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CLIMATE CHANGE ADAPTATION WITHIN LAND USE AND TENURE REFORMS IN RWANDA

POLICY RESEARCH BRIEF NO. 4

LAND PROJECT

June 2015
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1. BACKGROUND

Across equatorial and east Africa, climate change is affecting the frequency, intensity and variability of regional climate patterns.[1] Changes in rainfall patterns, temperatures and storm intensity are having significant effects on national economies, regional infrastructure, land use and local livelihoods. These changes are forcing national and local governments to adjust and adapt how they plan, prepare and implement day to day operations today and larger visions for the future. The ability of governmental policies and programs to address challenges from climate change will ultimately determine how economies grow and how social welfare and the environment are preserved and protected.

In Rwanda, climate change impacts are forcing the government to integrate adaptation measures to ensure that its environment, its economy, and, most importantly, its people are able to withstand the negative effects of floods, storms and droughts. Within the last two decades, and even more so in recent years, Rwanda has included climate change adaptation elements into some land use policies, regulations, programs and national growth strategies, although these elements are often weak and lack substantive direction or mandate for land use planners and managers. Additionally, since the implementation of those policies is, in many cases, too recent to determine how effective they are at reducing risks and vulnerabilities to climate change, there still exist opportunities for Rwanda to learn from the performance of matured policies, strengthen current adaptation approaches, adopt best practices from regional examples sharing similar experiences, and better integrate climate change adaptation interventions across governmental action.

Climate change impacts in Rwanda are amplified by a fast growing population under an increasing density distribution, with a large portion (45%) of the population living below the poverty line and increasing competition for dwindling natural resources.[2] These challenges have led to unsustainable and unhealthy land use practices, including: settlements on steep slopes and in floodplains, deforestation, overcrowding in urban areas, and poor waste management, to name a few.[3] With projections in the near future pointing toward increases in population, higher temperatures and more variable rainfall patterns, climate change impacts may be dramatically more intense in the near future and under increasing pressure from unsustainable land use. Rwanda has an opportunity now to incorporate sustainability and climate change adaptation measures into land use and tenure policies to accommodate larger future generations and reduce climate change risks through mitigation efforts implemented today.

Climate change policy is still relatively young in Rwanda, having only been triggered from staggering research findings in 2009.[4] Since then, Rwanda has moved to integrate climate change adaptation into policies, programs and land use planning

[1] International Panel on Climate Change (IPCC) (2014). *Fifth Assessment Report (AR5)*. Chapter 22: Africa.
[2] World Bank, Global Poverty Working Group. (2011). Website: http://data.worldbank.org/country/rwanda
[3] Republic of Rwanda (2011). *Green Growth and Climate Resilience: National Strategy for Climate Change and Low Carbon Development*. In collaboration with the Smith School of Business and the Climate Development Knowledge Network.
[4] Interview with FONERWA Coordinator (2/24/2015). ** The report: Stockholm Environment Institute (SEI). (2009). *The Economics of Climate Change in Rwanda.*

processes. Previously, many indirect adaptation efforts were already embedded within existing programs that were not explicitly designed for climate change, even if they do have risk mitigation implications. Strengthening existing programs and adopting addtional direct adaptation policies will be key to ensuring Rwanda's adaptive capacity in the shadow of increasing climate change risks.

This policy brief will: examine key impacts of climate change in Rwanda, assess the performance and implementation of climate change adaptation measures in land use policy frameworks and suggest key recommendations that could strengthen Rwanda's land use policies to better integrate climate change adaptation measures.

2. RESEARCH OBJECTIVES

I. To identify the key climates risks factors facing Rwanda and climate change projections.

The first objective will determine the climate change impacts of highest concern in Rwanda using events from recent years, historical weather patterns and disaster events that have occurred within the last few decades. Within this objective, climate change impacts and projections will help to better understand how these impacts are measured and manifested by Rwanda's social, environmental and economic facets over time.

II. To determine the extent to which land and natural resource policy, legislation and programs in Rwanda address climate change adaptation.

Within the second objective, this research examined how land and natural resource policies, legislation and programs have integrated climate change adaptation measures, either through directly addressing the issue or through interventions that indirectly have adaptation co-benefits.

III. To assess the outcomes of land policy, legislation, and programs (including the LTRP) on the adoption of climate change adaptation measures.

The third objective assessed how adaptation measures in policies, programs, and legislation have been implemented and what has been the effect on increasing Rwanda's adaptive capacity to climate change. While data collection was broad, the research primarily focused on the effects of climate change adaptation policies on disaster prevention practices, impact mitigation, social welfare protection and economic growth.

IV. To document climate change adaptation measures that Rwanda has implemented, the outcomes of these measures in terms of cost, disaster prevention and impact mitigation, economic growth, and social welfare.

The fourth objective evaluates how land policy, legislation and programs have affected the adoption of climate change adaptation measures and how land policy has supported investments with adaptation benefits.

V. To assess to what extent climate risk analysis and corresponding risk mitigation measures are integrated into the land use master planning process at the national and district levels (both for urban versus rural planning).

The fifth objective determines the how climate change adaptation is integrated in national, district, urban and rural land use planning processes.

VI. To propose recommendations for policy and practice that can be used to strengthen climate change adaptation considerations and approaches in policy, law and planning in Rwanda.

The final section offers conclusions and recommendations. Recommendations are provided to augment current land policy approaches, as well as suggested as new innovative strategies that have proven effective in other locales experiencing similar effects as Rwanda.

3. METHODS AND SOURCES OF INFORMATION

Policy research for this brief was conducted with primary and secondary sources. Primary sources included interviews with key informants, determined by the research team and through recommendations from key governmental partners in the Ministry of Natural Resources (MINIRENA). Reviews of secondary source material included national legislation, governmental reports, independent research and a review of international best practices.

Primary source research included interviews with key informants within national governmental offices, district offices, international organizations and civil society organizations. A questionnaire was designed to guide key informant interviews, and sent ahead of the interview in preparation for face-to-face interviews. This enabled the respondents to be familiar with the questions, to reflect on the information sought beforehand, and to point out important and relevant issues they found pertinent. Measures were taken in the preparation of the questionnaire to ensure that it was easily understandable, clear and comprehensive. While this provided more structure than only using a thematic guide, the interviewers made efforts to probe important information and not let the questionnaire restrict conversation. Doing so enabled the authors to fill knowledge gaps on both land tenure and climate change adaptation issues, making findings and recommendations more focused. A list of key informant interviews is provided in Annex I. The questionnaire is provided in Annex II.[5]

Secondary source research included a review of policies (Ministerial Orders, laws), national strategies (policies, sector strategic plans), land use plans, government reports, and independent international climate related research. In developing a list of recommendations that could strengthen Rwanda's climate change adaptation efforts in land use policy, a light review of best practices from countries with contexts similar to

[5] A list of key informant interviews is provided in Annex I. The key informant questionnaire is provided in Annex II. Not all key informants were actually interviewed, due to their availability, which is evident in the meeting date column. Some interviews were also cut short due to interviewee schedules, which left gaps in the information from some key institutions.

Rwanda was performed to supplement the recommendations from key informants or suggested amendments to existing adaptation programs.

4. ADAPTATION IN POLICY AND PRACTICE

From the research, it is evident Rwanda does have climate change adaptation elements within some land use and tenure policy, though their incorporation is not robust. In many instances, adaptation is indirectly addressed as an unintentional consequence of land policies that are currently underway. In other instances, adaptation measures are weakly contrived and poorly implemented, miss an opportunity to focus on climate change impacts and risks, lack inter-governmental coordination, or are missing altogether. To strengthen Rwanda's capacity to adapt to climate change, this brief provides an understanding of how some land policies have embraced adaptation principles and where the integration of climate adaptation is weak in current policies.

4.1 Key Climate Risk Factors

In recent decades, Rwanda has observed considerable changes in its climate. Higher temperatures, variations in seasonal rainfall patterns and increased frequency of extreme storms have led to more frequent flooding, droughts and landslides. These extreme events have led to famine, property damage and destruction (including agriculture, private property and infrastructure), costly emergency actions and increases in weather related morbidity and mortality.

Historical Climate Data Patterns and Scientific Projections

Since 1970, Rwanda has noticed a 0.35° C increase per decade in annual mean temperature, which is slightly higher than the global average at 0.27° C. Over time, these temperatures are projected to continue to increase by 2.5° C by 2050 and 4° C by 2080.[6] Regionally, in many parts of eastern Africa, extreme warming events are beginning to occur more frequently.[7] Temperature projections are given with high confidence due to historical data, projection confidence levels and global warming trend data supporting regional observations.

Rainfall patterns are also being disturbed by climate change, although projections carry less certainty how variability will be manifested seasonally and by volume. As well, less accurate historical data exists to track changes within recent decades. Despite lower confidence levels, rainfall patterns in eastern and central Africa are predicted to increase throughout the beginning and middle of the 21st century, resulting in a wetter and more intense wet season.[8] Insufficient data exists to determine regional seasonal precipitation variation. Uncertainty also surrounds dry

[6] Republic of Rwanda (2011). *Green Growth and Climate Resilience: National Strategy for Climate Change and Low Carbon Development*. In collaboration with the Smith School of Business and the Climate Development Knowledge Network.
[7] IPCC (2014). *AR5.* Chapter 22: Africa.
[8] IPCC (2014). *AR5.* Chapter 22: Africa.

seasons, with multiple theories aimed at predicting drought frequency and intensity in central and eastern Africa.[9]

Regional Observations and Recent Extreme Events

Over the last two decades in Rwanda, the most commonly observed natural disasters were the result of heavy precipitation in single, intense events. Floods and landslides have occurred during and after intense rainstorms. In 1997, a number of extreme events took place and caused extensive damage to property, public health and environmental zones. The most commonly observed extreme event has been flooding, with major flood events occurring in 1997, 2002, 2006, 2007, 2008, 2009 and 2011.[10] The majority of flood events occur in the Northern and Western Province where rainfall patterns are heavier and topography and soil type add to regional vulnerability. Large areas of steep slopes concentrate rainfall runoff into narrow valleys and floodplains. Rocky terrain with shallow topsoil and reduced forest cover due to spreading agriculture and charcoal production has led to limited soil absorption of precipitation, resulting in increased runoff and erosion.[11]

While less recurrent, droughts are occurring in Rwanda with increasing frequency and are more common in the Eastern Province.[12] Rwanda reports droughts occurring in 2000, 2006, 2011 and 2013. The 2011 drought was a large regional occurrence that caused famine throughout much of East Africa; however, this event was less intense in Rwanda, which was largely spared effects of food shortages.[13] Due to the risks of famine and food shortage surrounding drought events, droughts remain a large concern for Rwanda, regardless their of infrequent occurrence.

Climate Change Risks and Impacts

Climate change impacts are having extensive adverse effects on Rwanda's economy, its people and its environment. Already, the country is observing extreme events causing damage and public health concerns. More subtle shifts in the country's regional climate are also changing the landscape. Whether coupled with major events or slower weather pattern transitions, these impacts are only projected to intensify without focused intervention.

Flooding and landslides have led to displacement, loss of property and loss of agricultural production. In 2011, floods claimed the lives of 10 people and displaced hundreds of households in northwestern Western Province, destroyed over 350 homes and damaged over 3,000 hectares of farmland.[14] On May 7th, 2011, landslides claimed

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[9] IPCC (2014). *AR5.* Chapter 22: Africa.
[10] Interviews with officers from Nyabihu District (2/13/2015). Interviews with Officer from Musanze District (2/13/2015).
[11] Rwanda Environmental Management Authority (2009). *Rwanda State of the Environment and Outlook*. Chapter 9.
[12] Interview with officers from Bugesera District (2/20/2015). Interview with Officer from Nyagatare Districts (2/19/2015).
[13] Warnest, Mathew, Sagashya, Didier, Nkurunziza, Emmanuel. (2012). *Emerging in a Changing Climate – Sustainable Land Use Management in Rwanda.* FIG Working Group Week, Rome.
[14] Ministry of Distaster and Refugee Affairs (2012). *Impacts of Floods and Landslides on Socio-Economic Development Profile.* Department of Research and Public Awareness, Kigali.

the lives of 14 people in Nyabihu District.[15] Weather related injury, fatality and property loss are some of the most concerning impacts deriving from climate change.

Environmental impacts are also resulting throughout Rwanda as a result of climate change. Where heavy precipitation has caused erosion or landslides, natural waterways are being over silted, in turn ruining stream beds and natural riverine flows while degrading water quality for agriculture or household use. Loss of topsoil also is leading to loss of streambanks, forests and valuable agricultural resources.

Displacement from landslides, floods and other climate-related impacts are causing tensions between people neighboring affected areas and displaced people, due to damaged homes or loss of livelihoods. In Nyabihu District, displaced people from the genocide living in the Gishwati Forest were cultivating land on steep slopes that could not support agriculture. Heavy rains washed away crops, homesteads and forced the displacement of thousands of people, causing the Government to step in with relief and alternative areas for their settlement.[16] In response to these types of extreme cases, the Government has intervened to procure land and resources for the relocation of people living in vulnerable areas under stressful conditions. At the same time, some people in vulnerable areas are reluctant to leave, even as agricultural productivity diminishes and livelihoods are threatened, due to fear of the unknown in new locations, uncertain livelihoods and the dismantling of valuable social networks and resources. For these reasons, relocation is often a sensitive procedure, filled with warranted skepticism.[17]

Since much of Rwanda's rural employment and even its GDP is reliant on rain-fed agriculture, variations in regional precipitation will have large effects across large portions of the rural population and the national economy.[18] In the Eastern and Southern Province, variations in rainfall and droughts have resulted in food deficits, crop failures and decreases in livestock production. Disruptions to agricultural production are causing increasing competition for local resources, leading to disputes on land claims and leasehold rights. Livestock owners are extending searches for new places to graze, often impeding on others' crops and grazing areas and causing tensions with existing leaseholders and landowners.[19] Competition for resources is further amplified by regional political unrest, causing refugees to flee across borders where they compete with existing communities for natural resources.

Warmer temperatures also bring a threat of invasive species. New species, plant and animal, are now present in areas they did not previously exist, which may lead to crop damage and increases in rates of vector borne illnesses.[20] Higher temperatures are allowing mosquitoes to live at higher elevations, leading to increasing malaria rates at higher altitudes.[21] New species may also start to appear throughout Rwanda as the

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15 Ministry of Distaster and Refugee Affairs, (2012). *Impacts of Floods and Landslides on Socio-Economic Development Profile.* Department of Research and Public Awareness, Kigali.
16 Interview with officers from Nyabihu District (2/13/2015).
17 United Nations Interagency Framework Team for Preventive Action (2014). *Toolkit and Guidance for Preventing and Managing Land and Natural Resource Conflict: Land and Conflict.*
18 Interview with Rwanda Environmental Conservation Organization (3/4/2015).
19 Interview with officers from Bugesera District (2/20/2015).
20 IPCC (2014). *AR5.* Chapter 22: Africa.
21 Interviews with District Environmental Officer, Nyagatare District (2/19/2015). Interview with District Environmental Officer, Nyaruguru District (2/17/2015). Interviews with member of Parliamentary Committee on Agriculture, Livestock and the Environment (3/3/2015).

climate warms. Throughout central and eastern Africa, warming trends may increase the threat of the coffee berry borer (*Hypothenemus hampei*), which could have a significant impact on one of Rwanda's largest and most valuable agricultural exports.[22]

In terms of costs and economic loss, warmer temperatures and variations in precipitation patterns have led to extensive, and costly, damage and economic loss. The economic impact of a major flood in 2007 in Nyabihu and Rubavu Districts alone cost between $4 and $22 million, or roughly 0.6% of national GDP.[23] By 2030, it is estimated that climate change impacts will cost Rwanda 1% of its GDP each year.[24]

Climate change impacts are often experienced most by the poorest or most disenfranchised communities.[25] Poorer communities are often the ones located in more vulnerable flood or drought prone areas, as these are least desirable, reflected in low property values, lease rates or lack of tenure enforcement. These households also lack the resources to build adaptation measures or otherwise protect themselves when disaster strikes. Gradual displacement from areas of decreasing agricultural productivity and immediate displacement from disaster events cause tension between existing secured land owners and newly displaced people.

Collecting and Sharing Climate Change Data

To track and project climate change impacts, Rwanda has several programs in place to collect and disseminate weather and climate-related information. Some aspects of climate change impacts are collected more regularly and accurately than others. Information surrounding disaster events, including number of houses damaged or hectares of agricultural land ruined, for example, are easily collected and reported. Other information, such as costs of disasters, economic loss to local businesses, costs of infrastructure damage, are rarely tracked and reported.

The Rwanda Meteorology Agency (METEO), within the Ministry of Natural Resources (MINIRENA), collects weather related meteorological data. The agency was recently equipped with several advanced weather stations and powerful computer hardware to store and process weather information collected every five minutes.[26] METEO shares climate data with other ministries who disseminate that information through early warning systems specific to their separate domains. In advance of predicted extreme disaster events, METEO shares extreme event alerts with the Ministry of Disaster Management and Refugee Affairs (MIDIMAR), which oversees an early warning system. One of the first of its kind in East Africa, it is designed to share critical information before disaster strikes so that people and communities have an opportunity to prepare in advance. Since the system is relatively new, its

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[22] IPCC (2014). *AR5.* Chapter 22: Africa.
[23] SEI (2009). *The Economics of Climate Change in Rwanda*. **The large range accounts for the fact that the lower limit did not incorporate values of damaged infrastructure, loss of life and agriculture. The upper limit provides an estimate of the total impact of the flood event.
[24] SEI (2009). *The Economics of Climate Change in Rwanda*.
[25] Freudenberger, Mark, Miller, David(2010). *Climate Change, Property Rights & Resource Governance: Emerging Implications for USG Policies and Programming.* Website: http://usaidlandtenure.net
[26] Interview with representative in Rwanda Environmental Management Authority Climate Change Unit (2/24/2015).

performance and operation have yet to be assessed.[27] An early warning system is also managed through the Ministry of Agriculture that shares climate-related information with farmers for use in deciding planting schedules, seed or crop choices and fertilizer purchases. Because the system is relatively new and expensive to maintain and operate, it is currently only available for a few districts. It will be rolled out country wide as resources become available to expand its reach. Over time, more decentralized and specific information are expected to become available at the sector level for more precise prediction of climate change impacts on agriculture.[28]

Until recently, Rwanda participated in a worldwide program focused in regions vulnerable to food insecurity, the Famine Early Warning Systems Network (FEWS-NET), a USAID program implemented since 1985. The FEWS-NET program collected regional weather data and provided alerts, reports and predictions on regional food availability. While food availability information was provided publicly, it primarily targeted national and local governments for the sake of informing design interventions to prevent food insecurity. While food security is impacted by many different variables, FEWS-NET primarily focused on predicting drought conditions and analyzing other climate related variables to project food availability.[29] The Rwandan FEWS-NET office closed in early 2015, yet regional information will still be available through the FEWS-NET website collected from program offices in other East African countries.

The Ministry of Disaster Management and Refugee Affairs (MIDIMAR) is the lead ministry for climate risk identification and analysis, mitigation and disaster relief. Climate-related disaster data is collected and recorded by MIDIMAR. They have issued reports for public distribution to raise awareness on climate change impacts, but little has been done to ensure reports are actually raising public awareness. Many reports are hidden deep in the MIDIMAR website, limiting their accessibility.

Finally, MINIRENA is the lead ministry for climate change action and for land use policy and planning. Within MINIRENA, the Rwanda Natural Resource Authority (RNRA) develops national land use plans and land policy. The Rwanda Environmental Management Authority (REMA), also under MINIRENA, develops environmental policy and collects and disseminates climate and environmental data. REMA is in the process of finalizing a baseline climate vulnerability index for the entire country that will identify specific risks and areas of highest priority or most vulnerable.[30] When available, land use planners, developers, land users and policymakers will be able to use the index to inform future plans, policies and programs that incorporate climate change impacts and projections.

4.2 Climate Change Adaptation Integrated in Land Policy

[27] Interview with Program Analyst, United National Development Program (3/16/2015).
[28] Interview with representative from METEO (2/27/2015).
[29] Famine Early Warning System Network (FEWS-NET) (2015). USAID Program. Website: http://www.fews.net/east-africa/rwanda
[30] The baseline vulnerability index was commissioned by the Rwanda Environmental Management Authority with assistance from the United Nationals Framework Convention on Climate Change. It was reported as finalized on April 1, 2015, but the report has not yet been made public as of the publication of this research brief.

Reference to climate change adaptations in land sector policies exists, but their incorporation is weak and largely lacks any meaningful implications for preparing Rwanda for climate risks or for reducing the country's vulnerabilities. This absence of climate adaptation elements in land policy will be compounded by a growing population and increasing competition for increasingly limited resources. Rwanda has multiple policies, laws and programs that integrate climate change, even if climate change adaptation impacts are indirect results from other land use management activities. Indirect effects of these policies may lead to climate adaptation without being explicitly designed to do so.

Laws and Ministerial Orders

- The Organic Law on the Environment (2005) defines the process for requiring and approving Environmental Impact Assessments (EIA), a regulatory process that identifies effects that may be caused by land use projects.[31] EIAs are a prerequisite to the construction of roads, dams, buildings and other infrastructures, as well as other projects with large environmental footprints. The law also lists the procedures by which developers seek building permits and how those are approved. While climate change is not evident in these procedures, EIA approval processes and building permits can be used as an opportunity to require adaptation elements in site layout and building and project design.

- The Expropriation Law (2007) list acts of public interest that may be warranted for expropriation, including: public infrastructure, environmentally sensitive areas, mining facilities, cultural and historical reserved areas, and activities to implement land use and development master plans.[32] The law does not explicitly permit expropriation of people on steep slopes, wetlands, or other areas vulnerable to climate change in order to reduce climate risks. To strengthen climate adaptation measures within the law, it could amended to provide stipulations or processes for relocation after disaster events, without necessarily using expropriation as a mitigation action.

- The Land Law (2013) governs land use and tenure procedures by repealing and replacing previous laws in order to strengthen the law's scope on gender equality, property right protection and environmental conservation and protection.[33] This law does not mention climate change explicitly, but does list stipulations for sustainable land use, including buffers for wetlands and water bodies. In some sense, the law does have components useful for climate change adaptation planning, such as defining flood boundaries or soil erosion controls, but it largely lacks meaningful integration of climate change considerations.

[31] Organic Law, No 04/2005 of 08/04/2005 Determining the modalities of protection, conservation and promotion of environment in Rwanda.
[32] Law No 18/2007 of 19/04/2007 Relating to expropriation in the public interest.
[33] Law No 43/2013 of 16/06/2013 Governing Land in Rwanda.

- The Land Use Planning Law (2012) determines processes and authorities for land use planning at the national and at decentralized levels.[34] The law does not mention climate change, but certain provisions within the law do carry adaptation co-benefits. Limiting sprawl and excessive use of land and energy consumptipon can be seen as adaptation strategies to keep settlements from affecting soil erosion, wetland pollution or to minimize risks to settlements in vulnerable areas. In future revisions to the law, climate adaptation could help strengthen land use planning regulations and processes.

- The Land Consolidation Ministerial Order (2010) is designed to enable farmers to consolidate multiple parcels under one crop management program.[35] The primary objective of this order is to optimize agricultural productivity as well as strengthen connection between buyers and farmers. Although the program does not state climate change adaptation action, the order could be set up to increase adaptive capacity by charging implementing agencies with responsibility to identify agricultural technologies and practices that suit climatic conditions, inform farmers and provide extension support to implement them. Likewise, the order could provide a framework for delivering efficient relief efforts post disaster events.

Policies

Many of Rwanda's policies include some elements that may be considered as adaptation measures, but that are not explicitly stated, designed or implemented as such. Other policies that deal with land use do not include climate change adaptation at all, such as the Mining Policy (2009), regardless of the fact that national strategies and sector strategic policies list climate change is as a crosscutting issue that affects all sectors.

- The Environmental Policy (2003) cites climate change as a major threat to development, livelihood and public health and safety, and it acknowledges human contribution to major climate change.[36] Although the policy predates most of Rwanda's other climate change measures, the policy does include strong adaptation measures through recommendations to strengthen early warning systems and mitigation efforts, as well as policies to improve disaster management and relief efforts. While explicit mention of planning for climate change risks is not included in the policy, the 'Five Year Strategic Plan for the Environment and Natural Resources Sector (2014 – 2018)' states objectives to make Rwanda more resilient and adapted to climate change though the pursuit of financing mechanisms, infrastructure design requirements and mainstreaming climate change priorities.[37]

[34] Law No 24/2012 of 15/06/2012, Relating to the planning of land use and development in Rwanda.
[35] Ministerial Order No 14/11.30 of 21/12/2010, Determining the models of land consolidation and its productivity.
[36] Ministry of Lands, Resetttlement and Environment (2003). *National Environmental Policy.*
[37] Ministry of Natural Resources (2013). *The Five Year Strategic Plan for the Environment and Natural Resources, 2014 – 2018.*

- The National Land Policy (2004) outlines planning and land use goals and sets guidelines for sustainable land use.[38] This policy does not include specific measures to increase Rwanda's adaptive capacity; however, it does outline the country's strategies to determine settlement structures and the protection of environmental areas. By limiting sprawl, densifying urban and rural areas, the policy has the potential to ensure that communities are located out of vulnerable areas, or planned in a way to minimize risks and increase community resilience.

- The National Forestry Policy (2010) also does not make specific climate change adaptation recommendations.[39] Instead, the policy acknowledges that increasing forest cover helps to reduce climate change, risks, desertification, erosion and the degradation of water quality. The forest policy suggests the use of financial incentives to promote agroforestry and the sustainable management and expansion of forests. Finally, the plan sets a target of increasing the nationwide forest cover to 30% by 2016, from a 20% baseline in 2006, which would help reduce risks of climate change impacts over time.

- The National Housing Policy (2015) promotes green construction methods that minimize energy use and environmental impacts while also creating healthy living environments for occupants. Many of the green building treatments can be designed as climate adaptation measures, including: onsite storm water retention to reduce flooding down slope and passive lighting and cooling designs to minimize energy consumption and reduce blackouts from overstressed energy grids in periods of high demand.[40] The policy also includes strong risk mitigation and resiliency measures to encourage homeowners, builders and planners to adopt resilient designs and plans to protect settlements and the environment through the provision of sustainably designed public infrastructure.

- The National Human Settlement Policy in Rwanda (2009) states priority to mitigate and adapt to climate change, but substantive actions or procedures are not included within the policy.[41] The policy, however, does make recommendations and outlines processes to increase density in rural and urban areas, with the intention of better service provision, more efficient land use and improved environmental protection of areas surrounding settlements. Similar to the land policy, these interventions can be seen as adaptation measures since they can reduce exposure to risks in disaster prone areas and improve public intervention to reduce impacts following disaster events, both gradual and at once.

National Programs

[38] Ministry of Lands, Environment Forests, Water and Mines (2004). *National Land Policy.*
[39] Ministry of Forestry and Mines (2010). *National Forestry Policy.*
[40] Ministry of Infrastructure (2015) *National Housing Policy*.
[41] Ministry of Infrastructure (2009). *National Human Settlement Policy of Rwanda.*

Rwanda has several nationwide programs that are designed to both increase the country's adaptive capacity and protect and optimize land use, especially for agriculturalists.

- Rwanda's National Adaptation Program of Action (NAPA) (2007) is part of its obligations in signing the Kyoto Protocol. The NAPA is a reporting program prepared by Least Developed Countries to describe the country's most "urgent and immediate needs to adapt to climate change." The program is overseen by the United Nations Framework Convention on Climate Change (UNFCCC). As part of Rwanda's NAPA, activities are listed to integrate climate change in water resources management, hydro-agro early warning systems, and promotion of non-agricultural income generating activities. So far, the NAPA has held consultations in all provinces to develop an overall summary of climate change vulnerabilities across the country. Additionally, studies have been undertaken on vulnerability to climate change and adaptation measures implemented in Rwanda; however, few actionable projects have been undertaken under the program.

- The Land Tenure Regularization Program (2009-2012) demarcated and registered private property parcels across Rwanda. Secured land titles may help to facilitate smallholder access to credit, which could be used to construct adaptation measures and reduce risks. Data collected during the regularization program is maintained in the national land registry, which could be used to identify owners of property damaged from extreme events and expedite relief efforts. Finally, the land registry could be useful to identify landowners with property in vulnerable areas and focus mitigation efforts through encouraging these landowners to embrace adaptation policy, such as reforestation, irrigation, or other flood prevention measures, as examples.

- The Land Use Consolidation Program (2008) is a mechanism to bring farmers owning adjacent plots together to grow priority crops deemed best suited for the area. Farmer participation in the program makes them eligible for seed and fertilizer subsidies available through the Crop Intensification Program. Priority crops are determined by the Ministry of Agriculture, using climate and biophysical data to determine the best suited crops in the area under current conditions. This presents an opportunity to focus disaster relief efforts if all farmers are known and their crops (and crop values) are similar. This program could also be useful for implementing concentrated and specific adaptation measures across a larger area and at scale, or through which to verify the performance of a livestock and agriculture program, following exercises to increase productivity or mitigate risks.

- The Fund for the Environment and Climate Change in Rwanda (FONERWA) (2012) is a basket fund, available to private, public and non-profit sector organization, to support climate change mitigation and adaptation projects. Through a multi-layered application process, the fund prioritizes and supports projects that: contribute to the country's low carbon development, mainstream climate change into national policies and public action, and promote adoption of adaptation and resilience strategies. Eligible projects must fit within four thematic windows that include land conservation, technology and knowledge

transfer, climate change mainstreaming or monitoring and enforcement. Awarded projects must also track and report progress toward key indicators that measure climate change adaptation and mitigation action.

National Guiding Strategies

Rwanda has several guiding documents that contain climate change adaptation elements and that carry great weight in setting national priorities, influencing ministry performance plans and guiding sector specific policies. The latest versions of these policies include mention and measures for addressing climate change and increasing Rwanda's adaptive capacity.

- Vision 2020 (adopted in 2000 and revised in 2012) serves as the leading national policy, guiding other plans, legislation and sector strategies by setting the vision for where Rwanda aims to be in 2020. The original draft did not acknowledge climate change as a threat; whereas by 2012 Vision 2020 had accepted climate change as a crosscutting issue that affects all development sectors. It now cites the need to mitigate climate change impacts by focusing on environmental policy and green growth strategies. To achieve this, Vision 2020 cites a number of specific actions and priorities to ensure economic growth and commercial activity, public health, agricultural productivity and environmental protection. Activities vary from increasing forest cover, to ensuring access to water and sanitation, to wetland protection or strengthened design and construction of infrastructure, to name a few.[42]

- The Economic Development and Poverty Reduction Strategy II (2013-2018) (EDPRS2) serves as shorter term plan to reach goals set forth in Vision 2020, with primary focus on reducing poverty.[43] The policy is structured into four thematic areas, with climate change embedded as a crosscutting issue, transcending all areas. Specific activities for green growth and sustainability are included as key priorities within economic transformation principles, including climate change adaptation components to support a green economy and physical planning processes for urbanization goals. To gauge impacts and progress toward Vision 2020 goals, emphasis is also placed on monitoring and evaluation systems, including a green accounting framework that will demonstrate effective policy implementation and economic benefits of environmental protection."

- The Green Growth and Climate Resilience Strategy (2011) facilitates the integration of adaptation and mitigation policy into all sectors through identifying climate change impacts as a crosscutting issue in sector strategic plans.[44] The strategy acts as Rwanda's overarching climate change policy and includes measures for mitigating greenhouse gas emissions as well as adapting to and increasing resilience to climate change impacts. The strategy includes

[42] Republic of Rwanda (2012). *Rwanda Vision 2020: Revised 2012.*
[43] Republic of Rwanda (2013). *The Economic Development and Poverty Reduction Strategy: Shaping Our Development (2013-2018).*
[44] Republic of Rwanda (2011). *Green Growth and Climate Resilience: National Strategy for Climate Change Adaptation and Low Carbon Development.*

specific recommendations per sector, accounting for climate impacts to each sector by setting a longer term vision for Rwanda to 2050. The strategy proactively adopts a long term planning vision by recommending action now to ensure Rwanda's adaptive capacity and resilience in the future. It likewise offers specific recommendations within targeted programmes of action to address climate related challenges facing Rwanda's continued economic growth and development.

With the recent adoption and implementation of these policies, laws and programs, all ministries and governmental authorities are now tasked with integrating and mainstreaming climate change into their programmatic activities and service provision. Overseeing climate change programs and ensuring the widespread adoption of mitigation and adaptation policies is REMA, within MINIRENA. In 2009, a Climate Change Unit within REMA was established to guide the process of mainstreaming climate resilience and low carbon development into all sectors. The policy framework in place allows REMA to work closely with other ministries and actors in the private sector to ensure that coordination leverages strengths and resources from partners working towards shared goals. Unfortunately, many agencies operate within silo-ed environments, focusing on limited scopes withinframed by individual performance plans.[45] The tendency to work independently is a major reason why close coordination is often cited as a key recommendation toward strengthening climate change adaptation measures.[46]

4.3 Climate Change Adaptation: Implementation and Outcomes

Little formal research has been done to ensure that land use programs are reaching their intended level of impact and that climate change adaptation elements of land use policy are helping Rwanda to better adapt to climate related risks. Since few specific climate adaptation targets exist in sector specific strategic plans, development of such targets, with corresponding monitoring and evaluation efforts, could help to leverage stronger efforts to implement adaptation measures and further reduce climate related risks. Lacking scientific research or consistently tracked data, this report draws on qualitative information gained from land use planners, policymakers and civil society experts with insights on Rwanda's land policies and climate change impacts. Many subject matter experts cite single events, or lack of recent events, as evidence of advances in Rwanda's adaptive capacity, without directly attributing program impacts as adaptation successes. However, longer term monitoring and evaluation will be necessary to accurately determine effectiveness of programs and policies related to land use and climate change.

Some programs have been in place over longer periods of time and are generally seen as crucial interventions to preserve land quality. Although not designed with climate change adaptation in mind, they are unintentionally helping make Rwanda more adapted to climate change. Since Rwanda has long faced challenges associated with

[45] Interview with representative from the Rwanda Environent and Development Organization (3/2/2015).
[46] Interview with representative from the Rwanda Enviromental Management Authorities Climate Change Unit (2/24/2015).

heavy rain, challenges that are pronounced when many livelihoods rely on rain fed agriculture, the country has many programs already in place to address effects from heavy rainfall. Most interventions are aimed at controlling erosion, such as terracing, tree planting, mulching and ditching, and steep slope use restrictions. In some cases, Rwanda can point to successful implementation of policies that have had intended impacts. District officers report that limiting development in the Northern Province near the Gishwati Forest, paired with slope control, reforestation and erosion mitigation measures, have reduced the number of landslides and reduced soil loss. Although there is little scientific evidence to prove these interventions reduce erosion and landslides in Rwanda, they are widely considered by soil experts and environmental planners as effective measures to reduce topsoil loss.[47]

To protect wetlands and water bodies, reduce flood vulnerability and maintain water quality, Rwanda mandates buffer zones extending from the high water mark, in order to restrict land use close to the water's edge. This buffer zone could be seen as protecting investment, such as buildings, crops or infrastructure, in areas prone to flooding. Buffer zones are reinforced through building permits, Environmental Impact Assessments, zoning and enforcement of the Land Law (2013). Although buffer zones are not designed specifically to protect land use investments against flooding, they nevertheless do act as risk mitigation measures. Some temporary structures and settlements still occur in wetland areas, and agriculture is common in many wetlands. Yet government interventions to relocate people living or cultivating within these areas are typically singular events without coordinated effort or a formalized program to move people from harm's way. A publicly available inventory of these relocation events is also not available as government-based intervention to force community relocation is a sensitive issue that raises questions on compensation, effects on land owners in neighboring areas where displaced people are relocated, and economic and social impacts on relocated communities.

One of the strongest regulatory requirements in place is embedded in the Organic Law on the Environmental (2005) requiring Environmental Impact Assessments (EIA) for all new projects that have an effect on the environment or that pertain to any body of water (wetlands, rivers, lakes), in the interest of the public good. Public good projects include, but are not limited to: roads, drainage, energy, or infrastructure, to name a few. EIAs are required for projects that fall outside of permissible land use regulations, pertain to site disturbance, use, or zoning restrictions. They are an effective tool to ensure that all projects have adequately considered and minimized project impacts on the environment. Although neither climate change impacts nor inclusion of adaptation measures are required elements of the assessments, EIAs are an opportunity to ensure that projects are provisioning for site-level environmental impacts and working to mitigate those effects.

Finally, land use planning (discussed in the next section) is a strong example of land use policy integrating climate risk mitigation measures, if even not designed specifically for that purpose. For example, zoning regulations can act as effective land use controls that are already in place and determine allowable uses within specified

[47] Widomski, Marcin (2011). *Terracing as a Measure of Soil Erosion Control and Its Effect on Improvement of Infiltration in Eroded Environment, Soil Erosion Issues in Agriculture*. Ed: Dr. Danilo Godone. Website: http://www.intechopen.com/books/soil-erosion-issues-inagriculture/terracing-as-a-measure-of-soil-erosion-control-and-its-effect-on-improvement-of-infiltration-in-erod

areas. Planning and zoning are perhaps the strongest tools to regulate land use and can be designed to incorporate and promote climate change adaptation measures in public and private sector land use. More explicit design and adoption of adaptation integrated planning and zoning combined with effective enforcement through inspections, surveying and permitting would help to ensure that climate policy is actuated on the ground.

Implementation Costs

Costs of implementing climate change adaptation measures within land use and land tenure policies are difficult to measure as funding comes from multiple sources and is not explicitly dedicated or tracked for specific interventions. Rough estimates can give a sense of what climate adaptation costs, but not what the most specific and effective investments are over time. For example, terracing does reduce erosion and loss of topsoil, but it is also expensive and may not be the most appropriate or cost effective treatment in every instance.[48] Insufficient research exists to confidently determine which adaptation practices are most cost effective or are most appropriate to local conditions.

Since its inception in 2012, FONERWA has funded over 13 activities that have climate change mitigation and adaptation objectives as a central component of project design. With strong monitoring and reporting requirements, the FONERWA program creates an opportunity to track intervention costs across multiple projects to validate price and to determine how effective different approaches are to reaching intended impacts. The FONERWA logframe, for instance, provides set targets per specific actions that will achieve larger objectives over time. As it requires applicants to report on financial resources used to implement projects, it can track expenditures to determine real costs of erosion control or forestation per hectare, as examples. Over time, FONERWA will be able to analyze and report costs and benefits of different interventions and should be able to provide valuable information for prioritizing budgets for climate change adaptation measures.

Additionally, international donors are eager to fund countries with coordinated and well organized adaptation programs. Rwanda can showcase FONERWA and other implemented and well functioning adaptation measures to draw additional adaptation funding from other donors. Most donors also have extensive monitoring and reporting requirements, allowing implementers to integrate monitoring and reporting activities as systematic elements of each project. Over time, such rigorous monitoring and analysis should enable Rwanda to have a better understanding of effective methods of allocating resources toward strengthening climate change adaptation measures, including through land-related policy, strategies and programs.

4.4 Integration of Climate Change Adaptation in Land Use Planning

[48] Interview with FONERWA Coordinator (2/24/2015)

Rwanda is actively preparing land use and development plans at multiple scales across the country. At the national level, the Rwanda National Land and Development Master Plan (NLUDMP) (2010) determines large scale future plans, overlays and national level zoning. At the District level, District authorities are currently in the process of drafting and approving District Land Use Plans.[49] There are also District Development Plans (DDPs), which list development goals for smaller areas across the country. Within more centralized areas, urban land use master plans are designed to guide the growth of urban areas and address common challenges facing them. At each level of planning, climate change adaptation measures are evident, although their strength, implementation and ultimate objectives vary.

The National Land Use and Development Master Plan and Adaptation

In the National Land Use and Development Master Plan (NLUDMP), climate change is identified as a current and future threat to development, local livelihoods, plus investments in infrastructure, agriculture, and business. The plan even cites climate projections as a way of recognizing that current risks will pose larger threats in the not-so-distant future. Recognizing these threats and citing floods, landslides and droughts as primary impacts, the plan prioritizes protecting water and energy access for rural and urban populations and calls on districts to incorporate climate change adaptation measures in DDPs. The plan does not provide specific recommendations to promote climate change adaptation in DDPs; however, throughout the plan there are actions and provisions for land use, building and development that do have climate change adaptation implications, although they are not directly cited as such.

Specifically, the NLUDMP provides maps that identify vulnerable areas, including those areas most prone to erosion and flooding, and areas with settlements on steep slopes above a 20% grade.[50] For each map and environmental issue, the plan also provides a brief narrative of interventions and guidelines to mitigate risks and requirements to implement the DDPs. For example, to address erosion, the NLUDMP limits development on steep slopes above 20% grade. The plan outlines land types (steep slopes) and areas in which to prioritize reforestation programs and tree species appropriate for erosion and slope control. In terms of disaster events, the NLUDMP established the first call for an early warning system and for disaster management elements within DDPs.

Finally, the land tenure implications of climate change adaptation within the NLUDMP are largely focused on displacement and the corresponding effects on land rights. It cites successes and opportunities emerging from the land sharing programs and rural settlement policies, seeing formation of grouped settlements in rural areas as an opportunity to better provide services to rural communities outside of disaster areas. Simultaneously, the NLUDMP emphasizes that sustainable land use planning should prioritize onsite physical improvement and mitigation efforts to minimize relocation, regardless of tenure status. The NLUDMP tries to strike a balance between

[49] Districts were directed to finalize District Land Use Plans by March, 2015; however, few plans were ready by the deadline and as of the time of this report, eight Districts are still in the process of getting their plans approved. Future research will analyze the extent to which climate change adaptation measures have made it into decentralized land use planning processes, using the development of the DDPs as example.
[50] Ministry of Natural Resources (2010). *Rwanda National Land Use Development and Development Master Plan: Chapter 3: Land Use Guidelines and Standards.* Government of Rwanda.

improvement and adaptation measures (when resources are available through public subsidy and incentives) and relocation to safer areas less vulnerable to climate change risks.[51]

District Level Land Use Planning and Adaptation

At the district level, planners are in the process of finalizing District Land Use Plans (DLUP) that support goals and objectives within the NLUDMP. Since DLUPs are a more recent layer of regional planning, Districts have been using District Development Plans to set goals and objectives in five year plans. The next step in the updated planning process will be to merge DLUPs with DDPs to form an Integrated District Development Plan (IDDP) that lays out land use and development goals for each District. The IDDP will provide a framework that informs urban master plans within each District. Finally, master plan implementation is further outlined in more detailed small area action plans. Sector specific plans, or target area plans, are developed as needed to address specific challenges within smaller areas. For example, the City of Kigali is developing small area informal settlement plans in low income neighborhoods across the city to address specific issues identified by the community as priority concerns and to improve the quality of housing and service provision.

In a recent update to DDPs, environmental and sustainability elements were included within each plan as part of a national directive within the MINIRENA "Five Year Strategic Plan for the Environment and Natural Resources (2014 - 2018)."[52] Under the requirement, climate change, within a "Environment, Climate Change and Disaster Management" section, must be included as part of a package of cross cutting issues to be addressed to promote long-term sustainable development. Few plans include actionable items to promote adaptation, including: increasing forest cover to prevent erosion against heavier rainfall or allocating budget to address environmental issues and prevent climate related disasters. Most plans have vague measures to mainstream climate change through non-specific activities. The Muhanga District Development Plan (2013-2018), for example, includes climate change mainstreaming as a Key Performance Indicator, to be measured by budget amounts allocated to "environmental and climate change issues."[53] As a first attempt to include climate change adaptation, all DDPs so far approved, have acknowledged climate change as a barrier to development, manifested through an increase in disaster events.

Prior to the development of DDPs, each district worked with MIDIMAR to produce District Disaster Management Plans. The purpose of these plans was to identify possible environmental risks and corresponding mitigation and disaster response actions; however, specific climate change risk mitigation and adaptation measures were not usefully outlined in the plans. Remnants of the District Disaster

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[51] Ministry of Natural Resources (2010). *Rwanda National Land Use Development and Development Master Plan: Chapter 3: Land Use Guidelines and Standards.* Government of Rwanda.

[52] Ministry of Natural Resources (2013). *Five Year Strategic Plan for the Environment and Natural Resources.* Website: minecofin.gov.rw/fileadmin/templates/documents/sector_strategic_plan/Environment_Natural_Resource_SSP_Oct_13.pdf

[53] District of Muhanga, Southern Province, Republic of Rwanda (2013). *Muhanga District Development Plan (2013-2018).* Website: http://www.muhanga.gov.rw/uploads/media/MUHANGA_DISTRICT_DEVELOPMENT_PLAN_2013-2018-1_01.pdf

Management Plans still remain in the form of a District Disaster Management Committee, charged with preparing and coordinating response efforts following disaster events.[54] These committees are also responsible for allocating funds for disaster relief from the district budget. In extreme cases, the district may request additional support for relief from national funds available through MIDIMAR.[55] In many instances, district capacity to fund disaster relief efforts is limited and insufficient funds are likely to become a larger issue if disaster events occur more frequently in the future.

Urban Planning and Adaptation

The well regarded and award winning Kigali City Master Plan (KCMP) (2013) stands as the model of urban planning in Rwanda, providing an example by which to design master plans for six other secondary cities, a process started in late 2014. It does not explicitly mention climate change adaptation (or greenhouse gas mitigation), but it does include objectives and actions that indirectly address climate impacts, namely flooding, erosion and landslides. One of the primary goals of the KCMP is to make Kigali a city of "enchanting nature and biodiversity." Under this goal, the KCMP sets several targets that relate to climate change impacts, although climate change is not cited as the rationale for their adoption. The following targets are listed as ways to achieve the vision of "enchanting nature and biodiversity:"

Kigali City Master Plan Report 2013	
Chapter 7: A city of enchanting nature and biodiversity	No development on steep slope
	Relocation of unplanned communities in steep slopes and full restoration of slopes above 40%
	Mandatory soil stabilization of all slopes above 20%
	A citywide Watershed Management Plan
	Flood free city for a 50 years of flood return period
	100% conservation of all water bodies
	20m mandatory buffer for all water bodies (Organic Law)
	Zero net loss of existing forests
	Afforestation in slopes > 60%
	Reforestation to restore former forests
	Creation of innovative urban agriculture for slopes > 20%

Roughly 14% of the City of Kigali is wetland, with many low lying areas adjacent to or in wetland borders. Some high use areas are near enough to wetlands to be extremely vulnerable to flood events, including the Nyabugogo Bus Depot, for example. To address flooding, the KCMP sets a target of being flood free against a 50 year flood and plans to identify low and high risk areas within the floodplain,

[54] Ministry of Disaster Management and Refugee Affairs (2012). *The National Disaster Management Policy: A Revision to the 2009 Policy.* Website: https://www.ifrc.org/docs/IDRL/RwandaDisaster_Management_Policy_01.

[55] Ministry of Disaster Management and Refugee Affairs (2012). *The National Disaster Management Policy: A Revision to the 2009 Policy.* Website: https://www.ifrc.org/docs/IDRL/RwandaDisaster_Management_Policy_01.

corresponding to 100 year and 20 year flood boundaries.[56] The plan also sets buffer zones around wetlands and water bodies that correspond to buffers set in the Organic Law on the Environment (2005) with native vegetation in the buffer zone (20 meters around wetlands, 10 meters around rivers and 50 meters around lakes).

The KCMP's wetlands and flood protection measures are limited in that boundaries and buffer zones are weakly enforced and some limited development continues on the wetland edge. Since water boundaries fluctuate with seasonal precipitation, the plan could be strengthened to distinguish that the buffer zone starts at the high water mark, set at the 20 or 50 year flood boundary.[57] With Kigali City officials anxious to bring businesses and jobs to the city, there have been occasions when higher impact uses have been approved within the buffer zone and even within the wetland itself, resulting in lost revenue during floods, as well as the loss of ecologically valuable wetlands.[58] Measures to reduce flood risks within the KCMP could be strengthened by strict adherence to rigid boundary delineations.

The plan also outlines limited use in wetlands, with regulatory control provided within the zoning code. The zoning code allows limited low impact use (10% of parcel area) within protected areas designated as 'P4' zones, which include wetlands, forests and rivers. Within these zones, conditional uses are allowed upon approval by the city's planning review panel in the One Stop Center.[59] While protections do exist within the plan and the zoning code for wetlands and other flood vulnerable areas, unauthorized uses still occur within these areas, evident in the fact that the plan also includes actions to remove settlements from these areas.

Wetlands boundaries that are arbitrarily drawn may put wetland protection or land uses at risk as well. In terms of risks to wetlands, for example, light industrial use zoned near wetland borders threatens runoff pollution, or agricultural use in wetlands degrades natural hydrology. In terms of risks to land use, allowing use in wetlands and floodplains puts crops or other investments at risk of flood damage. Without protection, such as crop insurance, for example, many agriculturalist livelihoods are vulnerable to floods, adding to the economic impact of these events. While some form of crop insurance does exist that is related to weather, current insurance policies are designed to protect against rainfall variability and no insurance program would protect land uses contrary to zoning regulations, leaving farmers in the floodplains at considerable risk during the rainy season.[60] Enforcing limited use within these areas will reduce the number of livelihoods at risk from flood events. On the other hand, limiting use also reduces the number of livelihoods derived from the area, requiring public intervention and funds to resettle people in areas that are affordable and provide satisfactory livelihood opportunities.

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[56] A 50 year flood refers to the probability of a flood of a certain magnitude occurring within a single year. A 50 year flood has a 2% chance of occurring within a year, whereas a 100 year flood has a 1% chance.
[57] The Organic Law on the Environment (2005) states the water line ends at the furthest point reached during flood, or exceptional flood.
[58] Joint Report, The East African (December 29, 2012). *Rwanda grants Madhvani Group more land for sugarcane.* Website: http://www.theeastafrican.co.ke/news/Rwanda-grants-Madhvani-Group-more-land-for-sugarcane/-/2558/1653940/-/cfx8by/-/index.html
[59] Conditional uses within the P4 zone include: botanical gardens, infrastructure, restaurants, public facilties, outdoor recreational facilities, parks and small kiosks.
[60] Ministry of Agriculture and Animal Resources (2012). *Agriculture and Livestock Insurance.* Website: http://www.minagri.gov.rw/fileadmin/user_upload/documents/Agricultural_Finance_Facilities/AGRICULTURE_AND_LIVESTOCK_INSURANCE.pdf

The KCMP also provides land use actions to protect against landslides and erosion through provisions governing development on steep slopes (slopes greater than or equal to a 20% grade), which cover approximately 35% of Kigali's land area. The KCMP prohibits development on steep slopes that exceed 40% grade and allows development on gradual slopes up to 20% grade. In between, the zoning code's Steep Slope Overlay limits development pending special approval, based on adequacy of an Environmental Impact Assessments (EIA) and provision of surveys, geotechnical evaluations, and plans for grading, vegetation, erosion control and site drainage. Regardless of the zoning regulation, development and use of steep slopes is widespread with minimal enforcement of land use, particularly in rural areas of Kigali, where agricultural uses on steep slopes is prevalent.

While the KCMP has measures that protect against some of the primary impacts of climate change in Rwanda, it does not acknowledge climate change as an increasing threat and cause of environmental issues and extreme disasters events. With climate projections indicating increasing frequency and intensity of disaster events and ongoing environmental issues, there is no evidence within the KCMP to suggest that the city is preparing for these increases in climate change impacts. With limited resources to enforce the plan and ensure land use is in accordance with zoning regulations, communities continue to reside and cultivate in vulnerable areas. Relocation of vulnerable communities may depend on when the next extreme event occurs or on slow public intervention as resources to compensate or resettle those expropriated come available.

Following the KCMP model, six secondary cities are currently in the process of developing master plans and small area localized plans. With directive from Vision 2020 and EDPRS2, these secondary city plans are strengthening climate change adaptation within land use planning provisions and within the longer term growth and development of Rwanda's lesser urban areas. With lessons learned from the KCMP and stronger climate change integration in national and local government policy, the secondary city plans are expected to include more robust provisions for climate change adaptation in urban land use plans and regulations.

Land use master plans could benefit from incorporating climate change projections and related impacts into long term plans to guide land use, settlement, economic growth, infrastructure and environmental protection areas. By neglecting to use climate data to inform the design of land use master plans, Rwanda risks missing an opportunity to match growth and land use objectives with future climate change projections. Even the upper limit of today's most intense events may be tomorrow's baseline.

5. RECOMMENDATIONS

Rwanda has done significant work in recent years to incorporate climate change adaptation into land tenure and land use policies, strategies and planning tools, even if this incorporation is often not explicit to objectives of mitigating climate risks. Since much of this work has only been done in recent years, effects are still relatively too

young to fully understand, especially since insufficient information and assessment has been done to monitor effects. Additionally, some adaptation incorporation has been discordant, without focused or coordinated effort between separate sector policies. Just as there are trends in climate change impacts in Rwanda, so too are there trends in the strategies to address and mitigate risks to those impacts. As climate change is occurring now in Rwanda, with increasingly drastic effects year to year, and because these impacts are only going to intensify in the near and distant future, there is an urgent need to ensure that plans and policies that are drafted and designed now, and that will be in effect for years to come, are well equipped with the necessary provisions to increase Rwanda's adaptive capacity to protect against climate change. Listed below are specific recommendations to strengthen current land use policy and processes. These recommendations are suggested to address current weaknesses in incorporating climate change adaptation into existing policy, with several drawing on best practices from other locales that share many attributes in common with Rwanda and are facing similar climate threats and pressures.

Coordination, Sharing and Transparency

- A major issue plaguing land use planning and policy in Rwanda is that interagency and ministry coordination is lacking as attention is focused on achieving separately housed performance goals. Greater collaboration on shared climate adaptation and land use goals would significantly strengthen Rwanda's capacity to address climate change impacts. Harmonizing and coordinating climate change policies falling under multiple sectors will: ensure policies are comprehensive, ensure the use of funds for adaptation are optimized, minimize redundancy, minimize potential for contradiction, and ensure policies are easily implemented at the district and sector levels. One way to do this could be to mandate attendance within a climate change taskforce, comprised of representatives from each ministry with a stake in climate change policy (MININFRA, MIDIMAR, MINIRENA, MINAGRI) and their subsidiary agencies. Each representative would be responsible for ensuring that climate change is inserted into ministry policies and coordinated with efforts led by other partners. The taskforce could convene monthly to ensure progress is made to strengthen climate change adaptation policies and implementation, and to verify that policies are well coordinated. The taskforce could be formalized through a ministerial or presidential order that delegates a lead ministry, sets goals and responsibilities. Well coordinated efforts across a broad group of stakeholders would ensure that adaptation is spread across and integrated in land use and tenure policy under all sectors. Coordination activities would have an added benefit of building climate change planning capacity across the government as representatives would be able to learn from each other and share experiences and resources that strengthen their programs with adaptation elements.

- Rwanda is already collecting masses of data on climate patterns and has access to substantial climate change resources to get better information on projections, future impacts and variations in weather. Some of this information is disseminated effectively to end users, but it is unclear how that information is packaged, if target users find it useful or if there are any streams of data that

would be more useful to decision making among agriculturalists, planners, foresters, or other land use managers. Better data packaged for ministry policy makers could help ensure that future climate projections are considered now in policy decisions. Additionally, information on adaptation interventions could provide lessons learned, cost estimates, or predictions of intervention impacts. Through ongoing monitoring and evaluation of existing projects and programs, FONERWA progress reports and EIAs, there is another level of information that could be collected, analyzed and packaged so that new adaptation efforts build off of past experiences. Finally, the government could facilitate a two way exchange of information sharing so that policymakers also have the opportunity to learn from people's experiences on climate change. Mobile technologies, stakeholder reports to sector offices and quarterly surveys of people living in or near vulnerable areas could be easy ways of collecting non-traditional data that may provide valuable insights on climate change effects and reveal innovative ways that people are already addressing climate impacts on their own.

Allocating Resources, Strengthening Capacity

- Funding for climate change adaptation programs has been, and will continue to be, a major issue that prevents scaled up interventions, necessary capital improvements to reduce risk or incentives to persuade people to adopt adaptation activities. Even though Rwanda is committed to climate change adaptation, available funds do not match the need for interventions now. Over time, Rwanda may consider dedicating a portion of its budget to address climate change impacts, or use climate change projections to determine where to prioritize funding. By ensuring that investments in environmental protection, infrastructure or social programs are funded with climate considerations taken into account, adaptation will become more prominent within government programs, infrastructure investments and public work projects. Additionally, since districts are largely responsible for disaster relief efforts, they should also be adequately resourced to fund post disaster relief operations as well as pre-disaster mitigation efforts. Since FONERWA is already operating and funding climate change related projects, long term dedicated funding to continue the grant program should be developed, as well as some priority given to a certain number of adaptation projects each funding round. Finally, the Disaster Management Fund, managed by MIDIMAR, should be sized appropriately to keep scale with increasingly more frequent and intense extreme events. Alternatively, a risk mitigation fund could be operationalized in tandem to disaster relief funds, so that ongoing investments in mitigation activities reduce the impact of extreme events over time.

- In order to prepare the current and future workforce to address climate change, training, education and professional networks need to be expanded so that those in charge of developing, implementing, or strengthening adaptation programs, know what current best practices are or have a network to turn to in seeking additional solutions to local climate change challenges. For example, the City of Kigali was recently inducted into the "Rockfeller 100 Resilient Cities" program, a networking project that comes with some financial support

to incorporate adaptation and resilience measures in city policies.[61] Active participation in the 100 Resilient Cities network will allow city planners in Kigali to learn from planners around the world facing similar challenges. Additionally, climate change could be incorporated into relevant degree programs and university curricula, such as land use planning, agriculture, engineering and disaster relief, to name a few. This would ensure that recent graduates have a background in adaptation that they can bring straight to the field. Finally, those responsible for developing and implementing climate change policy and programs as well as land use planning need to be provided with adequate tools and resources to effectively do their jobs, especially at the district level, where budgets and staff capacity do not match the scale of the challenges facing those jursidictions. Providing them with resources, training, tools and equipment to implement adaptation projects will help reduce impacts where they occur. Special attention or prioritization should also be paid to those in charge of land use planning and enforcing land use regulations, such as zoning, inspection and development review specialists.

Conservative Estimations and Use of Projections

- Rwanda primarily sees floods, erosion, landslides and drought as priority climate change risks. One often neglected impact, especially in tropical climates, is higher temperatures that can and will have adverse effects on the environment, infrastructure, energy use, land productivity, biodiversity and health. Specific mitigation efforts that focus on higher temperatures will be crucial over time as higher temperatures gradually descend into Rwanda's annual weather patterns, which extend drought areas and drought periods as well as decrease agricultural productivity over time. Fuller consideration and preparation for all possible climate change related impacts will ensure that Rwanda is well equipped to address climate change and mitigate its risks and vulnerabilities.

- Since many land use plans are effective over long periods of time, they can be an opportunity to insert climate change projections into future land use, so that management matches and keeps pace with impacts over the course of the plan lifespan. Land use planning should use the upper limits of climate change projections, recognizing that these projections become increasingly likely in the future. Additionally, land use planners need to be able to accept the implications that projections will have, including: more soils will be lost, disasters may occur in unexpected areas, flood boundaries will extend and drought events may last longer and extend further across the country. Integration of climate change projections in the design and development of land use plans will ensure that current land use plans are deeply embedded with risk mitigation measures and adaptation controls.

Coordination with Vulnerable Communities

[61] Rockfeller 100 Resilient Cities Project (2015). Website: http://www.100resilientcities.org/cities/entry/kigali#/-_Yz46MDM4MydpPTEocz5j/

- Climate change impacts are affecting poorer communities more severely as these communities do not have the means to adopt or build adaptation measures and often are situated in more vulnerable, risk prone areas. Focusing interventions on communities in the most vulnerable areas will help to ensure adaptation efforts are going to those who need them most. Providing vulnerable communities with mitigation and adaptation advice during Umuganda meetings before flood or drought prone seasons is one way of sharing important information to large groups when most needed. These meetings are an avenue through which to disseminate climate projections and related impacts, as well as simple, low-cost adaptation measures individuals and households can take to prepare for and mitigate risks before they occur. Meetings could be hosted by District Disaster Management Committees (DDMC) (through Umuganda meetings for instance) before rainfall seasons, where local residents could learn about low to no-cost interventions to mitigate risk and where to turn for safety during extreme events. During these meetings, communities, in collaboration with the DDMCs, could establish communities of action and safety protocols, disaster event procedures and prioritize community-led mitigation efforts. DDMCs may also be able to learn from the community about local environmental conditions and activities that exist within the community to better understand adaptation possibilities within their districts. Finally, all expropriation or relocation activities should be done in close consultation with communities so that they are sensitized to their rights and have a voice in the relocation process, for the sake of preserving their communities' social cohesion and collaborative relationships with local and national government officials.

- In addition to focusing climate change adaptation efforts on vulnerable communities, public awareness campaigns on climate change impacts and simple adaptation activities that can be performed at the household level could help reduce risks and strengthen national adaptive capacity. For example, raising public awareness to reduce household energy use, through shutting off lights or appliances not in use, will ensure that the grid is not overwhelmed and reduces risks of blackouts, which is especially important during extreme events so that power outages do not hinder relief activities, such as water pump operations, or provision of emergency medical care. Simple public awareness campaigns can have a significant impact by making the population more aware of what to do when disaster strikes and how to mitigate risks before they occur.

Strengthen Land Use Regulation and Enforcement

- Land use controls and regulations are some of the most effective methods of protecting vulnerable areas, minimizing risks and protecting livelihoods since they are implemented at the landscape level and determine how development activities are designed and function. A proposed climate vulnerability overlay could identify areas of the country where climate impacts are projected to be most severe and outline priority interventions to mitigate risks and vulnerabilities. Within separate overlay areas, specific interventions could be prioritized that are best suited for priority climate impacts in those areas. As

zoning and land use regulations are packed with very specific regulations and guidelines for development (setbacks, and site drainage requirements, for example), climate adaptation can be integrated within key elements of zoning and land use regulation.

- While effective land use controls and regulations are in place, their enforcement and implementation are not always ensured. Development still gets approved in protected areas, steep slopes still see settlement and wetlands are still heavily farmed or used. Stricter enforcement, issuance of penalties and requirements to offset site disturbance and unapproved land uses could be implemented by employing teams of inspectors to ensure that new development is in line with zoning regulations, land use controls and master plans. Additionally, climate change risks could be part of EIAs, to ensure that future performance of a project has considered future climate projections and minimized risks. Over broader areas, or across development sectors, Strategic Environmental Assessments (SEAs) could also be used to ensure that overall program strategies within an area or a sector adequately address climate change risks. An agricultural SEA was recently performed to assess and identify priority environmental and climate change interventions.[62] Since then, SEAs have been suggested for other sectors to ensure full consideration of environmental impacts, including climate change, have been incorporated into larger sector strategic plans, programs and policies.

- Land use planning can also be an opportunity to design and offer incentives to promote climate change adaptation activity. Density bonuses, site coverage, and setbacks are all negotiating points for planning officials seeking to incentivize private development to incorporate specific site designs in their projects.[63] Designs that incorporate or promote adaptation could be incentivized, or even required in priority areas. Incentives for onsite storm water retention and treatment may be able to help reduce flooding risks, or collect and store water for irrigation in drought prone areas. Passive cooling and lighting designs could reduce energy usage, reducing the risk of blackouts. Green building designs are readily available locally and many have already been proven to be successful in Rwanda.[64] Encouraging energy efficient, green building design with adaptation elements, through property tax incentives, for example, could be a way for government assistance to directly promote climate change considerations in the public sector and on private property.

- Planning updates and revisions to zoning codes are critical opportunities to integrate up to date information and current and projected priority issues. Rwanda should use these opportunities to ensure that the most up to date and

[62] Pratt, John, Palerm, Juan and Gakuba, Alexis (2012). *Strategic Environmental Assessment of the Agricultural Sector in Rwanda.* European Union, SAFEGE Belgium. Website: http://eeas.europa.eu/delegations/rwanda/documents/eu_rwanda/finalsea_study_report_en.pdf

[63] Density bonuses are a tool used by city planners to allow developers more floor space and number of units in exchange for some provision of public good, which could be adaptation measures within site designs. Site coverages are a similar incentive that allow development of a higher percentage of the parcel area than is normally allowed in exchange for public benefit. Setbacks are also a negotiating tool that can allow development closer to the lot boundary in exchange for public benefit.

[64] The City of Kigali was working on developing green building standards to accompany building codes, but current status of that program was unavailable at the time of this report.

accurate climate projections are used to inform every new plan, existing plan update or land use related policy. These is also an opportunity ensure that climate change adaptation is deeply embedded in long term goals, objectives and actions within land use management tools.

6. CONCLUSIONS

Adaptation policy, particularly in regard to land use, in Rwanda is still fairly young, with room to mature and develop. Many land use programs and policies still see climate change as a barrier to development, but have not listed comprehensive strategies to strengthen adaptation elements beyond mainstreaming climate change, for which details are thin. Within past policies and programs, there are ample examples of interventions that have adaptation qualities, but that are not explicitly designed or implemented as climate interventions. Of existing adaptation measures, insufficient data exists to fully understand policy or plan impacts. With no guiding policy or enabling framework, large, costly interventions after disaster strikes will continue to be the mode of operation.

Broadly, Rwanda's adaptive capacity is constrained by its narrow economic base, high rural population density and stiff competition for limited natural resources. While the government is aware of these challenges and has started to incorporate adaptation into policies, planning and programs, efforts so far are largely scattered and poorly orchestrated. No central adaptation guideline or plan exists to create a clear path toward strengthening existing adaptation measures, mitigating current vulnerabilities or developing disaster response and relief procedures. Additionally, it has missed opportunities to incorporate climate change as a key concern and develop solutions to addressing those challenges in some of its most recent and keystone plans and policies, such as the Kigali City Master Plan. On the other hand, Rwanda is proactively assessing its vulnerabilities and better understanding key weaknesses or risks to climate change. A baseline vulnerability index will help prioritize mitigation efforts, target interventions and strengthen disaster preparedness plans.

Within land tenure issues, climate change adaptation has severe implications for property owners and renters in, or neighboring, the most vulnerable or disaster prone areas due to displacement, but corresponding adaptation measures are largely lacking from any existing policies or programs. There are entry point policies that address similar issues of displacement and land sharing that could be an opportunity to insert climate change implications through amendments to laws or adjustments to policies. Land sharing policies and rural resettlement programs both have implications for resettlement, from political to environmental issues. These policies should be used to shape a resettlement policy for displacement due to climate change impacts, or an incentive program aimed at encouraging movement of settlements in vulnerable areas. Most importantly, such a policy or program should be implemented only with close consultation with the community and with their active participation.

Land use regulations and policies, on the other hand, have some adaptation properties but only indirectly. Climate change is not mentioned as a key issue and many regulations show no evidence of having been conceived with climate change

projections in mind. Climate change adaptation could be integrated more deeply and with specific regard to actual and projected climate impacts. Fortunately, land use regulations are littered with opportunities to insert adaptation measures throughout physical site designs. Zoning regulations and land use plans are strong tools to use in determining site use and performance, and should be leveraged as some of climate adaptation effort's most valuable resources.

Rwanda's climate change adaptation efforts are still young and have some maturing before there is a solid understanding of effectiveness and performance, especially in regards to displacement of communities in vulnerable areas. Resettlement and relocation is a heavy social, political and economic burden and needs to be designed carefully to meet the needs of communities and to minimize undesirable tensions between new neighbors. Land use regulations are already hard at work and being effectively implemented, even if enforcement is sometimes lacking, but plans can be strengthened to better prepare communities, businesses and public institutions for climate change impacts, and opportunities to do so should be seized at the earliest possible instance as there is an increasing need for meaningful and robust adaptation activity across Rwanda. Climate change is not going to wait for adaptation plans, policies and funds to be in place.

7. ANNEXES

Annex I: Key Informants, Organizations and Interview Dates

PARTNERS	ABBREVIATION	CONTACT	MEETING DATE
Government Offices			
Rwanda Environmental Management Authority (Climate Change Unit)	REMA-CCU	Faustin Munyazikwiye, Climate Change Unit	2/24/2015
Fund for the Environment and Climate Change	FONERWA	Alex Mulisa, Coordinator	2/24/2015
Ministry of Disaster and Management and Refugee Affairs	MIDIMAR	Jean Baptiste Nsengiyumva, Director of Risk Reduction and Preparedness Unit	3/2/2015
Ministry of Natural Resources	MINIRENA	Emmanuel Uwizeye, Director of Land, Environment, Water and Forest Management	2/18/2015
Rwanda Meteorology Agency	METEO	Twahirwa Antoine, Acting Director Manager of Weather/Climate Services Applications	2/27/2015
Ministry of Agriculture and Animal Resources	MINAGRI	Innocent Nzeyimana, Irrigation and Mechanization Task Force	2/27/2015
Rwandese Association of Local Government Authorities	RALGA	Innocente Murasi	3/5/2015
National Institute of Statistics Rwanda	NISR	Jean Niyigaba, Environmental and Forest Statistician	2/24/2015
Rwanda Natural Resources Authority	RNRA	Leonard Kayonga, Land Use Planning Officer	2/24/2015
City of Kigali	CoK	Felix / Patrick	2/25/2015
Rwandan Parliament, Committee on Agriculture, Livestock and the Environment	P-CALE	Honorable Gabriel Semasaka, Committee on Agriculture, Livestock and Environment	3/3/2015
Districts Offices			
Musanze		Jean Pierre, District Environmental Officer	2/13/2015
Nyabihu		Benjamin Karambizi, District Environmental Officer	2/13/2015
Nyagatare		Samuel Murenzi, District Environmental Officer	2/19/2015
Bugesera		Sylvie Uwacu, District	2/20/2015

		Environmental Officer & Musabyimana Fredinard, Environment Facilitator	
Nyaruguru		Anselme Harerimana, District Environmental Officer	2/17/2015
Development Partners			
European Union	EU	Olivier Machiels	3/3/2015
United Nations Development Program	UNDP	Peter Kamau, Program Analyst	3/16/2015
Civil Society Organizations			
Rwanda Environment and Development Organization	REDO	Damascene Gashumba	3/2/105
Association for Conservation of Nature in Rwanda	ANCR	Jean Paul Kwibwimana, Annet Kasabiti Muhozi	3/2/2015
Rwanda Environmental Conservation Organization	RECOR	Ernest Bucyayungura, Sehene Chrysostom	3/4/2015
Albertine Rift Conservation Society	ARCOS	Faustin Gashakamba, Claudien Nsabagasani	3/4/2015

Annex II: Key Informant Interview Questionnaire Guide

Questionnaire Guide: Interviews with Key Informants on Land Tenure Reform and Climate Change Adaptation

Objective 1. Identification of key climate risk factors
To identify the key climate risks factors facing Rwanda and their associated realization timeline.

1. What are the key climate risks for the case of Rwanda in recent years? Have any of these been documented?

2. How often have they been observed? Who have observed them?

3. What are the impacts of the climate change (*both from the natural resource perspective and socio-economic impacts*)?

4. How are these impacts measured?

5. What are the key impacts of climate change on land tenure?

Objective 2. Assessment of relevant policies, legislations and programs
To assess the extent to which land and natural resource policy, legislations and programs in Rwanda address climate change adaptation

6. What are the existing land and natural resource policies, legislations and programs*?*

7. Do these policies, legislations and programs integrate Climate Change Adaptation? If so, how?

8. What are the institutions engaged with Climate Change Adaptation? What specific roles do they have in addressing adaptation? How are they inter-linked, if at all?

Objective 3. Effects of those policies, legislation and programs
To show case of what has been the impact of land policy, legislation, and programs (including the LTRP) on the adoption of climate change adaptation measures

9. Can you tell us about any adaptation measures adopted as a result of the land and natural resource policy, legislation and programs?

10. Have any land use measures or land investments been undertaken in Rwanda that may indirectly support climate change adaptation?

11. What are the impacts of the direct and indirect adaptation measures that have been adopted?

12. Has the adoption of adaptation measures has any implications on land tenure policies or implementation of reforms?

Objective 4. Climate Change Adaptation Measures

To document climate change adaptation measures that Rwanda has implemented, the outcomes of these measures in terms of cost, disaster prevention and impact mitigation, economic growth, social welfare

13. What climate change adaptation measures have so far been implemented in Rwanda?

14. What have been some of the key outcomes of these adaptation measures?

15. What are the estimated costs for the implementation of each adaptation measure?

16. Do you believe these measures have had any impact on reducing the risk of natural disasters, such as drought, floods, and landslides? In reducing the negative impacts of these disasters? If so, how?

17. Do you believe these measures have had any impact on economic growth? If so, how? On the welfare of ordinary citizens? How?

Objective 5. Integration of measures into the land use master planning

To assess to what extent climate risk analysis and corresponding risk mitigation measures are integrated into the land use master planning process at national and district levels (both for urban versus rural planning).

18. Was climate change adaptation taken into account in designing the national land use master plan? If so how? In designing the Kigali City Master Plan? In designing any of the district land use plans? If so, how?

19. Do you see any of these integrations into the land use planning process having an effect on climate resilience?

20. What are the potential implications of the land use master plans in terms of adaptation to climate change?

21. What institution/department is responsible for climate change risk analysis to inform land use planning?

22. What, if any, climate risk mitigation measures have been put in place? (*By whom and since when have they been initiated?)*

Objective 6. Recommendations

To propose recommendations for policy and practice that can be offered to further integrate climate change adaptation considerations and approaches into policy, law and planning in Rwanda

23. What policies can you recommend to ensure Rwanda is adequately prepared to adapt to climate change?

24. What potential actions can you recommend to ensure Rwanda is adequately prepared to adapt to climate change? Who should be responsible for championing these actions?