



Republic of Rwanda



Food and Agriculture Organization
of the United Nations

**COSTING OF SUSTAINABLE FORESTRY,
AGROFORESTRY AND BIOMASS ENERGY IN
RWANDA**

FINAL REPORT

PREPARED BY

Ajewole Opeyemi Isaac, Makundi Willy and Nduwamungu Jean

for

The UN Food and Agriculture Organization

Rwanda Country Office

Kigali

May 2016

EXECUTIVE SUMMARY

The Forestry sector plays key roles in supporting the livelihood of all Rwandans by providing most of the energy consumed by the bulk population, controlling soil erosion and protecting water catchments and supplying other goods and ecological services. Hence, the present and future extent of forest coverage in Rwanda is central to sustainable development and climate change considerations.

Currently, about 87% of the population and 70% of the country's land area are devoted to subsistence agriculture, while about 16% of the land area is devoted to fuel wood and timber production to meet the country's energy needs. With the population's high dependence on the country's limited land resources, degradation, deforestation, soil erosion and loss of biodiversity pose potential threats to the country's rural population. Furthermore, with an estimated 86% of Rwanda's energy provided by biomass, forest resources are under increasing pressure from a growing population and shrinking land availability.

The forestry sector continues to grapple with the challenges of loss of natural forest to agricultural land use to primarily satisfy the needs of a growing population, overcutting of small woodlots, low productivity of more than 50% of forest plantations which are at the end of their production life, low species diversity, and limited and poor genetic material. Consequently, sustainable forest development remains at the heart of Rwanda's development strategies for conservation, transformation of agriculture, energy and the rural sector.

In response to these challenges inter alia, the Government of Rwanda (GoR) came up with the Green Growth Climate Resilient Strategy (GGCRS) which encompasses several sectors and 14 programmes of actions including Sustainable Forestry, Agroforestry and Biomass Energy (SFABE). This study commissioned by Food and Agriculture Organization Rwanda (FAORW), in response to the request for technical assistance by GoR as a contribution to the costing of the immediate and medium term investment needs for the implementation of the Sustainable Forestry, Agroforestry and Biomass Energy (SFABE) program of action in the Green Growth

Climate Resilience Strategy (GGCRS) for the country. The time frame for costing this action plan is envisaged to cover 2016 to 2030.

Rwanda's forest cover was estimated to be around 686,636 ha in 2014, representing 28.8% of the total country land area. This includes about 258,067 ha of natural forest cover (37.6%) and 428,569 (62.4%) of forest plantations (MINIRENA, 2014). The forest plantation is dominated by Eucalyptus where it covers 384,000 ha (55%) among other species.

Forestry administration is currently domiciled in the Rwanda Natural Resources Authority (RNRA) in the Ministry of Natural Resources (MINIRENA). The Rwandan forestry sector is managed and governed by relevant laws and policies enacted and promulgated to enhance sustainable development of the sector. The first National Forestry policy was launched in 2004 and reviewed in 2010 for improvement and to accommodate EDPRS I (2008-2012) targets related to the forestry sector. The EDPRS II provides that the forestry sector will require interventions that include designing and implementing a reforestation strategy with diverse species, as well as inventorying and mapping national forest resources to provide the basis for a 10-year national forestry plan.

The Strategic Plan for the Forestry Sector (SPFS) produced in 2010 was to translate the 2010 Forest Policy objectives into concrete outcomes while the Rwanda Supply Master Plan for Firewood and Charcoal was produced in 2013 to serve as a decision making tool for planning and monitoring districts forest resources management for a sustainable supply of woodfuels in Rwanda. The Forest Law was enacted and promulgated in 2013 to guide the management and utilization of forests in Rwanda while the Forest Landscape Restoration Opportunity Assessment for Rwanda produced in 2014 had the objective of scaling up pilot projects that will support the Government of Rwanda to achieve border to border forest and landscape restoration that contributes to multiple sustainable development objectives.

Since sustainable forest development is a progressive process, this study considered the investment requirements to move from the current level to sub-optimum (medium level)

sustainability and then to the optimum level of sustainability. The three scenarios costed for sustainable forestry, agroforestry and biomass energy are:

- The Business as Usual (BAU) Scenario which considered those activities in the Strategic Plan for the Forest Sector (SPFS) that are being currently implemented for forestry, agroforestry and biomass energy development. The business as usual scenario is basically made up of existing activities in the sector without any additional measures towards sustainability. While these activities on their own are significant efforts for forestry development, they are not enough to secure the forest on a sustainable basis while providing a stream of forest benefits (goods and services) to the present as well as future generations of Rwanda.
- The sub-optimum or medium scenario considers activities within and outside the Strategic Plan for the Forestry Sector (SPFS) that are important for the achievement of a level of sustainability of forestry, agroforestry and biomass energy development but that are not yet implemented.
- The optimum or high level sustainability scenario which is made up of germane and salient requisite ingredients for sustainable forestry, agroforestry and biomass energy development in the country which were not succinctly captured in the Strategic Plan for the Forest Sector.

The total investment cost for the BAU scenario is USD229.6 million. An additional USD 55.6 million will be needed to get to sub-optimum or medium level sustainability scenario while another USD 4.9 million worth of investment will be required to get to high level of sustainability scenario. In essence, USD285.2 million will be needed to achieve medium level sustainable scenario while a total sum of USD290.1 million will be required to achieve high level of sustainability scenario.

Potential financing mechanisms for SFABE include: the Rwanda Environment and Climate Fund (FONERWA), Official Development Assistance (ODA), Global Environment Facility (GEF), the Adaptation Fund, the Green Climate Fund, Carbon market funds such as the CDM, REDD+, and voluntary market, pioneer private impact funds and also layered funds, while the potential sources of funds for the development of SFABE include Green Climate Fund, Altheda Climate

Fund, Moringa Fund, Terra Bella Fund, Permian Global Fund, Climate Investment Funds (CTF), Sustainable Energy Fund for Africa (CEFA), Degradation Neutrality (LDN) Fund, Special Climate Change Fund (SCCF), Adaptation Fund (AF), Global Climate Change Alliance (GCCA), Adaptation for Smallholder Agriculture Programme (ASAP), Pilot Programme for Climate and Resilience (PPCR), and the Least Developed Country Fund (LDCF).

Major implementation partners for SFABE include: Rwanda Natural Resources Authority (RNRA), the Ministry of Natural Resources (MINIRENA), the Ministry of Agriculture and Animal Resources (MINAGRI), the Urban Economics Department in the City of Kigali Province, the districts that house the six secondary cities in Rwanda, the Rwanda Energy Group (REG), the Ministry of Infrastructure (MININFRA), Ministry of Local Government (MINALOC), Ministry of Finance and Economic Planning (MINICOFIN), Ministry of Defense (MINADEF) the Rwanda Environment Management Authority (REMA) and private sector.

The Department of Forestry and Nature Conservation (DFNC) will have to continuously assess the progress of various monitoring indicators for SFABE projects, particularly at the activity level by gathering gradually the needed information on the evolution of SFABE activities under its strategic plan. The information which should be analyzed in order for DFNC to measure the achievements/impact in relation to the stated objectives, should be disseminated to various stakeholders reviewing SFABE development plans. The DFNC should coordinate all the activities within the institution to ensure that various departments share information, experiences and above all work towards a common vision. Effective M&E plan for SFABE development in Rwanda will have to make provision for: M&E guideline for SFABE, M&E unit/office with appropriate M&E facilities such as vehicle/motor cycle at every district, M&E officer at every district, internal M&E report submitted at the third quarter of every year and external M&E done every five years.

In order to implement effectively the sustainable forestry, agroforestry and biomass energy program, the study recommends:

- Production and use of management plans for all the public forest estates;

- Put in place agroforestry strategy which highlights the coordination between Ministry of Agriculture , Ministry of Natural Resources and Ministry of Local Government
- Establishment of forestry research institute in the country in order to promote research in SFABE;
- Encouragement of the use of value addition technologies such as mobile sawmills for a more efficient and rewarding wood conversion and introduce other wood processing plants;
- Promotion of modern efficient charcoal production plants to produce higher quality charcoal;
- Promotion and dissemination of improved cook stoves for both charcoal, firewood and pellets to reduce energy loss during cooking and heating;
- Urban forestry development in Kigali and the six secondary urban areas in the country for beautification and amenity purposes.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
TABLE OF CONTENTS.....	6
ACRONYMS AND ABBREVIATIONS	viii
1 INTRODUCTION.....	ix
1.1 Background	1
1.2 Overview of the forestry sector in Rwanda.....	3
1.3 Linkages of the forestry sector with other sectors.....	6
2 METHODOLOGY	9
3 SFABE: DEVELOPMENT OF SCENARIOS, PATHWAYS AND OUTPUTS	11
3.1 Scenario 1: Business-as-Usual (BAU): 2016-2030	11
3.2 Scenario 2: Medium Level of Sustainable Forestry, Agroforestry and Biomass Energy Development	12
3.3 Scenario 3: High Level of Sustainable Forestry, Agroforestry and Biomass Energy Development	15
4 COSTING OF INVESTMENTS IN FORESTRY, AGROFORESTRY AND BIOMASS ENERGY	21
4.1 Costing Methodology.....	21
4.2 Investments Costs under the Business as Usual Scenario.....	22
4.3 Investments Costs under the Medium Level of Sustainable Forestry, Agroforestry and Biomass Energy Development Scenario	24
4.4 Investments Costs under the High Level of Sustainable Forestry, Agroforestry and Biomass Energy Development Scenario	26
4.5 Progressive Expenditure Framework for SFABE	27
5 FINANCING MECHANISMS AND SOURCES OF FUNDS FOR IMPLEMENTING SFABE PRORAMME.....	28
5.1 Financing Mechanisms	28
5.2 Potential Sources of Funding	29
6 PROGRAMME IMPLEMENTATION PARTNERS	32

7	MONITORING AND EVALUATION PLAN FOR SUSTAINABLE FORESTRY, AGROFORESTRY AND BIOMASS ENERGY IN RWANDA	33
7.1	Introduction	33
7.2	Requisite Factors to Consider for Development of M&E Plan	34
7.3	Monitoring and Evaluation of Forestry, Agroforestry and Biomass Energy Projects in Rwanda	36
8	CONCLUSION AND RECOMMENDATIONS	38
9	BIBLIOGRAPHY	39
10	ANNEXES	50
10.1	Scenario 1: Business-as-Usual (2016-2030)	50
10.2	Scenario 2: Medium Level of Sustainable Forestry, Agroforestry and Biomass Energy Development (2016-2030)	51
10.3	Scenario 3: High Level of Sustainable Forestry, Agroforestry and Biomass Energy Development (2016-2030)	52

UNIVERSITY OF IBADAN LIBRARY

ACRONYMS AND ABBREVIATIONS

AF: Adaptation Fund

AfDB: African Development Bank

ASAP: Adaptation for Smallholder Agriculture Programme

BAU: Business As Usual

CDM: Clean Development Mechanism

CEFA: Sustainable Energy Fund for Africa

CIF: Climate Investment Funds

CSR: Corporate Social Responsibility

DFNC: Department of Forestry and Nature Conservation

EDPRS: Economic Development and Poverty Reduction Strategy

EU: European Union

FAO: Food and Agriculture Organization

FAORW: Food and Agriculture Organization Rwanda

FIP: Forest Investment Program

FONERWA: Rwanda National Fund for the Environment

GCCA: Global Climate Change Alliance

GEF: Global Environment Facility,

GGCRS: Green Growth Climate Resilient Strategy

GoR: Government of Rwanda

ICK: Improved Charcoal Kiln

ICS: Improved Cook Stoves

IUCN: International Union for Conservation of Nature

LDCF: Least Developed Country Fund

LDN: Land Degradation Neutrality Fund

MINAGRI: Ministry of Agriculture and Animal Resources

MINALOC: Ministry of Local Government

MINECOFIN: Ministry of Economic Planning and Finances

MINIFOM: Ministry of Forestry and Mines

MININFRA: Ministry of Infrastructure
MINIRENA: Ministry of Natural Resources
NAFA: National Forestry Authority,
ODA: Official Development Assistance
PES: Payment for Ecosystem Services
PAREF: Support Program to the Development of the Forestry Sector in Rwanda
PGREF: Rwanda Sustainable Woodland Management and Natural Forest Restoration Project
PPCR: Pilot Program for Climate and Resilience
REDD: Reducing Emissions from Deforestation and Forest Degradation
REG: Rwanda Energy Group
REMA: Rwanda Environment Management Authority
RNRA: Rwanda Natural Resources Authority
ROR: Republic of Rwanda
SCCF: Special Climate Change Fund
SDG: Sustainable Development Goals
SFABE: Sustainable Forestry, Agroforestry and Biomass Energy
SFM: Sustainable Forest Management
SPFS: Strategic Plan for the Forestry Sector
SREP: Scaling up Renewable Energy Programme
TEV: Total Economic Valuation
USD: United State Dollar
WRI: World Resources Institute

UNIVERSITY OF IBADAN LIBRARY

INTRODUCTION

1.1 Background

The Government of Rwanda (GoR) has taken a leading role in Africa in promoting the transition towards “inclusive green growth” (UNDP, 2013). The Green Growth Climate Resilient Strategy (GGCRS) adopted by the Government of Rwanda in 2011 outlines the strategic vision for Rwanda to achieve a developed, low-carbon, climate-resilient economy by 2050 (ROR, 2011). The strategic vision promotes cross-sectoral interventions intended to mainstream environment and climate change into the development of national policies and programs.

The GGCRS framework is supported by the Second Economic Development and Poverty Reduction Strategy (EDPRS II), which defines national development priorities from 2013 to 2018 with respect to four thematic areas:

- (1) Economic Transformation,
- (2) Rural Development,
- (3) Productivity and Youth Employment, and
- (4) Accountable Governance (Republic of Rwanda, 2013)

Both the GGCRS and EDPRS II provide a framework for addressing a wide range of development goals; the GGCRS provides the long-term strategic vision, while the EDPRS II prioritizes targets and strategies for a period of five years. The Forestry Sector is playing key roles in supporting the livelihood of all Rwandans especially by providing most of the energy consumed by the bulk population, controlling soil erosion and protecting water catchments and supplying other goods and ecological services. Hence, the present and future extent of forest coverage in Rwanda is central to sustainable development and climate change considerations. In terms of climate adaptation and low-carbon development pathways, management of Rwanda’s forests represents an opportunity for synergies. Therefore, sustainable forest management and rehabilitation remain at the heart of Rwanda’s development strategies for conservation, transformation of agriculture, energy and the rural sector.

About 87% of the population (NISR, 2015) and 70% of the country’s land area are devoted to subsistence agriculture, while about 16% of the land area is devoted to fuel wood and timber

production to meet the country's energy needs. With the population's high dependence on the country's limited land resources, degradation, deforestation, soil erosion and loss of biodiversity pose potential threats to the country's rural population. Furthermore, with an estimated 86% of Rwanda's energy provided by biomass, forest resources are under increasing pressure from a growing population and shrinking land availability (ROR, 2010). According to MINIFOM (2010), the forest sector in Rwanda faces many challenges and constraints which include: depletion of natural vegetation, land scarcity, under valuation of forestry, lack of standard forest management practices (lack of forest management plans), uneven distribution of forest cover in the country, poor knowledge of national forest stock, wasteful timber conversion and consumption, dominance and under-utilization of Eucalyptus, poor forest extension services, under funding and inadequate investment in forest research. Furthermore, with an estimated 86% of Rwanda's energy provided by biomass, forest resources are under increasing pressure from a growing population and shrinking land availability. Thus, the forestry sector continues to grapple with the challenges of loss of natural forest to agricultural land use to primarily satisfy the needs of a growing population, overcutting of small woodlots, low productivity of more than 50% of forest plantations which are at the end of their production life, low species diversity and limited and poor genetic material (MINIRENA, 2014).

Sustainable forestry, agroforestry and biomass energy (SFABE) which is one of the 14 programs of actions included in the GGCRS comprises:

- (1) Promotion of Afforestation/Reforestation (A/R) through enhanced germplasm and technical practices in the planting and post-planting process;
- (2) Improved forest management (IFM) for degraded forest resources;
- (3) Joint formulation and implementation of agroforestry by MINIRENA/MINAGRI and
- (4) Licensing of sustainable charcoal production techniques & promotion of improved cook stoves (ICS) for efficient and clean wood and charcoal consumption.

Targets directly related to SFABE in the EDPRS II document include:

- (1) Increased job creation in forestry from 0.3% to 0.5% by 2017,
- (2) Reduction in the use of biomass energy through the use of improved stoves and kilns to produce 75% of charcoal by year 2017,

- (3) Forest cover to reach 30% of country land surface by 2018,
- (4) Protection and maintenance of 10% of the existing country land covered by natural forests and savannah forest and reduction of wood energy consumption from 86.3% to 50% by 2020.

The Forest Landscape Restoration Opportunity Assessment for Rwanda (MINIRENA 2014), the Rwanda Supply Master Plan for fuelwood and charcoal (MINIRENA, 2013), the Forest Law promulgated in 2013 (ROR, 2013), the Strategic Plan for the Forest Sector 2009-2012 (NAFA, 2010) and the National Forest Policy (MINIFOM, 2010) provide basis and guidance for the country's SFABE related actions that are salient for the achievement of the overarching policy objectives of GGCRS and EDPRS II.

Although, the National Forest Policy (MINIFOM, 2010) and the Forestry Sector Strategic Plan (NAFA, 2010) provided rough cost estimates for meeting SFABE targets outlined in their respective plans, the GoR has identified the need to assess the costs associated with achieving specific "green growth" SFABE scenarios, developed in line with the GGCRS and EDPRS II and in coordination with alternative green growth scenarios for other sectors. In this regard, the Government of Rwanda requested the technical assistance of Food and Agriculture Organization (FAO) in costing the immediate and medium term investment needs for the implementation of the Sustainable Forestry, Agroforestry and Biomass Energy (SFABE) program of action in the Green Growth Climate Resilience Strategy (GGCRS) for the country.

This study commissioned by Food and Agriculture Organization Rwanda (FAORW), therefore aims at providing cost estimates that will help guiding the Government of Rwanda in its budgeting process for the overall green growth strategy, identify resource gaps, and inform and attract funding from the donor community to help implement the GGCRS strategic vision. The time frame for costing this action plan is envisaged to cover 2016 to 2030.

1.2 Overview of the forestry sector in Rwanda

The Rwanda's forest cover is about 686,636 ha, representing 28.8% of the total country land (RNRA/DFNC, 2015). This includes about 258,067 ha of natural forest cover (37.6%) and 428,569 (62.4%) of forest plantations. The area of natural forests inside protected area has been

declined since independence in the 1960's largely as a result of increased demand for agricultural land and fuel wood plantations (Nduwamungu, 2011; FAO, 2006).

Rwanda's forest estate comprises mainly four protected areas namely Akagera National Park, Nyungwe National Park, Volcano National Park, Gishwati - Mukura National Park; and several public and private plantations. Major public forest plantation blocks include forest plantations around Nyungwe buffer zone, Mukura buffer zone, Gishwati buffer zone, the Arboretum of Ruhande and as well as forests established by forest projects such as PPF, GBK, DRB, PAFOR and PAREF projects (Nduwamungu, 2011). The main private plantations are those owned by Religious institutions such as the Roman Catholic Church and those belonging to tea factories like Gisovu, Nyabihu, Pfunda, Kitabi and SORWATHE tea factories. Most forest plantations in Rwanda were established to address the dual objectives of protecting vulnerable soils against erosion and reducing pressures on protected areas (Nduwamungu, 2011)

Forestry administration is currently domiciled in the Department of Forestry and Nature Conservation (DFNC) in the RNRA.). The Department is made up of four units namely forest management, forest inspection and monitoring, extension and natural ecosystem management and since 2014 the Tree seed unit (Tree Seed Center). Each of these units is headed by a Director and has forest officers saddled with different job schedules.

The Rwandan forestry sector is managed and governed by relevant laws and policies enacted and promulgated to enhance sustainable development of the sector. The first national forestry policy was put in place in 2004 after 16 years of existence of the forestry law of 1988. This led to a confusing and unusual situation whereby in one way or another, the forestry policy was influenced by an old law given the socio-economic and political changes, Rwanda had undergone since 1988 and as a result of such impasse, none of the two tools did perform as expected. Consequently, the 2004 National Forestry policy was reviewed in 2010 so as to improve on the deficiency of the 2004 policy and to accommodate EDPRS 1 (2008-2012) targets related to the forestry sector. The EDPRS II provides that the forestry sector will require interventions that include designing and implementing a reforestation strategy with diverse

species, as well as inventorying and mapping national forest resources to provide the basis for a 10-year national forestry plan.

The overall goal of the National Forest Policy launched in 2010 is to make the forestry sector one of the bedrocks of economy and national ecological balance for sustainable benefits to all segments of the society. The specific objectives of this forestry policy are to:

- (1) Encourage the participation of private sector to invest in the forest sector for poverty reduction, employment creation and improvement of livelihood through sustainable use, conservation and management of forests and trees;
- (2) Contribute to sustainable land use through soil, water and biodiversity conservation, and tree planting through the sustainable management of forests and trees;
- (3) Strengthen the participation of communities and other stakeholders in forest management to conserve water catchment areas, forest biodiversity and ensure sustainability of the forest sector;
- (4) Promote farm forestry to produce timber, wood fuel and to supply wood and non-wood forest products;
- (5) Promote forest extension to enable farmers and other forest stakeholders to benefit from forest management approaches and technologies; and
- (6) Promote forest research, training and education to ensure a vibrant forest sector (MINIFOM, 2010)

The Strategic Plan for the Forestry Sector (NAFA, 2010) aimed at translating the 2010 Forest Policy objectives into concrete outcomes. The strategic plan comprises three outputs:

- (1) Increased forest and agroforestry resources,
- (2) Management of forests to optimize their economical as well as ecological functions and
- (3) Provision of institutional support to forestry actors.

The forest law was enacted and promulgated in 2013 to guide the management and utilization of forests in Rwanda. In this law, the forests of Rwanda are categorized into three groups, namely: State forests, District forests and Private forests. The state forests comprise protected forests, production forests and forests reserved for research. Protected State forests and isolated protected

trees consist of national parks, natural forests and forests along the shores of rivers and lakes as well as isolated protected trees. The state production forests on the other hand are made up of unprotected plantation forests, while the state forests reserved for research consist of natural forests and plantation forests reserved for research. The District forests on the other hand, comprise the production planted forests and protected forests meant to maintain and safeguard environment, while the private forests are made up of planted forests owned by individuals.

The National Forest Policy of 2010, the Forest Sector Strategic Plan (2009-2012), Rwanda Supply Master Plan for Firewood and Charcoal of 2013, the Forest Law of 2013 and the Forest Landscape Restoration Opportunity Assessment for Rwanda of 2014 are all based on the principles and programs of actions outlined in the EDPRS II, Vision 2020, and GGCRS with respect to SFABE. These documents served as key inputs in the development of targets and scenarios for the SFABE green growth costing exercise.

1.3 Linkages of the forestry sector with other sectors

1.3.1 Versatile nature of forest products and services

Forests are nature's most bountiful and versatile renewable resource, providing simultaneously a wide range of economic, social, environmental and cultural benefits and services. Forests are the most biologically-diverse ecosystems on land, home to more than 80% of the terrestrial species of animals, plants and insects. They provide shelter, jobs and security for forest-dependent communities as well as water for many of our rivers, helping to secure the quality and purity of the water we drink and use every day.

Forests are critical for sustainable development. They provide a wealth of goods and services that are essential for people's lives, livelihoods and the green economy. They also play a significant role in reducing the risk of natural disasters, including floods, droughts, landslides and other extreme events. At global level, forests mitigate climate change through carbon sequestration, contribute to the balance of oxygen, carbon dioxide and humidity in the air and protect watersheds.

In Rwanda, the role of forests varies from direct contributions to the economy through provision of varied forest products to indirect contributions via environmental services such as reduction of soil erosion and flooding risks, water catchment and reduction of greenhouse gas emissions and carbon sequestration.

Forests and trees play an important role in both agriculture and tourism sectors. Historically, clearing of forests for the purposes of expanding agricultural activities has been a major contribution to deforestation. In this regard, agriculture intensification by increasing productivity per unit farm area may contribute to reducing pressure on forests and even to releasing some areas for reforestation on one hand. On the other hand by protecting soil against soil erosion agroforestry may contribute to sustainable agriculture. In tourism, forests preserve biodiversity and habitats (mainly National Parks) suitable for various wildlife populations that attract tourists. In fact, even though the tourism policy of Rwanda does not explicitly mention forests, it recognizes the role of biodiversity and ecosystem services in tourism. The Green Growth and Climate Resilience Strategy has however been more explicit by stating that the survival of the tourism industry depends on the preservation of the habitats for the mountain gorillas of the Volcano National Park, and the forests of the Nyungwe and Gishwati forests (ROR, 2011).

1.3.2. Impacts of other sectors on forests

Forest areas are often cleared in favor of agricultural activities, mining and other industries, settlements (village settlement and urban development), infrastructure development (for example road, schools and health centers construction). The negative impacts on forests from other activities should therefore be monitored and policies set up to respond to or restrict those impacts. For example, agricultural intensification by increasing production unit per unit area and reducing dependence on wood for fuel by increasing access to electricity and other alternative sources of energy can reduce pressure on forests and improve people's livelihoods. Accordingly, the development of forestry and agroforestry must go hand in hand with promotion of alternatives sources of energy and efficient utilization of available biomass.

1.3.3. Linkages of SFABE and other GGCRS programmes

In general, while GGCRS programmes of action can be allocated to specific Ministries to lead on implementation, they are cross-cutting in nature and multiple sectors (ROR, 2011). Due to versatile nature of forest products and services, successful implementation of the SFABE programme of action will surely involve many other sectors including agriculture, water, land, energy, industry, health, education, local government and disaster management (ROR, 2011).

Rwanda being an agriculture country with high population density, the competition between agriculture has been reported throughout the country. Indeed forestland encroachment for expanding agriculture has been common practice since colonial period. Sustainable forestry, agroforestry and biomass energy will never be achieved without practicing sustainable agriculture.

Furthermore forests and trees play important roles in hydrology regulation, watershed management, provision of electricity transmission poles, fuelwood, timber, medicines; soil protection and landscape restoration; rural employment and income; research and biodiversity conservation, mitigation and adaptation to climate change, etc. It would therefore be unwise to dissociate SFABE programme from programs related to those countless functions played by forests and trees.

2 METHODOLOGY

In order to carry out the costing of the Sustainable Forestry, Agroforestry and Biomass Energy (SFABE) programme of the Green Growth Climate Resilient Strategy (GGCRS), the following sequential steps were carried out.

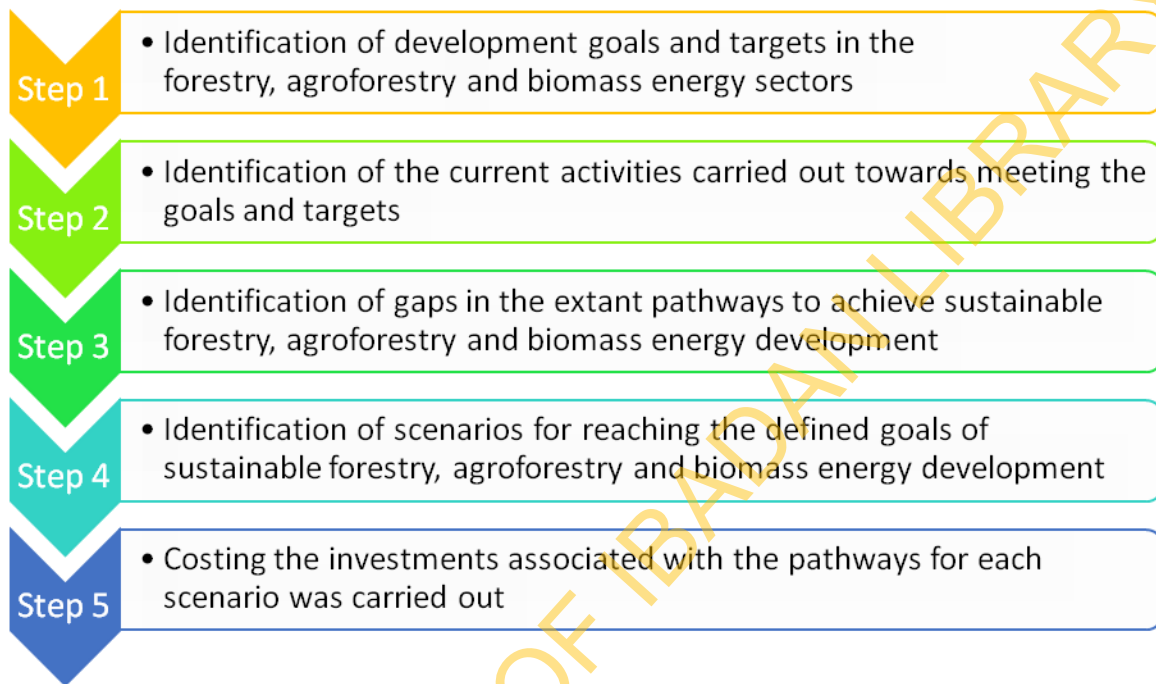


Figure 1: Illustration of Methodology on Costing of Investments in Sustainable Forestry, Agroforestry and Biomass Energy

In the first step, a desk study of background documentation on specific interventions and targets within forestry, agroforestry and biomass energy sectors which were in agreement with the GoR Economic Development and Poverty Reduction Strategy (EDPRS-II) and in support of the long-term vision of the Green Growth and Climate Resilience Strategy (GGCRS) were carried out.

The second step involved the identification in collaboration with government officials from relevant agencies and ministries, activities that are being currently carried out to achieve the defined developmental goals in these sectors.

In the third step, based on best practice guidance and technologies in the international literature, national experiences and technical expertise of the consultants, gaps in the extant pathways to achieve sustainable forestry, agroforestry and biomass energy development were identified and in step four plausible approaches to achieve the defined goals and targets for sustainable forestry, agroforestry and biomass energy development were conceptualized.

Finally in the fifth step, the conceptualized approaches or scenarios for sustainable development of forestry, agroforestry and biomass energy in Rwanda were broken down into distinct elements and pathways and cost estimates and development timelines were provided for these elements and pathways.

The exercise involved the costing of the current situation (the “business as usual” –BAU) scenario to serve as veritable baseline for investments required to transition to sustainable forestry, agroforestry and biomass energy development. In addition to the BAU, two other scenarios were developed and costed.

Data and other forms of information were sought and obtained from, but not restricted to officials, publications and reports from government agencies and ministries such as the Department of Forestry and Nature Conservation (DFNC), Rwanda Natural Resources Authority (RNRA) both of which are under MINIRENA; MINECOFIN, MINAGRI, MININFRA, Urban Economics Department in the City of Kigali as well as from districts that house the six secondary cities in Rwanda (Huye, Musanze, Muhanga, Nyagatare Rubavu and Rusizi).

Furthermore, supplementary information on the subject were sought and obtained from documentation on the subject matter from other countries and from the consultants’ colleagues across the globe.

3 SFABE: DEVELOPMENT OF SCENARIOS, PATHWAYS AND OUTPUTS

Sustainable forestry, agroforestry and biomass energy development requires investment, research and capacity building in the following key areas: forest establishment and management, forest protection, forest industry and utilization, forestry extension, charcoal production, woodfuel utilization, urban forestry development, participatory agroforestry, germplasm and seed production and management and forest based enterprises.

The Strategic Plan for the Forest Sector (SPFS) did identify actions aimed at increasing forest cover for the country, protection of the remaining natural forest, and also management of the forest to contribute meaningfully to income generation, employment and meeting the fibre and energy needs of the people. However, there is still more room for improvement in terms of sustainable development of forestry, agroforestry and biomass energy with particular reference to green and climate resilient economy. Based on this, the following scenarios are proposed:

3.1 Scenario 1: Business-as-Usual (BAU): 2016-2030

The Business as Usual Scenario in this exercise considered those activities in the SPFS that are being currently implemented for forestry, agroforestry and biomass energy development. The BAU in this context is characterized by increasing the land under forest plantation and agroforestry, rehabilitation of critical ecosystems and old plantations, promotion of forest based enterprises and forestry extension, as well as reducing the use of biomass energy in urban and rural areas. While these activities on their own right are significant efforts for forestry development, they are not enough to secure the forest on a sustainable basis while providing a stream of forest benefits (goods and services) to the present as well as future generations of Rwandese.

Specifically, the BAU scenario includes (based on SPFS activities):

- Increasing forest plantation to account for 30% of the total land area
- Increasing land under agroforestry to cover 85% of cultivated land
- Rehabilitation and maintenance of old plantations,
- Tree planting in the city of Kigali

- Promotion of bamboo propagation and processing,
- Rehabilitation of critical ecosystem
- Demarcation and licensing of state forest for harvesting
- Production of seedling and planting for Gishwati
- Maintenance of Gishwati plantation
- Promotion of national tree planting week
- Supporting of districts to produce seedling and other planting materials for energy production
- Operationalization of silviculture guidelines
- Reducing use of biomass energy in the country's energy portfolio
- Supporting more efficient and higher quality charcoal production
- Encouraging dissemination of improved cook stoves

3.2 Scenario 2: Medium Level of Sustainable Forestry, Agroforestry and Biomass Energy Development

In the sub optimum or medium scenario, activities within and outside the Strategic Plan of the Forestry Sector (SPFS) which are important for achievement of a level of sustainability of forestry, agroforestry and biomass energy development but which are not yet implemented were considered. The approaches for achieving this are:

Pathway 1: Promote growing of multi-purpose agroforestry trees in all farming systems

Sustainable agroforestry development is guided by four principles:

- (i) technical compatibility,
- (ii) economic efficiency,
- (iii) social acceptability and
- (iv) ecological benefits.

To bring these four principles into operation requires research and participation of the farmers in the decision of the components and the preferred agroforestry system. Therefore, this approach includes activities such as carrying out a study/studies to identify suitable agro-forestry trees and

spacing density and tending practices for planting in various agro-ecological systems, holding of meetings with farmers in every district to have inputs on the choice of desired/appropriate agro-forestry system, rewarding of best farmers practicing agro forestry in every sector and eventually upscaling of agroforestry development to cover 100% of cultivated land.

Pathway 2: Avail improved seeds and other germplasms

A healthy and productive forest ecosystem with high resistance and resilience to diseases, pests and other hazards, starts with the quality of seeds and seedlings used in the establishment of such a forest among other things. A healthy seed will usually give rise to good seedling with vigour. Therefore, in order to have good quality tree seeds and seedlings, there is a need to rehabilitate and upgrade the seed store to be able to make use of biotechnology in the production of tree seedlings and also storage of germplasm. Furthermore, farmers, youth and women who are used to collect seeds have to be trained in seed handling and management.

Pathway 3: Upscaling forest management towards sustainability

Forest management plans play very salient role in the sustainable management of the forest. Forest management plans help the forest manager and/or the owner to:

- Institute practices to protect natural resources of the site including: soil, water, fish and wildlife, natural vegetation, recreation, and aesthetic resources.
- Balance the economic, ecological and social values of forested parcels.
- Maintain healthy forest ecosystems through active management.
- Increase economic, environmental, and social benefits the property provides.
- Where feasible, coordinate forest management across property boundaries.
- Manage forest resources for long- term stewardship beyond the tenure of current ownership.
- Maintain desired natural vegetation systems by addressing removal of noxious and invasive plant species
- Developing a Forest Management plan also helps the forest manager/owner clarify short, medium and long-term objectives for the forest estate.

- Through the process of inventory of current conditions of the forest resources, forest management plan helps in determining which resource protection or enhancement measures would be beneficial on the forest estate, and then develop an organized sequence of activities to accomplish management objectives.

The activities under this approach therefore include supporting the implementation of the District Forestry Management Plan (DFMPs), training of forestry personnel across all cadre in all the districts in the use of the DFMPs, development of forest management plans for the state owned forests and upscaling the capacity of the forestry protection department through training and provision of equipment for effective forest monitoring and protection

Pathway 4: Promote Participatory Forestry Development.

One of the most important tenets of sustainable forestry is the community based forest management since forest cannot be sustainably managed without the education and the support of the host communities whose livelihood most of the time depends on the forest. Conservation efforts by the government who holds the forest in trust for the people must therefore carry all the forest stakeholders along in the decision making. Thus this pathway involves encouraging and supporting local communities, NGOs and CBOs to be involved in community based forest management.

Furthermore, there is a need to encourage and support the formation of an organized forum -such as the Forestry Association of Rwanda- for forest stakeholders. This forum among other things will be avenue to stimulate research and disseminate research findings for the Rwandan forestry development. In addition, such a forum will be burdened by retrogressive developments capable of militating against sustainable forestry development and will be able to draw the attention of concerned party to the possible consequences of such development and the need to revert the offensive decision or action. Some of these injurious decisions or actions could sometimes be a fall out of policy or actions from other sectors of the economy or even a consequence of ill advice to the government. In addition, such a forum could be a veritable instrument in the creation of awareness on contemporary beneficial issues that are related to sustainable forestry development.

3.3 Scenario 3: High Level of Sustainable Forestry, Agroforestry and Biomass Energy Development

This scenario reflects very important requisite ingredients for sustainable forestry, agroforestry and biomass energy development in the country which were not succinctly captured in the Strategic Plan for the Forest Sector. The pathways for this scenario include:

Pathway 1: Strengthen Forestry and Agroforestry Research

Research is an integral part and plays salient and prominent role in sustainable development of forestry, agroforestry and biomass energy development. Forestry research institutes are created and dedicated to carry out research in forestry and forest related activities to build the future of the forest sector by producing and disseminating information and knowhow for the wellbeing of the society. They have mandates and thrusts which help them to focus and pursue research relevant to sustainable development of forestry sector and by extension the development of the country.

The advantages of having a forestry research institute are many and include:

- Promotion through research of the economic, ecological and socially sustainable management and use of forest resources.
- Facilitation of linkages and international cooperation on sustainable forestry development.
- Attraction of inflow of funds to the economy through grants to the institute and staff members to carry out specific studies of interest in a particular agenda for example biodiversity conservation.
- A good avenue for provision of productive employment.
- Provide great support for forestry educational development by availing their facilities for teaching, training and research at higher educational levels.
- Provide technologies to increase the vegetative cover and to conserve biodiversity.

- A well-equipped forestry research institute is an asset to the country not only in carrying out breakthrough research that can turn around the fortune of the country, but also by placing the country on the global limelight through organization of training workshops on contemporary issues in sustainable forestry development.
- Forestry research institutes in fact play an important role in the innovation system by helping forest industries move ‘one step beyond’ their existing capabilities and reducing the risks associated with innovation to allow a faster rate of economic development. Institutes typically use a three step innovation model: building capabilities, using core funding and other resources such as cooperation with universities; extending these in pre-competitive work with industry; and finally using them to deliver services as the technologies mature.
- Finally, forestry as a big player in the global environmental conservation movement and climate change discourse has a lot of opportunities that only forestry research institutes can harness by virtue of their status.

Rwanda, with a laudable and epoch making vision of putting 30% of its highly sought after land mass under forest plantation, 10% under natural forest cover and 85% of cultivated land under agroforestry will no doubt require a good forestry research institute to chart ways for sustainable management of the forest and also to develop appropriate technologies for the development of the infant forest industry for sustainable utilization of the forest. Another important component of this pathway is to support Universities and other higher institutions of learning in doing research in forestry, agroforestry and biomass energy through provision of research grants and other incentives.

Pathway 2: Reduce wood energy consumption

One of the central development objectives for the forestry, agroforestry and biomass energy sector in the EDPRS II is to reduce wood energy consumption from 86.3% to 50% by 2020. Basically, there are two major approaches to reduce wood energy consumption in the country.

The first is to develop cheaper and more energy efficient alternative sources of energy. Such alternative sources of energy include more access to electricity for cooking, biogas, LPG, peat and pellets. This approach does not lie strictly within the domain of the forestry, agroforestry and biomass energy sector, therefore this study will not dwell into the array and nitty gritty of such alternatives.

The other approach is to develop technologies that will yield more heat energy in terms of quantity and quality of energy outputs from a given quantity of wood. Such technologies include more efficient modern charcoal production kilns and improved cook-stoves for charcoal and firewood. Table 1 shows the current charcoal production efficiencies and therefore the potential for efficiency improvements if more efficient kilns are adopted gradually through 2030.

Table 1: Charcoal Production Efficiencies

	Yield by weight	Historical	BAU Scenario		Efficient Scenario	
		2010	2020	2030	2020	2030
Traditional earth mound	11%	100%	100%	100%	70%	45%
Improved	18%				25%	30%
High-tech	29%				5%	25%
Average yield		11%	11%	11%	14%	18%
Energy yield		21%	21%	21%	26%	33%
Energy losses		79%	79%	79%	74%	67%

Source: “Sustainable Energy for All” Draft Proposal for Cabinet

Currently, most charcoal producers have not been making use of the improved kilns technology for various reasons. Most of the charcoal production in the country is based on the traditional earth kiln. Common reasons that have been put forth to explain the low penetration of modern charcoal kilns include but not limited to cost of the technology and dis-economies of scale.

Many charcoal producers are small scale operators and could not afford the required quantity of wood required for optimum and economically efficient use of the kiln. Secondly, for the kiln to be used continuously or over long period of time, it will require transportation of either kiln or wood. Thirdly, the modern kilns are much more expensive compared to the traditional earth mound. Hence, they stick to their conventional and traditional, less productive and less environmentally friendly way of production.

In order to overcome this constraint, there may be a need to facilitate the establishment of charcoal value chain scheme that involves incentives to both privately operated improved kilns as well as to centrally located improved kilns in districts or groups of sectors run in a cooperative model. This scheme would allow wood from several woodlot owners and/or current small scale charcoal producers to merge their efforts and use a modern kiln for production. The distribution of proceeds will depend on the yield for the kiln given known amount of wood contribution from the members. To a large extent, the use of modern charcoal kilns would commensurately reduce the wood used to produce a given quantity of charcoal since improved kilns produce higher yield and quality (calorific value) of charcoal, as such help to reduce the current gap of 20% of wood consumption compared to production from the forest estate.

The other intervention in the biomass energy involves dissemination of improved cook stoves for charcoal and firewood. The common improved cook stove has an estimated 19% efficiency compared to 14% for the 3 stone fire. More advanced stoves such as the Rocket stove have much higher efficiency, with an average of 30%. Employing the various vintages of improved cook stoves will greatly reduce the biomass needed to provide the same amount of heat service in the household or pertinent businesses such as hotels and restaurants, local breweries, schools etc. There are both health and environmental benefits associated with the ICS.

In both the improved kilns and stoves, the government can and will play a role in facilitating the dissemination and adoption of these technologies. The costs for these two programmes are extrapolated from those used in the Forestry Sector Strategic Plan 2009 – 2012 adjusted for inflation.

Pathway 3: Promote value addition technologies to wood and non-wood forest products

Technically and economically efficient and environmentally benign forest industries are the backbone of sustainable forestry, agroforestry and biomass energy development. Forest production without efficient utilization will not only be economically wasteful but will eventually constitute hazards to the society. Our investigations revealed that there is just only one primary forest industry in Nyungwe forest area which is involved with simple conversion of stumpage to transmission poles.

Further investigation revealed that primary wood processing into lumber are still carried out by either pit sawing or chain sawing. These wood processing methods are outdated and wasteful because they generate so much waste and do not also encourage recycling of the waste. In view of these challenges, there is a need to put in place in every province, a modern wood processing facility such as a wood mizer that does not need a big factory for housing, and is capable of efficiently converting small diameter logs, which are going to be the hall mark of the Rwanda forest plantation production in the nearest future. Furthermore, there will be a need to carry out a study to identify national needs in wood processing and the required production infrastructure so that the provision of such infrastructure can be built into national planning.

Pathway 4: Promote urban forestry development in the secondary cities

One of the acid tests of a country's disposition, willingness and effort at green economy is the city greening. Urban forestry apart from creating a serene and conducive environment for the city dwellers, it also attracts tourists and investors into the country giving the tourists the impression of a peaceful people and government committed to long term and sustainable development of their economy. Trees in the city also relieves the urbanites the diverse stress occasioned by the diverse harsh conditions of the urban environment. Trees in the cities also contribute substantially to climate change mitigation as a result of their impact on the environment and subsequent reduction in the energy use of city dwellers.

The city of Kigali province has an urban economics department with an urban and peri-urban agricultural officer who is responsible for implementing government policies and regulations on

urban development and management for Kigali. However, the situation with regards to urban forestry in the secondary cities is far from that of the Kigali city. There is a need therefore, to give urban forestry serious consideration in the secondary cities and incorporate it to the development plans of these cities from the onset while efforts at sustainable greening of Kigali city are sustained.

Pathway 5: Biomass Energy

Under the BAU scenario, we do not assume that the existing technologies will persist for the next 15 years, but rather we project the programmes that were initiated in the Forest Sector Strategy 2009-2012 and continue them at the same level for between 2016 through 2030. In the said program, the government initiated an improved charcoal kiln demonstration project involving 20 kilns over 3 years, with 13 targeted for 2012. In this pathway, we assume that the programme will continue at a rate of 10 kilns per year, with a much reduced cost due to the 2014 study (SE4All) that shows 3 vintages of improved kilns that have a total production cost of about 1,556,000 RwF. So inclusive of the cost of technology and programme administration and training we estimate a cost of 2 million RwF per kiln in 2015. These kilns will be used in combination at an accelerated penetration to form the basis of the more climate resilient scenario.

In the same programme there existed an initiative to support 100 households in each sector over a 3 year period to acquire and use improved cook stoves. Though the firewood stove is about 30 percent cheaper than the charcoal kiln, we used the higher charcoal stove as a basis since there is a more intense focus on introducing this in urban areas where most of the charcoal is consumed. To be on the safe side, we did not use the subsidy but rather the total cost since the difference may still need to be offset by other sources of funding like environmental NGOs/groups and/or development partners since the environmental and health impacts are highly attractive.

4 COSTING OF INVESTMENTS IN FORESTRY, AGROFORESTRY AND BIOMASS ENERGY

4.1 Costing Methodology

For the interest of comparability and summation across sectors, this study used the same costing approach and methodologies applied in the agricultural, water and energy programmes. Thus, an output based approach was used for the costing of the required investments for each pathway. In essence, the end product of a series of activities was costed, instead of costing those inputs and the activities that lead to the output. For example, if the objective is to plant a given area, the unit cost per hectare was used to estimate the total cost for the area to be planted.

Targets/Output costs, were obtained from the current and previous budgets of RNRA; Government Earmarked Budget (2015/2016), the Strategic Plan for the Forest Sector (2009-2012); existing investment projects in MINIRENA; investment projects and sector plans in other countries of comparable resource outlay, as well as from national sources and international literature. Five year moving average inflation rates obtained from World Bank were used to adjust the investment data for effects of inflation on the long term expenditure investment outlay, while five percent of the total investment cost was used for contingency.

The projection for the number of years it will take under the business as usual scenario to achieve one of the forestry sector development goals in EDPRS II of bringing 30% of the country land under forest cover by 2018 is based on the 7,818 ha which is the current rate of planting in 2015 and the 103,504 ha which is the difference between the 30% target (790,140 ha) and the 28.8% (686,636 ha) of the total country land already under forest cover (MINIRENA 2014).

Furthermore, the projection for the number of years it will take to achieve another forestry sector development goal in the EDPRS II of putting 85% of the country's cultivated land under agroforestry by 2018 is based on the assumption that the forestry department must have at least achieved 85% of the cultivated land to be under agroforestry. This assumption was necessitated because of non-availability of data on the extent of achievement in agroforestry development. On

these bases, 975,084 ha will have to be put under agroforestry to achieve the 85% target under the BAU and upscale by 260,254 ha to achieve 100% of cultivated land under agroforestry for the medium level sustainability scenario.

The detailed cost estimates were presented in Rwandan Francs and in US dollars that will facilitate investment monitoring and supervision, as project accounting systems and financial reports are likely to be maintained in local currency units. Expressing the costs in local currency is also required for the purposes of their incorporation into the economic analysis and project entity financial projections. The inclusion of investment cost estimates expressed in US dollars, allows for easier access by non-Rwandan stakeholders.

Since sustainable forestry, agroforestry and biomass energy development is not a once and for all process, but rather a gradual progressive process which comprises several interlinked elements, the investments considered under the different scenarios are not alternative, but rather are additional investments needed to get to medium/sub optimum and optimum levels of sustainability.

4.2 Investments Costs under the Business as Usual Scenario

The investments for the BAU that are costed, were taken from the outputs/targets of the current and previous budgets of the RNRA, the earmarked budget transfer and the budget of the city of Kigali province. This scenario is made up of five pathways namely: forest development; forest plantation management and agroforestry; Rwanda sustainable woodland management and natural forest restoration; terrestrial ecosystems and forest resource management; and Biomass Energy. Each of these pathways is made up of different activities. Thus the forest development pathway is made up of increasing forest plantation to account for 30% of the total land area, increasing land under agroforestry to cover 85% of cultivated land, rehabilitation and maintenance of old plantations and urban forestry development in the city of Kigali.

The forest plantation management and agroforestry pathway comprises promotion of bamboo propagation and processing, rehabilitation of critical ecosystem, demarcation and licensing of

state forest for harvesting, production of seedling and planting for Gishwati and maintenance of Gishwati plantation. The terrestrial ecosystems and forest resource management pathway is made up of activities which include promotion of national tree planting week, supporting of districts to produce seedling and other planting materials for energy production and operationalization of silviculture guidelines.

The Rwanda sustainable woodland management and natural forest restoration pathway is basically made up of counterpart funding of PGREF projects. The biomass energy pathway is made up of construction of 10 improved charcoal kilns per annum for the investment period under consideration and supporting of 100 families per sector with improved cook stoves. While the pathways for the BAU scenario were collated from the current and previous budgets of the RNRA, the earmarked budget transfer and the budget of the city of Kigali province, the activities within each of the pathways were identified in consultation with the officials of RNRA and the city of Kigali province.

The total investment cost for the BAU scenario is USD229.6 million. The forestry development element at USD 192.8 million has the lion share, accounting for 84% of the total investment cost for the Scenario, with the Biomass energy coming distant second with 1.4% of the investment over the period with Improved Stove support program taking about two-thirds of the investment in this pathway. The other three pathways do not consume notable investment because in this scenario they are actually supporting the forestry development pathway which is indeed the hall mark of the business as usual scenario. Table 2 shows the share of proposed investment cost under the business as usual scenario between 2016 and 2030.

Table 2: Share of Proposed Investment Costs per Program under the BAU Scenario (2016-2030)

Pathways	Total		%
	RwF	USD	
Forest Development	143,845,869,965	192,832,581	84
Forest Plantation Management and Agroforestry	1,756,598,010	2,354,807	1.0
Rwanda Sustainable Woodland Management and Natural Forest Restoration	441,817,500	592,278	0.3
Terrestrial Ecosystems and Forest Resource Management	560,646,629	751,575	0.3
Biomass Energy (ICK+ICS)	2,338,337,401	3134668.616	1.4
Total cost for BAU	148,943,269,505	199,665,900	
M&E	14894326951	19966589	8.7
Contingency	7,447,163,475	9,983,295	4.3
Total Project cost	171,284,759,931	229,615,784	100

Source: Consultants' Estimate 2015

4.3 Investments Costs under the Medium Level of Sustainable Forestry, Agroforestry and Biomass Energy Development Scenario

The total cost estimate for the medium path to sustainable forestry, agroforestry and biomass energy development is USD 55.6 million. Promoting the cultivation of multipurpose agroforestry trees in all the country's cultivated land had a lion share of the investment accounting for 55% of the investment. Upscaling forest management towards sustainability had the next major share of the investment accounting for 22.3% in this pathway while promoting participatory forestry development ranked third accounting for 4.2% of the proposed investment outlay for the medium level of sustainable forestry, agroforestry and biomass energy. Making improved seeds and other germplasms available accounts for 2.9% while building of improved kilns accounts for 2.5% of the scenario investment.

The fact that promotion of cultivation of multipurpose agroforestry trees in all the country's cultivated land had a lion share of the investment in this scenario is apt since agroforestry enhances multiple and efficient use of land resources to produce various multiple benefits of food, fodder, fibre and fuel depending on the agroforestry system selected in collaboration between the farmers and the forestry officials. It is important to note that agroforestry is a major and salient instrument for sustainable forest development. It is also very important to upscale forestry development activities towards sustainability pushing towards the goal of bringing 30% of the country's land mass under forest establishment and this explains why activity ranked second in this scenario. Table 3 shows the share of the proposed investment under this scenario.

Table 3: Share of Proposed Investment Costs per Program under the Medium Path to Sustainable Forestry, Agroforestry and Biomass Energy Development Scenario (2016-2030)

Pathways	Total		%
	RwF	USD	
Promote growing of multi-purpose agroforestry trees in all farming systems	22, 809, 867, 836	30577759	55.0
Avail improved seeds and other germplasms	1,222,931,811	1,639,401	2.9
Upscaling forest management towards sustainability	9,262,720,862	12,417,140	22.3
Promote participatory forestry development	1,725,000,000	2,312,449	4.2
Improved Charcoal Kilns	1,040,156,982	1,394,382	2.5
Total Cost for Medium Path to SFABE	36060677491	48341127	
M&E	3606067749	4834113	8.7
Contingency	1803033875	2417056	4.3
Total Project cost	41469779115	55592296	100

Source: Consultants' Estimate 2015

4.4 Investments Costs under the High Level of Sustainable Forestry, Agroforestry and Biomass Energy Development Scenario

This scenario is made up of very important pathways that are very crucial to sustainable forestry and are considered as acid tests of sustainable forestry development. These include strengthening forestry and agro-forestry research; promotion of value addition technologies for efficient and environmentally friendly wood conversion and utilization activities and also city greening which is one of the country's laudable aspirations to contribute towards climate resilient economy and livable environment.

As shown in Table 4 below, the total cost for investment in this scenario is USD 4.9 million, with strengthening research in forestry and agroforestry by establishing forestry research institute and supporting universities /higher institutions of learning to do research in forestry and agro forestry taking the major part of proposed investment, accounting for 42.3%, while greening the six secondary cities ranked second in terms of proposed investment magnitude, accounting for 38.9%. These two pathways are landmark activities that are capable of creating productive jobs thereby increasing the employment level in the sector; improving the contribution of forestry to GDP and in addition bringing in more earnings for the government.

Table 4: Share of Proposed Investment Costs per Program under the High Path to Sustainable Forestry, Agroforestry and Biomass Energy Development Scenario (2016-2030)

Pathways	Total		%
	Rwf	USD	
Strengthen forestry and agro-forestry research	1,547,513,408	2,074,519	42.3
Promote value addition technologies to wood and non-wood forest products	210,000,000	281,516	5.7
Promote urban forestry development in the secondary cities	1,422,660,929	1,907,148	38.9
Total Cost for High Path to SFABE	3,180,174,337	4,263,183	
M&E	318,017,434	426,318	8.7
Contingency	159,008,717	213,159	4.3
Total Project cost	3657200488	4,902660	100

Source: Consultants' Estimate 2015

4.5 Progressive Expenditure Framework for SFABE

Since the activities in the business as usual scenario are significant efforts for forestry development, but are not enough to secure the forest on a sustainable basis while providing a stream of forest benefits (goods and services) to the present as well as future generations of Rwandese, the medium level sustainability scenario is consequently a furtherance of the BAU with additional and complimentary activities towards the journey of sustainable forestry. Thus in a sense, the real investment need to achieve the medium level sustainability scenario is the sum of the cost of the BAU (USD229.6 million) and the nominal cost of the medium level sustainability scenario (USD55.6 million) which is USD285.2 million.

Furthermore, even though the medium level sustainability scenario is an advancement and improvement over the BAU in the journey towards SFABE, it is still sub optimal and requires additional and complimentary investments on requisite activities for SFABE. Therefore, the real cost of the high level sustainability scenario is the sum of the real cost of middle level sustainability scenario (USD285.2 million) and the nominal cost of the high level sustainability scenario (USD 4.9 million) which is USD290.1 million. In summary, the cumulative investment needs for the SFABE between 2016 and 2030 is USD229.6 million, USD285.2 million and USD290.1 million for the BAU, middle level sustainability and high level sustainability scenarios respectively.

5 FINANCING MECHANISMS AND SOURCES OF FUNDS FOR IMPLEMENTING SFABE PROGRAMME

5.1 Financing Mechanisms

The global Forest Land Restoration programme is ambitious, with a target of restoring degraded lands up to 150 million hectares by 2020 under the Bonn Challenge, and a further 200 million hectares by 2030 under the New York Declaration on Forests including the target 15.3 of the Sustainable Development Goals (SDG) for achieving land degradation neutrality by 2030. These goals are estimated to require US\$35 billion for the Bonn Challenge and at least US\$300 billion per year to meet the SDG degradation neutrality goal.

Sustainably raising the requisite amount of resources for Rwanda's commitment in this effort, GGCR must be integrated in regular government accounting and budgeting. To make this attractive to policy makers there is a need for incorporating green accounting indicators. Where the indicators are not easily available, effort must be made to adopt and adapt those used in the forest sector elsewhere (EU, 2002). Though there are barriers on methodologies for a complete integration of both market and non-market forest goods and services (FAO, 1998) into national accounting, there exist some simple accounting frameworks such as Total Economic Valuation (TEV) that have been applied in a few countries to influence allocation of funds to the forestry sector (EFIMED, 2013).

Therefore the following key areas need to be considered as part of financing mechanisms or specific sources of funds for SFABE:

1. Generally policy makers need to integrate GGCRS in **government budgets** and **public investment funds**, including national and local forest funds, microfinance instruments and credit lines in public and private banks. The Rwanda Environment and Climate Fund (FONERWA) is one such a fund, specifically created to mobilize funds for green growth and climate resilience.
2. Within the public investment mechanism, the government should launch a deliberate effort to mobilize **official development assistance** (ODA) for supporting GGCR programmes like SFABE.

3. Aggressively encouraging **effective and fundable partnerships and alliances** at local, national and international levels that are more attractive to global funding, e.g. the Global Environment Facility (GEF) funded project in Gishwati that involves 5 districts.
4. Access **climate change finance instruments** especially by targeting projects/programmes that involve both mitigation and adaptation which tend to get priority in such instruments like the **Adaptation Fund** and the **Green Climate Fund**
5. Since long-term objective is to ensure a self-sustaining financing strategy that arises from all possible financing instruments, emphasis should be on financing via **incentive schemes (e.g. payment for ecosystem services mechanisms - PES)** that can be combined with investments in sustainable value chains such as those described in this programme for charcoal production and supply. **Carbon market funds** including CDM, REDD+, voluntary market can be targeted to raise funds for undertaking activities in SFABE, with the credits benefitting all key stakeholders
6. Companies, corporations, non-government organizations and even local governments and cities in both industrialized and developing countries are now willing to support environmental and social projects in the framework of their corporate social responsibility (CSR) strategies. Public administration such as ministries (MINIRENA) or agencies (REMA) can assist in administering these efforts to coordinate the intended investments by various players.
7. Seek to involve the **private sector** to finance some of these SFABE activities. Though some expect a return of some form (e.g. carbon or profits), some have no expectation of a return. The most available funds are the innovative initiatives like **pioneer private impact funds** and also **layered funds** that can be accessed for funding SFABE. (FAO, 2014)

5.2 Potential Sources of Funding

Since the Copenhagen Accords (UNFCCC, 2009), an elaborate climate financing architecture has emerged even though not adequate for the demand for funds. It is estimated, that there are now (2015) about 50 climate funds in operation with a total financing pool of around US\$25 billion. These resources include both concessional and non-concessional finance. The following

is a partial list of some of the existing pertinent Funds that can serve as sources of non-public funding for implementing activities/projects in the SFABE programme:

1. Green Climate Fund – Korea-based currently at \$10 billion fund intended to funnel much of the \$100 billion a year pledged for adaptation and mitigation from 37 Annex 1 countries to developing countries under the UNFCCC Copenhagen Accord.
2. Altheda Climate Fund - Source of capital mostly private- and public sector institutions, high-net-worth individuals and family offices. Focuses on large scale restoration and conservation projects of \$10 million per project, and expects high quality carbon credits.
3. Moringa Fund- Source of capital include Development finance institutions, family offices, private foundations, high-net-worth individuals. Focus: Large scale agro-forestry projects (\$5 – 10 million per project), expects high quality carbon credits.
4. Terra Bella Fund – Capital mainly from private and public sector institutions, Focus: Community-based forestry and agricultural emission reduction projects (\$5 – 10 per project), expects high quality carbon credits and co-benefits
5. Permian Global Fund – Source of capital mostly from private and public sector institutions. Focus: Protection and restoration of natural forests (no project size limitation) and expects high quality carbon credits and no other economic return.
6. Climate Investment Funds (CIF) – a multilateral climate financing vehicle, that has four windows for fund allocation that are tailor-made for SFABE activities, especially renewable energy programmes. The four main windows in this fund through which resources are allocated are:
 - Window 1 - Scaling up Renewable Energy Programme (SREP) for low income countries,
 - Window 2 - Clean Technology Fund
 - Window 3 - Forest Investment Program (FIP) for Sustainable Forest Management (SFM)
 - Window 4 - Pilot Programme for Climate Resilience.
7. Sustainable Energy Fund for Africa (CEFA) – A European Commission fund that underwrites the cost of sustainable energy projects such as Improved Charcoal Kilns and Improved Cooking Stoves. Also partners with institutions like African Development Bank (AfDB)
8. Layered Funds – these are innovative new type of funds that are sources from various layers of investors assigned different levels of risk. For example, junior shares with high

risk are proposed to public investors (e.g. sovereign funds, development banks), while less risky assets (senior shares, notes) are proposed to institutional investors (e.g. commercial banks, pension funds). Finance in Motion (2015), for example, has designed such multi-layered private impact funds. Other funds under development such as the Land Degradation Neutrality (LDN) Fund will also integrate a similar structure, and will require the support of public administrations and funds as early investors.

9. Under the multi-lateral financing mechanisms, there are a number of Adaptation funds that have been the main source of funding in the last 5 years (ODI, 2013, website updated 2015). These include:
 - i. The Special Climate Change Fund (SCCF) with average annual total of \$5 million for the period 2010-2013.
 - ii. The Adaptation Fund (AF) with an average annual total funding of \$ 15 million for the period 2010-2013
 - iii. Global Climate Change Alliance (GCCA) with an annual funding average of \$ 27 million (2010-2014)
 - iv. Adaptation for Smallholder Agriculture Programme (ASAP) with an annual average of \$28 (2012-2014)
 - v. Pilot Programme for Climate and Resilience (PPCR) with an annual average of \$66 million (2010-2013)
 - vi. Least Developed Country Fund (LDCF) with annual average of \$80 million (2010-2014).

6 PROGRAMME IMPLEMENTATION PARTNERS

This Programme covers activities in two different sectors, i.e. Forestry, and Energy which are supervised and managed by different Agencies and/or Ministries, all of which are coordinated via the planning and funding process of the Ministry of Finance and Economic Planning (MINECOFIN). The partners that will be critical in the successful implementation of this programme will therefore include the Department of Forestry and Nature Conservation (DFNC), which is under Rwanda Natural Resource Authority (RNRA) and which in turn is under MINIRENA. The agroforestry cover forestry, agriculture and pastoral-silviculture activities and therefore will involve the cooperation of both MINIRENA and MINAGRI. Urban forestry will draw its supervision from the Urban Economics Department in the City of Kigali Province as well as from districts that house the six secondary cities in Rwanda.

The bio-energy subsector is mainly managed by the Rwanda Energy Group (REG) which is under the MININFRA and local districts which come under MINALOC. All these are overseen by MINECOFIN in the planning and finance process. REMA and RNRA will play a key technical and policy supervisory role in accordance to respectively their environmental management and natural resources mandates.

7 MONITORING AND EVALUATION PLAN FOR SUSTAINABLE FORESTRY, AGROFORESTRY AND BIOMASS ENERGY IN RWANDA

7.1 Introduction

Monitoring and Evaluation (M&E) is the systematic collection and analysis of information to enable managers and key stakeholders to make informed decisions, uphold existing practices, policies and principles and improve the performance of their projects. In specific terms, monitoring is the regular gathering, analyzing and reporting of information that is needed for evaluation and/or effective project management, while evaluation is a selective and periodic exercise that attempts to objectively assess the overall progress and worth of a project. It uses the information gathered through monitoring and other research activities and is carried out at particular points during the lifetime of a project.

M&E can be seen as a practical management tool for reviewing performance and for learning from experience, which can be used to improve the design and functioning of projects. M&E can help an organization to extract, from past and ongoing activities, relevant information that can be used as the basis for future planning. Without M&E it would be impossible to judge if a project was going in the right direction; whether progress and success was being achieved, and how future efforts might be improved?

A structured M&E approach makes information available to support the implementation of forestry projects and activities and will enhance the sustainability. Used effectively M&E can help to strengthen project implementation and encourage useful partnerships with key stakeholders. M&E is about feed-back from implementation and its ultimate purpose is change for the better.

The main objectives of M&E are to:

- Ensure informed decision-making;
- Enhance organizational and development learning;
- Assist in policy development and improvement;

- Provide mechanisms for accountability;
- Promote partnerships with, and knowledge transfer to, key stakeholders;
- Build capacity in M&E tools and techniques.

7.2 Requisite Factors to Consider for Development of M&E Plan

Utility: It must be useful and serve the practical and strategic information needs of the intended users for decision making purposes (from assessing program performance to allocating resources, etc.) Intended users may include those at the highest central levels making decisions about national programs to those making decisions to improve programs at the district level.

Feasibility: The M&E plan should be realistic and practical. To the extent possible, it should make the best use of existing data collection systems. If new data collections systems or studies are involved, resources (cost and technical capacity) must carefully be considered.

Propriety: Data collection, special studies included in the M&E plan must abide by regulations and protocols that consider the rights of those involved in and affected by M&E activities.

Accuracy: Finally, the M&E plan should provide technically accurate and useful information for decision making and program improvement.

Scale of program funding and resources for M&E

The scale of program funding and the proportion of resources devoted to M&E is a major important factor to be considered in the development of M&E plan. Obviously, the M&E effort should not be more costly than the program itself. One rule that has been suggested is that 10% of resources should be devoted to M&E. Costs that should be considered are those related to the cost of data collection systems and information dissemination and use of those for M&E coordination. M&E expenses may be higher in the first year because of the resources needed to improve or establish information systems. If new systems or special studies are to be conducted by outside agencies, these costs and their timeline must also be considered. Those developing the M&E Plan also need resources such as indicator guides, M&E guidelines (manuals, textbooks, etc.) and communication tools.

Technical capacity for M&E

For M&E plan to be realistic and appropriate for program's needs, there must be a strategically located M&E unit that will be made up of individuals who are motivated, committed, competent and interested in M&E.

Furthermore, a good M&E should make it possible to assess:

- **Relevance** – Does the project/activity deal with broader development objectives of DFNC?
- **Effectiveness** – Have the impacts, objectives, outputs and activities of the project been achieved?
- **Efficiency** – Did the process that was followed make the optimum use of the resources and time available in order to achieve the desired outputs?
- **Impact** – To what extent has the project contributed towards longer term goals such as job creation, poverty alleviation, or a reduction of dependency on forest resources?
- **Sustainability** – What is the likelihood that efforts will be continued by other agencies after the end of the project?

Monitoring and Evaluation in the Forestry sector is expected to:

- develop systematic M&E process for all the development projects/programs in the forestry sector.
- carry out the field monitoring and evaluation in order to check whether the development programs and projects implementation is being carried out according to the targets.
- prepare the monitoring and evaluation report and make recommendations based on facts and findings of the M&E activities for the concerned organizations including the Planning Section of the Ministry.
- monitor and evaluate the development projects and programs and to analyze the information to meet the set target.
- make progress report in a regular basis and organize the progress review workshops.
- organize quarterly and annual progress review meeting of the programs implemented in the forestry sector (The globalfund, 2015).

7.3 Monitoring and Evaluation of Forestry, Agroforestry and Biomass Energy Projects in Rwanda

It is the duty of the Department of Forestry and Nature Conservation (DFNC) to continuously assess the progress of various monitoring indicators for sustainable forestry, agroforestry and biomass energy projects, particularly at the activity level. Monitoring process requires collection and analysis of data that serves as a guide to either continue the pace and direction of implementation in case the institution is on the right course of action or set up corrective actions if it has diverted from the original path. It is therefore necessary that DFNC overall administration coordinates all the activities within the institution to ensure that various departments share information, experiences and above all work towards a common vision. This is particularly important as one department's weakness affects the performance of the other and vice versa

The role of DFNC's monitoring and evaluation framework is to gradually gather needed information on the evolution of SFABE activities under its strategic plan. The gathered information should be analyzed in order for DFNC to measure the achievements/impact in relation to the stated objectives. It is essential to disseminate this information to various stakeholders intervening in the sector for purposes of coordination. The information will also be used a basis for reviewing SFABE development plans.

Monitoring which will be based on the assessment of what has been achieved at budget and activities level as compared to the planned gives an indicator of performance at the technical, financial, and duration of the activity levels. For DFNC to achieve this, analyzed and verified field data should be used in analyzing plans and achievements. It is on this basis that technical reports will be prepared and linked with the financial data. An annual plan as well as quarterly plans will be developed at the beginning of the final year and these are monitored for comparison purposes. All departments will organize, under the supervision of their heads, a quarterly meeting to evaluate activities achieved in the previous quarter as compared to what had been planned. This will allow DFNC to make the necessary adjustments. The progress report on DFNC activities will be compiled by monitoring and evaluation staff based on quarterly reports.

Monitoring and Evaluation Plan for Sustainable Forestry, Agroforestry and Biomass Energy (SFABE) development in Rwanda will not be complete and effective without the provision and implementation of the following:

- M&E guideline for SFABE
- M&E unit/office with appropriate M&E facilities such as vehicle/motor cycle at every district
- M&E officer at every district
- Internal M&E report submitted at the third quarter of every year
- External M&E done every five years

The product of M&E based on the foregoing, will be a veritable tool for Government (Supervising Authority: MINIRENA) and donors; leaders of the DFNC (Board of Directors and the Director); other partners intervening in the Forestry sector; and primary beneficiaries such as the private sector and decentralized entities.

8 CONCLUSION AND RECOMMENDATIONS

This study has examined the current level of activities in the forestry, agroforestry and biomass energy sector and has charted paths for sustainable development of this sector. It has provided estimates of investment needs to achieve this sustainability both at the medium and high levels.

The following activities are however very germane and recommended for sustainable forestry, agroforestry and biomass energy development in the country. They include:

- (1) the production and use of management plans for all the public forest estates;
- (2) restructuring of agroforestry practice to include the farmers in the decision concerning agroforestry system of interest and the components;
- (3) establishment of forestry research institute in the country in order to promote research in SFABE;
- (4) encouragement of the use of value addition technologies such as mobile sawmills for a more efficient and rewarding wood conversion;
- (5) promotion of modern efficient charcoal production plants to produce higher quality charcoal;
- (6) promotion and dissemination of improved cook stoves for both charcoal, firewood and pellets to reduce energy loss during cooking and heating together with reducing indoor pollution that has disastrous health hazards disproportionately to women; and lastly
- (7) urban forestry development in Kigali and the six secondary urban areas in the country for beautification and amenity purposes.

9 BIBLIOGRAPHY

- Australian Forestry Standard (2010): Sustainable Forestry. <http://www.forestrystandard.org.au/sustainable-forestry/sustainable-forestry>.
- Byamukama, B., Carey, C., Cole, M., Dyszynski, J. and Warnest, M. (2011) National Strategy on Climate Change and Low Carbon Development for Rwanda, Baseline Report. Smith School of Enterprise and the Environment, University of Oxford.
- Dyszynski, J. Hogarth, R., Megan, C. and Rutabingwa, F. (2011). Forests and Tree-based Systems Sector Working Paper. Smith School of Enterprise and the Environment. University of Oxford.
- European Forest Institute (EFI), (2013). Forest Accounting Networks Suitable for National Accounting. Mediterranean Regional, Office for the European Forest Institute, Barcelona, Spain.
- European Union (EU), (2002). The European Framework for Integrated Environmental and Economic Accounting for Forests (IEEAF). Luxembourg, Office of the Official Publications of the European Communities.
- FAO (2006). Global Forest Resources Assessment 2005. Food and Agricultural Organization of the United Nations. Rome: Food and Agricultural Organization of the United Nations.
- FAO, (2014). Sustainable Financing of Forests and Landscape Restoration: The Role of Policy Makers. Rome, Italy.
- Food and Agricultural Organization of the United Nations (FAO), (1998). Economic and Environmental Accounting for Forestry. Status and Current Efforts. Rome, Italy.
- GTZ/Marge, (2009) Biomass Energy Strategy (BEST), Rwanda. Volume 2: Background & Analysis, 2009. European Union Energy Initiative Partnership Dialogue Facility.
- GTZ/Marge, (2009), Biomass Energy Strategy (BEST), Rwanda. Volume 4: The Proposed Strategy, European Union Energy Initiative Partnership Dialogue Facility.
- MINIRENA (2013). Rwanda Supply Master Plan for fuelwood and charcoal. PAREF /RNRA, Kigali, Rwanda.
- MINIRENA (2014) Forest Landscape Restoration Opportunity Assessment for Rwanda. IUCN/WRI/RNRA, Kigali.
- Ministry of Forestry and Mines (MINIFOM), (2010) National Forestry Policy, Kigali, Rwanda.
- NAFA (2010) Strategic Plan for the Forest Sector (2009- 2012). MINIFOM, Kigali.

- National Institute of Statistics of Rwanda (NISR) (2015) Rwandan Integrated Household Living Conditions Survey – 2013/14, Main Indicators Report, August 2015, Kigali, Rwanda.
- Nduwamungu, J. (2011). Forest Plantations and Woodlots in Rwanda. African Forest Forum Working Paper Series. Volume 1, Issue 14.
- Overseas Development Institute (ODI), (2013). Mobilizing International Climate Finance: Lessons From the Fast-start Period. Climate Funds Update website with data as of February 2015.
- Republic of Rwanda (ROR), (2000) Rwanda Vision 2020. Kigali
- ROR (2005), Organic Law determining the modalities of protection, conservation and promotion of environment in Rwanda. Official Gazette of the Republic of Rwanda, N° 04/2005 of 08/04/2005.
- ROR (2011) Green Growth and Climate Resilience: National Strategy for Climate Change and Low Carbon Development. Kigali
- ROR (2012) Economic Development and Poverty Reduction Strategy II, 2013–2018
- ROR (2013) Law determining the management and utilisation of forests in Rwanda. Official Gazette of the Republic of Rwanda, N°47bis/2013 du 28/06/2013.
- ROR, (2006). National Adaptation Programme of Action (NAPA). Kigali, Rwanda
- ROR, (2009). Strategic plan for the transformation of agriculture in Rwanda – Phase II (PSTA II). Ministry of Agriculture and Animal Resources, Kigali, Rwanda.
- ROR, (2010). Environment subsector strategic plan 2010-2014. Ministry of Lands and Environment. Prepared for the Environment Thematic Working Group, Rwanda Environment Management Authority (REMA)
- The Global fund (2015): Monitoring and Evaluation Plan Guidance for submission of an M&E plan for Global Fund grants. www.theglobalfund.org/documents/.../ME_Plan_Guidelines_en
- United Nations Development Program (UNDP), (2013): Terms of Reference for Consultancy Support towards Inclusive Green Growth in Rwanda: Costing of Integrated Water Resource Management Investments. United Nations Development Program.

10 ANNEXES

10.1 Scenario 1: Business-as-Usual (2016-2030)

Pathway 1: Forest Development	Units	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOTAL	RWF	USD	%
Plantation Development	ha	7,818	7,818	7,818	7,818	7,818	7,818	7,818	7,818	7,818	7,818	7,818	7,818	1,870			95,686	51,213,362,687		
Rehabilitation and Maintenance of Old Plantations	ha	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	15,150	15,269,746,390		
Agroforestry Development	ha	65,006	65,006	65,006	65,006	65,006	65,006	65,006	65,006	65,006	65,006	65,006	65,006	65,006	65,006	65,006	975,084	75,756,818,983		
Urban forestry in Kigali	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	1,605,941,906		
Pathway Total																		143,845,869,965	192,832,581	84.0
Pathway 2: Forest Plantation Management and Agro-forestry																				
Training people in bamboo propagation and processing	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	926,011,848		
Rehabilitation of critical ecosystem, state forest plantations and training people,	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	66,773,643		
Demarcating, and licensing for harvest state forests, Collecting employment data	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	373,229,642		
Seedling production and planting for Gishwati	No	1	1	1													3	369,226,111		
Maintenance of Gishwati Plantation	No				1	1	1	1	1	1	1	1	1	1	1	1	12	21,356,765		
Pathway Total																		1,756,598,010	2,354,807	1.0
Pathway 3: Rwanda sustainable woodland management and natural forest restoration																				
Counterpart funds PGREF	No	1	1	1													3	441,817,500		
Pathway Total																		441,817,500	592,278	0.3
Pathway 4: Terrestrial ecosystems and forest resource management																				
Organize National planting week	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	403,161,621		
Support districts to produce seedling and other planting materials for energy production	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	125,988,007		
Operationalize a silviculture guidelines implementation plan and monitoring system	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	31,497,002	42,223	
Pathway Total																		560,646,629	751,575	0.3
Pathway 5: Biomass Energy																				
Improved Charcoal Kilns	No	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	150	503,952,026		
Improved Cook Stoves	No	14,560	14,560	14,560	14,560	14,560	14,560	14,560	14,560	14,560	14,560	14,560	14,560	14,560	14,560	14,560	218,400	1,834,385,375		
Pathway Total																		2,338,337,401		1.4
Scenario Total																		148,943,269,505	199,665,900	87.0
M&E																		14,894,326,951	19,966,590	8.7
Contingency																		7,447,163,475	9,983,295	4.3
Grand Total																		171,284,759,932	229,615,785	100.0

10.2 Scenario 2: Medium Level of Sustainable Forestry, Agroforestry and Biomass Energy Development (2016-2030)

Pathway 1: Promote growing of multi-purpose agroforestry trees in all farming systems	Units	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOTAL	RWF	USD	%
Carry out a study to identify suitable agroforestry trees for planting in various farming systems	No	1															1	30,000,000		
Upscale agroforestry to cover 100% of farmland from 2019	ha	17,350	17,350	17,350	17,350	17,350	17,350	17,350	17,350	17,350	17,350	17,350	17,350	17,350	17,350	17,350	260,254	20,219,791,543		
Reward best farmers practicing agroforestry in every sector.	No	416	416	416	416	416	416	416	416	416	416	416	416	416	416	416	6,240	1,048,220,214		
Hold meetings with farmers in every district to have inputs on the choice of agroforestry system desired	No	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	450	1,511,856,078		
Pathway Total																		22,809,867,836	30,577,768	55.0
Pathway 2: Avail improved seeds and other germplasm																				
Rehabilitation and upscaling of Seed store in the use of biotechnology in the production of tree seedlings.	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	249,256,182		
Train and support 4 farmers in every sector in sourcing and handling of quality seeds	No	1,664		1,664		1,664		1,664		1,664		1,664		1,664		1,664	13,312	973,675,629		
Pathway Total																		1,222,931,811	1,639,401	2.9
Pathway 3: Upscaling forest management towards sustainability																				
Support the implementation of the District Forestry Plan	No	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	450	3,556,652,322		
Train 20 forestry personnel across cadre in all the districts in the use of the DFMPs	No	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	4,500	1,066,995,696		
Development of forest management plans for the state forest	No		10	10	10												30	750,000,000		
Upscale the capacity of the forestry protection department through training and provision of equipment for effective forest protection	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	3,889,072,844		
Pathway Total																		9,262,720,862	12,417,140	22.3
Pathway 4: Promote participatory forestry development																				
Encourage and Support Local Communities, NGOs and CBOs to be involved in community based forest management	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	960,000,000		
Encourage the formation of a forum (Forestry Association of Rwanda) of forestry stakeholders in the country	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	765,000,000		
Pathway Total																		1,725,000,000	2,312,449	4.2
Pathway 5: Biomass Energy																				
Improved Charcoal Kilns	No	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	10,320	1,040,156,982	1,394,382	2.5
Pathway Total																		1,040,156,982	1,394,382	
Scenario Total																		36,060,677,491	48,341,127	
M&E																		3,606,067,749	4,834,113	8.7
Contingency																		1,803,033,875	2,417,056	4.3
Total Project Cost																		41,469,779,115	55,592,296	100.0

10.3 Scenario 3: High Level of Sustainable Forestry, Agroforestry and Biomass Energy Development (2016-2030)

Pathway 1: Strengthen forestry and agro-forestry research	Units	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOTAL	RWF	USD	%
Establishment of a Forestry Research Institute	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	1,367,513,408		
Support universities /higher institutions of learning to do research in forestry and agro forestry	No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	180,000,000		
Pathway Total																		1,547,513,408	2,074,519	42.3
Pathway 2: Promote value addition technologies to wood and non-wood forest products																				
Carry out a study to identify national needs in wood processing and the required infrastructure	No	1															1	30,000,000		
Establish one modern wood processing and treatment unit such as mobile sawmill per province	No	4															4	180,000,000		
Pathway Total																		210,000,000	281,516	5.7
Pathway 3: Promote urban forestry development in the secondary cities																				
Upscale tree planting in the six (6) secondary cities		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	90	1,422,660,929		
Pathway Total																		1,422,660,929	1,907,148	38.9
Scenario Total																		3,180,174,337	4,263,183	
M\$E																		318,017,434	426,318	8.7
Contingency																		159,008,717	213,159	4.3
Total Project cost																		3,657,200,488	4,902,660	100.0