Managing natural resources in Rwanda's districts under competing development pressures

Introduction

Rwanda has committed itself to becoming a middle-income country by 2020. The country's Vision 2020 and Economic Development and Poverty Reduction Strategies (EDPRS I and II) both set out clear intentions to intensify agriculture, increase national energy output and improve access to modern energy services (Republic of Rwanda 2013d; Republic of Rwanda 2007). For example, agricultural GDP is expected to grow by 8.5% annually, energy generation is expected to grow from 45MW in 2006 to 563MW in 2018 – mainly through development of hydropower – and electricity access is expected to increase from 17% in 2010 to 100% by 2020. These ambitions are also present at a sub-national level as District Development Plans, which currently include provisions to modernize agriculture, invest in energy production and expand many water-intensive activities, such as mining, industrial development and ecotourism.

These development goals – in tandem with increasing population growth and urbanization – place increasing pressure on limited water and biomass resources, the latter comprising woody biomass widely used for charcoal and firewood, fodder (including crop residues) and food. For example, competition over water resources demanded by hydropower, irrigation, and water supply to major towns and various industries has the potential to create serious conflict. Meanwhile, rising demand for charcoal, construction materials and agricultural land is contributing to a scarcity of woody biomass. In 2009, 21% of the country's biomass consumption was ascribed to unsustainable use of woody biomass and "the constant flow of charcoal into Kigali, [which] exerts a considerable pressure on the wood resources of the country" (Drigo et al. 2013, p.vii). This demand has stimulated charcoal imports from neighbouring countries, such as Tanzania and the Democratic Republic of Congo, and the allocation of croplands to woodfuel plantations, such as eucalyptus, which can be seen as more lucrative. In addition, an intensified agricultural sector will demand more energy and water per hectare, although a modernized energy sector less dependent on traditional biomass is likely to be less land-intensive.

Rwanda developed a Green Growth and Climate Resilience Strategy (GGCRS) in 2011 to better understand the links between different sectors in future scenarios. The Strategy focuses on three cornerstones, shown in Table 1. However, the major challenge of how to translate national priorities and strategies into local action remains. This discussion brief contributes to the current revision of District Development Plans by exploring development challenges and opportunities in three districts in Rwanda – Rutsiro, Bugesera and Kirehe – each with differing landscapes. It draws on an integrated landscape monitoring survey carried out in each district from February to April 2016, and perspectives and opinions of key stakeholders and community

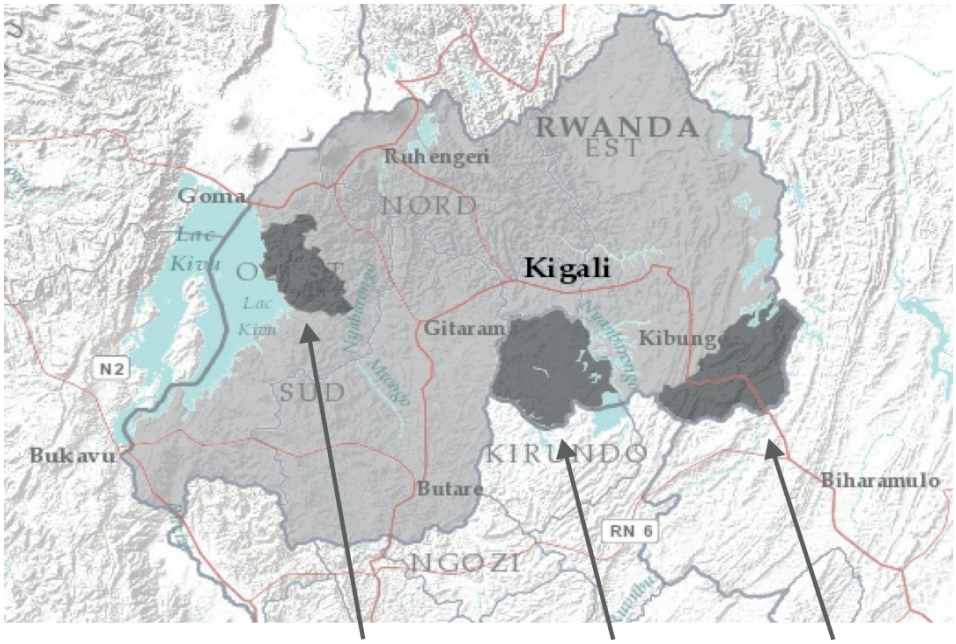
Key messages

- Rwanda has an ambitious economic and climate resilient development agenda. However, translating national strategies into local action is a challenge.
- When exploring natural resource issues in Rutsiro, Bugesera and Kirehe districts in Rwanda, we found slight variations across different landscapes. While areas of concern may be similar, drivers are often different, thus requiring solutions tailored to specific landscapes.
- Common to all three landscapes is increasing biomass resource scarcity driven by demand for charcoal, construction materials and agricultural land, leading to continued deforestation, forest degradation and soil degradation. Water resources also appear stretched in many areas.
- As District Development Plans are revised, we recommend that districts consider ways to effectively manage the natural resources (e.g. water, land and biomass) required for transforming agriculture and increasing access to modern energy services.
- We also recommend that the national government considers ways to provide policy, financial and technical support to different districts to help them build capacity and enhance local landscapes in light of growing competition over increasingly scarce water, woodfuel, energy and food resources. Specifically, there is a need to create policy mechanisms and incentive schemes that result in improved sustainability of cooking fuels, especially in urban regions, to combat deforestation and forest degradation.

Table 1: Cornerstones of Rwanda's Green Growth and Climate Resilience Strategy

Issue areas	Rwanda's GGCRS
Land and agricultural transformation	Ensuring sustainable land-use and natural resources management resulting in food security and the preservation of biodiversity and ecosystem services
Energy transition	Achieving energy security and low carbon energy supply, while avoiding deforestation
Societal impacts	Societal protection, including reduced vulnerability to climate change.

Source: Republic of Rwanda (2011)



	Rutsiro	Bugesera	Kirehe
Population	323,251	363,339	340,983
Poverty incidence	53%	48.4%	48%
Population with livelihoods dependent on agriculture	90%	78%	90%
Access to clean water	60%	56%	68%
Access to electricity	0.4%	4.3%	1.6%
Landscape characteristics	Chain of mountains and plateaus with average altitudes of 2,000m and 1,600m respectively. Bushland in the west, protected natural forest in the northeast and southeast	Mixture of plateaus between 1,100-1,800m and undulating hills of varying heights. Dense shrubby savannas covering hills and grassy savannas covering dry valleys	Low plateau averaging 1,300m, characterized, with lowly undulating hills separated by valleys. Dense eastern savanna type vegetation

Figure 1: Overview of Rutsiro, Bugesera and Kirehe districts

Source: Based on Republic of Rwanda (2013a; 2013b; 2013c)

representatives collected during workshops held in May and August 2017. The survey and the workshops were part of a project, funded by Rwanda's Green Fund (FONERWA) and undertaken by the Albertine Rift Conservation Society (ARCOS) and SEI, that looks at how the water-energy-food security nexus approach can help promote climate resilient decisions and model actions in the three districts.

Challenges at the district landscape level

Rutsiro, Bugesera and Kirehe lie within the Akagera basin, a 60 500 km^2 watershed stretched across parts of Burundi, Rwanda, Tanzania and Uganda. As the landscape shifts from the forest-covered mountains of Rutsiro, to the hilly savannahs of Bugesera, to the low plateau savannah of Kirehe, the Nyabarongo and Akagera Rivers act as major arteries supporting life and economic activity. Agriculture – the main economic activity in all three districts – is largely rain-fed and based around traditional farming practices (e.g. there are three tractors in Kirehe District). More than 15 small run-of-the-river hydropower plants with capacities ranging between 100kW to 1MW are located upstream, while downstream at Rusumo Falls a larger run-of-the-river hydropower plant is currently under construction.

All three districts have a similar number of people, and in each around half of the population is considered poor, one third do not have access to clean water, and 96–99% do not have access to electricity. Correspondingly, the major challenges in all three districts are water, energy and food security, although their root causes often differ due to geographical diversity.

- **Water:** The scarcity of clean drinking water in Rutsiro is a result of the difficulty of building infrastructure in hilly terrain. In Bugesera and Kirehe there is a lack of water treatment plants (although Bugesera is currently building an additional plant). Water pollution in Rutsiro is largely a result of extensive coltan mining, whereas pollution in Bugesera and Kirehe stems from agricultural farming on fertile riverbanks. The scarcity of clean drinking water in all three districts has severe health implications, such as increased risk of waterborne disease outbreaks, diarrhoea, and other regular incidences of preventable illnesses. These health concerns are exacerbated by limited health facilities.

- **Energy**: Electricity connectivity rates are low, and 95–97% of families rely on firewood for cooking and heating. Scarcity of firewood and a demand that is exceeding sustainable supply is contributing to forest degradation, as well as families having to allocate a lot of time for firewood collection that could have been spent more productively. Compounding these issues, local charcoal production to meet demand for cooking fuel in urban areas – alongside clearing of land for agriculture – is responsible for the majority of deforestation and degradation in the three districts.

- **Food:** Food productivity is low, and exacerbated by adverse climate variability. Farming practices in all landscapes are largely traditional, small-scale and un-mechanized, with regular use of chemical fertilizers, limited irrigation and scattered attempts to control soil erosion.

Most farmers have limited revenue and are thus typically unable to reinvest to upgrade their farms. Clearing land for agriculture is a big contributor to deforestation and forest degradation. Soil degradation may further limit farm productivity if the extraction of organic matter and nutrients is made less sustainable by growing resource scarcity (e.g. see Karlberg et al. 2015)

- **Environment and landscapes**: In Rutsiro, intense deforestation and clear-cutting, as well as traditional agricultural practices including extended periods of bare soil conditions, creates high vulnerability to erosion, land degradation and landslide risk during the rainy season. In Kirehe, flooding and drought are prevalent challenges to local communities, and erosion upstream has led to a high level of sedimentation downstream. In Rutsiro and Bugesera, charcoal and woodfuel supply to Kigali – where roughly 70% of residents use charcoal for cooking (see Drigo et al. 2013) – contributes to deforestation and forest degradation, both of which are exacerbated by small-scale timber production.

Visioning in district landscapes

Each of Rwanda's 30 districts formulated District Development Plans setting out their contributions to the national development targets set out in EPDRSII. The plans set out similar overarching priorities to address common issues faced in all district landscapes, such as transforming agriculture, encouraging the use of alternative energy sources, promoting tourism and education, and developing infrastructure and off-farm business opportunities (see Republic of Rwanda 2013a; 2013b; 2013c). Below we emphasize the interconnectedness of the regions' issues and highlight ways to address them at local and national level.

Local needs

In the workshops held in each district, local experts identified needs required to achieve their visions for their districts. Table 2 summarizes these needs. While some are clearly location specific, others are of a more general nature and could apply to the country as a whole.

In all three districts, improved water management was considered critical for sustainable, secure and efficient use of water resources for all sectors. In addition, an array of technical options to enhance water supply and quality were identified, such as wastewater treatment plants, an improved supply infrastructure, and rainwater capture for agriculture.

To increase access to electricity, and its affordability and reliability, participants in all three districts pointed to the importance of diversifying options for electricity generation and developing off-grid solutions. Local experts raised the pressing need to replace traditional cookstoves and fuels with cleaner and more efficient alternatives to reduce negative health impacts and improve fuel efficiency.

Several low-cost technological options were identified for agriculture, such as terracing, use of manure as fertiliser, and water harvesting solutions, all of which can potentially have positive impacts on resource use and sustainability. At the same time, local experts noted that limited technology, low awareness and poor access to finance were considerable barriers to agricultural transformation in Rwanda's districts. It is clear that deforestation remains one of the major pressures facing all three landscapes. Many proposed actions to address it involve tree plantations and agroforestry: for example, experts in Rutsiro stated that raising community awareness on terracing and tree planting programmes is critical for saving the district's natural habitat. However, growing urban demand for charcoal as a cooking fuel is a major cause of deforestation, which means that increasing the supply of woody biomass will not suffice: it will also be necessary to shift demand from charcoal to alternative energy sources. In addition, agricultural expansion and intensification continues to add further pressure on land resources.

The lack of available land for producing fuel and food is clearly a barrier to sustainable development in Rwanda. Part of the solution would be to reduce dependence on charcoal for cooking in urban centres. This would enable the conversion of woodfuel tree plantations into agricul-

Table 2: Needs identified by local experts to achieve goals in three District Development Plans

	Rutsiro	Bugesera	Kirehe
Water	Participatory water planning, management and monitoring Construction of water infrastructure, including water treatment plants, water harvesting systems and boreholes		
Energy	Increase electricity access, through on- and off-grid solutions Promote alternative energy sources for cooking, such as biogas and LPG Seek opportunities for local manufacture and distribution of clean cooking solutions		
Agriculture	Mobilize farmers to organize as cooperatives, link them with agricultural extension officers and train them in conservation agriculture Promote livestock and the use of organic manure fertilizer Encourage private sector investment in agro-processing		
Environment	Promote agroforestry, tree seedlings and afforestation Undertake sensitization of community on sustainable resource management		
	Support afforestation of catchment areas Pursue soil erosion control	Monitor use of agricultural inputs	Build a strict 10 m buffer around riparian zones
Other	Rehabilitate roads and bridges Enhance regulations on mining	Increase opportunities for off-farm income-generating activities	Construct health posts

tural land, thereby reducing pressure on forests caused by agricultural expansion. The question remains as to what would be most effective long-term use of land in the districts to ensure both forest ecosystem health and human well-being.

National support for local needs

To address needs at the local level and ensure coordinated action on issues that are common to multiple districts, we identify a range of actions that can be initiated by the national government, and which could apply broadly across all districts in Rwanda. These include creating an enabling environment, providing financial support and providing infrastructure and services, and ensuring access to knowledge services. Many of these actions and enabling conditions would require large financial investments by the state directed at those smallholder farmers that have limited access to other means of finance. Increasing pressures from a changing climate and a rapidly growing population adds to the urgency of the situation.

There is a critical need to create policies and incentives to encourage use of more sustainable cooking fuels in order to combat deforestation and degradation. For example, charcoal is produced in the districts but mainly supplies urban areas, so the promotion of sustainable cooking fuels needs to be tackled at the national level. The new biomass energy strategy that is under development could help to address these issues. Finally, there is a need for improved resource planning (i.e. water, land and biomass) at the national level to underpin national development targets.

Conclusions and recommendations

Achieving Rwanda's ambitious national development and green growth plans requires translating a coherent national vision into local action across diverse landscapes in Rwanda's many districts. In our study of three districts, we show that similar problems are faced across different landscapes. However, in some cases the drivers of those problems differed slightly, leading to different visions and specific needs in each district.

What is common to all three is resource scarcity, especially related to unsustainable use of woody biomass for charcoal production that results in severe problems with deforestation and soil degradation. Water is also scarce in the three districts, and across the country, particularly during the dry season. Assuming that Rwanda successfully transforms its energy sector (e.g. increasing access to electricity generated from renewable energy resources and improving access to modern and sustainably-produced cooking fuels) the nature of these resource scarcities may change, resulting in less pressure on biomass and land, but greater competition for water. Agriculture remains the backbone of the economy and will undoubtedly be impacted by shifting resource pressures. Less competition for land and biomass is likely to reduce deforestation and soil degradation, and potentially free up land that can be allocated to crop production or afforestation. In addition, a reliable energy supply will be critical for more modernized agriculture.

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On the other hand, increased demands for irrigation may result in increased water needs for hydropower.

As District Development Plans are revised, we recommend that districts consider ways to better manage natural resources as a means to achieve the objectives of transforming agriculture, increasing energy access and improving cooking fuel sustainability. We also recommend that the national government considers how it can provide policy, financial and technical support to different districts, to help build capacity and improve local landscapes in light of growing competition over increasingly scarce water and woody biomass resources.

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