climate variability. Loss of ecosystem services and biodiversity loss reduces the country's economic, social as well ecological resilience, and impact negatively on people's livelihoods (e.g. food insecurity) and the Rwandan economy (e.g. loss in tourism revenues, forgone incomes in agriculture, forestry, fisheries etc).

Water degradation: The quality of drinking water source remains as a major concern in areas of developing and underdeveloped countries worldwide. The treatment and supply of drinking water in Rwanda are carried out by Water and Sanitation Corporation, a state-owned public company. However, it is not able to supply water to all households. Consequently, the non-serviced households depend on natural water sources, like springs, to meet their water requirements. Nevertheless, the water quality in these springs is scarcely known (Valentine Mukanyandwi, 2019). In Rwanda, the high population density, expanding industrialization and urbanization, inappropriate waste and wastewater management, high rainfall intensity, and the country's high elevation are among the key sources of water pollution (Valentine Mukanyandwi,, 2019). This pollution is associated with the cost of traveling to and the location of piped water in rural areas, which encourages the residents to use unsafe water. There are also poor sewage systems and common use of public latrines and septic tanks in both rural and urban areas (Aboniyo, 2017)

Poor waste management and pollution: The high rate of urbanization and increased level of consumption have inevitably resulted in an increase in waste generation. The lack of proper infrastructure for waste and poor waste management is causing urban pollution to air, water and land as well as health issues. Untreated domestic wastewater and industrial effluents expose residents to diarrheal and other water-borne diseases. Currently, Rwanda lacks sufficient treatment plants for industrial effluents and storm-water drainage systems. Humans and receiving peri-urban environments are exposed to heavy metals, such as lead and chromium; and nutrients from organic material and soil runoff. Rwanda's urban population are also exposed to air pollution due to the increasing number of vehicles, poor traffic management, old and poorly maintained cars and indoor smoke from burning wood fuel and charcoal (SIDA, 2019).

Key trends:

In terms of environmental performance, Rwanda is ranked 138 out of 180 countries according to the 2022 Environmental Performance Index (EPI) (Yale Center for Environmental Law & Policy, 2022). Climate change is a major driver of environmental change and poses a serious challenge to future economic development. The

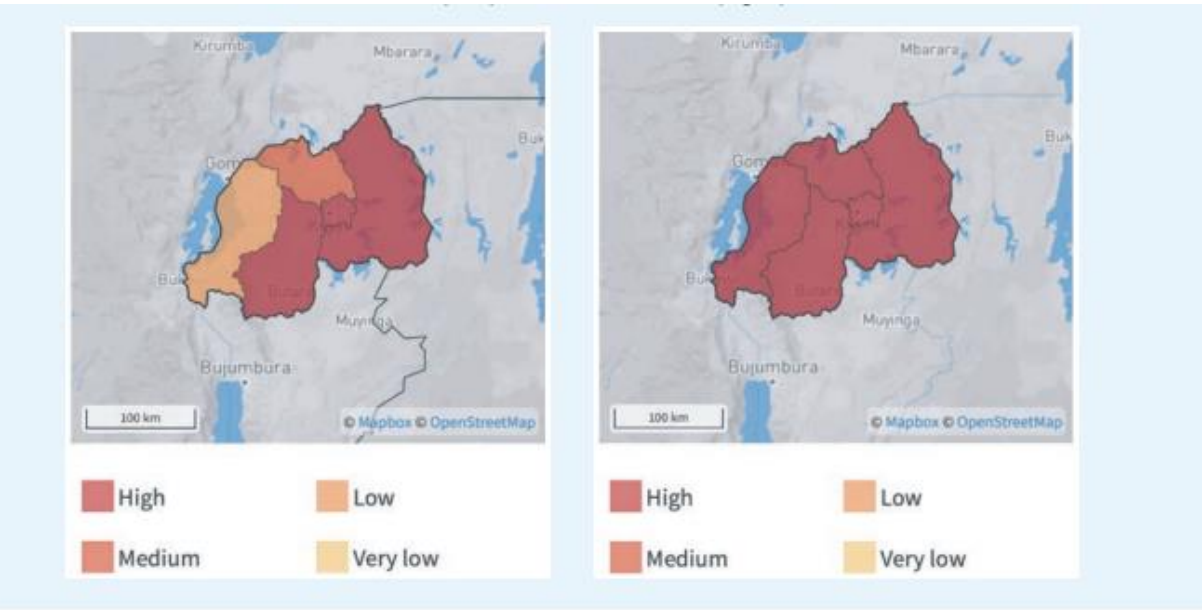
impacts of climate change are particularly disadvantageous to areas such as sub-Saharan Africa, including Rwanda. For example, Rwanda ranks 185 out of 188 countries in per capita GHG emissions, but despite its low contributions to greenhouse gas emissions, the Global Climate Risk Index ranked it in the top-10 countries most affected by climate change in 2018 (REMA 2. , 2021).

Climate change trends in Rwanda are expected to increase the risk and intensity of flooding through increased frequency and intensity of heavy rainfall events. Additionally, the country's eastern and central areas are expected to experience increased aridity and drought, with significant impact on livelihoods. Droughts have already resulted in famine, population displacement, conflicts, and biodiversity loss. Seasonal droughts are expected to be prolonged, which will cause problems especially in the east and southeast of the country (Bugesera, Mayaga, and Umutara). The country has experienced major floods over consecutive years (2006–2009), which has resulted in serious health problems, displacement, large scale erosion, and damage to infrastructure. Changes in rainfall with increased temperature and increases in floods and droughts will impact food security and water availability. Increased incidence of extreme rainfall may also result in soil erosion and water logging of crops, thus decreasing yields and increasing food insecurity. Given projected climate change trends, Rwanda and the surrounding region is expected to be a hotspot of food insecurity in the future, which limits opportunities for import. This may result in significant economic losses, damage to agricultural lands and infrastructure as well as human casualties. Land degradation and soil erosion, exacerbated by recurrent flood adversely impacts agricultural production, disproportionately affecting the livelihoods of the rural poor. Food security will be influenced because of the vulnerability of some crops to increasing temperatures and/or water stress. In Rwanda, the most food insecure regions of the country are the west and central south (Netherlands Commission for Environmental Sustainability, 2015).

Climate change, deforestation, watershed degradation, land use, urbanization and widespread settlements into flood and landslide-prone areas have already exacerbated issues and impacts from flooding and droughts and have also increased the risk of wildfires. Heavy rainfall can also trigger riverine and flash floods. Heavy rainfall and flash floods are common in the country's hill areas and can also trigger landslides and mudslides. Additionally, water stress during the traditional dry periods (June to August) may be further exacerbated with competing demands from household consumption and agriculture. Infrastructure projects are being developed to enable the construction of dams and irrigation networks. Increased heat will further strain existing water resources and impacts from changing rainfall patterns (REMA 2. , 2018).Figure 2 shows different risks from river flooding, water scarcity, extreme heat, and wildfires

Figure 2: Risk of River Flood (left)[11]; Risk of Wildfire (right)[12]

[11] ThinkHazard! (2021). Rwanda River Flood. URL: http://thinkhazard.org/en/report/205-rwanda/FL
[12] ThinkHazard! (2021). Rwanda Wildfire. URL: http://thinkhazard.org/en/report/205-rwanda/WF



How is Rwanda responding?

Policy Framework for Managing Environmental Challenges

This section provides brief information on Rwanda's national development priorities, how environmental aspects are mainstreamed into policies, and how the environmental challenges and climate change are addressed.

Institutional and Governance Context

Rwanda's planning and procedural ecosystem is extremely robust, with sectoral, district, national and supporting regional strategies linked to a centralized planning process. At the core of each planning document is the implicit drive to reduce poverty and increase economic development.

Key Development Plans, Policies and Strategies:

1. Rwanda has made significant progress in its efforts to identify the country's climate change risks and vulnerabilities, and has put in place key policy and strategic instruments that provide guidance on climate change response – in terms of both mitigation and adaptation. Environmental resource management and protection is guided by the National Policy on Environment (2003), which aims to improve human well-being, the judicious utilization of natural resources, and the protection and rational management of ecosystems for sustainable and fair development of Rwanda. In order for Rwanda to tackle climate change, this national policy needs to be mainstreamed into the national vision and sector strategies.

2. At the policy and strategy level, protection of environment and sustainable natural resource management is one of the priorities in Vision 2050. In fact, Rwanda's Vision 2050 articulates the long-term strategic direction for "the Rwanda we want" and the enabling pathways to achieve this ambition. Currently, the major areas of attention are the mainstreaming of environmental sustainability into productive and social sectors and reducing vulnerability to climate change (MoE 2. , 2020). Vision 2050 aims to reach upper middle-income status GDP per capita of over USD 4,036 in 2035, and high-income status GDP per capita of over USD 12,476 in 2050 (GoR 2. , 2020). The National Strategy for Transformation (NST1) is the framework for achieving Vision 2020 and the Sustainable Development Goals (SDGs).

3. Rwanda has been committed to addressing the challenge of climate change since 1998 when it ratified the United Nations Framework Convention on Climate Change (UNFCCC) and later the Kyoto Protocol in 2003 (MoE 2., 2011).

Rwanda submitted its Third National Communication to the UNFCCC in 2018, Rwanda's First Biennial Update Report under UNFCCC IN 2021, National Adaptation Programmes of Action (NAPA) in 2006, the Intended Nationally Determined Contributions (INDCs) in 2015, and the Updated Nationally Determined Contributions (NDCs) in 2020.

4. The Green Growth and Climate Resilience Strategy (GGCRS) aims to guide the process of mainstreaming climate resilience and low carbon development into key sectors of the economy. The GGCRS identifies climate change responses and recommended areas of intervention across fourteen different Programmes of Action, which and are meant to build and strengthen adaptive capacity and to collectively enhance Rwanda's resilience to climate change across the major sectors of Rwanda's economy. Since the GGCRS came into effect, Rwanda has consistently integrated climate change adaptation responses in its EDPRS 2 and NST1, and aligned several GGCRS-recommended interventions with the targets and priorities under the EDPRS-2 and NST1. This has given effect to the GGCRS to a certain degree.

However, there is a recognition amongst government as well as non-governmental stakeholders that Rwanda needs to take additional concerted steps to realize GGCRS objectives and to translate the GGCRS into large-scale, on-the-ground implementation. To this end, Rwanda must draw a critical mass of funding support to enable strategic, high-impact, technically viable, and financially bankable climate resilient investments.

5. Rwanda has also been an active member of regional and global initiatives to respond to the threat of climate change. These include participation in the East African Community (EAC) Climate Change Policy (2010) and subsequent East African Community (EAC) Climate Change Master Plan 2011–2031. Rwanda also joined the NDC Partnership and launched its NDC Partnership Plan during the Africa Green Growth Forum held in Kigali in November 2018. In addition, after conducting an assessment of economic impact of climate change in 2009, the GoR decided to establish a department of climate change within REMA to advise the government on all climate change related issues in the country.

6.The Government of Rwanda has recognized the strong links between poverty and the environment / natural resources and, therefore, the principles and objectives of environmental management and sustainable natural resource use have now been largely mainstreamed in public policy and planning, as well as in the programming of Rwanda's main development partners.

7. Rwanda has also looked at ways to assess and support the implementation of environment and climate change activities. It has provided checklists for environment and climate change mainstreaming into development sectors and district planning, in an attempt to ensure that climate change, as stipulated by Economic Development and Poverty Reduction Strategy-2 (EDPRS 2) and National Strategy for Transformation (NST1), remains at the forefront of sectoral and cross-sectoral planning.

8. Although mainstreaming of environment and climate change into Sectors Strategic Plans (SSPs), as well as Districts' Development Plans (DDPs), has improved, a more targeted and effective environmental and natural resources and climate change (ENR & CC) mainstreaming is needed in Rwanda, particularly for the new planning period under the National Strategy for Transformation (NST1).

9. The government has scaled up efforts to integrate disaster risk management (DRM) into its national policies and long-term development plans. In 2010, the Ministry of Disaster Management and Refugee Affairs was established to manage both natural and man-made disasters. The country formulated a National Disaster Management Policy (2012), which is guided by the country's National Disaster Contingency Matrix (2016). These

strategies serve as the country's legal and institutional framework for DRM and ensures that activities are coordinated and partnerships are fostered between the government and stakeholders. Climate change has been integrated as a critical pillar within the country's disaster management agenda

10. Other national documents, like the sector-based strategies for climate change and/or environmental resources, have attempted to provide sectoral and programmatic guidance to the effects and mitigation and adaptation solutions, but require significant strides in implementation as well as real budgetary expenditures to see tangible improvements in these sectors.

Key Institutions:

11. The Rwanda Environment Management Authority (REMA) is a public institution under the Ministry of Environment (MoE) responsible for ensuring that issues relating to the environment and climate change are integrated into all national development programs. To achieve its objectives, REMA has been working with government Institutions, the private sector, and civil society, with the support of development partners.

12. The Fund for Environment and Climate Change (FONERWA) was launched in 2014, with aim of being the engine of green growth, mobilizing and channeling domestic and international financing to public and private environment and climate change projects. The fund supports projects that align with the country's commitment to a strong and prosperous green economy.

13. Rwanda Water Resources Board (RWB) is public institution under the Prime Minister Office for ensuring the protection of catchments, coordinate the implementation of erosion control plans, and floods management strategies.

14. Rwanda Meteorology Agency is a public institution under the Ministry of Environment (MoE) responsible for providing accurate, timely weather and climate information and products for the general welfare of the peoples of Rwanda.

15. Despite the country's commitments to mainstream the environment and climate change policies, the implementation of these existing policies remains limited to guide decision making.

Current interventions

Efforts to tackle the issue of environmental problems have been supported with sizeable investments: Catchments restoration, forest landscape restoration, ecosystem-based adaptation and erosion control) from the Government and development partners that have further developed Rwanda's capacity in environmental management.

The Government and its partners have been also implemented projects through public and private institutions.

The Transforming Eastern Province through Adaptation Project (TREPA) implemented by the Ministry of Environment will restore ecosystems and transform fragile landscapes in this province which have been degraded and are unable to sustain livelihoods in the face of climate change. The project is funded by a $49.6 million Government and Green Climate Fund.

The Strengthening Climate Resilience of Rural Communities in Northern Rwanda project will increase the resilience of vulnerable communities to climate change in Northern Rwanda by targeting a range of integrated adaptation interventions. The project is funded by a $33.2 million Government and Green Climate Fund.

The Commercialization and De-Risking for Agricultural Transformation Project will build resilience of communities through irrigation, agricultural insurances and access to finance. The project is funded by a $300 million Government and World Bank.

MINAGRI irrigation Programme development: The Government of Rwanda has embarked on a substantive irrigation programme development in the Eastern Province with about 500 million USD invested in currently ongoing irrigation projects and those in pipeline in Eastern province. This programme consists in supporting several water management and water supply schemes such as the Muvumba Multi-Purpose Dam (USD 173,555,021), the Warufu Irrigation Project (USD 73,365,832)], the Gatare-Mugesera Irrigation Project (USD 9,044,320), the Rukumberi project (USD 9,000,000), the Rweru Irrigation scheme in Bugesera District (USD 23,355,000), the export targeted modern irrigation project (USD 120,500,000), the Gabiro Irrigation Scheme development project (USD 93,700,000).

This policy brief aims to provide recommendations that would reduce the risk that climate change poses to Rwanda livelihoods and therefore contribute to the social and economic development of the country.

Policy Recommendation

The Government of Rwanda and its partners recognize the importance of mainstreaming environment and climate change into policies.

The following recommendations and commitments can be highlighted among others:

- Rwanda Meteo should provide consistent and harmonized future climate projections for Rwanda that are country-specific, or for guidance on which external climate information sources to use and how to use them. This information needs to be accompanied by current information and local expertise to ground and interpret the future information in context.
- Rwanda Meteo should tailor climate information to the adaptation needs of decision-makers. As an example, this will require more information on variability and extremes, and relevant hydro- and agrometeorological variables of interest, particularly threshold levels. This information also needs to be developed in conjunction with hazard or biophysical analysis (e.g. hydrological modelling) to allow its use in decision analysis.
- RWB in collaboration with MINAGRI/RAB Rwanda should expand its soil conservation and land husbandry programs through the installation of land protection structures such as radical and/or progressive terraces.
- MoE/RWR should develop and implement policies and programs to influence farm-level land and water resource use and management practices (rain water harvesting, water ponds) in light of changing climate conditions.
- RWB should conduct research to better understand the country's water balance and the impacts from changed precipitation trends and increasing population and industry demand.
- MINAGRI/RAB should promote investment in irrigated agriculture that will increase production, harness fresh water resources and ensure food security to the population.
- RAB should rethink how to attract the private sector in diffusion of small-scale irrigation technologies.
- MINAGRI/RAB should design and promote District irrigation master plans and develop small-scale schemes where possible based on water catchments.
- MINAGRI/RAB in collaboration with Local Government for mainstreaming agro-ecology technologies in the current agriculture intensification program and natural resource-based livelihood programs.
- MINAGRI/RAB in collaboration with research institutions (Universities) should invest on developing new crop varieties, including hybrids, to increase the tolerance of and suitability of plants to temperature, moisture, and other relevant climatic conditions.
- MINAGRI/RAB should promote climate-resilient agriculture - solar irrigation,

renewable energy in agri-value chain, resilient cropping practices, resource conservation.

- MININFRA, MINAGR/RAB and RWB should promote the usage of solar water pumping systems for irrigation within agricultural production to replace diesel pumps, displacing fossil fuel use and associated GHG emissions.
- MoE/RFA should promote Sustainable Forest Management (SFM) approach as an integrated methodology for addressing the interconnected environmental, social, and economic challenges facing the forestry sector that require multi-sector responses that involve multiple institutions and stakeholders.
- RFA should decentralize seed banks for reforestation activities, extending the network of protected areas on land and in the wetlands and strategic investment to restore the country's degraded ecosystems.
- RFA should implement public private partnerships to sustainably manage all forestry plantations through multi-year contracts with forests operators (via cooperatives) who will plant and maintain young plantations until they reach their commercial size.
- MININFRA to set up the enabling framework and policies needed to massively scale up renewable energy and promote energy efficiency, which will inter alia uplift private investments.
- MININFRA, MINALOC (RURA, REMA, CoK/ municipal and local government, WASAC) should invest in wastewater treatment and reuse technology, reducing methane emissions from wastewater and providing a nutrient-rich digestate that can be used as a fertilizer.
- MININFRA to promote sector coupling: efficient use of electricity from renewable energy in heating, cooling, and the transport sector.
- MININFRA/REG should increase the share of renewable energy in its power generation through construction of hydro, solar power plants and methane-based electricity power plants in order to shift from using fossil fuels for its electricity needs.
- MININFRA and MoE should continue to promote the diffusion of improved cook stoves through subsidy programs to reach 100% of all households by 2030.
- City of Kigali in collaboration with Ministry of Infrastructure and MoE should integrate circular economy approaches in recycling, treatment and disposal of generated wastes.
- Ministry of Health in collaboration with REMA, Rwanda Meteo, and Rwanda National Police (Vehicle Inspection Services) should enforce through the regulation and implementation of policy and laws for air quality and indoor pollution and other environmental factors related to non-communicable diseases.
- Ministry of Health in collaboration with REMA and Rwanda Meteo should raise awareness about and educate the population on the prevention of diseases connected with climatic factors.
- MoE and REMA should build capacity of media, theatre groups, and entertainment and advertising industries to mobilize their participation and contribution in shaping public awareness and increase the active public participation in the climate change adaptation and mitigation debate.
- MINEMA should integrated disaster risk reduction and climate adaptation into the planning frameworks of decentralized governance structures and adaptive capacity built at that level.
- The NDC identified a total investment need of USD 11 billion by 2030 to deliver climate actions, with broadly equal resources allocated to mitigation (USD 5.7 billion) and adaptation (USD 5.4 billion). While there are strong enabling environments in place, there is a need for more awareness-raising, capacity-building and information-sharing between the public and private sectors. MINECOFIN in collaboration with FONERWA

also needs a more focused strategy for how to put enabling policies into action and actually mobilize private-sector finance for climate activities, prioritizing adaptation.

- Government and development partners should focus on empowering the Rwandan business community – much of it small and medium enterprises – to implement adaptation measures and to offer adaptation-related services and products.

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