Supporting healthy environments and livelihoods in the Congo-Nile Ridge landscape of Rwanda

Synthesis report

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Contents

List of boxes, figures and tables

Boxes

Figures

Tables

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Executive summary

Rwanda's landscape restoration commitments, aligned with an overall supportive national policy framework, provide an important opportunity to intervene to better manage the nation's forests and other lands. As well as supporting the environment, this alignment provides significant opportunities to benefit Rwanda's people. At present, however, landscape management as practised in Rwanda is often unsustainable, damaging the environment and negatively affecting local communities.

The purpose of the present study was to guide investment opportunities for sustainable landscape management and enhanced livelihoods in the Congo-Nile Ridge (CNR) landscape and surrounding region of western Rwanda. The current report is based on a number of technical studies undertaken in 2023 and 2024 in support of this objective. These studies were based primarily on three data sources: first, the documents, including national policies, strategies and plans, available for managing environments and livelihoods in the CNR landscape and for Rwanda as a whole; second, stakeholder consultations, through interviews, workshops and focus group discussions; and third, new spatial analyses of open access geographic datasets. Key findings and recommendations from the technical studies are aligned, streamlined and summarized in the current report, as are indicative investment plans for priority action areas. In total, 24 key recommendations that support healthy environments and livelihoods in Rwanda are provided.

The first five key recommendations are in support of an efficient tree seed and seedling delivery subsector for improving planting material used in forest management and restoration. Rwanda's large pledges to restore degraded lands provide important opportunities to improve degraded environments and support livelihoods, but the tree planting that is an essential component of restoration is hampered by not knowing where best to plant and for what species, and the low availability of high-quality tree planting materials, especially of native trees.

One of the five key recommendations in support of an efficient tree seed and seedling delivery subsector is to place greater emphasis on developing suitable native tree species planting-material (seed) sources, to better meet biodiversity and broader landscape restoration goals. This is to move away from the dominance of exotic tree planting in Rwanda. In support of this, tree seed sourcing interventions should focus especially on identifying, mapping and developing native tree seed sources. In the case of planting in the CNR landscape, particular attention should be given to developing – as seed sources – natural populations of native tree species still remaining in the unconverted parts of the landscape.

A second key recommendation in support of an efficient tree seed and seedling delivery subsector is to embrace a major role for the private sector. This increased role should be operationalized in the development of the action plans that will follow from the forthcoming revision of the Government of Rwanda's National Tree Reproductive Materials Strategy. In support of the increased role of the private sector, the Rwandan Tree Seed Centre should focus on quality assurance, initial seed sourcing and technical guidance for other stakeholders, including the private sector, to produce most of the tree seeds and seedlings for planting. Once the revised National Tree Reproductive Materials Strategy and action plans are in place, it is recommended that detailed planning and implementation should be supported by a stakeholder engagement platform, where roles and responsibilities among stakeholders in the subsector are further discussed and actions are aligned.

The next four key recommendations are in support of well-managed public forests through the better operationalization of the management of forest landscapes, especially for the CNR landscape and its surroundings. Rwanda's forested lands play a crucial role in environmental sustainability, economic development and social well-being, but the current development and operationalization of plans to support their management are broadly inadequate.

One of the four key recommendations in support of the better operationalization of forest management is to revise district forest management plans and then invest in their implementation. This is to address challenges related to current poor governance and limited existing capacity for forest management. This need applies for all seven districts of Rwanda's Western Province, the two assessed districts of Northern Province, and Rwanda more widely. The redesign of forest management plans and their subsequent implementation and monitoring should be supported by proper financing at the district level and at the sector level (sectors are subdivisions of districts) especially.

A second key recommendation in support of the better operationalization of public forest management, aligned with enhancing the tree seed and seedling delivery subsector, is to put more focus on the planting of native tree species in forest plantations. This is to move away, where possible, from the current dominance of planted exotic tree species. This intervention needs to be combined with the development of markets, as well as alternative incentives, for native tree species cultivation. In addition, the improved management of forest plantations is required, involving the capacity building of the contractors who are involved in their establishment. This is both needed for broad activities, and especially so that contractors know how to establish and manage native tree species.

The next eight key recommendations given in the current report are in support of well-managed biodiversity and sustainable tourism, through the putting in place of more supportive plans for enhancing biodiversity and livelihoods, especially for the islands of Lake Kivu and Gishwati-Mukura National Park in western Rwanda, which were focus areas of attention in the current study. Rwanda is home to a rich but threatened diversity of flora, fauna and landscapes that provide products and services directly to Rwandans, and support a foreign-tourist economy. However, significant gaps exist in the management of biodiversity and tourism that threaten the full benefits realizable from both.

One of the eight key recommendations in support of well-managed biodiversity and sustainable tourism is to undertake a full review and revision of the Ten-Year Management Plan for Gishwati-Mukura National Park. The review should document emerging or escalating threats to the park, and changes in the surrounding communities. The revision should address practical strategies for buffer zone management, for enhancing connectivity in the broader landscape, and for managing human-wildlife conflicts. Tourism-related activities also need to be fully aligned with broad management plans, and the plans should embrace the surrounding agricultural landscape.

A second important recommendation in support of well-managed biodiversity and sustainable tourism is to improve and expand biodiversity monitoring for the islands of Lake Kivu and Gishwati-Mukura National Park. This should involve the use of standardized, consistently-applied, methods, giving particular attention to monitoring species indicative of healthy ecosystems, as well as to threatened species. Recommended techniques to apply for monitoring are listed in the current report, including where possible the use of citizen science tools for recording observations that can be widely applied to better involve local communities and visitors in assessment.

The final set of seven key recommendations in the present report relate to developing stronger incentive mechanisms for supporting trees, forests, biodiversity, sustainable tourism and improved landscape management overall. Rwanda's current landscape restoration commitments provide an important opportunity to support the sustainable management and regeneration of its forests and other landscapes, but current incentives for sustainable landscape management practices are inadequate.

One of the key recommendations in support of stronger incentive mechanisms is to give resources to the relevant institutions to further implement the Community Adaptation Fund to enhance ecosystem service payments. In this regard, support should be given to government agencies, including the Rwanda Environment Management Authority, to further implement the fund to enhance payments for ecosystem services in the CNR landscape, based on community-led activities. The effective implementation of payments requires a clearer institutional framework reaching to field practitioner level, and a better-defined market system in Rwanda, specifying criteria for buyers and sellers of services. Working with mining companies, hydropower generators, water service providers, tea companies and coffee washing stations may provide particular opportunities.

Another key recommendation in support of stronger incentive mechanisms is to move away from uncoordinated, local, short-term projects to networked, long-term, integrated programmes of interventions in support of nature-based solution financing. This involves providing support to strengthening networks of communities that are interested in improving landscape management, that spread information, and that extend training to other groups. Specific support to drive the desired change on the ground with farmers, private forest owners, local businesses and wider communities requires that incentive mechanisms are made an integral component of the broad extension system. This requires financing and capacity building of public extension agents at the district level and below in Rwanda.

A third key recommendation in support of stronger incentive mechanisms is the establishment of the previously proposed, but not yet put in place, Sustainable Value Chain Fund for Rwanda. The establishment of this fund to undertake small-scale investments in innovative projects in order to embed sustainability in key value chains was recommended by the Rwanda Sustainable Finance Roadmap developed in 2022. The fund could support the transformation of livelihoods of CNR communities by boosting agribusiness in the key value chains of sustainable agriculture.

Considering landscape management broadly in the CNR region, the incentives applied to improve management and support livelihoods should place emphasis on wide community and local business participation in managing a wide range of native plant and animal species and habitats, through both species-level and ecosystem approaches. A diverse set of native species should be targeted for biodiversity monitoring and management, and a broad range of native trees should be included in planting and value chain development programmes.

The current study supports an integrated approach embracing biodiverse tree planting for landscape restoration where cross-sectoral attention is required to tree planting material sources. Needed seed sources require protection and management in forest landscapes, and their harvesting and further planting for multiplication provides incentives for sustainable landscape management.

Going forward, an integrated approach is necessary in developing a strategic regional conservation plan to connect existing forested parks and (other) remnant forests in the CNR region. The development of this plan can build on the spatial prioritization for assisted natural regeneration and planting interventions undertaken in the present study by taking the landscape connectivity contributions of these interventions into account, and by spatially directing incentives accordingly. The development of the plan should involve the bringing together of the various stakeholders consulted across all elements of the present study.

A common thread across the current assessment is the need for spatially-explicit decision-support tools for improved landscape management, covering knowledge on how and where to plant a wider range of tree species; on how to target and undertake forest management; on how to monitor and manage biodiversity; and on context-specific appropriate financial and other incentives for sustainable management. These tools need to be appropriately targeted to different stakeholder groups, especially at the district level and below.

To support cohesive development across sectors, a broad emphasis on human skills development is required. This skills development should embrace a wide range of stakeholders, and could be designed around an engagement platform to support co-learning. In support of this, a cross-sectoral training needs assessment should be undertaken to develop an integrated skill-capacity-building programme that is then properly financed.

1 Introduction

Increased attention globally is being given to biodiversity and nature-based solutions in planning and policy making. Rwanda's landscape restoration commitments of two million hectares of land under the African Forest Landscape Restoration Initiative (AFR100) and the Bonn Challenge (MINIRENA 2014) are aligned with an overall supportive policy framework that is focused on the sustainable management of natural resources and the environment. This provides opportunities nationally to transition to a green economy, with the Government of Rwanda aiming to expand investments in forest landscape restoration and nature-based economic activities by creating enabling conditions for enterprises and investors (Republic of Rwanda 2022). Current landscape management practices in Rwanda are unsustainable, however, and a transition is needed to sustainable approaches that support Rwandans.

The World Bank, with financing from the Global Partnership for Sustainable and Resilient Landscapes (PROGREEN), is supporting the transition to sustainable landscape management in Rwanda. This is through technical assistance – which explains how and where investments are needed – and through investment financing. A target region for PROGREEN investment is the Congo-Nile Ridge (CNR) landscape and the areas surrounding it in western Rwanda. As technical assistance to effective landscape management in and around Rwanda's CNR landscape, the World Bank supported the current study.

The fundamental purpose of the present study is to support the development of stronger incentives for better landscape management in the CNR region. With this overall purpose, the present study also looked at how the restoration of landscapes with trees can be enhanced through improving planting material used in forest management and restoration; how forest landscapes can be better managed operationally; and how more supportive plans can be put in place for enhancing biodiversity and livelihoods.

The Rwandan portion of the CNR landscape runs from the Virunga Mountains and Volcanoes National Park in the north of the country to the southern end of Lake Kivu and Nyungwe National Park. The landscape between these limits includes Gishwati-Mukura National Park (GMNP). The region harbours Rwanda's montane forests, and sustains nearly one-third of the nation's population. Rural poverty in the CNR landscape and surrounding areas is high, however, and land clearance and poor agricultural practices have contributed to rapid land erosion and flooding (Republic of Rwanda 2016).

In total, 12 named districts of Rwanda are specifically considered in the current report. This includes all of Western Province (seven districts) and some districts in Northern and Southern Provinces (two and three districts, respectively), as illustrated in Figure 1.

The present report is founded on four separate but inter-related technical studies undertaken in support of healthier environments and sustainable livelihoods within Rwanda's CNR landscape. These studies are summarized in Box 1. Sections 2 to 5 of the current report align, streamline and summarize the contents of these studies. In each case, the importance of the topic and the methods used in the study are first outlined to provide important context for the reader of the present report. Then, key findings, key recommendations for action, and priority investment needs are summarized. The sectional recommendations for sustainable landscape management action in Rwanda are the core of the present report. A final summary (Section 6) presents some further issues and opportunities to consider at a cross-sectoral level.[1]

1 The content of an initial draft of the current synthesis report, which was based on condensing and refining information from initial drafts of the individual technical studies, was – together with the individual studies – discussed in a stakeholder workshop held in Rwanda in May 2024. Written comments on the draft synthesis report and the studies were subsequently provided by the World Bank and Government of Rwanda institutions. These comments, and the feedback on the individual technical study report drafts, were used to revise the synthesis report into the present version.

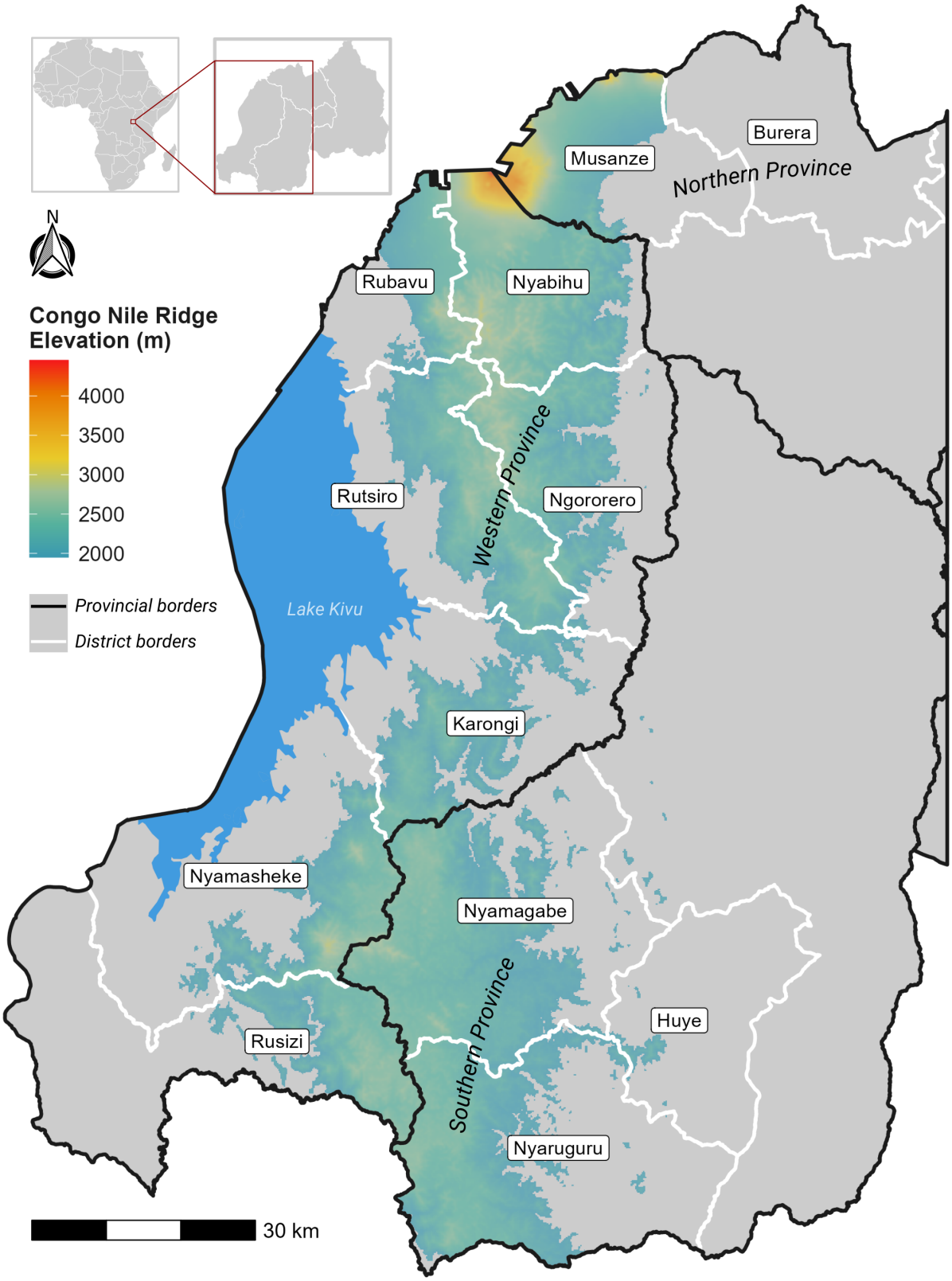

Figure 1. The Congo-Nile Ridge landscape in western Rwanda

The map shows the extent of the Congo-Nile Ridge (CNR) landscape and the twelve individual districts considered specifically in the present report. All the districts in Western Province, and the subsets of shown districts in Northern and Southern Provinces, are considered in one or more technical studies summarized in Sections 2 to 5 of the current report. In the map, the CNR is defined using agroclimatic zoning of Rwanda with an altitude lower limit set at 1,950 m. District and provincial boundaries are shown with white and black borders, respectively. The inset maps show western Rwanda in geographic context.

Box 1. Outline of the technical studies contributing to the present report

The current synthesis report brings together recommendations for action based on four separately-published technical studies. The content and purpose of each of these studies is outlined below.

1. **Study on how to improve planting material used in forest management and restoration:** This study on "tree improvement" looked at where to target tree planting activities in western Rwanda, and in what landscape context. It also considered what tree species may be priorities for planting, and the current status of seed and seedling availability of different trees. The study revealed some of the bottlenecks within the tree seed and seedling supply subsector that need to be addressed for tree planting to be more effective in support of forest management and restoration. The study resulted in recommendations for investments as well as other measures to improve the subsector. The study resulted in a proposed Tree Improvement Strategy for Rwanda.
2. **Study on how to better operationally manage forest landscapes:** This study on forest management was undertaken to examine the current status of public forests in western Rwanda. It also considered existing management plans and their implementation. The study considered how to go about the revision of these plans in order to make them more effective. It focused on forests outside formal protected areas, including planted tree landscapes. The study resulted in recommendations to operationally improve forest management.
3. **Study on how to put in place more supportive plans for enhancing biodiversity and livelihoods:** This study on biodiversity and tourism planning evaluated existing plans. It also considered current biodiversity inventory methods, and how both plans and inventory methods could be revised to increase their effectiveness. The study specifically considered appropriate recommendations for improving biodiversity management and sustainable tourism for Lake Kivu's islands and for Gishwati-Mukura National Park in western Rwanda. Both of these areas are high priorities nationally for conservation and tourism development, and the study's recommendations support these activities.
4. **Study on how to develop stronger incentives for better landscape management:** This study on incentive mechanisms and products reviewed good practice in incentive mechanisms. It also discussed possible land management incentives with stakeholders in western Rwanda, and approaches for implementing appropriate financing mechanisms. The study provided recommendations for appropriate incentive development and use.

The individual technical studies summarized above involved three primary data sources. The first source was the documents – including national policies, strategies and plans – available for managing environments and livelihoods in the Congo-Nile Ridge landscape and for Rwanda as a whole, which were reviewed. The second source was stakeholders engaged in landscape management, who were consulted through interviews, workshops and focus group discussions. The third source was (limited) new spatial analyses of available geographic datasets that were conducted specifically for the technical studies. The different sources of information used for specific studies are outlined in the following sections of the present report. The reviews of existing documentation, the consultations and the geo-spatial analyses that support the individual studies were conducted in 2023 and 2024.

While focused on the Congo-Nile Ridge landscape (see Figure 1), the technical studies also considered, where relevant, adjacent regions of Rwanda, and Rwanda as a whole. The specific geographic coverage of each study is indicated in individual sections of the present report.

In a separate report for each technical study, the detailed methods used to undertake the study are explained, along with findings, recommendations and an investment plan. This information has been compiled, refined and summarized into the present report, but readers requiring in-depth information should refer to the individual reports. These reports – for which titles, authors and further information are provided in the References section and Annex 1 of the present report – are held by the World Bank, and are also available from CIFOR-ICRAF.

2 Improving planting material used in forest management and restoration

2.1 Background

Rwanda's pledge to restore two million hectares of degraded land under AFR100 and the Bonn Challenge provides important opportunities to improve the environment and livelihoods of its people (MINIRENA 2014). Tree planting is an essential component of restoration for extensively deforested landscapes in Rwanda, but the opportunities to plant trees are hampered by a lack of knowledge on what areas should be prioritized for planting-based interventions. A lack of location-specific information on what type of tree planting is required – and of what tree species – also inhibits restoration. So, too, does the low availability of high-quality tree planting material (Ministry of Lands and Forestry 2018a). In these respects, Rwanda is similar to most other countries in sub-Saharan Africa (and many other nations globally), where the development of the tree seed and seedling supply subsector has long been neglected (Box 2) (Jalonen et al. 2018; Roshetko et al. 2018). Fortunately, this situation is now beginning to change, with recent recognition of the importance of tree seed and seedling supply for meeting landscape restoration goals. However, significant efforts to continue initial progress are required.

The technical study summarized in this section (made up of the parts reported by Graudal et al. 2025a; Lillesø et al. 2025; and Pedercini et al. 2025a,b; also compiled as Graudal et al. 2025b), which used the approaches outlined in Box 3, was about developing recommendations for the better targeting of tree planting in terms of the locations for planting and the species to plant. It also provides recommendations for the development of the tree seed and seedling subsector in Rwanda.

Box 2. A global overview of needs for tree seed and seedling subsector development

Effective tree seed and seedling delivery systems are required to enable farmers, foresters and other tree growers to plant trees to enhance livelihoods, support biodiversity and combat climate change. As detailed by Graudal et al. (2021), however, current delivery systems are generally highly suboptimal. Growers often use planting material that is neither matched to the conditions of the planting site nor to the planting purpose, and the seed used if often of low physiological quality. Furthermore, typically the seeds and seedlings of only a few tree species are available for planting, which does not well serve the needs of planters and broad landscape restoration goals.

These deficiencies in seed and seedling sourcing have contributed to frequent failures of restoration projects and programmes to meet their targets. Many planted trees do not survive the initial stages of establishment because of poor sourcing, and even when they survive initially, they often do not reach maturity. In a comprehensive study of tropical and subtropical Asian forest restoration projects, for example, on average around half of planted trees had not survived for 10 years after planting (Banin et al. 2023), while in Rwanda itself, smaller studies focused on agroforestry settings and forest plantations found approximately similar survival rates (Murekezi et al. 2013). This failure is due to a variety of reasons, but the poor quality of the planting materials for the planting sites per se is a factor, as is the trees' lack of effective provision of the products and services that local communities most need, meaning local people do not see the value of maintaining them.

continue to next page

Box 2. Continued

The pathways by which growers obtain tree planting material are referred to as 'tree seed and seedling delivery systems'. The components of these systems include the seed sources and the distribution mechanisms of seeds and seedlings that are derived from these sources. Other parts of the systems are the stakeholders involved in supplying the planting material, including public and commercial actors, and the networks, policies and rules related to delivery.

Currently, it is rare to find efficient tree seed and seedling delivery systems, but when they do occur, they typically share a number of features. These include good practices in tree seed sourcing, and the effective propagation and distribution of high-quality, source-identified tree seedlings. Effective systems also have well-defined, complementary roles for public and commercial stakeholders, as well as well-founded policies and regulations that both support equitable stakeholder relationships and encourage sub-sectoral investments.

A starting point to improve the typically prevailing poor situation for tree seed and seedling supply is a sub-sectoral assessment of tree seed and seedling delivery systems. There is no one-size-fits-all approach for assessment, but guidelines are available (Lillesø et al. 2024). Surveys that determine the tree seeds and seedlings that are available to plant and are actually being planted are important elements of assessment, while the mapping of the stakeholders involved in the subsector in order to describe the major models of supply is another. Assessing the policy and regulatory landscape around supply is also important, as is determining the current capacity of the stakeholders involved, and the funding environment for the subsector. Assembling all of these elements of information into a sub-sectoral overview then informs where interventions are needed and which interventions should be prioritized.

Box 3. Approaches used in the technical study on improving planting material used in forest management and restoration

The technical study summarized in this section of the present synthesis report used a variety of approaches to collect information and devise recommendations for action.

The first part of the study (Pedercini et al. 2025a) looked at where, and within what type of landscape, tree planting activities in western Rwanda should be targeted, considering Western Province and the Congo-Nile Ridge (CNR) landscape. The approach taken for spatial prioritization was a multi-indicator one, involving eight indicators, and built on earlier work led by the Government of Rwanda (MINIRENA 2014). Seven of the applied indicators were environmental in nature, and were based on proxies of biodiversity value, climate change adaptation, climate change mitigation, tree cover change, land degradation, erosion risk and slope. The eighth indicator, socioeconomic in nature, was based on a proxy for access to markets for rural communities (for details on all indicators see the full technical study report and Pedercini et al. 2021). Information for each indicator, collected from geographically-gridded data sets, was combined using an integer linear programming algorithm to indicate geographic locations in Rwanda representing priorities for tree planting. The approach was applied to Rwanda at a national level and to each of Rwanda's provinces individually. The findings from the national-level analysis were then considered specifically for the CNR landscape. Priority areas for planting intervention were considered independently for converted landscapes – where tree cover has been lost (mostly current agricultural land); and for unconverted landscapes – where natural tree cover remains. This was because appropriate tree planting-based interventions for these two landscapes differ: for converted landscapes, agroforestry-type interventions are relevant; while for unconverted landscapes, forest and woodland enrichment interventions are appropriate.

continue to next page

Box 3. Continued

The second part of the study (Pedercini et al. 2025b) considered what tree species may be priorities for planting in Rwanda as a whole and in the CNR landscape specifically. The approach taken to species prioritization was to begin by taking a 'master list' of tree species gathered by government, consultants and researchers. Prioritization among these species was then undertaken by considering the number of times each species was mentioned among 14 different data sources. In addition, weighting was given during rankings to species specifically targeted to the CNR landscape. Information on whether or not existing seed sources are known for this list of prioritized species (seed sources that could potentially be used for the scaling up of tree planting) was then compiled, based on available literature and the Rwandan Tree Seed Centre's seed register. Information on the attributes of the prioritized species was also compiled to support their use.

The third part of the study (Lillesø et al. 2025) considered the current status of tree seed and seedling availability in Rwanda. The approach taken was to review information available from a Rwanda Forestry Authority survey conducted in 2023 on expected tree nursery seedling production by district. The available data from this survey were not differentiated by species; however, these data were supplemented by species-specific information provided by One Acre Fund on (its) nursery seedling production for 2022. One Acre Fund, active in most districts of Rwanda, is one of the most prominent organizations planting trees in the country, and is recognized by the Government of Rwanda as having an important role in landscape restoration. In addition to these data on nursery production, a desktop review of available information on tree seed sourcing in Rwanda was conducted, and records on tree seeds distributed by the Rwandan Tree Seed Centre for the years 2016 to 2019 were examined. These observations were complemented by further work coordinated by CIFOR-ICRAF that is currently being undertaken to characterize and support the tree seed and seedling subsector in Rwanda. This work includes creating a more enabling overall policy environment for tree seed and seedling delivery systems in the country, and specifically supports the engagement of the private sector. This work also includes the operationalization of climate appropriate portfolios of tree diversity (Kindt et al. 2023). These are mixes of tree species' planting materials, delivered to growers, that are environmentally matched to planting sites and purpose matched to planting requirements. This work is part of the projects listed later in the current section of the present report (Box 5).

The three parts of the study together resulted in a proposed Tree Improvement Strategy for Rwanda (Graudal et al. 2025a).

2.2 Key findings

In the CNR landscape, 1,900 and 600 square kilometres of converted and unconverted lands, respectively, are identified as priorities for landscape restoration. Based on the use of a multi-indicator approach (Box 3) and framed within a national-level analysis, the CNR landscape is identified as a hotspot for tree-based planting interventions in Rwanda. Forty-five percent of the CNR landscape area, which is equivalent to 1,900 square kilometres, was identified as priority converted land for tree-based landscape restoration, while another 14 percent of the CNR landscape area, equivalent to 600 square kilometres, was identified as priority unconverted land for tree-based landscape restoration.

Ninety tree species are identified on a 'long list' of priorities for planting, but the seed sources available to support the planting of these species are limited. From an initial master list of 458 tree species, a preliminary 'long list' of 90 species was identified for planting through the present priority-setting exercise (Box 3). The initial long list of prioritized trees was composed almost equally of species native to Rwanda and exotic tree species. Of the initially prioritized species, however, only 32 were identified to have known national seed sources, with 183 seed sources indicated in total for these species. Among these seed sources, only 17 were of native trees, covering nine species, which indicates a lack of diversity in the availability of native tree species sources. Most of the identified native tree seed sources were also of unknown genetic quality, and the use of the sources was poorly

documented. Together, these observations indicate insufficient attention to genetic quality, and sub-optimal tree planting.

Currently, tree seedling production in Western Province of Rwanda is generally higher in its southern part than elsewhere in the province. The Rwanda Forestry Authority survey for 2023 (Box 3) indicated an expected total production of 57 million tree seedlings across the country, with 44 different organizations involved in these operations. Considering the districts of Western Province specifically, seedling commitments were generally higher for the districts in the southern part of the province than elsewhere. According to the 2023 survey, Rutsiro District, in the centre-north part of Western Province, had the lowest number of seedlings in nurseries for any district in Rwanda as a whole, which may indicate a particular gap in production capacity.

Most seedling production in Rwanda's tree nurseries is of a limited range of exotic tree species. Taking the example of One Acre Fund (Box 3), its records indicate that with a production of more than 20 million seedlings annually it is responsible for around a third of all currently documented tree seedling production in Rwanda. Most of the seedlings it produces, however, are of exotic trees, with the exotic *Grevillea robusta* (grevillea) responsible for over three-quarters of its total production in 2022. Assuming that One Acre Fund data are representative of the types of tree seedlings being raised by other tree nurseries in Rwanda (which seems reasonable), it is evident that only a low diversity of tree species is being promoted through tree nurseries in the country, with only a limited supply of native tree species being generated for planting.

Current tree planting programmes are broadly spread across Rwanda. A desktop review of 191 documents revealed a total of 64 projects or programmes in Rwanda that contained a tree planting component. Coverage was relatively broad across Rwanda, with 217 operational sites identified. Taking the case of One Acre Fund as an example (Box 3), it is active in 27 of Rwanda's 30 districts. These observations indicate an underlying geographically widespread institutional capacity across Rwanda, which it should be possible to build on for scaling tree planting.

Most of the seed supplied by the Rwandan Tree Seed Centre is of exotic trees. The 2016 to 2019 records of the Rwandan Tree Seed Centre (Box 3) indicated the sale of seed of 55 tree species, with this seed originally being sourced both nationally and globally. Of the 55 species, the top ten distributed in terms of seed numbers, as estimated by seed weight conversions, were all exotic trees (Table 1). The top three ranked species, by seed number, were all eucalypts, the fourth ranking was *Alnus acuminata*, and the fifth was grevillea. Considering that the Rwandan Tree Seed Centre is the only authorized tree seed seller in Rwanda, these data support tree nursery observations (see above) that a relatively narrow range of tree species, mostly of exotics, dominates tree planting in Rwanda.

To date there has been limited private sector involvement in tree seed supply in Rwanda. Further ongoing assessment of the tree seed and seedling subsector in Rwanda in work coordinated by CIFOR-ICRAF has involved review of the Government of Rwanda's current National Tree Reproductive Materials Strategy (Ministry of Lands and Forestry 2018a) and a broader sub-sectoral assessment. As part of the sub-sectoral assessment, the current roles of stakeholders in the subsector have been analysed. An important group of stakeholders is seed cooperatives, which sell seed to the Rwandan Tree Seed Centre for onward sale. However, these cooperatives are not authorized to sell seed directly to tree nurseries, in what would be a more decentralized and potentially more sustainable and scalable model of tree seed supply. Overall, the sub-sectoral assessment shows that there has been limited implementation of private sector involvement in tree seed supply, despite the National Tree Reproductive Materials Strategy making provision for this. This appears to be a major hinderance in the development of a sustainable tree seed and seedling subsector in the country. The Government of Rwanda is currently revising the National Tree Reproductive Materials Strategy and the action plans derived from it, and this will provide opportunities to make changes to reinforce private sector involvement, as well as to introduce other changes that support the tree seed and seedling subsector.

Table 1. The ten most sold tree species from the Rwandan Tree Seed Centre, 2016 to 2019, in terms of seed numbers

Species	Numbers of seeds, in thousands (average 2016 to 2019)	Origin
Eucalyptus grandis	152,832	Exotic
Eucalyptus microcorys	148,969	Exotic
Eucalyptus camaldulensis	140,824	Exotic
Alnus acuminata	111,085	Exotic
Grevillea robusta	97,832	Exotic
Eucalyptus saligna	72,828	Exotic
Casuarina equisetifolia	42,667	Exotic
Eucalyptus globulus subsp. *maidenii*	29,160	Exotic
Solanum betaceum	17,807	Exotic
Senna spectabilis	6,902	Exotic

Note: Species are ranked by calculated seed numbers that are average values for the years 2016 to 2019. The calculated seed numbers are based on the weight of seed sold and typical numbers of seeds per unit weight. Data on seed weight sold came from the records of the Rwandan Tree Seed Centre.

2.3 Key recommendations

Rwanda's large pledges to restore degraded lands provide important opportunities to improve degraded environments and support livelihoods, but the tree planting that is an essential component of restoration is hampered by not knowing where best to plant, what species to plant, and the low availability of high-quality tree planting materials, especially of native tree species. Based on current findings, five key recommendations for improving tree planting in forest management and restoration are identified. These recommendations are as follows:

Improving tree planting material R1: A multi-indicator spatially-based approach for identifying priority locations for landscape restoration should be applied to Rwanda in combination with a community-based assessment of restoration priorities. The multi-indicator approach for priority setting applied in the present study is a useful systematically-based method to identify priority areas for tree planting interventions in the CNR landscape. These interventions should be based on agroforestry, diverse plantations and silvopastoralism in priority converted landscapes, and enrichment planting and assisted natural regeneration in priority unconverted landscapes. The findings of the current approach to priority setting should be presented in an open access decision-support tool on prioritized land areas that has previously been unavailable for Rwanda, and the spatial indicators used should be further adjusted to embrace a greater range of socioeconomic variables. However, a multi-indicator spatial approach is clearly insufficient in itself for guiding priority locations for tree planting-based interventions. To further guide location priorities and planting options, additional work should combine the current 'desk-based' multi-indicator spatial approach with findings from community-based approaches for setting restoration priorities. In addition, the multi-indicator spatial approach used in the current study could consider connectivity between existing natural forest blocks as a further criterion in modelling priority locations for action. By defining priority areas for intervention, key locations for establishing tree seed and seedling delivery infrastructure will, thereby, also be determined.

Improving tree planting material R2: The preliminary 'long list' of priority tree species identified for planting in the current study should be further prioritized with local communities, and suitable seed sources determined or established for final species choices. Tree planting in the CNR landscape should take the preliminary list of 90 prioritized species identified in the present study as a starting point for consultation with local communities, including local businesses, to establish final priorities

for specific locations. This is in order to align priorities fully with community needs and support focused action. For the majority of the trees on the current preliminary priority species list, current findings indicate a lack of well documented, high-quality seed sources. Therefore, after community prioritization, efforts are needed to develop and operationalize a strategy for seed sourcing, including through defining, registering and (where necessary) establishing and improving suitable seed sources for the final species choices. Different strategies and timelines may be needed for exotic and native tree species, and it is recommended that this work be done in collaboration with the existing tree seed cooperatives that currently work with the Rwandan Tree Seed Centre to support tree seed supply. The approach used to define the seed sources should be based on five defined categories of source that allow an assessment of source quality and availability, and help direct sub-sectoral interventions, as follows: seed from natural tree stands; seed from farmland trees; seed from plantation trees; seed from seed orchard trees; and, finally, clonally propagated 'seed' (in fact, vegetative propagules rather than seed) from mother block trees (these five sources are described by Lillesø et al. 2024). In addition to defining and establishing seed sources for tree species on the final priority list, the development of propagation and field management methods should be undertaken where these are not yet available, with particular attention to native tree species (see following recommendation). For all tree planting programmes in Rwanda, a clear strategy for high-quality tree seed and seedling sourcing should be part of the implementation plan.

Improving tree planting material R3: Native tree species should receive greater promotion attention for planting in the CNR landscape to better reach landscape restoration goals. A move away from the dominance of exotic tree planting in Rwanda (see also the coverage of this topic in Section 3 below, where when exotic tree planting remains important is also discussed) is recommended to better meet biodiversity and broader landscape restoration goals, and is supported by Rwanda's policies for tree planting. In support of this, tree seed sourcing interventions should focus especially on promoting the availability of native tree species by identifying, mapping and developing native tree seed sources. In the case of planting in the CNR landscape, particular attention should be given to developing natural populations of native tree species that still remain in the unconverted parts of the landscape as seed sources. The use of native trees for planting also requires considerable effort in developing protocols for tree propagation and management, and in sharing these methods and the building of capacity in their use. It also requires guidance on what species should be planted where, and for what purposes. These activities should therefore also be priorities. Specific skills gaps that need to be addressed in order to enhance seed supply for native tree species in Rwanda have already been identified in a training needs assessment, and the measures that have already been outlined to address these gaps should be referred to and supported (Ouedraogo et al. 2024). The recommendations from this training needs assessment are summarized in Box 4.

Improving tree planting material R4: The Government of Rwanda's ongoing revisions of the National Tree Reproductive Materials Strategy and associated action plans should fully implement commercial stakeholder involvement in tree seed and seedling delivery. During the revision of the National Tree Reproductive Materials Strategy and associated action plans, it is recommended that a more equitable environment for the different stakeholders involved in tree seed and seedling supply in Rwanda is supported. Instead of the Rwandan Tree Seed Centre having the major role in direct tree seed provision, it is recommended that the Centre focus on quality assurance, initial seed sourcing and technical guidance for other stakeholders, including the private sector, to produce most of the tree seeds and seedlings for planting. A particular focus should be on supporting relatively decentralized small and medium enterprises that can reach growers more easily with planting materials. To enhance the role of these enterprises, it is recommended that the Government of Rwanda test models for their involvement in the subsector with the collaboration of One Acre Fund. This is because One Acre Fund supports a large number of decentralized nurseries across Rwanda, and already has plans in place to support the commercial development of these nurseries. Initial support to One Acre Fund, given centrally, could be extended through a 'hub and spoke' model to their broadly distributed nurseries

nationally. Once the new National Tree Reproductive Materials Strategy and action plans are in place, it is recommended that detailed planning and implementation should be supported by a stakeholder engagement platform, where roles and responsibilities among stakeholders in the subsector are further discussed and actions are aligned.

Improving tree planting material R5: The revised National Tree Reproductive Materials Strategy should be supported by guidelines for the use of tree seed sources. To enhance the quality and sustainability of tree seed sourcing, a formal, multi-species seed source quality certification scheme should be introduced. This scheme must encompass both immediate and future tree seed sources (source categories as outlined above in an earlier recommendation), with a strong focus on genetic improvement. To support informed decision making, the development and dissemination of decision-support tools will be essential, guiding the selection of tree species and seed sources, based on landscape functionality. Certification should rely on verified assessments grounded in internationally recognized criteria and be backed by a national registry of certified seed sources. An independent technical committee should be established to oversee the source certification and registration processes. Strengthening the role and regional presence of the Rwandan Tree Seed Centre will reinforce this approach. Capacity building in seed source quality should be prioritized across seed cooperatives, seed source custodians, tree nurseries, growers and support organizations. To promote the use of high-quality seed sources, the fostering of collaboration and knowledge exchange through information sharing and engagement networks is needed.

Box 4. Skills gaps identified in a training needs assessment of the tree seed subsector in Rwanda

As part of the Green Climate Fund-supported Transforming Eastern Province through Adaptation project (TREPA) in Rwanda (Box 5), a training needs assessment was undertaken in support of tree seed supply for native trees. The assessment resulted in 13 recommendations, nine directed to the skills gaps and staff capacity needs of the Rwandan Tree Seed Centre and similar partner institutions, and four directed to the seed cooperatives that support the centre in the provision of seed. In brief, recommendations were as follows (details in Ouedraogo et al. 2024):

Recommendations directed to the Rwandan Tree Seed Centre:

- Prioritize skills development on tree genetic improvement, genetic quality and climate change adaptation.
- Prioritize skills development on native tree species.
- Prioritize skills development in the use of online decision-support tools on tree seed supply, and on tree planting more broadly (e.g., on what to plant and where, and for what purpose), and improve access to these tools.
- Review the training offered to seed cooperatives and build skills to cover training gaps.
- Focus on shared 'strategic' learning with other tree seed centres (in Africa).
- Recognize staff participation in training as part of career development.
- Fill vacant staff positions.
- Focus on developing skills in seed standards development and application.
- Focus on developing skills for providing technical support to seed suppliers and for facilitating supplier networking.

Recommendations directed to seed cooperatives:

- Prioritize technical skills development on native trees species.
- Prioritize business skills development.
- Train in broader roles in the tree seed and seedling sector.
- Support shared learning among cooperatives.

2.4 Indicative investment needs

The operationalization of an effective tree seed and seedling subsector through a proposed Tree Improvement Strategy for Rwanda requires attention to five component parts: (i) the enabling institutional and policy environment; (ii) the mobilization and provision of knowledge and know-how; (iii) mobilizing and building tree genetic resources for tree planting; (iv) capacity development of the tree seed subsector; and (v) capacity development of the tree nursery subsector. This programme addresses the major challenges to the planting of diverse, high-quality seedlings of tree species by supporting the organizational setup of the tree seed and seedling subsector, providing species-specific knowledge, building up tree seed sources, and supporting capacity among the key sub-sectoral stakeholders of tree seed suppliers and tree nurseries.

The outcome of investment will be a Rwandan tree seed and seedling subsector enabled to provide high-quality tree planting materials for large-scale plantings. Achieving this outcome depends upon recommendations for the successful addressing of current hurdles to the tree seed and seedling subsector being taken up by government policymakers and planners, and the take up of decision-support tools and guidance by restoration planners and tree planters. It furthermore depends on access to diverse, high-quality seed sources of native trees being assured for seed collectors, and that improved tree seed and seedling inputs increase the range and yield of tree products available for tree growers, thereby supporting their livelihoods and encouraging participation in tree planting to meet landscape restoration targets and other national policy goals.

The technical study summarized in the present section of this synthesis report indicated that significant operational support to the tree seed and seedling subsector in Rwanda is currently being provided by a number of projects (as listed in Box 5). It is recommended therefore that further investment should complement these initiatives by addressing gaps and by supporting further scaling. To develop a coherent overall programme for tree seed and seedling supply, further needed support over a five-year period is summarized in Table 2. Scenarios of high and low investment which relate in part to the number of tree species considered for improving planting material supply and to the extent of tree seed centre infrastructure are provided, as are costs at a nationwide level and for a scenario limited to the Rwandan CNR landscape. Nationwide investment is preferable due to tree planting in the CNR landscape being dependent on the overall status of the tree seed and seedling subsector in Rwanda.

Guidance on the timing of interventions with further details on activities is provided in Table 3. Operationalization can be divided into two periods, with Year 1 being a feasibility period covering the indicated activities at a cost of approximately USD 300,000, and Years 2 to 5 covering other needed activities. It is recommended that support then be renewed in further five-year tranches.

Box 5. Projects currently supporting the development of the tree seed and seedling subsector in Rwanda

Further investments as outlined in the present report should complement these ongoing tree seed and seedling sub-sectoral development projects that are being implemented in collaboration with the Rwanda Forestry Authority:

- The Green Climate Fund-supported project for eastern Rwanda titled Transforming Eastern Province through Adaptation (TREPA 2021–2027), https://www.greenclimate.fund/project/fp167. This project addresses climate resilience and restoration challenges in Rwanda's Eastern Province. By combining adaptation strategies with landscape restoration, the project targets sustainable agricultural practices and ecosystem recovery to support both livelihoods and biodiversity. An incipient tree improvement programme for the Eastern Province of Rwanda has been initiated within the framework of the project, covering policy support, development of knowledge, tree breeding and capacity enhancement of the tree seed and seedling subsector. The total Green Climate Fund investment for the tree improvement part of TREPA, including technical assistance, amounts to USD 2.3 million.

continue to next page

Box 5. Continued

- The Bezos Earth Fund-supported project for Kenya and Rwanda titled Strengthening Expertise in Production of Quality Tree Seed and Seedlings to Accelerate Landscape Restoration and Conservation in Africa's Rusizi Basin and The Great Rift Valley (QT-Seed 2024–2026), https://www.cifor-icraf.org/project/232f8a4890074fb9bdbe08dbce133699/. This project aims to improve the quality and availability of tree seeds for restoration and agroforestry efforts. It works with local communities to ensure that seeds are ecologically and culturally appropriate for target regions. The investment of this project in Rwanda, including technical assistance, amounts to approximately USD 1.4 million.
- The German Government-supported multi-country project for Burkina Faso, Ethiopia, Kenya, Uganda and Rwanda titled Right Tree, Right Place – Seed (RTRP-Seed 2024–2030), https://www.cifor-icraf.org/rtrp-seed/. This project focuses on enhancing the availability and accessibility of high-quality native tree seeds to support restoration goals in Africa. It bridges gaps between policy and implementation, while promoting scalable and sustainable restoration efforts across multiple landscapes. The investment of this project in Rwanda amounts to approximately USD 2.3 million.

Table 2. Indicative investments for improving planting material used in forest management and restoration

Programme elements (over a 5-year period)	Budget, Rwanda nationwide (USD x 1,000)		Budget, Rwanda CNR landscape (USD x 1,000)	
	Low	High	Low	High
1. Enabling institutional and policy environment	350	1,000	200	500
2. Mobilization and provision of knowledge and know-how	450	1,500	200	300
3. Mobilizing and building tree genetic resources for tree planting	1,500[a]	3,500[b]	1,500[c]	2,500[d]
4. Capacity development of the tree seed subsector	1,000[a]	2,500[b]	300[c]	1,000[d]
5. Capacity development of the nursery subsector	500	1,500	250	500
Total	**3,800**	**10,000**	**2,450**	**4,800**

Note: Superscript-indicated references detail the numbers of tree species and the tree seed centre infrastructure involved for different investment scenarios at nationwide and CNR landscape levels. The numbers of tree species indicated in the investment plan scenarios are relatively large as there is a need to diversify tree planting – of native tree species especially, but also of exotic trees – in Rwanda.

a Low investment scenario for Rwanda as a whole, involving a tree seed source programme for 100 species, low-input breeding cum conservation efforts for 10–15 tree species (both programme element three), and two additional tree seed centre nodes (programme element four).

b High investment scenario for Rwanda as a whole, involving a tree seed source programme for 200 species, low-input breeding cum conservation efforts for 25–30 tree species (both programme element three), and an additional regional tree seed centre (programme element four).

c Low investment scenario for the CNR landscape only, involving a tree seed source programme for 100 species, low-input breeding cum conservation efforts for 10–15 tree species (both programme element three), and a single additional tree seed centre node (programme element four).

d High investment scenario for the CNR landscape only, involving a tree seed source programme for 150 species, low-input breeding cum conservation efforts for 15–20 tree species (both programme element three), and an additional sub-regional tree seed centre (programme element four).

Table 3. Further information on indicative investments for improving planting material used in forest management and restoration

Provisional outputs and activities	Yr 1	Yrs 2–5
1. Enabling institutional and policy environment		
1.1. Tree seed and restoration sub-sectoral assessment		
1.2. Policy and governance support development for the revised National Tree Reproductive Materials Strategy		
1.3. Implementing a sectoral stakeholder engagement platform		
2. Mobilization and provision of knowledge and know-how		
2.1. Integrate spatial multi-indicator prioritization for restoration with community-based assessment of restoration priorities		
2.2. Undertake further, community-based prioritization of priority tree species for planting		
2.3. Update and consolidate climate appropriate species priorities, distribution maps and deployment zones		
2.4. Assess conservation status and needs of priority species		
2.5. Establish a web portal 'What to plant where' to guide users on species, seed sources and seed-seedling suppliers		
3. Mobilizing and building tree genetic resources for tree planting		
3.1. Identify, document (describe) and manage seed sources of priority species, especially of native tree species		
3.2. Collect and acquire reproductive material of priority tree species for new planting material production stands, and development of propagation protocols		
3.3. Establish and manage new planting material production stands in relevant deployment zones		
4. Capacity development of the tree seed subsector		
4.1. Capacity needs assessment with respect to training, infrastructure/ equipment and management/governance of the subsector, especially with reference to native tree species		
4.2. Develop and implement a 'capacitation' strategy, including training of stakeholders		
4.3. Provide for facilities and facilitation (including incentives) in accordance with the capacitation strategy		
5. Capacity development of the nursery subsector		
5.1. Capacity needs assessment with respect to training, infrastructure/ equipment and management/governance of the subsector, especially with reference to native tree species		
5.2. Develop and implement a 'capacitation' strategy, including training of stakeholders		
5.3. Provide for facilities and facilitation (including incentives) in accordance with the capacitation strategy		

Note: Suggested responsibility for the implementation of activities will be the Rwanda Forestry Authority working with CIFOR-ICRAF.

3 Better operationally managing forest landscapes

3.1 Background

Rwanda is endowed with varied forest ecosystems made up of both natural and planted forested areas, and contains many other landscapes within which trees are an important component (MINIRENA 2014). As of 2019, forested areas, including natural forests, planted forests, wooded savannas and shrublands, were estimated to cover around 30 percent of Rwanda's total land area (Ministry of Environment 2019). These lands play a crucial role in environmental sustainability, economic development and social well-being. Livelihood values include direct use and sale of forest products such as fuelwood, timber, building poles and medicines, and supporting services such as the control of soil erosion that provide benefits to agriculture. The Government of Rwanda is seeking to boost the timber industry to improve productivity and revenues, and seeks to protect forests to support the availability of the products and environmental services they provide (Ministry of Lands and Forestry 2018b).

However, in common with many other countries (Box 6), in Rwanda increased demand for land and unsustainable forest exploitation are challenges to forest landscapes. As also noted in Box 6 for elsewhere, the current development and operationalization of plans to support forest management in Rwanda are broadly inadequate. Reflecting this, a marked reduction in natural forest cover in the CNR landscape has been observed since the 1980s. The calculations of Arakwiye et al. (2021), for example, estimated that approximately 19 percent (around 23,000 hectares) of the initial forest extent in western Rwanda was lost between 1986 and 2006, primarily due to forest conversions including pastureland expansion. These authors indicated that further natural forest loss then peaked between 2010 and 2014, corresponding with rapid expansion in public infrastructure and the overexploitation of forest products to supply growing urban areas. Over the same period, however, the same authors noted increases in tree planting in Western Province, fitting with the picture of greater tree planting nationally (Ministry of Environment 2019).

The technical study (Nduwamungu et al. 2025) summarized in this section, which used the approaches outlined in Box 7, was about developing recommendations for improved forest management in Rwanda, with a specific emphasis on forests in the CNR landscape and neighbouring areas. The study considered the current status of forests and management plans, the implementation of these plans, and how the plans could be revised. The study was concerned primarily with non-protected natural forests and planted tree landscapes.

Box 6. A global overview of needs for mainstreaming biodiversity in forest management

The Food and Agriculture Organization of the United Nations (FAO) recently commissioned a global study on mainstreaming biodiversity in forest management. The study, published in 2022 (Harrison et al. 2022), was supported by a review of forest management policies and their implementation in eight country case studies. The two African case studies chosen (detailed in Harrison et al. 2024) did not include Rwanda, but were based on Ethiopia and the Democratic Republic of the Congo. Despite the exclusion of Rwanda, many of the findings across the included countries were broadly in common, and the recommendations for action from the study are therefore expected to have some relevance for the Rwanda case.

continue to next page

Box 6. Continued

The country case studies of the FAO study indicate that progress has been made globally towards mainstreaming biodiversity in production forest management, with the important role of community-based forest management now widely recognized. Forest landscapes globally continue to be lost and to be poorly managed, however, due in large part to poorly defined, impractical and overly complex laws and regulations, and the conflicts that exist institutionally among the different agencies and levels of government that are involved in management. Taking the case study based on Ethiopia, for example, it was not the lack of laws and regulations that was the main limiting factor in effective management, but the lack of practical implementation and enforcement of the existing rules framework (Pedercini et al. 2025c).

For the situation to improve, the FAO study recommended that simplifying regulatory frameworks and clarifying institutional responsibilities are key steps, as is properly addressing incentives for sustainable management. Empowering communities and local-level institutional representatives to be involved in management is important, through measures including networking, infrastructure and knowledge capacity building, and the supply of decision-support tools. In order to manage trade-offs across productive economic benefits and ecosystem services, better spatial planning is required, considering how activities in different land use types affect each other.

Box 7. Approaches used in the technical study on better operationally managing forest landscapes

The technical study (Nduwamungu et al. 2025) summarized in this section of the present synthesis report used a variety of approaches to collect information and devise recommendations for action.

The study first assessed the status of forest lands (both natural and planted tree cover) for the seven districts of Western Province of Rwanda by calculating land cover changes over the past two decades. Data for land cover assessment were amalgamated from spatially-explicit open-access global datasets for six variables related to land cover (baseline land cover, cropland area change, tree height change, land cover change, tree cover change, plantation establishments) within a timeframe spanning 2000 to 2020 (with the exception of the data on plantation establishments, which encompassed the years 1982 to 2020).

The technical study secondly assessed the legislative background and status of current forest management plans in Rwanda, and the challenges experienced in the management of forest resources specifically in the seven districts of Western Province and the contiguous districts of Musanze and Burera in Northern Province. These nine districts in total cover the majority of the CNR landscape and include the Volcanoes National Park. To assess plans and challenges, relevant planning documents were reviewed. These included district forest management plans (DFMPs) that give information on the extent of planted tree areas as well as on forest management.

The technical study thirdly involved stakeholder consultations conducted during field visits to the nine districts for which DFMPs were reviewed. A consultation workshop was also held. Key informants during these consultations included district forestry and natural resources officers, district agronomists, district environmental officers, tourism consultants and CIFOR-ICRAF staff (agroforestry experts). Issues covered in discussions included the status of forests, and forest management threats and opportunities. The implementation of current management plans was discussed, along with the possible revision of these plans.

3.2 Key findings

According to the land cover calculations of the present study, net tree cover loss over recent decades has occurred in six of the seven districts of Western Province. The spatial assessment of land cover changes in Western Province conducted as part of the present study (Box 7) indicated that for six of seven districts there was net tree cover loss over the assessed time period, with Nyabihu District at the northern edge of Western Province the only district to show a (small) increase in tree cover area. In every district, an increase in built up areas was observed in the analysis, that corresponds broadly with tree cover losses. The present analysis revealed that Nyamasheke and Rusizi districts, in the southern part of Western Province, are at present the most forested districts of the province as a whole, both as a proportion of the land area that has tree cover, and in absolute terms (total land area with tree cover). On the other hand, Nyabihu District, and the bordering district of Ngororero in the northern part of Western Province, are the districts with the highest proportion of cropland.

Public forest plantation establishment has relied heavily on exotic tree species. Of the 23,000 hectares of public forest plantations recorded in nine examined district forest management plans, the largest areas planted are of exotic eucalypts. District forest management plans (DFMPs) recorded a total area of public forest plantations of approximately 23,000 hectares as of 2017 for the nine reviewed districts. Ngororero District in Western Province was indicated to have the greatest public forest plantation area at around 4,800 hectares, and Musanze District in Northern Province the smallest area with around 700 hectares (Table 4). Applying the land cover map on plantation establishments that was used in the current spatial study (see Box 7) indicated that many of the public forest plantations recorded in DFMPs were established in the 1980s. Consistent with planting efforts of that time broadly across the tropics and subtropics, and aligning with the tree seed sales logged by the Rwandan Tree Seed Centre for the years 2016 to 2019 (see Section 2), eucalypts are the dominant species in the recorded public forest plantations in the assessed Rwandan districts. For the districts of Western Province, for example, eucalyptus species account for more than 80 percent in area of all plantings recorded for public forest plantations. Use of a limited range of other exotic tree species, including pines (around five percent of the recorded area of all public forest plantings in Western Province), was also reported for establishing plantations, but the use of native tree species was indicated to be rare. Native tree species when they were reported to be used for plantation establishment included *Syzygium parvifolium*, locally known as 'umugote', *Maesopsis eminii* ('umuhumuro'), *Polyscias fulva* ('umwungo') and *Markhamia lutea* ('umusave'). The dominance of exotic trees in plantations around natural forest areas, where these trees may invade (or have already invaded) natural forest, is not in alignment with current national management plans for exotic tree containment and removal in such locations.

Public forest plantations are poorly managed for plantations recorded as established in nine examined district forest management plans. The establishment and initial management of plantations is contracted out, with limited oversight and accountability. Consultations with stakeholders (see Box 7) indicated that most of the public forest plantations summarized in Table 4 are no longer formally managed, with silvicultural operations such as pruning and thinning neglected. In addition, many stands are overmature (have gone beyond the normal harvest date), and many have low stocking densities due to past illegal harvesting. These factors hamper plantation productivity and timber quality. Although the monetary effects of the poor management of plantations have not been estimated, they are likely to be significant. Factors contributing to failed management are only short-term contracts being given to the contractors involved in tree planting and (initial) management; too great a focus on numbers rather than quality in meeting planting targets; inadequate supervision; and poor management handover.

Forests of Western Province of Rwanda and the examined districts of Northern Province of Rwanda lack systematic management, despite the existence of district forest management plans. The national Forest Sector Strategic Plan states that "achieving forest sector targets has been hindered in Rwanda by the absence of comprehensive, standardized and technically appropriate development and operations planning". The formulation of ten-year DFMPs seeks to address management gaps and attract private investments in forest management. The seven districts of Western Province and the contiguous districts of Musanze and Burera in Northern Province have DMFPs that were developed in 2017. However, the DFMPs generally lack implementation, the establishment of smaller forest management units has been slow, and forests

largely continue to lack systematic management. The reasons given for this situation by the stakeholders consulted in support of the present study (see Box 7) included lack of awareness of the content of plans among forestry staff, insufficient decentralization in decision making, and lack of harmonization in issuing harvest permit fees for private forests. Additional reasons mentioned were limited funds for the implementation of plans (such as a lack of funds for transportation and tools), lack of clear prioritization of interventions, and lack of coordination. Also mentioned as barriers were the absence of monitoring, and insufficient individuals with the necessary skills in forest management. As well as indicating current reasons for poor forest management, stakeholder consultations identified potential businesses, projects and other organizations and institutions to involve in further plan development (Table 5).

Table 4. The extent of public forest plantations in Western Province and two districts of Northern Province of Rwanda. Extents are shown on a district-by-district basis.

District	Public forest plantation area (hectares)
Karongi (WP)	3,668
Ngororero (WP)	4,794
Nyabihu (WP)	3,928
Nyamasheke (WP)	2,119
Rubavu (WP)	1,959
Rusizi (WP)	1,708
Rutsiro (WP)	2,921
Burera (NP)	1,154
Musanze (NP)	715
Total	**22,966**

Notes: Data are as of 2017 and were extracted from district forest management plans (DFMPs). Figures for separate 'state' and 'district' forest areas within districts that are given in DFMPs are combined in the current table. WP = Western Province; NP = Northern Province

Table 5. Key stakeholders and projects involved in the forestry sector in Western Province and two districts of Northern Province of Rwanda. Stakeholders and projects are shown on a district-by-district basis.

District	Key stakeholders
Karongi (WP)	Tubura, SAIP, Rugabano Tea Company, Karongi Tea Factory, Gisovu Tea Company, EA Sawmill Company, ARCOS, One Acre Fund
Ngororero (WP)	Rwanda Mountain Tea Company (Rubaya, Rutsiro), Tubura (One Acre Fund), ARCOS, RWB (Vunga corridor), Volcano Community Resilience Project
Nyabihu (WP)	One Acre Fund, SAIP (Sustainable Agriculture Intensification and Food Security project), Rwanda Mountain Tea Company (Nyabihu), Horizon-SOPYRWA, Volcano Community Resilience Project
Nyamasheke (WP)	Tubura (One Acre Fund), Kageno, REDIR, Kura Project, EA Sawmill Company, Gisakura Tea Company, Gatare Tea Company, Cyato Tea Company, Nyungwe Management Company (NMC), Rwanda Environment Management Authority (NAP)
Rubavu (WP)	Bralirwa, Rwanda Environment Management Authority, Rwanda Water Board (RWB)-Sebeya Catchment project, One Acre Fund
Rusizi (WP)	Rwanda Environment Management Authority (NAP project), RAB (CIDAT project), Tubura (One Acre Fund), EA Sawmill Company, Shagasha Tea Company, Nature Rwanda (local NGO)
Rutsiro (WP)	Tubura (One Acre Fund), RDB (Gishwati-Mukura National Park), ARCOS (Murakira project), CIFOR-ICRAF, Rwanda Mountain Tea Company (Rutsiro, Pfunda), EA Sawmill Company, Rugabano Tea Factory
Burera (NP)	Mining companies (Gifurwe, New Bugarama), Rwanda Wildlife Conservation Association, RWB, schools, Rwanda Environment Management Authority (Rugezi wetland buffer zone), Volcano Community Resilience Project, One Acre Fund
Musanze (NP)	Tubura (One Acre Fund), Rwanda Environment Management Authority (Mukungwa Eco-Park), Nature Rwanda, Rwanda Mountain Tea Company (Nyabihu), CAVM, SOPYRWA, Volcano Community Resilience Project

Notes: Key stakeholders were identified during a stakeholder consultation workshop held as part of the technical study in November 2023. WP = Western Province; NP = Northern Province

3.3 Key recommendations

Rwanda's forested lands play a crucial role in environmental sustainability, economic development and social well-being, but the current development and operationalization of plans to support their management are broadly inadequate. Based on current findings, four key recommendations for better operationally managing forest landscapes, with a specific emphasis on the CNR landscape and neighbouring areas, are identified. These recommendations are as follows:

Better managing forest landscapes R1: Targeted tree planting interventions should take into account the distribution of tree cover and land cover changes across the districts of Western Province in Rwanda. The spatial assessment of tree cover and land cover changes in Western Province conducted as part of the present study should guide recommendations for where to target tree planting interventions, and what interventions are appropriate. For the districts of Nyamasheke and Rusizi in the southern part of the province, where most forested land currently occurs, putting in place measures to maintain this tree cover and improve its quality are priorities. For the districts of Nyabihu and Ngororero in the northern part of the province, where a large proportion of the land area is cropland, agroforestry-based interventions may be most appropriate. Tree planting activities should furthermore build on areas set as priorities for restoration by multi-indicator spatial methods and community approaches (discussed in Section 2, and enhanced by considering the contributions of tree planting action to supporting connectivity among existing natural forest blocks).

Better managing forest landscapes R2: A greater focus on native tree species is needed in forest plantation establishment. Whilst there remains an important role for exotic tree species in the efficient plantation production of wood for timber and fuel, a greater focus on using native tree species in plantations is needed, in line with government policy on wider native tree species use. This is especially the case when establishing forest plantations in and around locations where landscape restoration goals include supporting and enhancing biodiversity, as applies for the CNR landscape. Exotic tree species have been preferred for plantations in the past because of ready markets or because planting material of the trees has been available; because the species have known propagation and management methods; and, sometimes, because they are – or are perceived to be – more productive than native alternatives. To support native tree species plantations, the development of markets for the produced wood is necessary (refer to Section 5), as is centring the development of the tree seed and seedling supply subsector on the provision of high-quality planting material of native trees (see Section 2). Also required is capacity building for contractors involved in the establishment of forest plantations. This is required for contractors to work more effectively generally (see also next recommendation), but especially so for the establishment and management of native tree species.

Better managing forest landscapes R3: The selection process for choosing contractors to plant and establish forest plantations should be improved. In order to address challenges related to poor productivity and quality, improved management of public forest plantations in and around the CNR landscape is needed. This requires a more rigorous selection process for choosing the contractors to be involved in plantation establishment, and an extension of the period of initial support to contractors for stand management. It also requires the development of standard operating practices for contractors, the definition of clear expectations in terms of quality outcomes, and the definition and application of specific incentives that support quality. Using certified nurseries for tree seedling production, and employing qualified foresters among the contractors for tree planting and establishment, are recommendations to improve current practice. Monitoring of the success of establishment in terms of performance (and tree species diversity – see previous recommendation) should be increased, and be a factor in the payment of contractors and in their securing repeat contracts. Local government should be more involved in the contractor procurement process, and government forestry extension staff at district and sector levels should be trained and equipped to engage in regular, effective plantation monitoring, which is currently absent. Data on monitoring should be maintained at district level and

fed back to a national inventory. The cost-to-benefit ratio of improved plantation management should also be estimated based on the monitoring, as a driver to improved practice.

Better managing forest landscapes R4: The revision and implementation of district forest management plans in the nine assessed districts of Western and Northern Provinces in Rwanda should focus support on financing and capacity building at the district level. For all seven districts of Western Province and the two assessed districts of Northern Province, there is a clear need to further develop, share, validate, approve and properly implement DFMPs to address current challenges related to poor governance and limited existing capacity in forest management. The redesign of forest management plans – and subsequently their implementation and monitoring, with the guidance of the Rwanda Forestry Authority – should be supported by proper financing at the district level (and extending down to the sector level) especially. Some of the features of a proposed revised DFMP, coherent with (but building on) existing guidance, are indicated in Box 8. Guidance on the process to use to develop the plan is also provided in the box. A broad range of potential stakeholders to include in plan development includes those already listed in Table 5.

Box 8. Recommended content and development process for revised district forest management plans

A good district forest management plan (DFMP) should show what is to be done, where, when, why, and by whom. It is built on a number of steps that involve situational and resource assessments, the active participation of stakeholders in setting objectives and approaches, and periodic revision based on regular monitoring.

A DFMP document should include the following features:

- Justification and legal background
- General district information
- Methodology for developing or revising the DFMP
- Presentation of survey findings on the current status of forest resources
- The present state of both public and private forest management schemes
- Management of road, river and lake protection forest plantations
- Agroforestry management modalities
- Gender considerations during implementation
- Consolidated action plans, budgeting and financial analysis
- Monitoring and evaluation plans

The preparation of DFMPs should be initiated by the Rwanda Forestry Authority in collaboration with funders and local government at district level. The Authority should prepare and publish the terms of reference for plan development, and tender for qualified individuals and institutions to lead the work. Subsequent activities to develop an initial draft plan should involve a participatory process including all relevant forestry stakeholders. The initial draft plan should then be validated through further consultations with stakeholders. An approved plan should be distributed as 'hard copy' to relevant authorities and stakeholders in the district. Plans should also be published online to make them more accessible to forestry staff and the public nationally.

Each DFMP should also integrate simplified forest management plans, developed by the forest owner or the forest concession contractor for approval by the relevant authority, for smaller forest management units. These plans should be submitted to a central repository database to enhance planning, and for monitoring purposes.

3.4 Indicative investment needs

The consultations of the technical study summarized in the present section of this synthesis report indicated that the operationalization of effective forest management requires attention to five component parts: (i) the revision of DFMPs; (ii) the adequate implementation of revised DFMPs; (iii) the diversification of seedlings raised in tree nurseries for forest plantation establishment; (iv) capacity building of forestry staff and plantation contractors; and (v) monitoring and evaluation. This programme addresses the major challenges to improved forest management, covering the revision and implementation of district management plans focused on the CNR landscape, and the diversification and better management of the tree species planted in the landscape's plantations. Achieving the intended outcome of investment for better forest management will depend upon the ability to devolve the revision, implementation and monitoring of management plans to the district level in Rwanda, and capacity building at this level.

The consultations of the technical study indicated that investments are required for a ten-year period, in congruence with the ten-year lifetime of DFMPs. Costs are indicated in Table 6 along with guidance on the timing of interventions for particular activities. While some proposed interventions span the whole time period, other interventions can be achieved during the first five years of the programme. Operationalization is divided into three periods: Years 1 to 2; Years 2 to 5; and Years 5 to 10. Year 1 represents a feasibility and inception period at a cost of approximately USD 500,000.

Table 6. Indicative investments for better operationally managing forest landscapes

Programme elements	Yrs 1–2	Yrs 2-5	Yrs 5-10	Responsible	Budget (USD x 1,000)
1. Revision of DFMPs of the districts under the project					
1.1. Elaborate DFMPs and simplified forest management plans using reviewed guidelines (9 districts)				RFA, stakeholders (forest owners/ contractors)	1,440
1.2. Validate revised DFMPs in workshops of key stakeholders				RFA, districts and other stakeholders	97
2. Adequate implementation of revised DFMPs					
2.1. Organize consultation workshops for sharing implementation roles and responsibilities among key stakeholders				RFA, districts and other stakeholders	97
2.2. Monitor forest management activities (annual audit)				RFA and districts	324
2.3. Support private forest management				RFA, districts and other stakeholders	196
3. Diversification of seedlings raised in tree nurseries for forest plantation establishment					
3.1. Coordinate the acquisition of tree seeds from diverse species, with more native species, targeting prioritized areas for planting				RFA, districts and other stakeholders	162
4. Capacity building of forestry staff and plantation contractors					
4.1. Regular refresher training of forestry staff at district level (minimum one training per year)				RFA	100
4.2. Regular organization of forestry fora for forestry staff (exchange meeting – at least once per year)				RFA	100

continue to next page

Table 6. Continued

Programme elements	Yrs 1–2	Yrs 2-5	Yrs 5-10	Responsible	Budget (USD x 1,000)
4.3. Acquisition and distribution of forestry tools to district forestry staff				RFA	1,080
4.4. Recruitment and salary of forestry extension officers at the sector level				RFA and districts	2,547
4.5. Facilitation of movement of forestry staff at district level (motorbikes, maintenance and fuel)				RFA	501
4.6. Capacity building of forest plantation establishment contractors				RFA	200
5. Monitoring and evaluation					
5.1. Monitoring and evaluation of forest resources, including health and management research				RFA, universities, districts and other stakeholders	4,155
Total					**10,900**

Notes: Responsibilities for implementation of activities are shown. RFA = Rwanda Forestry Authority

4 Putting in place more supportive plans for enhancing biodiversity and livelihoods

4.1 Background

Rwanda is home to a rich diversity of flora, fauna and landscapes, and foreign exchange earnings from ecotourism are an important source of revenue (Bizuru et al. 2011). Rwanda is committed to biodiversity conservation as exemplified by the various policies it has put in place and by its Sixth National Report to the Convention on Biological Diversity (Republic of Rwanda 2020a). Rwanda's National Biodiversity Strategy and Action Plan (NBSAP), first developed in 2003 and last revised in 2016 (Republic of Rwanda 2016), sets out 19 targets within a framework to respond to threats to biodiversity in the country that arise from loss of habitat due to encroachment from agricultural activities, over-harvesting of resources, mining, urban development and other threats.

As indicated by Republic of Rwanda (2020a), progress has been achieved towards the targets of the NBSAP, but many actions have not reached sufficient scale to adequately address the pressures on national biodiversity. There has, for example, been an insufficient integration of biodiversity conservation issues into broader policies, strategies, development programmes and actions that support biodiversity while addressing livelihood concerns. Addressing pollutants and invasive species so that they are not detrimental to ecosystem function and biodiversity, fully integrating traditional knowledge into management, and mobilizing financial resources for effective implementation of the NBSAP, are among other important concerns. As a result, the underlying drivers of biodiversity loss in Rwanda have still not been sufficiently addressed.

The technical study (Bizuru and Ntawuhiganayo 2025) summarized in the present section, which used the approaches outlined in Box 9, was concerned with developing recommendations for enhancing biodiversity and livelihoods in Rwanda, with a specific emphasis on particular landscapes in the west of the country that include Lake Kivu's islands and Gishwati-Mukura National Park (GMNP). These locations are rich in species (Box 10) and are among high priority areas for biodiversity conservation and sustainable tourism development in order to address biodiversity threats while improving livelihoods. The study considered existing plans for biodiversity and tourism, and biodiversity inventory methods. It also explored how existing plans and inventory methods could be revised to make them more effective.

4.2 Key findings

The attainment by GMNP of UNESCO Biosphere Reserve status was supported by its ten-year management plan. The 2017 to 2026 GMNP Ten-Year Management Plan, which outlined management programmes crucial for the park's sustainable development, was instrumental in the park attaining UNESCO Biosphere Reserve status. Furthermore, this plan, in combination with the former Forest Reserve Three-Year Interim Management Plan of 2015 to 2018 for the GMNP area, and along with the 2014 Conservation Plan of Lake Kivu Islands, provide important blueprints for ecosystem restoration and wildlife preservation in these locations.

Existing management plans for the landscapes of Lake Kivu's islands and of GMNP have not been adequately implemented. Stakeholder workshops, focus group discussions and informant interviews (see Box 9) indicate that there has been only limited implementation of existing management plans for the landscapes of Lake Kivu's islands and of GMNP, with both areas still subject to substantial degradation. Since the 2014 Conservation Plan of Lake Kivu Islands was drawn up, there has been a

lack of leadership for conducting management, and no systematic management activities have taken place. In addition, proposals in the NBSAP to establish biosphere reserves for the islands of Lake Kivu have not yet been pursued. One hindering factor is that ownership remains unresolved for many islands. In the case of GMNP, implementation of The Ten-Year Management Plan has been hindered by financial constraints and was affected by Covid-19. Restoration activities are taking place in the landscape between Gishwati and Mukura forests with NGO involvement, but these are not adequately coordinated among the stakeholders.

Monitoring of Lake Kivu's islands and the GMNP landscape has been inadequate. Various studies have inventoried the landscapes of Lake Kivu's islands and of and around GMNP (see Box 10), using traditional count methods and remote sensing. However, a lack of established research and monitoring protocols and schedules, a current focus on measuring in any detail only a few species, and a reliance on consultants to do the work who are not fully integrated into a national system for research and monitoring, have affected evidence-based decision making. In addition, the absence of an accessible information database with information on GMNP was specifically identified as a constraint for the management of the park, with this absence restricting collaboration and knowledge-sharing among stakeholders. Most current approaches to monitoring have been project-specific, limited to project lifetimes and inconsistent. This has prevented essential comparisons for a comprehensive assessment and understanding of current biodiversity status and trends.

Box 9. Approaches used in the technical study on putting in place more supportive plans for enhancing biodiversity and livelihoods

The technical study (Bizuru and Ntawuhiganayo 2025) summarized in this section of the present synthesis report used a number of approaches to assess biodiversity and tourism plans and biodiversity inventory methods, and to devise recommendations for action.

First, the study undertook a review of relevant planning documents and other literature to understand the current state of biodiversity management and tourism development plans.

Second, this desk review was combined with a stakeholder consultation workshop that brought together government, conservation NGOs, tourism operators and other parties to explore the effectiveness of existing biodiversity planning in the Lake Kivu and GMNP areas. In the consultation workshop, participants were asked to recommend measures to enhance biodiversity planning, with the 2014 Conservation Plan of Lake Kivu Islands and the 2017 to 2026 Ten-Year Management Plan for GMNP as baselines.

Third, further consultations were undertaken with local government authorities and tourism development actors, and four distinct focus group discussions were held with communities to collect information on community awareness of biodiversity plans and determine potential recommendations for improving biodiversity conservation and livelihoods. One focus group involved fishers, mainly from the Twuzuzanye fishing cooperative. Two groups involved wider residents of the islands (separate focus groups for Bugarura and Nkombo). A final group involved the farming community within Rutsiro District in Western Province of Rwanda in the landscape surrounding GMNP.

Fourth, key informant interviews were held with 16 actors to determine current biodiversity management and tourism development challenges. Tour operators, government institutions, local government authorities and development partners were among the institutions represented by the interviewees. Views on how to improve biodiversity conservation and livelihoods were also gathered through these interviews.

Finally, field visits were made to Lake Kivu's islands and GMNP and its surrounding landscape, to cross-check the information gathered through document review and consultations.

Box 10. The biodiversity value of Lake Kivu's islands and Gishwati-Mukura National Park

Lake Kivu, at the western edge of Western Province of Rwanda, contains numerous islands with high biodiversity. In a survey of seven islands, for example, the inventory included 142 plant species, 80 birds, 52 invertebrates, six mammals, six reptiles and five amphibians (Rwanda Environment Management Authority 2012). Species on the International Union for Conservation of Nature Red List include the marsh mongoose, certain water birds and various snakes.

Gishwati-Mukura National Park, within the CNR landscape of Ngororero and Rutsiro districts of Rwanda's Western Province, was designated a UNESCO Biosphere Reserve in 2020. It is a biodiversity hotspot with unique ecological values. It features eastern chimpanzees, mountain and golden monkeys, servals, genets, civets, a diversity of other small mammals, amphibians and reptiles, more than 120 species of birds, and over 250 plant species (Rwanda Environment Management Authority 2018). Many of these species are endemic to the Albertine Rift Valley, underscoring the significance of the park in global conservation efforts. The park is recorded to have a core forested area of 3,588 hectares shared between Gishwati (1,570 hectares) and Mukura (1,988 hectares) forest reserves.

Stakeholder consultations revealed a broad range of challenges and a number of opportunities for tourism development. In terms of the tourism industry, a range of challenges and a number of opportunities for the GMNP landscape were identified by the stakeholder consultation workshop and key informant interviews (see Box 9) undertaken in the current study. Communities starting community-based initiatives often lack skills related to understanding the industry, and language barriers hinder effective communication. Additional key challenges identified included limited finance options to start new tourism initiatives, and inadequate tourist facilities on trails connecting Gishwati and Mukura forests in GMNP. The same challenges were identified to apply broadly to the tourism-designated islands in Lake Kivu. These and other challenges were identified to result in poor customer experiences and hold back tourism development. On the other hand, the main identified opportunities for the GMNP landscape included enhancing visits to chimpanzee populations in Gishwati forest, initiating visits to observe the unique features and scenery of Mukura forest, hiking more broadly in GMNP, and culture-based tourism within the wider GMNP landscape.

4.3 Key recommendations

Rwanda is home to a rich but threatened diversity of flora, fauna and landscapes that provide products and services directly to Rwandans, and support a foreign tourist economy. However, significant gaps exist in the management of biodiversity and tourism that threaten the full benefits of both. Based on current findings, eight key recommendations for putting in place more supportive plans for enhancing biodiversity and livelihoods, with a specific emphasis on landscapes in the west of the country that include Lake Kivu's islands and GMNP, are identified. These recommendations are as follows:

Supportive plans for biodiversity and livelihoods R1: The development of a comprehensive management plan for Lake Kivu's islands should be undertaken using a zoning approach. A comprehensive management plan for Lake Kivu's islands should be developed, in which landscapes are categorized into zones including strictly protected conservation areas; agricultural land; tourism and recreation areas; research and education areas; and residential areas. The adoption of these zoning categories is recommended in order to support reaching the right balance between conservation and development objectives. This plan will require that ownership and existing rights for islands are clarified and described. In the plan, specific legislation regarding lake shore buffer zones will also need to be considered.

Supportive plans for biodiversity and livelihoods R2: A complete revision of the current Ten-Year Management Plan for GMNP is recommended, fully aligning tourism-related activities. Analysis of the Ten-Year Management Plan for GMNP indicated that a full review and revision of the current plan, working with stakeholders, is needed. The review should document emerging or escalating threats to the park and changes in the surrounding communities, such as socioeconomic shifts that influence the use of (and attitude to) biodiversity. As part of the revision of the plan, determining practical strategies for buffer zone management, enhancing connectivity in the broader landscape and addressing human-wildlife conflicts are crucial. Tourism-related activities also need to be fully aligned with broad management plans. Establishing effective fencing mechanisms for the safety of both the park's biodiversity and surrounding communities is needed. The plans for GMNP should embrace the surrounding agricultural landscape by considering measures to reduce insecticide use and prevent invasive species establishment, and address practical steps to promote regenerative agriculture including agroforestry. Particular attention should be given to how tree planting supports the connectivity among existing natural forest blocks including those of the GMNP in the overall regional landscape. This should be addressed under a strategic regional conservation plan that also considers long-term regional park expansions.

Supportive plans for biodiversity and livelihoods R3: GMNP should seek to achieve International Union for Conservation of Nature Green List status. To meet global conservation standards while supporting adaptive management and local engagement for sustainable biodiversity and community outcomes, the Ten-Year Management Plan for GMNP needs to align with the requirements of the UNESCO Biosphere Reserve guidelines and the Post-2020 Kunming-Montreal Biodiversity Targets. To enhance alignment, International Union for Conservation of Nature Green List status for GMNP should be sought. The Green List is analogous to the International Union for Conservation of Nature Red List focusing on threatened species, but for sites rather than flora and fauna. Entry to and continued presence of protected areas on the Green List emphasizes improvement and excellence in protected area management, with robust verification mechanisms in operation for assessing conservation outcomes. The application and its independent evaluation for obtaining Green List status for a protected area typically takes six months to two years, after which successful applications are on the Green List for five years. Applications for renewal of status should be made after four years. Further information on the listing process is given in International Union for Conservation of Nature guidelines (IUCN 2019).

Supportive plans for biodiversity and livelihoods R4: Standardized, consistently-applied methods for biodiversity monitoring should be put in place for Lake Kivu's islands and for GMNP, giving particular attention to monitoring species indicative of healthy ecosystems and threatened species. The present study indicated a clear need to improve and expand biodiversity monitoring for Lake Kivu's islands and for GMNP. Standardized, consistently-applied, methods for monitoring need to be implemented, giving particular attention to species selected to be indicative of healthy, intact ecosystems, as well as species particularly threatened by exploitation or changes in the environment. Recommended techniques to apply for monitoring include point counts and acoustic monitoring for birds; stratified sampling for plants; and transect-based searches and acoustic monitoring for amphibians and reptiles. Monitoring techniques suitable for insects are captures with sweep nets and traps; and for mammals they include drones and camera traps, combined with live trapping. Where possible, monitoring should use already designated sampling locations (as available for GMNP). Citizen science tools already available for recording observations, such as smartphone applications, should be widely applied to better involve local communities and visitors in assessment, where possible. Lessons on appropriate monitoring approaches can come from The Global Biodiversity Standard (Bartholomew et al. 2024). In the case of Lake Kivu's islands specifically, monitoring should include baseline mapping of remnant natural vegetation and the identification of invasive species.

Supportive plans for biodiversity and livelihoods R5: The capacity of the Centre of Excellence in Biodiversity and Natural Resources Management should be built for biodiversity management planning and monitoring. Improving biodiversity management planning and monitoring requires

building the capacity of institutions, through developing and recruiting skilled personnel and providing adequate financial resources. To move away from a reliance on consultants for biodiversity research and monitoring, the Centre of Excellence in Biodiversity and Natural Resources Management, based at the University of Rwanda, should be supported to become more involved in these activities. This should include the Centre being enabled through financing and staff recruitment to undertake further capacity building of colleagues in national institutions, in method design and implementation.

Supportive plans for biodiversity and livelihoods R6: Capacity development to promote responsible tourism and effective biodiversity conservation is recommended for a broad range of tourism operators. Capacity development in responsible tourism and conservation should include local guides and community-based tourism initiative owners. Training should cover language skills, tourism management, biodiversity conservation, and the basics of offering informative and sustainable experiences. Community leaders should be educated on welcoming visitors, and should be empowered to identify challenges, set objectives and make informed decisions to achieve their goals.

Supportive plans for biodiversity and livelihoods R7: Sustainable tourism facilities should be built on Lake Kivu's islands and in GMNP. Sustainable tourism facilities, including built infrastructure for hosting visitors, should be established on the tourism designated islands of Lake Kivu and along trails connecting Gishwati and Mukura forests in GMNP. Islands known for birdwatching can benefit from well-defined trails, viewing platforms, eco-friendly toilets and other facilities to enhance the visitor experience and mitigate ecological impacts.

Supportive plans for biodiversity and livelihoods R8: Investment should be directed to stakeholder-defined opportunities for tourism development in the GMNP landscape. Opportunities to develop tourism in the GMNP landscape that should be considered as priorities for support include visits to chimpanzee populations in Gishwati forest, visits to Mukura forest, and hikes in GMNP. Culture-based tourism within the broader GMNP landscape should also be supported, including in the Gishwati and Bigogwe pasturelands, which offer insights into Rwandan cattle-keeping traditions. Agriculture-based tourism can be further expanded by developing new tourist experiences such as walks in coffee and tea farms, and demonstrations of banana wine production and honey harvesting.

4.4 Indicative investment needs

The technical study summarized in the present section of this synthesis report indicated that the operationalization of enhanced biodiversity management and improved livelihoods requires attention to three component parts for the Lake Kivu islands and GMNP: (i) improving Lake Kivu's islands management; (ii) improving GMNP management; and (iii) developing tourism in key biodiversity areas. This programme addresses the major challenges to biodiversity management and tourism development. By enhancing management plans, promoting regenerative agriculture, restoring degraded areas and building local capacities, ecological resilience will be fostered, local livelihoods improved, and tourism experiences enriched, and a balanced approach will be promoted between conservation efforts and community development. Achieving the intended outcome of investment for enhancing biodiversity management and improving livelihoods will depend upon the ability to devolve the revision, implementation and monitoring of management plans to the specific landscape level in and around the CNR landscape, and the full integration of these plans into national programmes.

The technical study indicated that investments are required for a ten-year period. The costs involved are shown in Table 7, where guidance on the timing of interventions for activities is also provided. While some of the proposed interventions are continuous, others can be achieved during the first five years of the programme. The ten-year investment is recommended to enable inclusion of longer-term interventions. Year 1 represents a feasibility and inception period at a cost of approximately USD 500,000.

Table 7. Indicative investments for putting in place more supportive plans for enhancing biodiversity and livelihoods

Programme elements	Budget (USD x 1,000)	Lead	Years									
			1	2	3	4	5	6	7	8	9	10
1. Improvement of Lake Kivu's islands management												
1.1. Develop a comprehensive management plan for Lake Kivu's islands using a zoning approach, and strengthen the coordination of management.	335	MOE, RDB										
1.2. Build capacity, establish and implement a standardized framework for regular biodiversity monitoring on the islands.	900	RDB, REMA										
1.3. Assess socioeconomic impacts of activities on the islands, and provide access to essential services to island residents.	590	REMA										
1.4. Initiate and scale-up regenerative agriculture and broader restoration activities on populated and highly degraded islands.	2,800	RAB, RFA, REMA										
2. Improving GMNP management												
2.1. Conduct a review and undertake a revision of the ten-year management plan.	225	RDB										
2.2. Build capacity, establish and implement a standardized framework for regular biodiversity monitoring of GMNP.	960	RDB										
2.3. Scale-up and support regenerative agriculture and agroforestry in the GMNP landscape, based on the development of integrative landscape restoration guidelines.	1,745	RAB, RFA										
2.4. Take necessary measures to adopt the International Union for Conservation of Nature Green List approach for GMNP	45	RFA										
3. Developing tourism in key biodiversity areas												
3.1. Invest in stakeholder defined opportunities in tourism development.	1,860	RDB										
3.2. Establish sustainable tourist facilities on tourism designated islands, and along Gishwati Mukura trails.	640	RDB										
3.3. Develop the capacity of actors in tourism operations, and enhance district-level authorities' competence in tourism.	660	RDB										
Total	**10,760**											

Notes: Lead institutions for implementation of activities are shown. MOE = Ministry of Environment; RAB = Rwanda Agriculture Board; RDB = Rwanda Development Board; REMA = Rwanda Environment Management Authority; RFA = Rwanda Forestry Authority

5 Developing stronger incentives for better landscape management

5.1 Background

Rwanda's landscape restoration commitments, aligned with an overall supportive policy framework, provide an important opportunity to intervene to support the sustainable management and regeneration of its forests and other landscapes. In common with many other countries, however, the current financing for sustainable landscape management practices in Rwanda is limited (Republic of Rwanda 2022). In the case of climate financing, for example, Rwanda's Third National Communication indicated insufficient funds for climate action implementation, with limited private sector involvement (Republic of Rwanda 2018). Furthermore, according to Rwanda's Country Climate and Development Report (World Bank Group 2022), implementing Nationally Determined Contributions commitments would require new investments of USD 11 billion, of which USD 7 billion is conditional on new financing. In addition, Rwanda's 2022 update of its Green Growth and Climate Resilience Strategy (Republic of Rwanda 2022) indicated that the investment needed to finance it will reach an estimated USD 2 billion annually, of which only around USD 700 million will come from government budgets and spending.

The technical study (Ntawuhiganayo and Dobie 2025) summarized in this section, which used the approaches outlined in Box 11, was concerned with developing recommendations for incentive mechanisms for the wide-scale implementation of nature-based solutions to environmental and livelihood challenges in Rwanda. This includes incentives for better forest management, for sustainable tourism development, and for sustainable agriculture and biodiversity-supportive carbon market initiatives. The study considered current incentives applied in Rwanda and good practices in Africa more widely, and engaged in a discussion of appropriate incentives with Rwandan stakeholders. The study indicated approaches for implementing stakeholder incentives, particularly for the CNR landscape and surrounding areas in western Rwanda.

5.2 Key findings

Rwanda has demonstrated innovation in crafting approaches to implement its commitments to sustainable landscape management and nature-based solutions. A literature review of incentive mechanisms (see Box 11) applied in Rwanda indicates that over the past decade the country has demonstrated innovation in crafting financial tools and initiatives to implement its commitments to sustainable landscape management and nature-based solutions. These mechanisms include:

- The Rwanda Green Fund that has mobilized USD 274 million for 46 green projects, using financial instruments ranging from innovation grants and credit lines to traditional grants (see further information on the Green Fund in Box 12).
- The Community Adaptation Fund, piloted in 2023 in Gicumbi District with World Bank support, that empowers rural communities to tackle climate change impacts through projects such as beekeeping and renewable energy generation. In the pilot, 25 cooperatives with over two thousand members received training and financing.
- Ireme Invest, an initiative recently launched with USD 104 million of secured funding from bilateral and multilateral organizations, which encourages private sector investment in climate smart agriculture as well as investments to support sustainable cities, smart mobility, clean energy and circular economies, through credit guarantees, concessional loans and grants.

Box 11. Approaches used in the technical study on developing stronger incentives for better landscape management

The technical study (Ntawuhiganayo and Dobie 2025) summarized in the present section of this synthesis report used a number of approaches to assess incentive mechanisms and devise recommendations for action.

First, the study undertook a comprehensive literature review to identify incentive mechanisms being applied in Rwanda and in other African countries.

Second, the above desk review was combined with key informant interviews held with 22 actors to determine the current status of nature-based solution financing in Rwanda. Interviewed actors included central government, local government, development partners, NGOs and the private sector. Views on how to improve incentives for nature-based solutions to current challenges were also gathered through these interviews.

Third, a stakeholder consultation workshop that involved district forest and natural resources officers from the seven districts of Western Province, and from Burera and Musanze districts from Northern Province, was conducted. This workshop identified the difficulties faced in the implementation of nature-based solutions to current environmental challenges, the present situation for incentives, and possible future incentive developments.

Fourth and finally, focus group discussions were held with lead farmers and forest extension officers and agronomists in Western Province. These discussions involved 21 lead farmers in Nyabihu, Rubavu and Ngororero districts, and 15 forest extension officers and agronomists from Ngororero, Rutsiro and Karongi districts. The focus group discussions sought to identify the main drivers of landscape management practices and functional incentive mechanisms for wide adoption of improved practices.

- The Development Bank of Rwanda Sustainability-Linked Bond that enhances funding for environmental, social and governance (ESG) initiatives, including through providing loans to women-led businesses. Tranches of bonds, credit-enhanced through a World Bank lending operation, were issued through the Rwanda Stock Exchange in 2023 and 2024.
- The National Carbon Market Framework, which aims to strengthen Rwanda's emission reduction commitments outlined in its NDC Climate Action Plan, reinforcing the voluntary carbon market and expanding the compliance carbon market. The Rwanda Environment Management Authority serves as the carbon market regulator.
- At a community level, one of the longest and most consistent incentive mechanisms applied has been the tourism revenue sharing scheme. By the end of 2018, the scheme had shared USD 5.3 million, and 690 community development projects had been funded (Republic of Rwanda 2020a). Funds from the scheme have addressed community needs such as access to schools, health facilities and income-generating initiatives, and the scheme has positively affected community attitudes toward biodiversity conservation.

Furthermore, Rwanda continues to innovate and is currently developing a 'Green Taxonomy', which is a policy instrument that intends to provide clear, relevant and actionable guidance to support the unlocking of substantial green investments. The country has also put other supportive policy and planning instruments in place, including the Payment for Ecosystem Services (PES) Roadmap and Action Plan, and different PES strategies are being tested to overcome challenges including establishing a buyer/seller market, developing a functional institutional framework, and ensuring reliable ecosystem

service delivery. To glean insights from elsewhere, Rwanda signed a memorandum of understanding with Costa Rica in 2019, focusing on innovative financial mechanisms for environmental conservation, including PES for water.

Stakeholders identified key challenges to the financing of nature-based solutions. Interviews with actors from across Rwanda and a consultation workshop conducted with stakeholders working in the CNR landscape and surrounding area (Box 11) identified current challenges in nature-based solution financing. Key among these were that present funding is mostly project based and focused on immediate goals, leading to only transient positive change in environmental stewardship. Moreover, incentives directed to individual operators and farming communities have lacked coordination and reach, and have typically been applied sporadically, without integration into broader programmes geographically and across time. Government extension support for the local implementation of incentive schemes was also identified to be very limited. Furthermore, interviews and workshop discussions with stakeholders identified current counterproductive incentives to implementing nature-based solutions to present challenges. These included subsidies for chemical fertilizers and pesticides that have harmful effects on the environment. The harmful effects identified included soil degradation, the loss of beneficial soil micro-organisms and pollinators, and water pollution. The distribution of exotic tree species' seedlings for free by various tree planting projects is also a disincentive to the sustainable development of the tree seed and seedling subsector (see Section 2), particularly for the planting of native tree species in support of landscape restoration.

Rwanda can learn from other African nations for the design and implementation of incentive mechanisms. Literature review and stakeholder discussions (Box 11) indicated that the implementation of new incentive mechanisms for sustainable land management and biodiversity conservation in Rwanda can learn from schemes elsewhere in Africa, where these demonstrate how combining financial empowerment with environmental stewardship can lead to enhanced ecological and social outcomes. Relevant schemes include Uganda's Plan Vivo Framework, which provides tangible incentives to encourage farmers to invest in long-term tree growth, and could be applied to Rwanda's National Carbon Market Framework (see above) for generating carbon credits through native tree species planting. A second relevant scheme, successfully tested in South Africa in 2022 when the World Bank issued a USD 150 million bond to raise around USD 10 million for black rhino conservation, is the use of conservation bonds. Plans are already being developed to apply a similar scheme to Rwanda in the form of the Rwanda Wildlife Conservation Bond, which will fund conservation efforts to support flagship animal species, initially targeting Gishwati-Mukura and Nyungwe national parks. A third relevant initiative is Ghana's Forest Out-Growers Incentives scheme, which provides market guarantees and other rewards to motivate landholders to manage native trees on degraded lands, and could similarly be applied to engage Rwandan land managers.

5.3 Key recommendations

Rwanda's landscape restoration commitments provide an important opportunity to support the sustainable management and regeneration of its forests and other landscapes, but current incentives for sustainable landscape management practices are inadequate. Based on current findings, seven key recommendations for developing stronger incentives for better landscape management are identified. These recommendations are as follows:

Stronger incentives for landscape management R1: Key government agencies should be supported to implement the National Carbon Market Framework. Support should be given to the Rwanda Environment Management Authority, the Rwanda Development Board and the Rwanda Forestry Authority to implement the National Carbon Market Framework (see Section 5.2), through enabling the development of a comprehensive policy, legal and implementation framework, and by the

Box 12. The Rwanda Green Fund and the financing of the revised Green Growth and Climate Resilience Strategy

The Rwanda Green Fund, established by the Government of Rwanda in 2012, drives the financing of Rwanda's revised Green Growth and Climate Resilience Strategy (Republic of Rwanda 2022) in alignment with Rwanda's Vision 2050 for development (Republic of Rwanda 2020b). As such, the Green Fund seeks to drive partnerships for leveraging additional finance from climate funds, the private sector, enhanced domestic revenues and other financing mechanisms.

The international climate funding currently flowing into Rwanda is not sufficient to finance the revised Green Growth and Climate Resilience Strategy in full. The Government of Rwanda has therefore recognized that it is crucial to leverage private capital for low carbon and adaptation activities. In support of the implementation of the revised Green Growth and Climate Resilience Strategy will be increasing the percentage of disbursements to private sector-implemented projects. Other funding sources muted for possible earmarking to the Green Fund by the government include tourism levies, debt-for-nature swaps and environmental taxes.

Success for the Green Fund will be characterized by a diversified funding pool enabling Green Growth and Climate Resilience Strategy implementation, with a pipeline of well-developed projects, effective funder engagement, and productive partnerships with investors. Within the Green Fund, a designated window for biodiversity conservation – the Biodiversity Conservation Fund – has been proposed, which could link with the Global Biodiversity Framework Fund to access global biodiversity finance.

enhancement of capacity among technical experts to manage the market. The Rwanda Development Board, through its Skills Development Department, could facilitate this undertaking by the sourcing of relevant experts and the linking of Rwandan professionals who have skills development needs to qualified trainers and educational programmes.

Stronger incentives for landscape management R2: Government agencies should be supported to further implement the Community Adaptation Fund to enhance ecosystem service payments. Support should be given to government agencies, including the Rwanda Environment Management Authority, to further implement the Community Adaptation Fund (see Section 5.2) to enhance payments for ecosystem services in the CNR landscape, based on community-led activities. Incentives should specifically support the planting by farmers, foresters, community NGOs and other land managers of native tree species in support of climate mitigation targets. Particular attention should also be given to leveraging payments for maintaining already planted native trees established through now completed projects. Incentives for planting (and maintaining already planted) native trees should be targeted to locations where the impact is likely to be highest in support of regional landscape connectivity. The effective implementation of payments requires a clearer institutional framework reaching to field practitioner level, and a better-defined market system in Rwanda, specifying criteria for buyers and sellers of services. Working with mining companies, hydropower generators, water service providers, tea companies and coffee washing stations may present particular opportunities and provide an important bridge between field practitioners and the Community Adaptation Fund.

Stronger incentives for landscape management R3: The tourism revenue sharing scheme should be improved to indicate how communities will actively contribute to biodiversity conservation. Although the tourism revenue sharing scheme of Rwanda has successfully improved the livelihoods and behaviours of communities in locations where it has been applied (see Section 5.2), improvements in the scheme are possible by working with communities in the selection of the projects funded by the scheme to best promote biodiversity conservation outcomes. The terms of the scheme should also be

adjusted to indicate clearly how communities will actively contribute to biodiversity conservation. Lessons from how the scheme reaches local communities should be integrated into the implementation of other incentive approaches.

Stronger incentives for landscape management R4: Movement away from uncoordinated short-term projects to long-term integrated programmes of interventions is required. To address the challenges identified in the present study for nature-based solution financing (see Section 5.2), a movement away from uncoordinated short-term projects to long-term integrated programmes of interventions over broader geographic areas and longer time scales is required. Support should therefore be targeted to strengthening networks of communities that are interested in improving landscape management, but for which financial barriers to participate in nature-based solutions are high. Revolving funds and microfinance schemes should support farmer cooperatives, that spread information and train not only their members, but those of other cooperatives, in nature-based solutions. Incentives should build social capital, strengthen trust and enhance community-driven monitoring networks. Specific support to drive the desired change on the ground with farmers, private forest owners, local businesses and wider communities requires that incentive mechanisms are made an integral component of the broad extension system. This requires financing and capacity building of public extension agents, extending to the sector and cell levels within districts (cells are subdivisions of sectors in Rwanda).

Stronger incentives for landscape management R5: In support of wood value chain development and regenerative agriculture, implementing blended finance options is recommended. In support of sustainable and profitable businesses based on the wood value chain and regenerative agriculture, blended finance options combining grants and loans are recommended to provide access to capital. The implementation of this approach will require collaboration between commercial banks and microfinance institutions. To derisk and encourage this engagement, Rwanda's Business Development Fund, established by the Government of Rwanda in 2011 with the Development Bank of Rwanda to support small and medium enterprises in accessing finance and advisory services, could take a lead role in negotiating arrangements. For the wood value chain, finance could especially support investments in timber dryers, while for regenerative agriculture the focus could be on establishing and managing food tree orchards, and producing and using 'green' fertilizers and eco-friendly pesticides. In addition, incentives for the planting specifically of native tree species that can be integrated into the wood value chain could be introduced through support to the tree seed and seedling subsector that is centred on native trees, and educating growers, sawmills and woodworkers on management, processing and woodworking of these species (see Section 2).

Stronger incentives for landscape management R6: Support should be given to the establishment of the Sustainable Value Chain Fund in Rwanda. Support to sustainable agricultural development in Rwanda should involve the establishment of the Sustainable Value Chain Fund. The establishment of this fund, to concentrate on small-scale investments in innovative projects in order to embed sustainability in key value chains, was recommended by the Rwanda Sustainable Finance Roadmap developed in 2022 (Kigali International Financial Centre 2022), but to date establishment has yet to take place. The fund could support the transformation of livelihoods of CNR communities by boosting agribusiness in the key value chains of sustainable dairy, poultry, pork, aquaculture and fertilizer production. The Kigali International Finance Centre, in collaboration with the Ministry of Trade and Commerce, could lead fund mobilization efforts if supported by initial seed capital for fund setup. The fund could draw on international investments, with support from development banks and partners.

Stronger incentives for landscape management R7: Iconic species in the CNR landscape should be the focus of further testing of wildlife conservation bonds. It has already been proposed that wildlife conservation bonds similar to those used for black rhino conservation in South Africa be applied to Rwanda, and the development of pilot schemes to fund such conservation efforts to support flagship animal species in Gishwati-Mukura and Nyungwe national parks is underway (see Section 5.2). Lessons from these pilot schemes should be applied more broadly to the CNR landscape and Rwanda

as a whole. This work should be led by the Rwanda Development Board. The further testing of tailored approaches will require the establishment of verification mechanisms and transparent fund management procedures.

5.4 Indicative initial investment needs

The technical study summarized in the present section of this synthesis report indicated that the operationalization of stronger incentives for better landscape management requires attention to three component parts: (i) implementing existing national frameworks and funds; (ii) establishing new funds; and (iii) adjusting and testing proven community-based approaches. Whereas the other technical studies making up the present synthesis report have included field-level implementation costs within given indicative investment needs, in the current case only activities to put frameworks in place to manage existing and new mechanisms, and to further test incentive schemes, have been included. This is why the timescale of the investments is shorter than for the other investments proposed in the current report, and why the initial scale of investment is smaller.

An initial three-year strategic roadmap for investments is proposed (Table 8). This work could be supported through a single successful dedicated grant application, or by integrating activities across a number of successful grant proposals. Year 1 involves evaluating and planning incentive schemes through feasibility studies, legislative reviews and stakeholder negotiations; Year 2 adapts and begins to pilot some of these plans, including by capacity building; and Year 3 finalizes preparations and seeks funds to implement plans sustainably, which will involve integrating all activities into the broader PROGREEN initiative (see Section 1). This structured approach aims to systematically address the financing challenges in landscape and biodiversity conservation, while fostering sustainable economic growth through nature-based solutions and community engagement. Achieving the ultimate intended outcome of investments for better landscape management in Rwanda will depend upon larger investments enabled by the success of the initial three-year pilot stage.

Table 8. Indicative roadmap for the initial design of stronger incentives for better landscape management

Programme elements (budgets by year in USD)	Year 1	Year 2	Year 3	Budget total	Responsible
1. Implementing existing national frameworks and funds					
1.1. Implement the National Carbon Market Framework.	130,500	87,000	0	217,500	REMA, RDB, RFA
1.2. Plan to implement the Community Adaptation Fund.	38,250	25,500	0	63,750	REMA
1.3. Develop a platform to integrate incentives for long-term, coordinated programmes of intervention.	51,000	35,700	15,300	102,000	REMA
2. Establishing new funds					
2.1. Design a functional structure for implementing the Sustainable Value Chain Fund.	15,600	10,400	0	26,000	KIFC, RAB
3. Adjusting and testing proven community-based approaches					
3.1. Design improvements to the tourism revenue sharing scheme.	22,200	14,800	0	37,000	RDB
3.2. Make plans to implement blended finance options in support of wood value chain development and regenerative agriculture.	125,250	72,325	11,175	159,250	BDF, BRD
3.3. Make preparations to further test wildlife conservation bonds in the CNR landscape.	69,000	34,500	11,500	115,000	RDB, BRD
Totals	**451,800**	**280,225**	**37,975**	**770,000**	

Note: The investment plan shown only covers the initial stages of the setting up, managing and limited further testing of incentive schemes for better landscape management. It does not cover payments administered though the schemes, or their long-term management. This explains the shorter timescale of the current investments compared to other investments laid out in the present synthesis report. Responsibilities for implementation of activities are shown. BDF = Business Development Fund; BRD = Development Bank of Rwanda; KIFC = Kigali International Financial Centre; RAB = Rwanda Agriculture and Animal Resources Development Board; RDB = Rwanda Development Board; REMA = Rwanda Environment Management Authority; RFA = Rwanda Forestry Authority

6 Final summary

The key recommendations summarized in Sections 2 to 5 of the present synthesis report, founded on four separate but inter-related technical studies, guide investment opportunities for sustainable landscape management and enhanced livelihoods in the CNR region of Rwanda. The recommendations given in each of these sections for sustainable landscape management action, totalling 24 across the four sections (Table 9), are the core of the present report.

A model for how outcomes from these sets of recommendations fit together in support of each other in a cross-sectoral context is provided in Figure 2. In this model, each of the outcomes corresponding to Sections 2 to 4 of the current synthesis report – an efficient tree seed and seedling delivery subsector, well-managed forests, and well-managed biodiversity and tourism – are underpinned by the stronger incentive mechanisms for supporting trees, forests, biodiversity and sustainable tourism that are the outcome of Section 5.

Considering recommendations from the technical studies together and in the framework of this model, it is particularly important to consider how incentive mechanisms that underpin desired outcomes for the tree seed and seedling subsector, for forest management, and for biodiversity and tourism, may lead to trade-offs or be mutually reinforcing. Considering the overall picture, the incentives applied to improve landscape management and support livelihoods in the CNR region should place emphasis on broad community and local business participation in managing a wide range of native plant and animal species and habitats, through both species-level and ecosystem approaches. A diverse set of species should be targeted for biodiversity monitoring and management, and a broad range of native trees should be included in planting and value chain development.

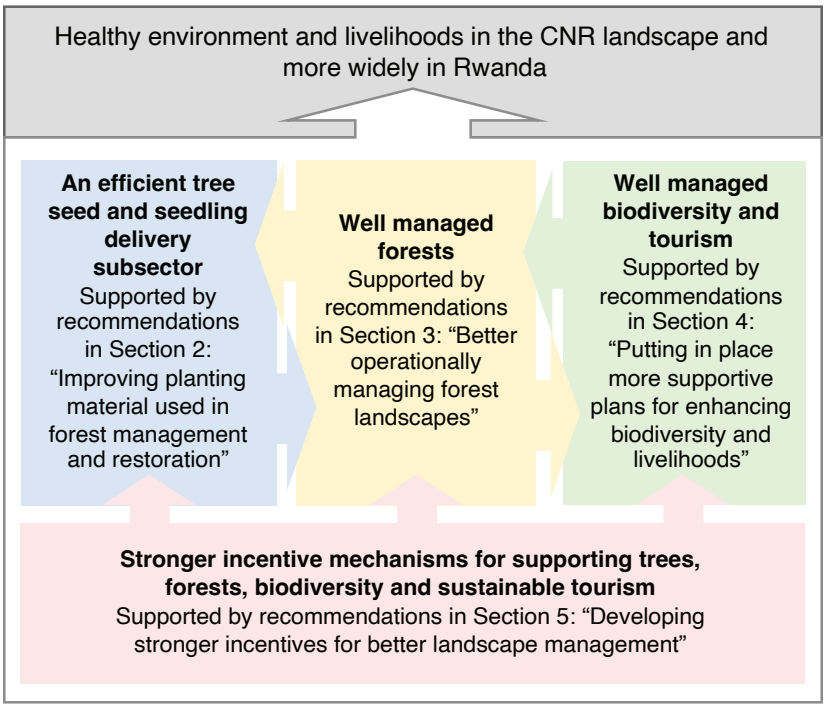

Figure 2. Model of the relationship between the purpose and elements of the current study

An example of the above integrated approach is in the embracing of biodiverse tree planting for landscape restoration, including for agroforestry, plantation establishment and enrichment plantings, where cross-sectoral attention is required to tree planting material sources. Here, tree seed and seedling sub-sectoral assessment provides recommendations on the needed seed sources (Section 2 of the present report), the protection of which sources in forest landscapes is an integral component of improved forest management guidance and practice (Section 3), and of better biodiversity management (Section 4). The harvesting and further planting for multiplication of these seed sources is an opportunity for the development of small and medium enterprises that support local livelihoods, and the revenues obtained from seed sales incentivize sustainable landscape management (Section 5). Here, attention is needed to fully integrate the pending revision of the Government of Rwanda's National Tree Reproductive Materials Strategy – and the actions plans that are derived from it – with district forest management plans and specific landscape conservation plans that also require revision.

Going forward, another example where an integrated approach is necessary is in the need to develop a strategic regional conservation plan to connect existing forested parks and (other) remnant forests in the CNR area (Sections 3 and 4 of the current report) through regenerative agriculture (including agroforestry, possibly involving shade coffee: see Reckmann et al. 2025) in converted landscapes and assisted natural regeneration and enrichment planting in unconverted landscapes. Locations for planting and regeneration action should be selected through multi-indicator prioritization approaches such as applied in the present study (Section 2 of the current report, adding further social dimensions), but that also take landscape connectivity contributions of implementation into account. Although the current spatial analysis of priority areas for action did not consider connectivity as a factor in intervention-location prioritization, it would be possible to integrate such considerations into spatial modelling by measures such as seeking to minimize 'travel times' through intervening landscapes (between forest areas needing connection) by focusing on identifying intermediate locations capable of supporting similar vegetation types. Implementation of landscape connectivity should involve spatially-directed incentives (Section 5) to prioritized locations to support the planting and regeneration of tree species prioritized in the present study (Section 2), but additionally considering the habitat contributions of the trees' planting and regeneration (Section 4), which will likely favour the use of native species. The development of the strategic regional conservation plan should involve the bringing together of the various stakeholders consulted across all elements of the present study.

A common thread across the current assessment is the need for spatially-explicit decision-support tools for improved landscape management, covering knowledge on how and where to plant a wider range of tree species (Section 2); on how to target and undertake forest management (Section 3); on how to monitor and manage biodiversity (Section 4); and on context-specific appropriate financial and other incentives to support sustainable management (Section 5). The tools need to be appropriately targeted to different stakeholder groups, especially at the district level and below.

To support cohesive progress to sustainable landscape management and enhanced livelihoods, a broad emphasis on human skills development is needed at technical and strategic levels. This skills development should embrace a wide range of stakeholders, including tree seed producers, tree nursery operators, forest managers, and the designers and implementers of biodiversity monitoring schemes. It should also include tourism operators, the managers of carbon markets, business plan developers, and extension agents supporting regenerative agricultural methods such as agroforestry. In support of this, a cross-sectoral training needs assessment should be undertaken to develop an integrated skill-capacity building programme that is then properly financed for skills development. Coordinated training could involve the establishment of a multistakeholder engagement platform (or platforms) for co-learning. This could be done in combination with the ongoing update of Rwanda's NBSAP (last revised in 2016), which involves the development of capacity building strategies for the implementation of the plan.

Table 9. Summarized list of recommendations presented in Sections 2 to 5 of the present report

Target of recommendation	Recommendation
Improving tree planting material (Section 2)	R1: A multi-indicator spatially-based approach for identifying priority locations for landscape restoration should be applied to Rwanda in combination with a community-based assessment of restoration priorities.
	R2: The preliminary 'long list' of priority tree species identified for planting in the current study should be further prioritized with local communities, and suitable seed sources determined or established for final species choices.
	R3: Native tree species should receive greater promotion attention for planting in the CNR landscape to better reach landscape restoration goals.
	R4: The Government of Rwanda's ongoing revisions of the National Tree Reproductive Materials Strategy and associated action plans should fully implement commercial stakeholder involvement in tree seed and seedling delivery.
	R5: The revised National Tree Reproductive Materials Strategy should be supported by guidelines for the use of tree seed sources.
Better managing forest landscapes (Section 3)	R1: Targeted tree planting interventions should take into account the distribution of tree cover and land cover changes across the districts of Western Province in Rwanda.
	R2: A greater focus on native tree species is needed in forest plantation establishment.
	R3: The selection process for choosing the contractors to plant and establish forest plantations should be improved.
	R4: The revision and implementation of district forest management plans in the nine assessed districts of Western and Northern Provinces in Rwanda should focus support on financing and capacity building at the district level.
Supportive plans for biodiversity and livelihoods (Section 4)	R1: The development of a comprehensive management plan for Lake Kivu's islands should be undertaken using a zoning approach.
	R2: A complete revision of the current Ten-Year Management Plan for GMNP is recommended, fully aligning tourism-related activities.
	R3: GMNP should seek to achieve International Union for Conservation of Nature Green List status.
	R4: Standardized, consistently-applied methods for biodiversity monitoring should be put in place for Lake Kivu's islands and GMNP, giving particular attention to monitoring species indicative of healthy ecosystems and threatened species.
	R5: The capacity of the Centre of Excellence in Biodiversity and Natural Resources Management should be built for biodiversity management planning and monitoring.
	R6: Capacity development to promote responsible tourism and effective biodiversity conservation is recommended for a broad range of tourism operators.
	R7: Sustainable tourism facilities should be built on Lake Kivu's islands and in GMNP.
	R8: Investment should be directed to stakeholder-defined opportunities for tourism development in the GMNP landscape.

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Table 9. Continued

Target of recommendation	Recommendation
Stronger incentives for landscape management (Section 5)	R1: Key government agencies should be supported to implement the National Carbon Market Framework.
	R2: Government agencies should be supported to further implement the Community Adaptation Fund to enhance ecosystem service payments.
	R3: The tourism revenue sharing scheme should be improved to indicate how communities will actively contribute to biodiversity conservation.
	R4: Movement away from uncoordinated short-term projects to long-term integrated programmes of interventions is required.
	R5: In support of wood value chain development and regenerative agriculture, implementing blended finance options are recommended.
	R6: Support should be given to the establishment of the Sustainable Value Chain Fund in Rwanda.
	R7: Iconic species in the CNR landscape should be the focus of further testing of wildlife conservation bonds.

Note: For details, please refer to individual sections. GMNP = Gishwati-Mukura National Park

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Annex

Annex 1. List of technical studies

Sections 2 to 5 of the present synthesis report summarize information from four separate, detailed technical studies (referred to as "tasks", numbered from one to four) commissioned by the World Bank, and available from the World Bank and CIFOR-ICRAF. This annex lists these separate reports, and their full citations are given in the References section of the present report.

Section 2. Improving planting material used in forest management and restoration

Task 1. Tree improvement

Synthesis and three technical sub-tasks (parts). The task synthesis gives a summary of the findings and recommendations of the three sub-tasks.

- Proposed Tree Improvement Strategy for Rwanda. Synthesis of Task 1 on tree improvement for the Congo-Nile Ridge landscape in Rwanda. Lars Graudal, Fabio Pedercini, Roeland Kindt, Jens-Peter Barnekow Lillesø, Ramni Jamnadass. May 2024, final version March 2025.
- Priority landscapes for tree-based restoration in Rwanda: A spatially explicit approach to prioritize areas for intervention. Part 1 of Task 1 on tree improvement for the Congo-Nile Ridge landscape in Rwanda. Fabio Pedercini, Roeland Kindt, Lars Graudal. August 2023, updated May 2024, final version March 2025.
- Selection of a master list of priority tree species, including some potential seed sources for tree improvement in Rwanda. Part 2 of Task 1 on tree improvement for the Congo-Nile Ridge landscape in Rwanda. Fabio Pedercini, Roeland Kindt, Lars Graudal. August 2023, updated May 2024, final version March 2025.
- Tree seed sector analysis: Seed-seedling demand, and certification of seed sources. Part 3 of Task 1 on tree improvement for the Congo-Nile Ridge landscape in Rwanda. Jens-Peter Barnekow Lillesø, Erick Ngethe, Fabio Pedercini. September 2023, updated May 2024, final version March 2025.

Section 3. Better operationally managing forest landscapes

Task 2. Forest management planning

Forest management status of public forests in seven districts in Western Province and two districts in Northern Province of Rwanda. Jean Nduwamungu, Athanase Mukuralinda, Fabio Pedercini. November 2023, updated May 2024, final version March 2025.

Section 4. Putting in place more supportive plans for enhancing biodiversity and livelihoods

Task 3. Development planning in high-priority areas

Development planning in high-priority areas for biodiversity conservation and tourism development. Elias Bizuru, Elisee Bahati Ntawuhiganayo. November 2023 version covering first round consultations, December 2023 including second round of consultations, updated May 2024, final version March 2025.

Supplements to Task 3 (not for circulation):

- Development planning in high-priority areas: Stakeholder consultations – first round. Elias Bizuru, Elisee Bahati Ntawuhiganayo. October 2023.
- Development planning in high-priority areas: Stakeholder consultations – second round. Elias Bizuru, Elisée Bahati Ntawuhiganayo, Jean de Dieu Nsabimana. October 2023.

Section 5. Developing stronger incentives for better landscape management

Task 4. Incentives and financing mechanisms

Incentives and financing mechanisms for improved landscape management, biodiversity conservation, nature-based solutions, and livelihood development. Elisée Bahati Ntawuhiganayo, Philip Dobie. January 2024, updated May 2024, final version March 2025.

DOI: 10.17528/cifor-icraf/009376

CIFOR-ICRAF Working Papers **contain preliminary or advanced research results on important tropical forest issues that need to be published in a timely manner to inform and promote discussion. This content has been internally reviewed but has not undergone external peer review.**

Rwanda's landscape restoration commitments, aligned with an overall supportive national policy framework, provide an important opportunity to intervene to better manage the nation's forests and other lands. As well as supporting the environment, this alignment provides significant opportunities to benefit Rwanda's people. At present, however, landscape management as practiced in Rwanda is often unsustainable, damaging the environment and negatively affecting local communities. The purpose of the present study was to guide investment opportunities for sustainable landscape management and enhanced livelihoods in the Congo-Nile Ridge landscape and surrounding region of western Rwanda. The current report is based on a number of technical studies undertaken in 2023 and 2024 in support of this objective. In total, 24 key recommendations that support healthy environments and livelihoods in Rwanda are provided.

The first five recommendations are in support of an efficient tree seed and seedling delivery sub-sector for improving planting material used in forest management and restoration. The next four recommendations are in support of well-managed public forests through the better operationalization of the management of forest landscapes, especially for the Congo-Nile Ridge landscape and its surroundings. The next eight recommendations are in support of well-managed biodiversity and sustainable tourism, through the putting in place of more supportive plans for enhancing biodiversity and livelihoods, especially for the islands of Lake Kivu and for Gishwati-Mukura National Park in western Rwanda, which were focus areas of attention in the current study. The final set of seven recommendations relate to developing stronger incentive mechanisms for supporting trees, forests, biodiversity, sustainable tourism and improved landscape management overall.

Considering landscape management broadly in the Congo-Nile Ridge region, the incentives applied to improve management and support livelihoods should place emphasis on wide community and local business participation in managing a wide range of native plant and animal species and habitats, through both species-level and ecosystem approaches. A diverse set of native species should be targeted for biodiversity monitoring and management, and a broad range of native trees should be included in planting and value chain development programmes.

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