Policy brief on contribution of Ecosystem-based Adaptation to Water Resources Resilience to Climate Change in Rwanda

Summary

The government of Rwanda is a landlocked country located in the east of central Africa with a moderate climate and relatively high rainfall. Floods, water logging, and ground water are mainly affected by climate change effects, which in turn may affect the achievement of the Sustainable Development Goal (SDG) 6 that is to ensure availability and sustainable management of water and sanitation for all. To overcome this challenges, the ecosystem based adaptation (EbA) is essential. The EbA is defined as the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. It aims to maintain and increase the resilience and reduce the vulnerability of ecosystems and people in the face of adverse effects of climate change. The EbA caters for the sustainable provision of key ecosystem services that drive the water cycle. This is achieved by the protection, restoration, planning and management approach that develop support functions in degraded watersheds. These measures increase climate resilience and work for water security in adequate quantity and quality, hence its application in Rwanda can help to overcome challenges related to water resource management.

1. Introduction

Rwanda is a landlocked country with a moderate climate and relatively high rainfall. Climate change is expected to result in increased temperature, intensified rainfall, and prolonged dry seasons. These presents different challenges for different regions of Rwanda, where the central north and south are susceptible to severe floods due to changes in the rain fall, while the east and southeast may suffer from droughts and desertification. Some climate change effects, such as the lowering level of lakes and water flows as well as forest degradation, are expected to continuously occur in the country.

The current ND_GAIN index for climate vulnerability ranks Rwanda at 185 places out of 188 countries in per capita greenhouse gas emissions where Rwanda contributes to 0.01% global emissions that contribute to climate change. Further, changes in rainfall and temperature are expected to continue increasing in the future.

Specifically, Rwanda has experienced increase in temperature to 1.4^{o}C since 1970, higher than the global average. This trend is expected to continue to 2.0^{o}C from 1970 to 2030. The increase is expected to be consistent across the country and across seasons. Even though the country receives a relatively high average annual rainfall of 1200mm, the West of the country receives an average of 1400mm, while the East receives less than 1000mm. The total annual precipitation of the country is 27.5 billion m^3, that is translated into a per capita freshwater availability of less than 1000 m^3/year, hence the country is classified as a water scarce.

There is also unevenly distribution of water resource both spatially, temporally and in quantity. For example, the general climate pattern reflects two rainy seasons and two dry seasons during the year, but about half of the precipitation may occur in a single season (March to May). These changes may cause extreme events including severe droughts and floods. Droughts have already resulted in famine and biodiversity loss, while major floods resulted in health problems, erosion, and damages of different types of infrastructure affecting food security and water availability. Surface water of Rwanda occupies 5.3% of the country's land area (135 295ha), that includes 101 lakes and 861 rivers. However, only less than 10% of the available water resources are used mainly for agriculture and domestic activities. Industry, mining, fishponds, coffee washing stations, and infrastructure are classified as minor water users, even tough actual water use certainly exceed the recorded data. However, this is expected to change dramatically by 2040.

2. Sustainable Development Goals and Water resource

The Sustainable Development Goal (SDG) 6 is "to ensure availability and sustainable management of water and sanitation for all". It suggests the water use efficiency overtime, especially in its indicator 6.4.1 seeks to measure the change in water use efficiency over time' to shed light on the effect of economic development on the use of water resources. Data from recent natural capital accounts has increased over the 4-year period since 2012 efficiency has increased by around 4500 to 5100Rwf/m^3 in 2019. An improvement of almost 13%. The indicator 6.4.2 addresses the level of water stress over year. This is the ratio of the total fresh water withdrawn by all major sectors to the total renewable freshwater resources available after considering environmental requirements for water flow. In 2019, water stress in Rwanda was 8.9%. This means that the ability if lack of to meet human and ecological demand for water.

3. Main water problems related to climate change effects

Floods - refer to the inundation of large parts of land by water, which otherwise remain dry for some duration of time with many consequences including mainly the loss agricultural products, livestock and different kinds of infrastructures and properties. The main causes of floods that are linked to climate change effects include human activities namely deforestation, overgrazing, mining, industrialization, and global warming. To solve problems, different strategies and options have been applied as of the solutions to overcome challenges imposed by erosion (Table 1). However, these have been criticized because direct contributions of the strategies and activities to socio-economic development are not well captured. These are the reasons why approaches such as those of the Ecosystem-based adaptation are needed for water management.

Table 1: Strategies and Options for flood Management (Adapted from Asumadu-Sarkdie et al. 2015)

Strategy	Options
Reducing flooding	Dams and reservoirs Dikes, levees, and flood embankments High flow diversions Catchment management Channel improvements
Reducing susceptibility to damage	Floodplain regulation Development of policies Design and build facilities Flood proofing Flood forecasting
Mitigating the impacts of flooding	Information and education Disaster preparedness Post-flood recovery Flood insurance
Preserving the Natural Resources of Flood Plains	Floodplain zooning and regulation

Water Logging - soil is said to be waterlogged when it is completely saturated with water, which is caused by water stagnation on flat land and low-lying areas. It occurs due to excess rainfall, floods, seepage high water table, obstruction to natural drainage, over irrigation, etc. effects of water logging are the persistence of wet conditions in most of the low-lying areas that result in delayed sowing and less crop production. Further, when water dries, salts accumulate on the soil surface resulting in an increase in soil salinity. Since water logging is the second biggest threat to the soil, next to erosion, it is therefore,

necessary to study water table fluctuations, groundwater recharge, assessment of seepage from canals, tanks, etc.

Groundwater – in Rwanda, ground water is the main source of water that is either fetched directly form wells and springs or piped to communities from springs and wells. However, over the years, the water resources were degraded due to erosion, pollution from agricultural activities, industrial effluent, and household waste, all leading to reduced water levels and shortages, in addition to contamination. The ground water is mainly affected by human induced factors like soil erosion from agriculture and mining activities, lack of wastewater treatment, application of pesticides and fertilizers among others.

4. Esystem-based Adaptation for water resource management

The climate change adaptation challenge varies geographically and with local circumstance. The pressure on, and condition of local ecosystems affect their capacity to deliver ecosystem services, and consequently people's vulnerability. Ecosystem-based adaptation (EbA) measures can help to secure ecosystem services and reduce people's vulnerability in ecosystem contexts ranging from largely natural to heavily modified landscapes, such as cities or agricultural lands.

Terrestrial ecosystems are under increasing pressure from changes in the use of land and natural resources, ultimately driven by population growth and lifestyle changes. At the same time, climate change impacts, including increased risk of floods, droughts, landslides, and soil erosion, are degrading ecosystems and their ability to provide services important to people, as well as directly causing harm to people, their property and production. This in turn puts people under increased pressure to resort to unsustainable ecosystem use and management, further degrading ecosystems and their capacity to deliver services. While climate change affects the various terrestrial ecosystems in different ways, and each ecosystem is accompanied by its unique set of socio-economic and political issues, this vicious cycle of degradation is common to most.

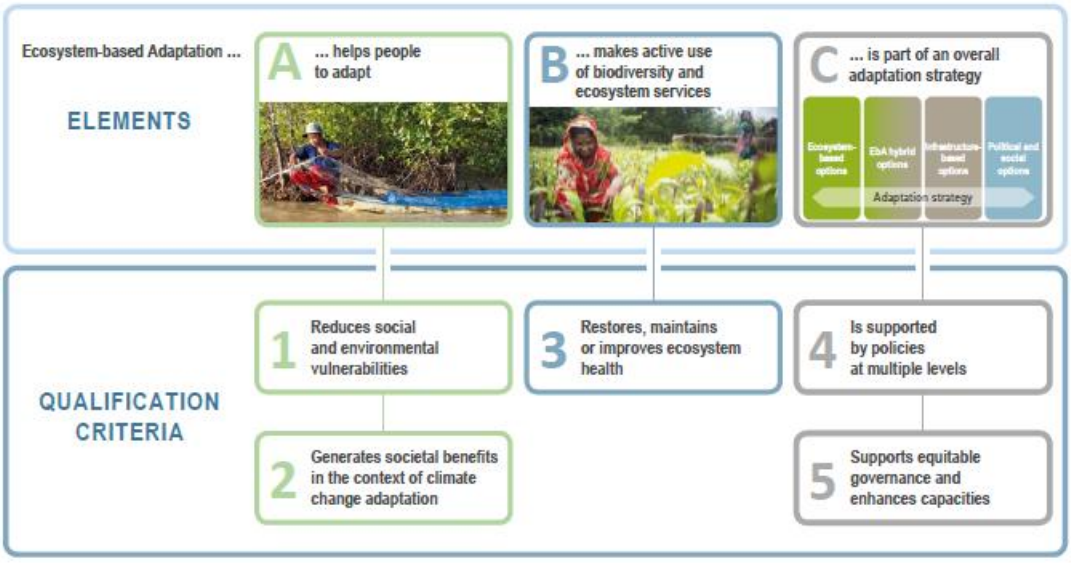

Figure: making EbA effective: a framework for defining qualification criteria and quality standards (Copied version from FEBA, 2017)

EbA was interchangeably used with the nature-based solution for water resource management. The EbA is defined as the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. It aims to maintain and increase the resilience and reduce the vulnerability of ecosystems and people in the face of adverse effects of climate change. The concept of EbA stems from socio-ecological systems research that proposes the use of ecosystems for human adaptation to climate change. EbA is gaining growing attention within climate policies as it often creates addition co-benefits for adaptation and mitigation. Currently, a new set of recommendations is being developed that calls for the prioritization of EbA approaches in national adaptation planning where possible and appropriate.

5. Key elements to apply EbA for water resource management

- The EbA caters for the sustainable provision of key ecosystem services that drive the water cycle. This is achieved by the protection, restoration, planning and management approach that develop support functions in degraded watersheds. These measures increase climate resilience and work for water security in adequate quantity and quality
- The strengths of EbA to improve water availability, water quality and to minimize the impact of extreme events are gaining growing attention in global key policies in the fields of climate change, disaster risk reduction, sustainable development and biodiversity conservation.
- New recommendations include applying EbA as a prioritized approach in national adaptation planning; wherever possible, these are to be complemented by grey measures to protect human lives, ecosystems and infrastructure when EbA as a stand-alone approach reaches its limits

EbA measures can enhance storage capacities and improve water quality, reduce the impact if extreme weather events and climate variability. They can also support ecosystem functions that provide cross-sectoral benefits for sustainable development as well as co-benefits fpor climate mitigation. EbA in watersheds offers a valuable opportunity to opt for water security in the face of climate change. To maximize the potential of EbA, the Approach should be mainstreamed into water policies and planning.

6. Conclusion

It is time now to apply the EbA approaches to cope with climate change effects in Rwanda. This ca be more successful through the integration of local knowledge into the planning processes, an important factor for the suitability of the measures in a local context. In this case, living weirs as environmentally-friendly weir constructions can act as a flood buffer as local solution. In this regard, Eba interventions can enhance water availability, improve water quality and reduce water-related risks in watershed.

Readings

1. Esther D & Dipankar (2021). Integrating EbA and IWRM for climate-resilient water management. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Federal Republic of Germany

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4. REPUBLIC OF RWANDA, INDC (2015), pp.2. http://www4.unfccc.int/submissions/INDC/Published%20Documents/Rwanda/1/INDC_Rwanda_Nov.2015.pdf