ADAPTATION FUND

AFB/PPRC.38/Inf.75
20-21 October 2026

Adaptation Fund Board
Project and Programme Review Committee
Thirty-eighth meeting
Bonn, Germany, 20-21 October 2026

LOCALLY-LED ADAPTATION SINGLE COUNTRY PROPOSAL FOR BURUNDI

ADAPTATION FUND

ADAPTATION FUND BOARD SECRETARIAT
TECHNICAL REVIEW OF PROJECT PROPOSAL FOR
"COMMUNITY-LED ADAPTATION FOR RESILIENCE AND INCLUSIVE SUSTAINABILITY IN BURUNDI"

Project Title	Community-Led Adaptation for Resilience and Inclusive Sustainability in Burundi
Project ID	AF00000575
Category	LLA
Type	Single country project
Stage	Concept
Country	Burundi
Implementing Entity	OSS
Financing Requested	USD 5,000,000.00
Reviewer	Rywon Mayang

Co-reviewer(s)

IE Contact Person | Mr. Nabil BENKHATRA,Mr. Steve MUHANJI,Mrs. Khaoula JAOUI

Secretariat's Overall Comment

The initial technical review raises several issues, such as insufficient climate evidence for the adaptation rationale in the target area, lack of clarity on the beneficiaries, an underdeveloped locally led adaptation approach, gaps in the stakeholder consultation process and gender considerations, and ESP compliance, as is discussed in the number of Clarification Requests (CRs) and Corrective Action Requests (CARs) raised in the review.

Country Eligibility

Is the country party to the Kyoto Protocol and/or the Paris Agreement?

Response: Yes

Secretariat: Burundi is a party to both treaties. It acceded to the Kyoto Protocol in 2001 and ratified the Paris Agreement in 2018.

Is the country a developing country particularly vulnerable to the adverse effects of climate change?

Response: Yes

Secretariat: Burundi is among the most climate-vulnerable countries globally, with about 70% of the population below the poverty line and an economy dependent on rain-fed agriculture that employs the large majority of the workforce. The target provinces of Muyinga and Ngozi combine high population density, steep hillside cultivation and advanced land degradation with increasingly irregular rainfall, prolonged dry periods and more intense rainfall events, which are accelerating soil erosion, reducing water retention and raising exposure to floods and landslides in the upper catchments of the Ruvubu River Basin.

Project Eligibility

Has the designated government authority for the Adaptation Fund endorsed the project/programme?

Response: Yes

Secretariat: Yes. As per the Endorsement letter dated 15 May 2026.

Does the length of the proposal amount to no more than fifty (50) pages for the Concept note project document, including its annexes?

Response: Not Cleared

Secretariat: CAR 1: The concept note runs to 56 pages. The page numbering restarts at 1 on the seventh page, so that the final page is numbered 50 although it is the 56th page of the document. Please bring the document within the fifty-page limit, which applies to the concept note including its annexes, and number the pages continuously from the first page, bearing in mind that additional text will be needed in response to the requests raised in this review.

Does the project / programme support concrete adaptation actions to assist the country and/or the local actors in addressing adaptive capacity to the adverse effects of climate change and build in climate resilience?

Response: Not Cleared

Secretariat: The project proposes ecosystem restoration in the upper Ruvubu catchments, climate-smart agriculture, and livelihood, finance and risk-management measures across four communes of Muyinga and Ngozi provinces, organized under three components with a stated 20,000 beneficiaries and 5,000 ha under restoration. However, the climate rationale is presented in general terms only, and the technical annexes cover provinces other than the target area. CR 1: Please provide, even at indicative level, the observed climate trends, projections and hazard occurrence for the target area, Muyinga and Ngozi provinces and, where available, the four target communes, with data sources. CR 2: Please clarify, to the extent possible at this stage, the tenure and current use of the land to be restored, how much of it is presently under cultivation, and what support is envisaged for households whose cultivation is displaced. The proposal estimates more than 20,000 direct beneficiaries and 100 local institutions without stating how the figures are derived. CR 3: Please provide the basis for the estimated number of beneficiaries and local institutions, together with an indicative breakdown by sex and vulnerable group, and clarify the relationship between the cooperatives that receive funds and the households counted as beneficiaries. At the fully developed proposal stage, the results framework should include the expected number of direct and indirect beneficiaries, disaggregated by gender, with targets and indicators specified per activity. The proposal states implementation in four communes, while the cost-effectiveness section refers to composting hubs "in each of the 8 targeted communes" and Activity 2.1.2.1 refers to approximately 20 compost hubs. CR 4: Please reconcile the number of target communes and, accordingly, the number of compost hubs and revolving funds. Output 3.2.2 pairs community-based early warning with a climate risk insurance scheme, and Inkinzo Assurances Générales is named as the co-designing partner. It is not yet clear what type of product is envisaged. CR 5: Please indicate whether the insurance scheme is index-based or indemnity-based, noting that the annexes describe the earlier design as parametric while the concept note does not characterise it. Activity 3.2.2.1 installs rainfall gauges and weather stations and Activity 3.2.2.4 refers to payout triggers monitored locally. CR 6: Please explain how those triggers would be verified for the purpose of settling claims, and on what data the product would be priced, given that the equipment would begin recording only during implementation. CR 7: Please clarify the status of the arrangement with Inkinzo Assurances Générales and how affordability would be maintained after the project, since premiums are to be subsidised for female-headed households. The proposal refers to community adaptation funds and micro-grants (Output 3.2.1), women-led revolving funds capitalised at USD 15,000 per commune, village savings and loan associations, and match-funding mechanisms implemented through BCAB. CR 8: Please clarify: (i) the respective function of the

community adaptation funds and micro-grants under Output 3.2.1, the women-led revolving funds, the village savings and loan associations, and the match-funding mechanisms implemented through BCAB, and how they relate to one another; (ii) whether the community adaptation funds and the revolving funds disburse grants or repayable finance; and (iii) the basis for the expected USD 240,000 in cumulative financing from the revolving funds.

Does the project/programme enable devolving decision making to the lowest appropriate level? Does it give local institutions and communities more direct access to finance and decision-making power over how adaptation actions are defined, prioritized, designed, implemented; how progress is monitored and how success is evaluated.

Response: Not Cleared

Secretariat: The proposal channels 70% of resources directly to pre-vetted youth and women's cooperatives through an On-Granting Mechanism managed by BCAB, and refers to grassroots administrative structures (hill and zone chiefs) in local planning. The structures through which decisions would be taken and funds allocated are unclear. CAR 2: Please set out the structure through which decision-making and access to finance would be devolved (i) which body decides, how it is composed, selected and mandated, (ii) what it decides and with what effect on the allocation of funds, (iii) whether a cooperative acts for its members or for the community as a whole, and how households that are not members take part in those decisions. CR 9: Please clarify what the 70% channelled to cooperatives consists of and of which total amount it is calculated, noting that Components 1 and 2 together amount to USD 2,919,355, exactly 70% of the activity budget. Please also clarify whether the cooperatives would decide how those resources are used or implement activities already fixed in the design. CR 10: Please describe the cooperatives and community committees on which the approach relies: (i) how many are currently active in the four target communes, and how they are composed in terms of membership, legal form and registration status; (ii) the basis for the figure of 100 cooperatives cited in the proposal; and (iii) what proportion of households in the target communes belongs to a cooperative. CR 11: Please describe the On-Granting Mechanism, including the criteria and process for pre-vetting cooperatives, the conditions a local institution must meet to receive and manage funds, the indicative size of awards and the number of entities expected to receive them. The Executing Entity is a bank and no further delivery partner is identified, while the substantive work of the components is agronomic rather than financial. CR 12: Please describe the arrangements for delivering the substantive work: (i) which entity delivers each component; (ii) what agronomic and safeguards capacity the Executing Entity holds or would contract, and its presence in the four communes; and (iii) how the vetting, custody and disbursement functions are separated. At the fully developed proposal stage, please provide the grant procedures, reporting requirements, community oversight and audit arrangements. CR 13: Please clarify how community decisions would relate to the roles of the hill and zone chiefs and the communal administration.

Does the project / programme provide economic, social and environmental benefits, particularly to vulnerable communities, including gender considerations, while avoiding or mitigating negative impacts, in compliance with the Environmental and Social Policy and Gender Policy of the Fund? Does the project/programme address structural inequalities faced by women, youth, children, people with disabilities, people who are displaced, Indigenous Peoples and marginalized ethnic groups?

Response: Not Cleared

Secretariat: The proposal commits to 50% women's leadership quotas, subsidized insurance premiums for female-headed households and Batwa engagement through FPIC. However, the gender and poverty baselines

rest on modelled datasets described in the annexes as synthetic records rather than field observations, and the gender analysis (Annex 3) covers provinces other than the target area. CAR 3: Please provide an initial gender assessment for the target communes based on actual data. Batwa households in Burundi are commonly land-poor and dependent on common-property resources, while the project's benefits are mediated through land and cooperative membership. CR 14: Please clarify the presence of Batwa communities in the four target communes and how they and other vulnerable groups will be identified and engaged, consistent with the FPIC commitments made in the proposal. CR 15: Please describe the pathway by which a household that holds no land, or that is not a cooperative member, would obtain a benefit under each component, and what protection would apply where restoration measures or conservation bylaws restrict access to resources.

Is the project / programme cost effective?

Response: Not Cleared

Secretariat: The proposal presents quantitative cost-effectiveness claims whose basis is not shown, a restoration unit cost of USD 350/ha that equals the entire Component 1 budget although the component also includes nurseries, soil and water conservation structures and land-use agreements; savings claims of 30–40% and USD 150,000 without derivation; and a coordination platform costed for four years against a five-year implementation period. CR 16: Please provide the basis for the quantitative cost-effectiveness figures and a comparison of the proposed approach with alternative options that could deliver similar outcomes.

Is the project / programme consistent with national, sub-national or local sustainable development strategies, national, sub-national or local development plans, poverty reduction strategies, national communications and adaptation programs of action and other relevant instruments?

Response: Cleared

Secretariat: The concept note aligns with the National Adaptation Plan, the NDC, the National Climate Change Strategy and Action Plan, the National Development Plan, the National Agriculture Strategy, the Poverty Reduction Strategy Paper, the Technology Needs Assessment, and Community Development Charters and Local Government Action Plans. (pages 15-16)

Does the project / programme meet the relevant national technical standards, where applicable, in compliance with the Environmental and Social Policy of the Fund? Does the project provide support to local actors and build their capacities to comply with the standards?

Response: Not Cleared

Secretariat: Table 4 sets out the standards applicable to each area of intervention, which includes the Environmental Code of Burundi, the national environmental impact assessment regulations and the National Forest Policy, National Climate-Smart Agriculture guidelines, Forest Landscape Restoration (FLR) technical standards. CR 17: Please identify the specific instruments behind the categories listed in Table 4, with their titles and legal references, together with the authority responsible for each. For example, the legislation referred to as "national land laws" is understood to be the Land Code (Law No. 1/13 of 9 August 2011). CR 18: Please clarify whether there are regulatory requirements applicable to the on-granting operations of the Executing Entity, to the community-managed funds and micro-grants, and to the climate risk insurance scheme, together with the responsible authorities.

Is there duplication of project / programme with other funding sources? Does the project enhance collaboration across sectors and enhance efficiencies and good practice?

Response: Not Cleared

Secretariat: Table 5 categorises seven initiatives as duplication, no duplication or complementarity, and identifies a potential site-level overlap with the Forest Landscape Restoration project in Muyinga.(pages 12-13) CR 19: Please expand the table to give, for each initiative, its thematic focus, implementing partner and donor, its geographic coverage within Muyinga and Ngozi, and its duration and implementation status, together with the lessons taken from it into the design of CLARiS. CR 20: Please describe how the overlap with the Forest Landscape Restoration project would be resolved, including the mechanism by which restoration sites are checked against those of other initiatives before selection, and who applies it.

Does the project / programme have a learning and knowledge management component to capture and feedback lessons, in particular managing traditional and/or indigenous knowledge, where relevant? Does it contribute to building and institutionalizing local capabilities?

Response: Not Cleared

Secretariat: The proposal provides for community-based monitoring, evaluation and learning, participatory scorecards, peer exchange and a knowledge-sharing platform, and for the documentation of traditional and indigenous knowledge in Kirundi-language formats under free, prior and informed consent. These arrangements are described in the narrative but are not reflected in the component structure. CR 21: Please indicate where the learning and knowledge management activities sit in the component structure, who is responsible for delivering them, and how they are financed.

Has a consultative process taken place, and has it involved and encouraged all key stakeholders, and vulnerable groups, to meaningfully participate in and lead adaptation decisions? Did the consultative process consider and address gender-based, economic and other inequalities in compliance with the Environmental and Social Policy and Gender Policy of the Fund?

Response: Not Cleared

Secretariat: A consultation report has been prepared for the proposal, consolidating engagement carried out in October 2024 and March 2025 across eight provinces for an earlier project design. It does not cover Muyinga, Ngozi or the four target communes, and the report itself lists this among the actions to be completed before submission. Initial consultations in the project area, and a report on them, are required at concept note stage. CAR 4: Please conduct and document initial consultations in Gashoho, Gasorwe, Tangara and Busiga, and explain how the earlier evidence informed the design without presenting it as coverage of the target area.

Is the requested financing justified on the basis of full cost of adaptation reasoning?

Response: Cleared

Secretariat: Table 6(page 16) compares the baseline and adaptation scenarios by thematic area and sets out the incremental adaptation benefits.

Is the project / program aligned with AF's results framework?

Response: Not Cleared

Secretariat: The concept note does not yet include an alignment with the Adaptation Fund Strategic Results Framework, which is required at concept note stage. CAR 5: Please include an alignment table using the Adaptation Fund's updated alignment template, showing the project outcomes and outputs, the project's own indicators, the corresponding Fund outcomes, outputs and indicators, and the grant amount allocated to each, with outcome-level and output-level totals, including the core indicator on the number of beneficiaries and the other applicable core indicators. Given the locally led design, please include Output 2.2 and Indicator 2.2 on local institutions receiving funding directly or other direct support under the locally led adaptation modality, and Output 3.3 and Indicator 3.3 on local institutions and communities responsible for decision-making over how adaptation solutions are defined, prioritized, designed and implemented. Please refer to the Strategic Results Framework Guidance (2026).

Has the sustainability of the project/programme outcomes been taken into account when designing the project? Does the project/programme support long-term development of local governance processes, and improve the capacity of local institutions to ensure that communities can effectively implement adaptation actions over the long term?

Response: Not Cleared

Secretariat: The proposal anchors commune-level adaptation committees, community assemblies and cooperatives within existing decentralization frameworks and builds their capacity in financial management, procurement and monitoring, and it favours measures that draw on locally available knowledge, materials and labour. Revolving funds and locally retained enterprise revenue are presented as the financial basis for continuation. An exit strategy is not described, and the arrangements for maintaining the restored areas, conservation structures and nurseries after closure are not yet set out. CR 22: Please clarify, to the extent possible at this stage, how the long-term sustainability of outcomes would be ensured at the sub-project level: (i) the sustainability criteria to be applied to sub-project selection and approval; and (ii) how communities and institutions would be supported to mobilise resources or access funding once the project ends. CR 23: Please describe in particular how the restored areas, conservation structures and nurseries would be maintained, by whom and with what resources. CR 24: Please provide further information on whether the community-managed adaptation funds (Output 3.2.1) and the women-led revolving adaptation funds are intended to persist beyond the project and under what legal form. Output 3.2.2 provides for community climate monitoring with locally defined hazard thresholds and alert protocols. CR 25: Please clarify how the community-based early warning systems would relate to the national meteorological and hydrological service. In particular, please indicate which authority issues warnings and how community-defined thresholds relate to nationally issued alerts. Please also clarify who would maintain and calibrate the equipment after the project.

Does the project / programme provide an overview of environmental and social impacts / risks identified, in compliance with the Environmental and Social Policy and Gender Policy of the Fund?

Response: Not Cleared

Secretariat: The proposal anticipates a Category B classification, screens the fifteen principles of the Environmental and Social Policy and identifies risks including ecosystem disturbance during works, land disputes, unequal distribution of benefits within cooperatives and exclusion of marginalized households. It also

acknowledges that a number of sub-projects will remain unidentified at approval and commits to an Environmental and Social Management Framework covering their screening, categorization, approval and monitoring. However, the ESP checklist does not yet follow the order or numbering of the fifteen principles, and two numbers are used twice. The checklist records the Indigenous Peoples principle as "No Risk — No indigenous communities identified in the project areas", while the concept note states throughout that Indigenous Batwa communities would co-create interventions under free, prior and informed consent, are engaged as stakeholders and are a target group for benefits. The accompanying risk table also refers to principles that do not appear in the Environmental and Social Policy, including "Public Participation and Access to Information", "Accountability" and "Livelihoods of the Poor". CAR 6: Please revise the checklist to follow the fifteen principles in the order and wording of the Policy and to identify risks only, moving the mitigation measures to the management plan. CR 26: Please double-check the Indigenous Peoples principle consistently with the Batwa presence described in the proposal. Also, please correct the principle references in the risk table. CR 27: Please set out the basis for screening the Involuntary Resettlement principle as low risk on the ground that land access is voluntary, given that the project foresees conservation bylaws and land-use restrictions that may result in restrictions on access to resources.

Resource Availability

Is the requested project / programme funding within the size for LLA single country grants?

Response: Cleared

Secretariat: The requested financing of USD 5,000,000 is within the size for a single-country locally led adaptation project.

Is the Implementing Entity Management Fee at or below 8.5% per cent of the total project/programme budget before the fee?

Response: Cleared

Secretariat: Yes. The Implementing Entity management fee is 8.5% of the total project cost before the fee

Are the Project/Programme Execution Costs at or below 9.5% per cent of the total project/programme budget (including the fee)?

Response: Cleared

Secretariat: Yes. The project execution cost is 9.5% of the total project/programme cost.

Eligibility of IE

Is the project/programme submitted through an eligible Implementing Entity that has been accredited by the Board?

Response: Cleared

Secretariat: Yes. The Sahara and Sahel Observatory is an accredited Regional Implementing Entity. The accreditation is valid until 30 October 2027.

LOCALLY-LED ADAPTATION PROJECT/PROGRAMME PROPOSAL FOR SINGLE COUNTRY

PART I: PROJECT INFORMATION

Title of Project:	Community-Led Adaptation for Resilience and Inclusive Sustainability in Burundi
Country:	Burundi
Thematic Focal Area:	Multisector project
Type of Implementing Entity:	Regional Implementing Entity
Implementing Entity:	Sahara and Sahel Observatory (OSS)
Executing Entities:	Community and Agricultural Bank of Burundi (BCAB)
Amount of Financing Requested:	USD 5,000,000
Letter of Endorsement (LOE) signed:	Yes [x] No [ ]

NOTE: The LOE should be signed by the Designated Authority (DA). The signatory DA must be on file with the Adaptation Fund. To find the DA currently on file check this page: https://www.adaptation-fund.org/apply-funding/designated-authorities

Stage of Submission:

[ ] This proposal has been submitted before including at a different stage (pre-concept, concept, fully- developed proposal)

[x] This is the first submission ever of the proposal at any stage

In case of a resubmission, please indicate the last submission date: 22/07/2026.

Please note that fully-developed proposal documents should not exceed 100 pages for the main document, and 100 pages for the annexes.

Official Use Only

Project Background and Context

1. Burundi is increasingly exposed to climate variability and environmental degradation, with particularly severe impacts in vulnerable provinces such as Muyinga and Ngozi, where livelihoods depend largely on rain-fed agriculture and fragile hillside ecosystems. These regions are characterized by high population density, steep slopes, and strong pressure on land resources, which amplify the effects of climate change. In recent years, communities have experienced more irregular rainfall patterns, prolonged dry periods, and episodes of intense rainfall. These changes have accelerated soil erosion, land degradation, and the loss of vegetation cover, weakening ecosystem functions that are essential for agricultural production and water regulation. As soils become less fertile and less able to retain moisture, the risks of floods and landslides increase, particularly in upstream catchment areas.
2. These environmental stresses are closely linked to economic and social vulnerability. The majority of households in Muyinga and Ngozi rely on small-scale agriculture and livestock as their primary sources of food and income, leaving them highly exposed to climate shocks. Declining agricultural yields, recurrent crop losses, and reduced livestock productivity have become increasingly common, contributing to food insecurity, unstable household incomes, and rising poverty levels. Climate shocks often force households to adopt negative coping strategies, such as selling productive assets or reducing food consumption, which further undermines long-term resilience.
3. Smallholder farmers, women, youth, and marginalized groups are disproportionately affected by these challenges. Many of these groups have limited access to land, productive assets, extension services, and financial resources, reducing their ability to invest in climate-resilient practices. Women and youth, in particular, face structural barriers related to land tenure, access to credit, and participation in local decision-making processes. Marginalized groups often experience additional constraints linked to social exclusion and insecure land tenure, further increasing their vulnerability to climate-related shocks and stresses.
4. At the institutional level, the capacity to address these interconnected challenges remains limited. Local governance structures are often under-resourced and overstretched, with insufficient technical expertise, coordination mechanisms, and financial means to support climate-resilient land management and livelihood diversification. While national climate strategies exist, their translation into effective action at the local level is constrained by weak implementation capacity and limited decentralization of resources. Community access to climate finance, early warning systems, and climate risk management tools remains very limited, and adaptation efforts are often fragmented or externally driven. As a result, responses to climate shocks tend to be reactive and short-term, focusing on immediate coping rather than prevention, preparedness, and long-term resilience building.
5. In this context, there is growing recognition that top-down and externally designed adaptation interventions have delivered limited and uneven results, particularly at the community level. Although rural communities possess valuable local knowledge of their landscapes, farming systems, and coping strategies, they have had little influence over how adaptation priorities are defined, how resources are allocated, or how interventions are implemented. This disconnect between local needs and decision-making processes has constrained the effectiveness, relevance, and sustainability of past adaptation efforts, and has often limited community ownership of project outcomes.
6. The CLARiS project has been developed in direct response to this context, operating in areas where climate risks, environmental degradation, socio-economic vulnerability, and institutional constraints intersect. The project is grounded in a locally led adaptation (LLA) perspective, which recognizes that effective and lasting resilience depends on strengthening community leadership, reinforcing local institutions, and enabling direct access to resources and decision-making power at the local level. Rather than treating communities as passive beneficiaries, CLARiS positions them as central actors in identifying adaptation priorities, managing financial and natural resources,

Official Use Only

and implementing context-specific actions that respond to local risks, capacities, and knowledge systems. By embedding adaptation planning and implementation within existing community structures and local governance mechanisms, the project seeks to ensure that resilience outcomes are inclusive, locally owned, and sustainable over the long term.

Project Objectives

7. The overall goal of the project is to empower rural communities in Burundi through decentralized and locally led decision-making, enabling them to restore degraded land, strengthen agricultural resilience, and protect the livelihoods of vulnerable and marginalized groups.
8. By reinforcing local capacities and institutions, the project aims to enhance communities' ability to anticipate, manage, and adapt to climate risks in a sustainable manner.
9. This goal will be achieved through the following specific objectives:
    - **Enhance ecosystem resilience** by restoring degraded landscapes through soil conservation measures, reforestation, and sustainable land management practices.
    - **Improve soil management and agricultural resilience** through the adoption of climate-smart agricultural practices, including terracing, agroforestry systems, organic farming techniques, crop rotation, and cover cropping, to increase soil fertility and water retention.
    - **Promote climate-resilient livelihoods** by diversifying income sources through sustainable agriculture, agroforestry-based production systems, and value-added agro-processing activities.
    - **Strengthen access to climate finance at the local level** by building the capacity of community institutions and cooperatives to access, manage, and implement climate adaptation funds, and by supporting community-led projects aligned with Burundi's climate and green growth priorities.
    - **Reduce disaster risks and climate-related losses** by addressing flood, drought, and landslide risks through soil stabilization measures, community-based early warning systems, preparedness actions, and climate risk insurance mechanisms

Project Components and Financing[1]:

Table 1: Project Components and Financing

Project Components	Expected Concrete Outcomes	Expected Outputs	Amount (US$)
Component 1: Ecosystem Restoration and Landscape Resilience	**Outcome 1.1:** Restored ecosystem functions and landscape stability in climate-vulnerable catchments	**Output 1.1.1**: Degraded hillsides and micro-catchments restored through agroforestry, reforestation, and nature-based soil and water conservation measures	1,751,613
		Output 1.1.2: Community-managed tree nurseries established and sustainably operational	
	Outcome 1.2: Reduced climate-induced erosion, flooding, and landslide risks	**Output 1.2.1:** Soil and water conservation structures constructed, rehabilitated, and maintained	
		Output 1.2.2: Local land-use agreements and conservation bylaws developed and enforced	
Component 2: Climate-Smart Agriculture and Adaptive Soil Management	**Outcome 2.1:** Improved soil fertility and water retention	**Output 2.1.1**: Climate-smart agricultural practices locally led and adopted based on agroecological conditions	1,167,742
		Output 2.1.2: Women-managed compost hubs established and supplying organic inputs	

[1] IE and EE fees calculator: https://www.adaptation-fund.org/document/ie-and-ee-fees-calculator/

Official Use Only

	Outcome 2.2: Increased and more stable agricultural productivity and food security	**Output 2.2.1:** Farmers trained and supported in adaptive soil and water management	
Component 3: Community Livelihood, Financial and Risk Resilience	**Outcome 3.1:** Diversified and climate-resilient livelihoods and value chains strengthened for vulnerable households	**Output 3.1.1:** Climate-resilient livelihood activities supported for women, youth, and vulnerable groups	1,251,152
		Output 3.1.2: Market access and local value-addition mechanisms strengthened	
	Outcome 3.2: Local financial autonomy and climate risk resilience strengthened	**Output 3.2.1:** Community-managed adaptation funds and micro-grants established and operational	
		Output 3.2.2: Climate risk insurance schemes and community-based early warning systems established and operational	
Total Component			**4,170,507**
6. Project Execution cost			**437,788**
7. Total Project Cost			**4,608,295**
8. Project Cycle Management Fee charged by the Implementing Entity (if applicable)			**391,705**
Amount of Financing Requested			**5,000,000**

Projected Calendar:

Milestones	Expected Dates
Start of Project Implementation	January 2027
Mid-term Review (if planned)	December 2029
Project Closing	December 2031
Terminal Evaluation	Jun 2032

PART II: PROJECT JUSTIFICATION

A. Description the project components

10. Decision-making is facilitated at the lowest appropriate level through a decentralized, community-led approach where local institutions and communities drive adaptation efforts. Grassroots administration (hill chiefs, zone chiefs) and cooperatives conduct participatory risk assessments during Community Assemblies to identify climate vulnerabilities.
11. Funding is channeled through an On-Granting Mechanism managed by BCAB, allocating 70% of resources directly to pre-vetted youth and women's cooperatives. Insurance schemes are co-designed with Inkinzo Assurances Générales to define payout triggers. Inclusive participation includes 50% leadership quotas for women and subsidized insurance premiums for female-headed households. Indigenous Batwa communities co-create interventions through free, prior, and informed consent (FPIC) protocols. Community-led monitoring systems feature farmers using digital tools for real-time tracking, local committees auditing progress and fund use. Capacity-building initiatives support cooperatives in financial management, proposal development, and conflict resolution, while anti-elite capture measures include public budget disclosures and third-party audits. To reinforce long-term resilience and community investment, 20% of profits from agroforestry and value-added enterprises are retained locally for reinvestment in future projects. This approach strengthens local ownership, shortens response times to climate shocks, and enables national replication of successful models through BCAB's funding cycles.

Project sites:

12. The CLARiS project will be implemented in four high-priority communes in northeastern Burundi, within the provinces of Muyinga and Ngozi. These communes are predominantly rural and highly dependent on rain-fed subsistence agriculture, which remains the main source of food and income for the majority of households. High population density, combined with limited availability of arable land, has intensified pressure on natural resources, leading to the progressive degradation of soils,

Official Use Only

forests, and water resources. Climate variability reflected in increasingly irregular rainfall patterns, prolonged dry periods, and more frequent intense rainfall events has further amplified these pressures, undermining agricultural productivity, destabilizing fragile hillside ecosystems, and increasing households' exposure to climate-related shocks.

13. The socio-economic vulnerability of these communes is closely linked to environmental conditions. Declining soil fertility, reduced water retention, and increased erosion have contributed to recurrent crop losses, declining yields, and income instability. Many households have limited capacity to absorb climate shocks, often resorting to negative coping strategies that further weaken long-term resilience. At the same time, the selected communes benefit from active community institutions, cooperatives, and decentralized governance structures, which play an important role in local development and natural resource management. These institutional assets provide a strong foundation for implementing a locally led adaptation (LLA) approach, enabling communities to participate meaningfully in identifying climate risks, prioritizing adaptation actions, managing resources, and sustaining outcomes over time.
14. In Muyinga Province, the project will focus on the communes of Gashoho and Gasorwe, both situated in the upper catchments of the Ruvubu River Basin, one of Burundi's most important ecological and hydrological corridors. These upstream areas are critical for regulating water flows, recharging groundwater, and maintaining downstream ecosystem services that support agriculture and livelihoods across a wider landscape. However, decades of cultivation on steep slopes, deforestation for fuel and farmland, and limited access to sustainable land management practices have resulted in severe land degradation and widespread soil erosion. These processes have increased sedimentation in waterways, reduced water quality, and heightened flood risks in downstream areas. By prioritizing ecosystem restoration, soil and water conservation, and improved land-use governance in Gashoho and Gasorwe, the project seeks to address both local and downstream climate risks, restoring hydrological balance while strengthening the ecological functions that underpin agricultural livelihoods.
15. In Ngozi Province, the project will be implemented in the communes of Tangara and Busiga, which are characterized by rugged topography, declining soil fertility, and recurrent drought conditions. Agricultural systems in these areas are highly sensitive to rainfall variability, and even short dry spells or intense rainfall events can result in significant crop losses. Households face growing challenges related to food insecurity, reduced income opportunities, and increased exposure to landslides and runoff-related damage. Despite these constraints, Tangara and Busiga offer strong potential for climate-resilient interventions, particularly in agroforestry, erosion control, adaptive soil management, and livelihood diversification. Community organization and existing local governance frameworks provide favorable conditions for participatory planning, collective action, and community-led implementation of adaptation measures.
16. By concentrating activities in these four communes, the CLARiS project adopts a strategic landscape approach, focusing on upstream and hillside areas where targeted adaptation investments can generate high resilience returns. Interventions in these zones are expected to reduce climate risks, restore ecosystem services, and create positive spillover effects across the wider Ruvubu River Basin, including improved water regulation and reduced downstream flooding. This geographic focus strengthens the effectiveness of the project's ecosystem-based and locally led adaptation strategy, while also creating opportunities for learning, replication, and scaling in other climate-vulnerable regions of Burundi.

Theory of Change:

17. The CLARiS project seeks to address the growing climate vulnerability of rural communities in northeastern Burundi, particularly in Muyinga and Ngozi provinces, where livelihoods depend heavily on rain-fed agriculture and fragile hillside ecosystems. These areas are increasingly affected by land degradation, erratic rainfall, floods, droughts, and landslides, compounded by limited access to climate finance and the structural exclusion of women, youth, and marginalized groups from

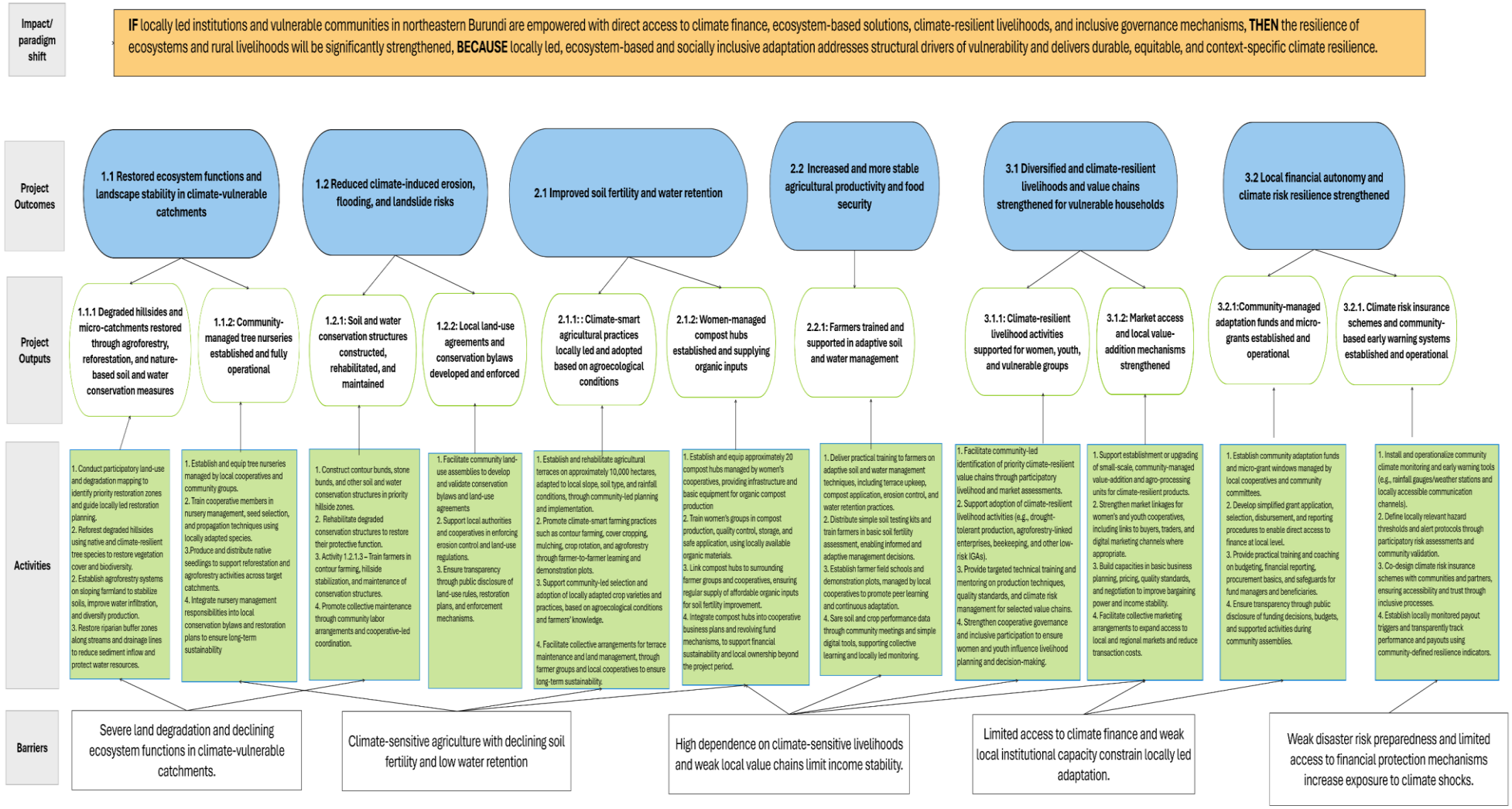
Official Use Only

adaptation planning and decision-making. Previous responses have often been externally driven, fragmented, and focused on short-term coping rather than systemic resilience and local ownership.

18. **IF** vulnerable communities are empowered to lead climate adaptation planning and implementation, degraded ecosystems are restored and managed sustainably through nature-based solutions; climate-smart agriculture and diversified livelihood systems are locally adopted, disaster risks are proactively reduced, and local institutions gain direct, inclusive, and transparent access to climate finance and decision-making authority, **then** rural households and ecosystems in northeastern Burundi will significantly strengthen their resilience to climate shocks, improve food and livelihood security, and reduce long-term vulnerability to climate-related hazards, **because** locally led, ecosystem-based adaptation that integrates community knowledge, inclusive governance, risk reduction, and direct resource access addresses the root structural drivers of vulnerability and enables sustained, context-specific resilience.
19. This transformation pathway begins with restoring the ecological foundations of resilience. By rehabilitating degraded hillsides and stabilizing climate-vulnerable catchments in the upper Ruvubu River Basin, vegetation cover is restored, soil erosion is reduced, and water regulation functions are strengthened. Community-agreed land-use governance reinforces sustainable management of restored areas. These ecosystem-based interventions reduce exposure to floods and landslides while improving soil and water retention, creating the biophysical conditions necessary for resilient agricultural and livelihood systems.
20. Building on this ecological foundation, the project strengthens agricultural systems through the adoption of locally adapted climate-smart practices. Improved soil fertility, organic inputs, terraces, agroforestry, and farmer-led knowledge exchange increase productivity while reducing sensitivity to rainfall variability. As farming systems become more stable and regenerative, food security improves and climate-induced yield fluctuations decline, enhancing household adaptive capacity.

Official Use Only

Figure 1: Theory of Change of CLARiS project



Official Use Only

Component 1: Ecosystem Restoration and Landscape Resilience

21. This component addresses the rapid degradation of landscapes in the upper Ruvubu River Basin, where soil erosion, deforestation, and declining vegetation cover are undermining ecosystem services and increasing exposure to floods and landslides. Operating in highly climate-vulnerable hillside and upstream catchment areas, it promotes community-led, nature-based solutions to restore ecosystem functions while supporting sustainable land use and long-term climate resilience. Interventions combine ecological restoration, soil and water conservation, and participatory land-use governance, anchored in Locally Led Adaptation (LLA) principles and inclusive decision-making.

Outcome 1.1: Restored ecosystem functions and landscape stability in climate-vulnerable catchments

22. This outcome reflects the recovery of degraded hillside and upstream ecosystems so they can regulate water flows, stabilize soils, and support productive landscapes under increasing climate variability. By restoring vegetation cover and improving land management practices, the component reduces erosion, enhances water retention, and strengthens resilience to intense rainfall, droughts, floods, and landslides.

Output 1.1.1: Degraded hillsides and micro-catchments restored through agroforestry, reforestation, and nature-based soil and water conservation measures

23. Under this output, degraded hillsides and micro-catchments are restored through a package of agroforestry, reforestation with locally adapted species, and nature-based measures that reduce runoff and improve infiltration. Restoration priorities and sites are identified through participatory land-use and degradation mapping that integrates technical assessments and local ecological knowledge. These interventions improve soil stability, restore ecosystem services, and reduce downstream sedimentation.
24. This output will include these key activities:
    - Activity 1.1.1.1: Conduct participatory land-use and degradation mapping to identify priority restoration zones and guide locally led restoration planning.
    - Activity 1.1.1.2: Reforest degraded hillsides using native and climate-resilient tree species to restore vegetation cover and biodiversity.
    - Activity 1.1.1.3: Establish agroforestry systems on sloping farmland to stabilize soils, improve water infiltration, and diversify production.
    - Activity 1.1.1.4: Restore riparian buffer zones along streams and drainage lines to reduce sediment inflow and protect water resources.

Output 1.1.2: Community-managed tree nurseries established and fully operational

25. This output supports the establishment and sustainable operation of community-managed nurseries that supply native and climate-resilient seedlings for restoration and agroforestry activities. Nurseries are managed by local cooperatives and community groups, creating employment and strengthening stewardship and ownership of restored landscapes. Sustainability is reinforced through local capacity building, cooperative business planning, and integration into community restoration bylaws and plans.
26. This output will include these key activities:
    - Activity 1.1.2.1: Establish and equip community tree nurseries managed by local cooperatives and community groups.
    - Activity 1.1.2.2: Train cooperative members in nursery management, seed selection, and propagation techniques using locally adapted species.
    - Activity 1.1.2.3: Produce and distribute native seedlings to support reforestation and agroforestry interventions across target catchments.
    - Activity 1.1.2.4 – Integrate nursery management responsibilities into local conservation bylaws and restoration plans to support long-term sustainability.

Outcome 1.2: Reduced climate-induced erosion, flooding, and landslide risks

27. This outcome captures reduced physical climate risks in hillside and upstream areas through improved land stabilization and strengthened local governance. By combining structural soil and water conservation measures with locally enforced land-use rules, communities reduce exposure

Official Use Only

to erosion, floods, and landslides under increasingly intense rainfall events.

Output 1.2.1: Soil and water conservation structures constructed, rehabilitated, and maintained

28. Under this output, soil and water conservation structures are constructed and rehabilitated in highly erosion-prone zones to reduce runoff, stabilize slopes, and protect productive land. Farmers and community groups are supported with practical skills and organization to maintain structures over time. This improves slope stability and reduces downstream flood and sediment risks.
29. This output will include these key activities:
    - Activity 1.2.1.1 – Construct contour bunds, stone bunds, and other soil and water conservation structures in priority hillside zones.
    - Activity 1.2.1.2: Rehabilitate degraded conservation structures to restore their protective function.
    - Activity 1.2.1.3: Train farmers in contour farming, hillside stabilization, and maintenance of conservation structures.
    - Activity 1.2.1.4: Promote collective maintenance through community labor arrangements and cooperative-led coordination.

Output 1.2.2: Local land-use agreements and conservation bylaws developed and enforced

30. This output strengthens local governance by formalizing community-agreed land-use rules that support sustainable land management and ecosystem restoration. Local assemblies define practical bylaws and responsibilities, while local authorities and cooperatives reinforce compliance through transparent enforcement mechanisms. Public disclosure improves accountability and reduces conflict around land-use restrictions.
31. This output will include these key activities:
    - Activity 1.2.2.1: Facilitate community land-use assemblies to develop and validate conservation bylaws and land-use agreements
    - Activity 1.2.2.2: Support local authorities and cooperatives in enforcing erosion control and land-use regulations.
    - Activity 1.2.2.3: Ensure transparency through public disclosure of land-use rules, restoration plans, and enforcement mechanisms.

Component 2: Climate-Smart Agriculture and Adaptive Soil Management

32. This component strengthens soil health, agricultural productivity, and food security in climate-vulnerable farming systems by supporting a transition to locally adapted climate-smart agriculture. It responds to declining soil fertility, increasing rainfall variability, and growing exposure to droughts and intense rainfall events that undermine smallholder production. The component combines physical soil and water conservation, organic soil fertility management, farmer-led learning, and locally driven decision-making, consistent with LLA principles and agroecological conditions in the target areas.

Outcome 2.1: Improved soil fertility and water retention in climate-vulnerable agricultural systems

33. This outcome reflects measurable improvements in soil structure, organic matter, and moisture retention across hillside and rain-fed agricultural lands. By adopting climate-smart and locally adapted practices, farming systems become more resilient to dry spells and heavy rainfall, reducing erosion and nutrient loss while strengthening long-term soil productivity.

Output 2.1.1: Climate-smart agricultural practices locally led and adopted based on agroecological conditions

34. Under this output, climate-smart agricultural practices are implemented at scale using approaches adapted to local slopes, soils, and rainfall patterns. Farmers actively guide land preparation, field design, and practice selection, ensuring interventions reflect local realities and knowledge. The result is improved water retention, reduced erosion, and more stable yields under climate variability.
35. This output will include these key activities:
    - Activity 2.1.1.1: Establish and rehabilitate agricultural terraces adapted to local slope, soil type, and rainfall conditions through community-led planning and implementation.

Official Use Only

- Activity 2.1.1.2: Promote climate-smart practices such as contour farming, cover cropping, mulching, crop rotation, and agroforestry through demonstration plots and farmer-to-farmer learning.
- Activity 2.1.1.3: Support community-led selection and adoption of locally adapted crop varieties and practices based on agroecological conditions and farmers' knowledge.
- Activity 2.1.1.4: Facilitate collective arrangements for terrace maintenance and land management through farmer groups and local cooperatives to ensure long-term sustainability.

Output 2.1.2: Women-managed compost hubs established and supplying organic inputs

36. This output establishes women-managed compost hubs that supply affordable organic inputs while creating income opportunities and strengthening women's economic empowerment. Compost production improves soil organic matter and water retention, reduces reliance on chemical fertilizers, and supports regenerative land management. Sustainability is reinforced through cooperative management, quality control, and integration into revolving fund and business planning systems.
37. This output will include these key activities:
    - Activity 2.1.2.1: Establish and equip approximately 20 compost hubs managed by women's cooperatives, providing infrastructure and basic equipment for organic compost production
    - Activity 2.1.2.2: Train women's groups in compost production, quality control, storage, and safe application, using locally available organic materials.
    - Activity 2.1.2.3: Link compost hubs to surrounding farmer groups and cooperatives, ensuring regular supply of affordable organic inputs for soil fertility improvement.
    - Activity 2.1.2.4: Integrate compost hubs into cooperative business plans and revolving fund mechanisms, to support financial sustainability and local ownership beyond the project period.

Outcome 2.2: Increased and more stable agricultural productivity and food security under climate variability

38. This outcome reflects increased yields, reduced yield variability, and improved food security resulting from healthier soils and adaptive farming practices. By strengthening farmers' capacity to respond to climate variability, agriculture becomes a more reliable source of food and income despite increasingly erratic rainfall.

Output 2.2.1: Farmers trained and supported in adaptive soil and water management

39. Under this output, farmers are equipped with practical knowledge, tools, and peer-learning systems to make informed management decisions under changing climate conditions. Training and demonstration activities strengthen adaptive capacities in terrace upkeep, compost application, erosion control, and moisture retention. Shared learning and simple monitoring tools reinforce continuous adjustment of practices based on results.
40. This output will include these key activities:
    - Activity 2.2.1.1: Deliver practical training on adaptive soil and water management, including terrace maintenance, compost use, erosion control, and water retention practices.
    - Activity 2.2.1.2: Distribute simple soil testing kits and train farmers in basic soil fertility assessment to support adaptive decisions.
    - Activity 2.2.1.3: Establish farmer field schools and demonstration plots managed by local cooperatives to promote peer learning and continuous adaptation.
    - Activity 2.2.1.4: Share soil and crop performance data through community meetings and simple digital tools to support locally led monitoring and learning.

Component 3: Community Livelihood, Financial and Risk Resilience

41. This integrated component strengthens household resilience by combining climate-resilient livelihoods, local climate finance access, and community risk management tools. It responds to recurrent climate shocks that erode incomes and assets, and to limited access to finance and preparedness systems that constrain recovery. The component supports women, youth, and vulnerable households to diversify income sources, strengthen value chains and market access, and access financial mechanisms including micro-grants and risk transfer tools while improving preparedness through early warning systems. Implementation is grounded in locally led planning, inclusive governance, and transparent, community-managed mechanisms.

Official Use Only

Outcome 3.1: Diversified and climate-resilient livelihoods and value chains strengthened for vulnerable households

42. This outcome reflects a shift toward more diversified and resilient livelihood portfolios, reducing dependence on high-risk, climate-sensitive income sources. By strengthening production options and value chains, and by improving access to skills and markets, targeted households especially women- and youth-led groups achieve more stable incomes and improved capacity to withstand climate variability.

Output 3.1.1: Climate-resilient livelihood activities supported for women, youth, and vulnerable groups

43. Under this output, communities identify and implement climate-resilient livelihood options that are aligned with local contexts, skills, and market opportunities. Support prioritizes women, youth, and marginalized groups through cooperative-led approaches, technical training, and mentoring. Selected activities emphasize resilience and viability under climate variability, strengthening household income stability.
44. This output will include these key activities:
    - Activity 3.1.1.1: Facilitate community-led identification of priority climate-resilient value chains through participatory livelihood and market assessments.
    - Activity 3.1.1.2: Support adoption of climate-resilient livelihood activities (e.g., drought-tolerant production, agroforestry-linked enterprises, beekeeping, and other low-risk IGAs).
    - Activity 3.1.1.3: Provide targeted technical training and mentoring on production techniques, quality standards, and climate risk management for selected value chains.
    - Activity 3.1.1.4: Strengthen cooperative governance and inclusive participation to ensure women and youth influence livelihood planning and decision-making.

Output 3.1.2: Market access and local value-addition mechanisms strengthened

45. This output increases income stability by strengthening the ability of cooperatives to add value locally and access markets more effectively. It supports small-scale processing and collective marketing arrangements that reduce transaction costs and improve bargaining power. Strengthened market linkages help beneficiaries maintain income during climate shocks and reduce exposure to climate-related market disruptions.
46. This output will include these key activities:
    - Activity 3.1.2.1: Support establishment or upgrading of small-scale, community-managed value-addition and agro-processing units for climate-resilient products.
    - Activity 3.1.2.2: Strengthen market linkages for women's and youth cooperatives, including links to buyers, traders, and digital marketing channels where appropriate.
    - Activity 3.1.2.3: Build capacities in basic business planning, pricing, quality standards, and negotiation to improve bargaining power and income stability.
    - Activity 3.1.2.4: Facilitate collective marketing arrangements to expand access to local and regional markets and reduce transaction costs.

Outcome 3.2: Strengthened local financial autonomy and climate shock absorption capacity

47. This outcome captures improved ability of communities and households to finance adaptation actions and absorb climate shocks without falling into negative coping strategies. By establishing community-managed funds, micro-grants, and risk transfer tools, communities gain predictable resources for locally prioritized adaptation. Combined with early warning systems, these mechanisms improve preparedness, protect livelihoods, and strengthen recovery capacity.

Output 3.2.1: Community-managed adaptation funds and micro-grants established and operational

48. Under this output, local financing mechanisms provide direct, flexible, and transparent support for community-prioritized adaptation and livelihood investments. Cooperatives and community committees manage grants using simplified procedures suited to local capacity, with clear criteria for inclusion of women, youth, and vulnerable households. Public disclosure and community oversight strengthen accountability and trust.
49. This output will include these key activities:

Official Use Only

- Activity 3.2.1.1: Establish community adaptation funds and micro-grant windows managed by local cooperatives and community committees.
- Activity 3.2.1.2: Develop simplified grant application, selection, disbursement, and reporting procedures to enable direct access to finance at local level.
- Activity 3.2.1.3: Provide practical training and coaching on budgeting, financial reporting, procurement basics, and safeguards for fund managers and beneficiaries.
- Activity 3.2.1.4: Ensure transparency through public disclosure of funding decisions, budgets, and supported activities during community assemblies.

Output 3.2.2: Climate risk insurance schemes and community-based early warning systems established and operational

50. This output strengthens preparedness and financial protection by combining community-based early warning systems with locally appropriate climate risk insurance mechanisms. Communities define risk thresholds and locally relevant triggers, establish communication channels for alerts, and build local capacity for system maintenance. Insurance and early warning tools complement each other by reducing losses through preparedness and supporting faster recovery through risk transfer mechanisms.
51. This output will include these key activities:
    - Activity 3.2.2.1: Install and operationalize community climate monitoring and early warning tools (e.g., rainfall gauges/weather stations and locally accessible communication channels).
    - Activity 3.2.2.2: Define locally relevant hazard thresholds and alert protocols through participatory risk assessments and community validation.
    - Activity 3.2.2.3: Co-design climate risk insurance schemes with communities and partners, ensuring accessibility and trust through inclusive processes.
    - Activity 3.2.2.4: Establish locally monitored payout triggers and transparently track performance and payouts using community-defined resilience indicators.

B. Economic, social and environmental benefits

52. The CLARiS project is designed to generate tangible and lasting economic, social, and environmental benefits for some of Burundi's most climate-vulnerable communities, with a particular focus on women, youth, Indigenous Peoples, people with disabilities, displaced populations, and marginalized ethnic groups. By targeting upstream communes in the Ruvubu River Basin, where climate risks, land degradation, poverty, and social exclusion intersect, the project prioritizes communities that have historically had limited access to adaptation finance and decision-making processes.
53. Economically, CLARiS strengthens household resilience by improving agricultural productivity, diversifying livelihoods, and expanding access to climate finance. Activities such as the distribution of drought-tolerant seeds, training in climate-smart agriculture, syntropic agroforestry, beekeeping, and the development of women-led agro-processing cooperatives contribute to increased incomes and improved food security. Village savings and loan associations, revolving funds managed by women's groups, and match-funding mechanisms implemented through BCAB provide communities with direct control over financial resources. These mechanisms reduce dependency on external actors and enable households especially women and youth to invest in long-term, climate-resilient livelihood strategies.
54. Socially, the project strengthens inclusive local governance and social cohesion by embedding participatory processes at all stages of planning and implementation. Community assemblies, cooperatives, and local adaptation committees serve as platforms where adaptation priorities are defined collectively, with minimum 50% representation of women in leadership roles. Particular attention is given to groups that are often excluded from development processes, including Indigenous Batwa communities, youth, displaced households, and people with disabilities. Batwa communities are engaged through free, prior, and informed consent (FPIC) processes to co-design interventions and risk thresholds. Women's land rights are strengthened through participatory land mapping and legal support, enhancing long-term tenure security and control over productive assets. Communication tools, including Kirundi-language radio programs and accessible mobile platforms, ensure broad access to information and participation.
55. Environmentally, Environmentally, CLARiS applies nature-based solutions to restore degraded ecosystems and strengthen landscape resilience in the Ruvubu River Basin. The restoration of more

Official Use Only

than 5,000 hectares through reforestation, agroforestry, erosion control, and soil conservation improve biodiversity, stabilizes soils, and enhances water retention. These interventions reduce the risks of floods and landslides while supporting sustainable agricultural production. Composting programs reduce reliance on synthetic fertilizers, and terracing and soil conservation structures limit nutrient runoff. Environmental benefits are realized both locally through improved ecosystem services and livelihoods and globally, through carbon sequestration and reduced emissions from sustainable land management practices.

56. Gender equality Gender equality is a cross-cutting priority of the CLARiS project and is embedded in both its design and implementation. Women in Burundi are disproportionately affected by climate change due to limited land rights, restricted access to finance, and unequal participation in decision-making. To address these structural barriers, the project adopts targeted measures that promote women's economic empowerment, leadership, and agency. At least 60% of income-generating initiatives including agro-processing activities, composting hubs, and revolving funds are led by women's cooperatives, ensuring direct control over financial resources. Women's secure access to land and productive assets is strengthened through participatory land mapping and legal aid, while capacity-building activities are tailored to different literacy levels and caregiving responsibilities. Governance structures, including local adaptation committees and resource management bodies, are required to maintain a minimum of 50% female representation, with women actively encouraged to take on leadership roles.
57. In line with the Adaptation Fund's Gender Policy, the project applies gender-disaggregated indicators, establishes gender-sensitive grievance mechanisms, and provides targeted subsidies to ensure that female-headed households and other vulnerable women can participate fully in project activities. These measures contribute to improved livelihood security, stronger agency, and more equitable community resilience.
58. Environmental and Social Safeguards: the CLARiS project is implemented in full compliance with the Adaptation Fund's Environmental and Social Policy. Environmental and social risks are identified and managed through participatory screening processes, supported by site-level Environmental and Social Management Plans (ESMPs) and commune-level assessments.
59. All project activities and subprojects are screened for potential risks related to land tenure conflicts, biodiversity loss, social exclusion, and unintended negative impacts. Mitigation measures are developed and implemented in close consultation with affected communities, ensuring transparency and local ownership. These safeguard measures ensure that adaptation interventions are environmentally sound, socially inclusive, and aligned with national and local regulations.
60. In parallel, the project promotes diversified and climate-resilient livelihoods, particularly for women, youth, and marginalized groups. By supporting climate-resilient production systems, local value addition, strengthened market linkages, and improved economic inclusion, households reduce dependence on highly climate-sensitive income sources. More diversified and locally anchored value chains increase income stability and enhance the capacity to absorb and recover from climate shocks.
61. To ensure sustainability and scalability, the project embeds adaptation finance within local governance systems. Through community-managed adaptation funds, micro-grants, and strengthened institutional capacities, local cooperatives and community institutions gain direct access to financial resources and practical management tools. Transparent procedures and inclusive decision-making mechanisms reinforce accountability, ownership, and long-term institutional resilience, shifting adaptation from externally financed interventions to locally governed investment processes.
62. Complementing these structural measures, disaster risk reduction and financial protection mechanisms enhance preparedness and recovery. Community-based early warning systems improve anticipation of climate hazards, while soil stabilization infrastructure reduces physical exposure. Climate risk insurance mechanisms provide financial buffers against losses. By integrating risk information, physical protection, and financial risk transfer, households are better able to avoid negative coping strategies and sustain development gains despite recurrent shocks.
63. Throughout implementation, adaptive learning mechanisms reinforce continuous improvement. Community-based monitoring and feedback systems allow local actors to assess results, refine interventions, and share lessons across communes and provinces. This iterative learning process strengthens innovation, accountability, and responsiveness to evolving climate risks.

Official Use Only

C. Cost-effectiveness of the project

64. The CLARiS project offers a high-return, cost-effective model for climate adaptation in Burundi by leveraging community-based, low-cost, and scalable interventions. Its design minimizes resource intensity while maximizing resilience outcomes by avoiding capital-intensive infrastructure in favor of nature-based solutions and decentralized implementation. These interventions align with the Adaptation Fund's Environmental and Social Policy and the Locally Led Adaptation (LLA) principles, delivering tangible results with strong economic efficiency.
65. More than 70% of the total project budget is allocated directly to field-level adaptation measures, particularly in restoring degraded ecosystems and improving community livelihoods. For instance, agroforestry and erosion control interventions will be implemented across 5,000 hectares, at an average cost of USD 350 per hectare less than 10% of the cost of traditional engineered land rehabilitation. Additionally, composting hubs, to be established in each of the 8 targeted communes, cost approximately USD 5,000 per hub and will directly serve over 800 farmers per site by improving soil fertility and reducing reliance on expensive chemical inputs.
66. Cost-efficiency is further strengthened through the mobilization of local labor and indigenous knowledge systems, which account for more than 65% of technical implementation activities. By engaging community members, cooperatives, and locally trained facilitators, the project reduces reliance on external consultants and contractors. This approach lowers operational costs by an estimated 30–40% compared to externally managed projects, while simultaneously creating rural employment, strengthening local skills, and enhancing community ownership benefits that extend beyond the project's lifetime.
67. To reduce administrative and monitoring costs, CLARiS integrates simple, low-cost digital solutions, including SMS-based reporting tools and youth-developed mobile applications. With a total budget of approximately USD 40,000 (less than 2% of the overall project budget), these tools are expected to reach more than 4,000 users across the target areas. They enable real-time data collection, support community-based early warning systems, and significantly reduce the need for costly, centralized monitoring and evaluation processes, thereby improving efficiency without compromising accountability.
68. Implementation is structured through a decentralized model that empowers local cooperatives, women's groups, and commune councils to manage approximately 80% of project activities. Annual implementation budgets for these entities range between USD 3,000 and 7,000, ensuring tailored delivery at minimal cost. This locally anchored approach enhances responsiveness and accountability, while reducing the need for centralized administration.
69. Project governance is supported by a multi-stakeholder coordination platform, budgeted at approximately USD 60,000 over four years, which brings together national institutions, local authorities, and civil society actors. By improving coordination and alignment with existing initiatives, this platform is expected to avoid duplication and generate estimated savings of up to USD 150,000, particularly in areas such as land restoration, water governance, and rural livelihoods.
70. Financial sustainability is further enhanced through the establishment of women-led revolving adaptation funds in each target commune, with an initial capitalization of USD 15,000 per fund. These funds are designed to recycle resources into new adaptation activities and are expected to generate approximately USD 240,000 in cumulative financing during the project period. This mechanism reduces dependence on external funding, strengthens women's economic autonomy, and increases the long-term cost-effectiveness of adaptation investments.
71. Finally, CLARiS is designed for cost-efficient replication and scaling. Tools, training materials, and governance templates developed in Muyinga and Ngozi will be reused in additional communes and provinces, reducing start-up and administrative costs by more than 40%. With a total project budget of USD 5 million, CLARiS will directly benefit more than 20,000 people, restore 5,000 hectares of degraded land, and strengthen the capacity of 100 local institutions. Through its lean delivery model, decentralized financing arrangements, and emphasis on local ownership, the project delivers strong value for money while laying the foundation for sustained, community-driven climate resilience.

Official Use Only

Table 2: Cost-Effectiveness and Efficiency Strategy of the CLARiS Project

Strategy	Description	Cost-Effectiveness Rationale
Nature-based, low-cost interventions	Composting hubs, agroforestry, syntropic farming, erosion control	Avoids expensive infrastructure; uses locally available materials and practices with long-term regenerative benefits
Use of local labor and knowledge	Employment of community members, integration of indigenous knowledge	Reduces external technical costs, builds local ownership, and ensures context-specific solutions
Digital monitoring tools	SMS systems, youth-developed mobile apps for monitoring and reporting	Reduces transaction and coordination costs; promotes efficiency in dispersed, rural settings
Decentralized implementation	Delivery through local cooperatives, commune councils, and women's groups	Reduces administrative overhead and fosters accountability and responsiveness
Multi-stakeholder coordination	Oversight by national and subnational actors through inclusive governance platforms	Avoids duplication of efforts, ensures synergy across sectors and levels of government
Revolving adaptation funds	Women-led cooperatives manage and reinvest profits into new resilience activities	Enhances sustainability and promotes reinvestment in community priorities
Micro grant readiness training	Financial literacy and proposal development support for 100 cooperatives (60% women-led)	Builds local capacity to access funding directly, reducing reliance on intermediaries
Scalable model	Proven pilots in two provinces scaled to six more through replication and adaptation	Minimizes start-up costs in new areas by reusing tools, systems, and protocols

D. Consistency with national or sub-national sustainable development strategies

72. Aligned with key national frameworks in Burundi, the initiative supports the National Adaptation Plan (NAP) (2018, Chapter 2) by enhancing soil health and decentralized climate resilience, contributing to the First Nationally Determined Contribution (NDC) (2015, updated 2021, Chapter 3) under the Paris Agreement, focusing on ecosystem restoration, sustainable agriculture, and disaster risk reduction. It also reflects the National Climate Change Strategy and Action Plan (2012, Chapter 4) by integrating climate resilience into rural development and improving food and water security. The project aligns with the National Development Plan (PND) (2018-2027, Chapter 5), the National Agriculture Strategy (2018-2027, Chapter 6), and the Poverty Reduction Strategy Paper (PRSP II, 2012, Chapter 7), contributing to Vision 2025's goals of poverty reduction and inclusive growth. It complements Provincial Development Plans, supports technology integration (TNA, 2019, Chapter 8), and strengthens local governance through Community Development Charters and Local Government Action Plans, ensuring long-term sustainability and policy coherence.

Table 3: National Frameworks for the CLARiS Project

National Framework	Year	Relevant Alignment with CLARiS
National Adaptation Plan (NAP)	2018	Enhances decentralized climate resilience and soil health management; promotes locally led adaptation through community-based planning and action.
Nationally Determined Contribution (NDC)	2015 (updated 2021)	Supports ecosystem restoration, sustainable agriculture, and disaster risk reduction; contributes to climate-resilient livelihoods and emissions reduction.
National Climate Change Strategy and Action Plan	2012	Integrates climate resilience into rural development; improves food and water security through nature-based solutions and early warning systems.
National Development Plan (PND)	2018–2027	Contributes to inclusive and sustainable development, poverty reduction, and gender-responsive governance through climate-smart cooperatives and land tenure reforms.

Official Use Only

National Agriculture Strategy	2018–2027	Promotes climate-smart agriculture, land restoration, and capacity building of agricultural cooperatives; supports diversification and food security.
Poverty Reduction Strategy Paper (PRSP II)	2012	Strengthens social inclusion and rural resilience; empowers women and Indigenous groups economically and socially.
Technology Needs Assessment (TNA)	2019	Supports deployment of climate-smart technologies, digital monitoring tools, and mobile-based adaptation solutions for smallholders and cooperatives.
Community Development Charters and Local Government Action Plans	Ongoing	Empowers local institutions and planning committees; integrates project activities into commune-level action plans to ensure long-term sustainability and policy coherence.

E. Alignment with national technical standards

73. The project will strictly adhere to all relevant national technical standards and regulatory frameworks applicable in Burundi, including Environmental Impact Assessment (EIA) regulations, water resource management guidelines, land-use planning rules, and construction safety standards. Prior to the initiation of any physical interventions such as terracing, soil and water conservation structures, reforestation activities, or small-scale infrastructure works site-specific environmental and social screening will be carried out in collaboration with the Burundi Office for Environmental Protection (OBPE) and relevant decentralized technical services. These assessments will ensure that potential environmental and social risks are identified early and that appropriate mitigation measures are integrated into activity design and implementation.
74. All agroecological and agricultural practices promoted under the project will follow technical guidelines and standards issued by the Ministry of Agriculture and Livestock, including those related to climate-smart agriculture, soil fertility management, and sustainable land management. Reforestation and agroforestry activities will be implemented in line with national forestry policies and restoration standards, with a strong emphasis on the use of native and locally appropriate species. Small-scale climate-resilient infrastructure, such as water harvesting systems or early warning installations, will comply with national building codes, occupational safety standards, and local zoning and land-use regulations, ensuring structural safety, environmental integrity, and community acceptance.
75. In parallel, the project fully integrates the principles and requirements of the Adaptation Fund's Environmental and Social Policy (ESP) and Gender Policy. Environmental sustainability, protection of human rights, gender equality, access and equity, and the inclusion of vulnerable and marginalized groups are embedded throughout project design, implementation, monitoring, and evaluation. Dedicated environmental and social safeguard officers will be appointed at both the national coordination unit and provincial implementation levels to oversee compliance with national and Adaptation Fund standards, support local actors in applying safeguard requirements, manage grievance redress mechanisms, and ensure continuous monitoring and reporting. Through targeted capacity-building activities, local institutions, cooperatives, and community groups will be supported to understand, apply, and sustain compliance with these standards, thereby strengthening local ownership and long-term institutional capacity beyond the project lifecycle.

Table 4: Applicable National Technical Standards and Compliance Measures

Area of Intervention	Relevant National / International Standards	Application within the Project	Capacity-Building & Compliance Measures
Environmental assessment and screening	Burundi Environmental Impact Assessment (EIA) Regulations; Environmental Code of Burundi	Site-specific environmental and social screening conducted prior to all physical works (terracing, reforestation, small infrastructure).	Training of local committees and implementing partners on EIA screening procedures; support from national and provincial environmental safeguard officers.

Soil and water conservation structures	National guidelines for soil and water conservation; Ministry of Environment and Agriculture technical manuals	Design and implementation of terraces, bunds, and check structures follow approved technical specifications adapted to local topography.	Technical training for community groups and cooperatives; supervision by qualified technicians; community-based monitoring of compliance.
Agroecological and agricultural practices	Ministry of Agriculture and Livestock agroecological standards; National Climate-Smart Agriculture guidelines	Climate-smart agricultural practices implemented using nationally endorsed methods and locally adapted techniques.	Farmer field schools, extension support, and training of lead farmers to ensure correct application of standards.
Reforestation and agroforestry	National Forest Policy; Forest Landscape Restoration (FLR) technical standards	Use of native and locally appropriate tree species; reforestation and agroforestry activities aligned with national restoration priorities.	Training of nursery managers and community monitors; technical oversight to prevent use of invasive species.
Small-scale infrastructure and construction	National building codes; local zoning and land-use regulations	All small-scale infrastructure complies with safety and construction standards.	Capacity building for local artisans and contractors; supervision by commune-level technical services.
Land tenure and land-use agreements	National land laws; decentralization and local governance frameworks	Land-use agreements and conservation bylaws developed through participatory processes and validated by local authorities.	Legal awareness sessions; mediation support; application of Free, Prior and Informed Consent (FPIC) where relevant.
Environmental and Social Safeguards	Adaptation Fund Environmental and Social Policy (ESP); Gender Policy	All activities screened and implemented in line with ESP principles, including gender equality, access and equity, and protection of vulnerable groups.	Appointment of safeguard focal points; grievance redress mechanisms; gender-responsive training for local institutions.
Monitoring, reporting, and accountability	National monitoring frameworks; Adaptation Fund reporting requirements	Regular monitoring of environmental and social performance with community participation.	Training of local actors on safeguards monitoring, reporting tools, and adaptive management.

F. Project duplication with other funding sources

76. The CLARiS project has been designed through an extensive consultative and analytical process to ensure strong alignment with existing initiatives and to avoid duplication of efforts. During project formulation, a systematic mapping of past and ongoing climate adaptation, landscape restoration, and livelihood support interventions in Burundi particularly in Muyinga and Ngozi provinces was conducted in close consultation with government institutions, development partners, civil society organizations, and local stakeholders. This analysis confirmed that while several donor-funded projects address specific aspects of land degradation, climate-smart agriculture, or rural livelihoods, few initiatives adopt an integrated, landscape-scale and locally led adaptation approach in the upper catchments of the Ruvubu River Basin. Existing interventions are often sector-specific, geographically fragmented, or limited in duration, which reduces their cumulative resilience impact and limits long-term sustainability at the community level.

77. CLARiS is therefore designed to complement and add value to existing initiatives by acting as a convergence platform for locally led adaptation. It coordinates small grants, community-based sub-projects, and technical interventions under a unified resilience framework that integrates environmental, social, and economic dimensions. For instance, it builds on lessons from GEF-funded watershed management activities and aligns with national priorities articulated in Burundi's National Adaptation Plan (NAP), National Biodiversity Strategy, and Strategic Framework for Climate Resilience. The project

Official Use Only

also strengthens linkages with decentralized governance mechanisms, including commune-level development plans and climate task forces.

78. To ensure coordination and efficiency, CLARiS will establish a multi-stakeholder coordination platform involving government line ministries (Environment, Agriculture, Water, and Local Governance), civil society, private sector actors, and community-based organizations. This platform will guide project implementation, promote cross-sectoral dialogue, and enable joint monitoring of outcomes. A knowledge and learning component will capture good practices and disseminate them through national and regional networks, thereby avoiding fragmentation and enhancing the collective impact of adaptation investments.
79. Furthermore, the project will apply standardized tools for participatory planning, safeguards compliance, and monitoring, which will be used across all sub-projects and small grant initiatives. This approach not only reduces transaction costs and overlaps but also ensures that all interventions contribute to a shared theory of change, reinforcing systemic resilience across the targeted landscape. The project's design also allows for coordination with other climate finance actors, including the Green Climate Fund (GCF), particularly through exchange on locally led adaptation strategies and sustainability mechanisms.
80. By fostering integrated delivery, cross-sector collaboration, and alignment with national frameworks, CLARiS will generate added value while maintaining a strong focus on locally defined needs and ownership key to achieving long-term climate resilience.
81. The categorization of existing initiatives into duplication, no duplication, and complementarity provides strategic value to the CLARiS project by guiding effective coordination and maximizing impact. By identifying potential duplication such as overlaps with the Forest Landscape Restoration (FLR) project in Muyinga CLARiS can proactively adjust its site selection and activity design to ensure it delivers added value without competing for the same resources or beneficiaries. Complementary projects like the GEF-funded Watershed Management Project (PABV) and the ACRA-CRAFS initiative offer tested models and datasets that CLARiS can adapt, enhancing technical efficiency and reducing design and piloting costs. No-duplication efforts, including PAGIRE and the GCF-supported National Adaptation Plan (NAP), provide valuable policy frameworks and coordination structures that CLARiS can align with to strengthen institutional collaboration and coherence. This alignment also fosters opportunities for mutual learning, capacity-building, and communication across projects, ultimately enabling the replication and scaling of successful practices. Through coordinated timelines, geographical complementarity, and cross-sector integration, CLARiS is positioned to maximize its resilience outcomes and contribute meaningfully to Burundi's broader climate adaptation agenda. Below is a defined and categorized table that classifies existing and recent projects in Burundi into three categories — *Duplication, No Duplication, and Complementarity* — and explains how each classification benefits the CLARiS project in terms of synergy, efficiency, and added value.

Table 5: Complementarity and Coordination with Ongoing and Planned Initiatives

Project Name	Category/ Justification	Benefit to CLARiS
Watershed Management and Restoration Project (PABV) – GEF/FAO	**Complementarity** Targets watershed management in areas adjacent to CLARiS; focuses on similar ecological objectives	CLARiS can build on technical models (e.g. agroforestry, terracing), adopt proven practices, and coordinate to expand geographical coverage without overlap
Project to Support Sustainable Land Management (PAGIRE) – World Bank	**No Duplication** Operates in broader national scope, not focused on targeted CLARiS zones	Opportunity to align methodologies and reporting systems; share land use mapping tools
Climate Resilient Agriculture for Food Security (ACRA-CRAFS) – IFAD/ACRA	**Complementarity** Active in Ngozi; focuses on CSA and food security	Enables coordination on CSA extension services, input supply chains, and community mobilization strategies
Adaptation Fund Project: PCCRB (UNDP)	**No Duplication** Nationwide climate resilience framework; not localized in CLARiS areas	Policy alignment with national climate priorities; synergy in monitoring and evaluation indicators
Forest Landscape Restoration Project (FLR) – IUCN	**Potential Duplication (Site-level)**Operates in Muyinga; may engage in similar restoration in same hillsides	Requires spatial coordination to avoid overlapping restoration sites; potential to harmonize ecological zoning and avoid resource duplication

Official Use Only

PADCI (Integrated Community Development Project) – EU/CARE	**Complementarity** Socioeconomic focus on community empowerment in overlapping provinces	Can reinforce CLARiS social inclusion, women's livelihoods, and local governance objectives
GCF NAP Readiness Support – UNDP	**No Duplication** Strategic-level support for NAP formulation	Strategic policy alignment; use NAP priorities as basis for CLARiS justification and targeting

82. The categorization of existing initiatives into duplication, no duplication, and complementarity provides strategic value to the CLARiS project by guiding effective coordination and maximizing impact. By identifying potential duplication such as overlaps with the Forest Landscape Restoration (FLR) project in Muyinga CLARiS can proactively adjust its site selection and activity design to ensure it delivers added value without competing for the same resources or beneficiaries. Complementary projects like the GEF-funded Watershed Management Project (PABV) and the ACRA-CRAFS initiative offer tested models and datasets that CLARiS can adapt, enhancing technical efficiency and reducing design and piloting costs. No-duplication efforts, including PAGIRE and the GCF-supported National Adaptation Plan (NAP), provide valuable policy frameworks and coordination structures that CLARiS can align with to strengthen institutional collaboration and coherence. This alignment also fosters opportunities for mutual learning, capacity-building, and communication across projects, ultimately enabling the replication and scaling of successful practices. Through coordinated timelines, geographical complementarity, and cross-sector integration, CLARiS is positioned to maximize its resilience outcomes and contribute meaningfully to Burundi's broader climate adaptation agenda.

G. Learning and Knowledge management

83. The CLARiS project integrates a strong learning and knowledge management component designed to capture, apply, and disseminate lessons learned, while strengthening and institutionalizing local adaptive capacities over time. Learning is treated not as a parallel activity, but as an integral part of project implementation, monitoring, and decision-making, ensuring that adaptation actions remain relevant, effective, and locally owned.
84. At the community level, learning is embedded through community-based monitoring, evaluation, and learning (MEL) processes. Local adaptation committees, cooperatives, and user groups participate in defining indicators, tracking progress, and reflecting on results during regular review meetings. These learning moments allow communities to assess what works, adjust practices, and share experiences across villages and communes. Practical tools such as participatory scorecards, field demonstrations, and peer-to-peer exchanges are used to support continuous learning and adaptation.
85. The project places strong emphasis on the recognition, documentation, and transmission of traditional and indigenous knowledge, particularly related to land management, soil conservation, water harvesting, crop diversity, and climate risk coping strategies. Indigenous Batwa communities and other local knowledge holders are engaged through free, prior, and informed consent (FPIC) processes to ensure that traditional knowledge is shared voluntarily, respected, and used appropriately. This knowledge is documented in locally accessible formats (Kirundi-language guides, community maps, audio recordings) and combined with scientific and technical knowledge to co-develop context-specific adaptation solutions.
86. At the institutional level, CLARiS strengthens learning by building the capacity of local institutions and cooperatives to manage knowledge and apply lessons learned. Training is provided on documentation, basic data analysis, and adaptive planning, enabling local actors to use evidence to inform future decisions and investments. Standardized but flexible learning tools are applied across sub-projects, allowing lessons to be aggregated and compared at the commune and provincial levels without undermining local specificity.
87. To support broader dissemination, the project establishes a knowledge-sharing platform that links community-level learning with sub-national and national stakeholders. Lessons learned, good practices, and innovations are shared through learning briefs, policy notes, exchange visits, radio programs, and workshops involving local authorities, civil society organizations, and national institutions. Collaboration with national platforms and climate finance actors, including those associated with the NAP and GCF processes, ensures that locally generated knowledge informs policy dialogue and future programming.

Official Use Only

88. By embedding learning within local governance structures, strengthening community ownership of knowledge, and valuing both traditional and scientific expertise, CLARiS contributes to the institutionalization of adaptive capacity at multiple levels. This approach ensures that learning continues beyond the project lifecycle and supports the replication and scaling of effective, locally led adaptation practices across Burundi.

H. Consultative process

89. The CLARiS project was prepared through a participatory and inclusive consultative process conducted at national, sub-national, and community levels in Muyinga and Ngozi provinces, in line with the Adaptation Fund's Environmental and Social Policy and Gender Policy. The process aimed to ensure that project design reflects local priorities and addresses gender-based, economic, and social inequalities.
90. Consultations involved national line ministries, provincial and communal authorities, civil society organizations, community-based organizations, women's and youth cooperatives, farmer groups, Indigenous Batwa representatives, people with disabilities, displaced households, and local private sector actors. Development partners and technical institutions were also consulted to ensure alignment with existing initiatives.
91. At the community level, consultations were carried out through community assemblies, focus group discussions, and participatory risk assessments, using locally appropriate methods and Kirundi language facilitation. Separate discussion spaces were organized for women, youth, and marginalized groups to ensure their voices were heard and power imbalances were addressed.
92. Gender considerations were explicitly integrated throughout the process. Inputs from women's groups informed project priorities related to land access, livelihoods, finance, and governance, leading to the inclusion of women-led activities, gender quotas in decision-making structures, and targeted financial mechanisms. Indigenous Batwa communities were engaged through free, prior, and informed consent (FPIC) processes to ensure culturally appropriate and meaningful participation.
93. Feedback from consultations was systematically reflected in project components, safeguards measures, governance arrangements, and monitoring indicators. By emphasizing meaningful participation and local leadership, the consultative process strengthened ownership, accountability, and the foundation for equitable and sustainable adaptation outcomes. Below is a summary of the consultations conducted for the project and linked to the full consultation report in annex 2

Dates	Consultations	Summary outcomes of discussion	Incorporation into the CLARiS concept note
8-12 October 2024	Institutional entry meetings and key-informant consultations	Provincial governors, municipal leaders and technical stakeholders confirmed that climate impacts differ across locations and highlighted drought, erratic rainfall, flooding, erosion, landslides, watershed degradation and weak climate-information services. Discussions also identified uneven local capacity, coordination constraints, and the need to align with existing government and partner initiatives.	Reflected in the problem statement, locally led adaptation rationale and decentralized governance approach. The findings informed participatory risk assessment, commune-level planning, institutional capacity building, coordination arrangements, community early warning, and the requirement to assess overlap and complementarity before sub-project approval.
15-24 October 2024	Community consultation workshops, gender-segregated focus groups and participatory mapping	Farmers, women, men, youth, Indigenous participants and local leaders validated lived climate impacts and prioritized soil and water conservation, agroforestry, resilient seed varieties, water harvesting and storage, seasonal forecasting, livelihood diversification, market access, accessible finance and insurance. Women emphasized water	Reflected across all three components: landscape restoration and soil-water conservation under Component 1; climate-smart agriculture, adaptive soil management and women-managed compost hubs under Component 2; and livelihoods, local value addition, community adaptation funds, micro-grants, climate-risk insurance and early warning under Component 3. Inputs also

Official Use Only

		security, food preservation, health, care burdens and decision-making voice.	informed gender quotas, targeted finance and FPIC commitments.
27-31 October 2024	Administrative close-out, bilateral follow-up and submission of consultation records	Follow-up discussions confirmed institutional support and the importance of realistic implementation schedules, clear responsibilities, accessible local-language communication, consistent documentation, and formal feedback to provincial and community stakeholders. Operational constraints included difficult travel, weather disruption, dialect differences and participatory sessions requiring more time than planned.	Reflected in the proposed use of existing local governance structures, phased capacity support, transparent resource allocation, community-based monitoring and grievance arrangements. The operational lessons informed recommendations for decentralized venues, trained interpreters, accessible materials, standardized attendance and consent records, and a central consultation evidence archive.
17-22 March 2025	Multi-stakeholder validation workshop series	The validation process reported engagement of more than 320 stakeholders and 89% agreement on priority adaptation interventions. Participants validated the integrated link between ecosystem restoration, climate-resilient production, inclusive livelihoods, finance, insurance, early warning and institutional strengthening. They called for context-sensitive insurance, local knowledge integration, community-owned success indicators and clearer institutional roles.	Reflected in refinement of component sequencing and linkages, especially the connection between restored landscapes, resilient agriculture, livelihood and market support, finance and risk protection. The feedback reinforced adaptive implementation, community-defined monitoring, anti-elite-capture controls, inclusive facilitation, local-language materials and the need to clarify roles before disbursement.
July 2026 proposal synthesis and appraisal preparation	Evidence consolidation and design-reconciliation review	Comparison of the consultation records with the updated CLARiS concept note confirmed strong thematic alignment but identified unresolved differences in project geography, institutional arrangements, participation totals and the evolution of the project title and design. The current concept note focuses on Gashoho, Gasorwe, Tangara and Busiga, whereas the principal field evidence covers an earlier eight-province process.	Reflected in the report's recommendation for a focused appraisal consultation round in the four current communes. The proposal should add a current-commune stakeholder map, verify participation statistics and validation metrics, reconcile OSS/BCAB and earlier AfDB-linked references, disclose how previous inputs informed the final design, and close the feedback loop before submission.

I. Justification for funding request

94. The funding requested for the CLARiS project is justified by the need to address the incremental and climate-induced costs faced by vulnerable communities in Burundi's Ruvubu River Basin, which go beyond existing development needs. Communities in Muyinga and Ngozi provinces are experiencing increasingly severe climate stresses, including prolonged droughts, erratic and intense rainfall, soil erosion, and land degradation. These impacts directly undermine agricultural productivity, food security, water availability, and ecosystem services that are critical for sustaining rural livelihoods. Without targeted adaptation investments, climate change will continue to erode development gains and deepen poverty in these areas.

95. Under a baseline (non-adaptation) scenario, households are expected to continue relying on traditional coping strategies that are increasingly ineffective under changing climatic conditions. These include cultivation on steep and degraded slopes, deforestation for fuel and income, limited soil conservation practices, and heavy dependence on rain-fed agriculture. While such practices may provide short-term

coping options, they accelerate environmental degradation, increase exposure to climate shocks, and lock communities into a cycle of vulnerability. Existing development finance does not sufficiently address these climate risks, as it typically focuses on production or service delivery without integrating climate risk management or long-term resilience considerations.

96. The adaptation scenario enabled by CLARiS represents the full cost of responding to these climate-specific risks. The project introduces targeted adaptation measures that would not be implemented without dedicated climate finance, including participatory landscape restoration, climate-smart and soil-conserving agricultural practices, water harvesting and runoff management, community-managed early warning systems, and climate-resilient livelihood diversification. These measures reduce exposure to climate hazards, strengthen ecosystem functions, and increase the adaptive capacity of households and landscapes over time.
97. In addition to physical investments, the project covers the incremental institutional and social costs of adaptation, which are essential for sustainability but rarely financed through conventional development programs. These include strengthening local governance and planning capacities, integrating climate risk into local decision-making, establishing inclusive and gender-responsive institutions, applying environmental and social safeguards, and supporting community-based monitoring, learning, and early warning systems. The project also pilots locally led adaptation mechanisms that build community ownership and generate knowledge and models that can be replicated and scaled.
98. The requested funding further accounts for the additional costs of ensuring that adaptation benefits reach the most vulnerable and marginalized groups, including women, youth, displaced persons, Indigenous communities, and households with limited assets. These incremental costs include tailored capacity building, inclusive consultation and FPIC processes, targeted financial mechanisms, and safeguards measures designed to address structural inequalities and prevent exclusion. Without dedicated adaptation finance, these groups would remain underserved and disproportionately exposed to climate risks.
99. By financing these incremental and climate-specific costs, the Adaptation Fund enables CLARiS to go beyond business-as-usual development and directly address the root causes and impacts of climate vulnerability in northeastern Burundi. In the absence of this support, communities in the targeted areas would continue to face escalating climate risks, undermining both local livelihoods and national efforts to achieve climate-resilient and sustainable development.
100. The table below presents the full cost of adaptation analysis for the CLARiS project, contrasting the baseline (non-adaptation) scenario with the adaptation scenario enabled by the requested funding. It highlights the incremental adaptation costs and corresponding resilience benefits, in line with the Adaptation Fund's full-cost justification requirements.

Table 6: Comparison of Baseline and Adaptation Scenarios and Incremental Adaptation Benefits

Sector / Thematic Area	Baseline (Non-Adaptation) Scenario	Adaptation Scenario (With Project Funding)	Incremental Adaptation Benefits
Land and Watershed Management	Continued deforestation and cultivation on degraded hillsides leading to erosion and reduced water retention	Implementation of participatory landscape restoration, hillside stabilization, and native species reforestation	Reduced erosion and flood risk, improved ecosystem services, and enhanced resilience of watersheds
Agriculture and Livelihoods	Reliance on rain-fed, low-yield agriculture with high climate risk exposure	Adoption of climate-smart agriculture (CSA), agroforestry, and diversified resilient income-generating activities	Improved food security, income stability, and reduced livelihood vulnerability to climate shocks
Water Access and Management	Seasonal water scarcity, low water storage capacity, and inefficient use of existing resources	Community-based water harvesting infrastructure and integrated watershed-level planning	Increased year-round water availability for households and agriculture; reduced conflict over water
Institutional Capacity and Governance	Weak coordination and limited local capacity to plan, finance, and implement climate-resilient development	Strengthened local governance, devolved planning, and multi-stakeholder coordination platforms	Empowered local institutions, improved decision-making, and sustained adaptation delivery mechanisms
Social Inclusion and Equity	Marginalized groups (women, youth, displaced) excluded from	Targeted inclusion strategies, capacity building, and community-	Enhanced social cohesion, equitable access to

	development benefits and climate planning	led sub-projects for vulnerable groups	adaptation benefits, and reduced structural inequalities
Knowledge, Innovation, and Learning	Lack of access to climate information, poor knowledge exchange between projects and regions	Integrated M&E, community feedback systems, and adaptive knowledge-sharing networks	Improved evidence-based adaptation, scaling of best practices, and long-term learning loops

J. Project sustainability

101. The CLARiS project has been deliberately designed to ensure that adaptation outcomes are sustained well beyond the project lifecycle, by strengthening local governance systems, building durable institutional capacity, and enabling communities to plan, finance, and implement adaptation actions independently over the long term. Sustainability is not treated as a separate objective, but is embedded across all project components through locally led decision-making, simplified access to finance, and long-term institutional anchoring.
102. At the governance level, CLARiS strengthens commune-level adaptation committees, community assemblies, and local cooperatives as permanent platforms for climate planning, coordination, and accountability. These structures are embedded within existing decentralization and local development frameworks, ensuring alignment with communal development plans and continuity after project closure. By supporting participatory risk assessments, inclusive decision-making processes, and transparent resource allocation, the project reinforces governance practices that can be maintained and progressively strengthened over time.
103. Institutional sustainability is further reinforced through targeted capacity building of local institutions and cooperatives in areas such as financial management, project planning, safeguards compliance, procurement, and monitoring. Simplified access modalities including direct small grants, revolving funds, and match-funding mechanisms enable local actors to manage adaptation resources with minimal external intermediation. These mechanisms not only reduce transaction costs but also build practical experience in managing climate finance, positioning local institutions to access and absorb future funding from national mechanisms and other climate finance sources.
104. At the community level, CLARiS prioritizes locally adapted, ecosystem-based solutions that rely on local knowledge, materials, and labor, minimizing dependence on costly external inputs and technical assistance. Activities such as ecosystem restoration, climate-smart agriculture, and livelihood diversification are designed to generate tangible economic and environmental benefits, creating incentives for continued adoption and maintenance. Women-led enterprises, agroforestry initiatives, and revolving adaptation funds further enhance sustainability by reinvesting locally generated revenues into ongoing resilience-building actions.
105. The project also strengthens sustainability through learning, knowledge management, and adaptive management mechanisms. Community-based monitoring, evaluation, and learning processes enable local actors to track progress, reflect on results, and adjust practices in response to changing conditions. Lessons learned are documented and shared across communes and institutions, strengthening institutional memory and supporting the replication of effective adaptation practices beyond the original project sites.

K. Environmental and social impacts and risks

106. The CLARiS project is grounded in Locally Led Adaptation (LLA) and designed to enhance ecosystem resilience and sustainable livelihoods in Burundi's Muyinga and Ngozi provinces. While it is expected to deliver long-term environmental and social benefits, it also poses moderate risks that require mitigation measures aligned with the Adaptation Fund's Environmental and Social Policy (ESP). The project is anticipated to be classified as Category B, due to its manageable and reversible environmental and social impacts.
107. Potential **environmental and social risks** include disruption of ecosystems during infrastructure construction, land disputes from land rights formalization, unequal benefit distribution within

Official Use Only

cooperatives, and unintentional exclusion of marginalized populations. To mitigate these risks, an Environmental and Social Management Plan (ESMP) will be implemented, adhering to the Adaptation Fund's safeguard framework. This will involve conducting environmental screening and stakeholder consultations for all site-specific works, establishing grievance redress mechanisms accessible to all community members, applying conflict-sensitive land tenure protocols, and promoting inclusive cooperative governance. Gender and social equity audits will monitor equity and inclusion, ensuring fair representation and participation. Regular reviews and adaptive management strategies will be employed to minimize adverse impacts and maximize benefits for all stakeholders.

108. This integrated approach ensures that all 15 ESP principles of the Adaptation Fund are considered from the concept stage and that LLA principles guide implementation, ownership, and risk management. Compliance with Burundi's national environmental laws, land policies, and decentralization frameworks is a cross-cutting priority, reinforcing legal alignment and institutional legitimacy.

109. A full Environmental and Social Management Plan (ESMP) will be developed during the full proposal phase, including participatory risk monitoring frameworks and compliance verification procedures.

Table 7: Assessment of Compliance with the Adaptation Fund Environmental and Social Policy (ESP)

ESP Principle	Risk Level	No Further Assessment Required for Compliance	Potential Impacts and Risks and Further Assessment Required for Compliance
1. Compliance with the Law	Low	National and international laws are considered; monitoring mechanisms in place.	
2. Biodiversity Conservation	Low		Land conversion for agriculture may affect biodiversity; needs awareness and monitoring.
3. Natural Habitats	Low		Potential disturbance to habitats; will be screened in the ESMF.
4. Involuntary Resettlement	Low		Project avoids physical resettlement; voluntary land access only.
5. Access and Equity	Medium		Risk of unequal benefit distribution; measures for inclusion of women and youth required.
6. Human Rights	Low	Human rights upheld through participatory processes and equitable access.	
6. Physical and Cultural Heritage	Low	No interference with cultural heritage; culturally respectful practices ensured.	
7. Gender Equality and Women's Empowerment	Medium		Local norms may limit women's access; mitigation through empowerment activities needed.
8. Marginalized and Vulnerable Groups	Medium		Potential exclusion of vulnerable groups; comprehensive stakeholder strategy required.
9. Indigenous Peoples	No Risk	No indigenous communities identified in the project areas.	
10. Public Health	Low	Health interventions enhance household wellbeing and hygiene awareness.	

11. Pollution Prevention and Resource Efficiency	Low		Irrigation systems may cause water contamination; mitigation in ESMF.
12. Climate Change	No Risk	Project enhances resilience with no emissions risk.	
13. Lands and Soil Conservation	Low		Land use changes require sustainable practices and ongoing monitoring.
4. Core Labour Rights	Low	National labour laws applied; child labor and gender pay gaps avoided.	

Table 8: Environmental and Social Risks, LLA Principles, and Mitigation Measures

Identified Risk	Relevant AF ESP Principle(s)	LLA Principle(s) Applied	Mitigation Strategy
1. Unequal access to project benefits for women, youth, or vulnerable groups	1. Compliance with Law; 5. Access and Equity; 7. Gender Equality and Women's Empowerment; 8. Marginalized and Vulnerable Groups	Inclusive Participation; Access to Finance	Conduct social mapping and inclusive beneficiary selection. Establish women- and youth-led cooperatives. Implement a Gender Action Plan and community-based subgranting schemes.
2. Limited integration of traditional/local knowledge in design and monitoring	1. Compliance with Law; 8. Marginalized and Vulnerable Groups; 10. Public Participation and Access to Information	Devolved Decision-Making; Collaborative Monitoring	Facilitate participatory land-use planning and community mapping. Integrate traditional ecological knowledge into intervention design. Engage local actors in monitoring and reporting.
3. Risks of biodiversity loss or use of invasive species during reforestation or agroforestry	1. Compliance with Law; 2. Biodiversity Conservation; 3. Natural Habitats	Ecosystem-Based Approaches; Local Capabilities	Ensure environmental screening; use only native species; provide training on ecosystem-based adaptation. Restore degraded areas without impacting ecologically sensitive zones.
4. Community tensions from new conservation bylaws or land use restrictions	1. Compliance with Law; 4. Involuntary Resettlement; 6. Protection of Cultural Heritage	Local Ownership; Transparency and Accountability	Use Free, Prior, and Informed Consent (FPIC). Validate local conservation measures through dialogue with customary authorities and local councils. Avoid any physical displacement.
5. Temporary disruption to land use or livelihoods due to restoration activities	1. Compliance with Law; 5. Access and Equity; 9. Livelihoods of the Poor	Sustainable Local Livelihoods	Introduce short-term support and community-selected alternative livelihoods (e.g., beekeeping, processing units). Provide training and starter kits through community micro-grants.
6. Lack of culturally appropriate grievance mechanisms	1. Compliance with Law; 10. Public Participation and Access to Information; 11. Accountability	Transparency and Responsiveness	Design and implement a locally accessible Grievance Redress Mechanism (GRM) managed by elected community representatives, with clear referral pathways and public awareness.
7. Minor carbon emissions or construction-related impacts	1. Compliance with Law; 12. Climate Change	Environmental Stewardship; Local Control	Minimize emissions through low-carbon practices, local material sourcing, and community oversight of infrastructure activities. Promote renewable energy and manual tools where feasible.

Unidentified sub projects

110. The CLARiS project includes a number of Unidentified Sub-projects (USPs), particularly at the community and micro-catchment levels, which will be defined during the first phase of implementation through participatory planning and local consultations. These USPs relate to specific investments such as the selection of degraded sites for ecosystem restoration, localized infrastructure for water harvesting and small-scale irrigation, and tailored livelihood support packages for vulnerable groups including women, youth, displaced persons, and marginalized communities. While the overall project components and objectives are clearly established, the use of USPs reflects the project's commitment to Locally Led Adaptation (LLA) by ensuring that final decisions on the nature, scale, and location of interventions are made in collaboration with local actors based on context-specific needs and priorities.

111. To manage the environmental and social risks associated with USPs, the project will operationalize an Environmental and Social Management Framework (ESMF) that outlines the procedures for sub-project screening, categorization, impact assessment, approval, and monitoring. All USPs will be subjected to a structured environmental and social screening process prior to implementation, using tools aligned with the Adaptation Fund's Environmental and Social Policy (ESP) and Gender Policy. Free, Prior, and Informed Consent (FPIC) will be applied in cases involving customary or sensitive land tenure systems, and targeted training will be provided to local government authorities, community committees, and implementing partners on safeguards compliance and monitoring. Furthermore, a culturally appropriate Grievance Redress Mechanism (GRM) will be established at multiple levels to ensure transparency, accountability, and responsiveness throughout the sub-project cycle.

112. This flexible but safeguarded approach allows the CLARiS project to remain adaptive and inclusive, while ensuring that no intervention proceeds without adequate assessment and consent. By embedding the identification and management of USPs within a participatory governance structure, the project strengthens the decision-making power of local communities, aligns with national devolution policies, and reinforces the principles of equity, environmental integrity, and social inclusion at the core of effective adaptation.

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

Record of endorsement on behalf of the government[2]

Eng. HATUNGIMANA Berchmans *National Designated Entity for the Adaptation Fund* *Director General* *Director's office of the Environment and Climate Change* *Office Burundais pour la Protection de 'Environnement (OBPE)*	Date*: May 15th 2026*

Implementing Entity certification

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans of the Government of Burundi and subject to the approval by the Adaptation Fund Board, commit to implementing the project in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project.	
Mr. Nabil BEN KHATRA *– Executive Secretary of the Sahara and Sahel Observatory (OSS) as the Implementing Entity Coordinator*	
Date: *May 20 th, 2026*	Tel. : (+216) 71 206 633 Email: boc@oss.org.tn
Project Contact Person: **Mrs. Khaoula JAOUI**	
Tel.: (+216) 71 206 633 Email: khaoula.jaoui@oss.org.tn	

6. Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

Annex 1: endorsement Letter

REPUBLIQUE DU BURUNDI

MINISTERE DE L'ENVIRONNEMENT,
DE L'AGRICULTURE ET DE L'ELEVAGE

Gitega, le 15/1/5...../2026

Office Burundais pour la Protection de l'Environnement

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for Community-Led Adaptation for Resilience and Inclusive Sustainability in Burundi (CLARiS)

In my capacity as designated authority for the Adaptation Fund in Burundi, I confirm that the above national project proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Burundi.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. If approved, the project will be implemented by **Sahara and Sahel Observatory (OSS)** and executed by **Banque Communautaire et Agricole du Burundi (BCAB).**

Sincerely,

Eng. HATUNGIMANA Berchmans

National Designed Entity
for the Adaptation Fund

REPUBLIQUE DU BURUNDI
OBPE
Office Burundais pour la Protection de l'Environnement
B.P.56 GITEGA B.P.2757 BUJUMBURA
Ministère de l'Environnement, de l'Agriculture et de l'Elevage

B.P. 56. Gitega • Tél. (257) 22403031 •TéléFax: (257) 22403032
B.P. 2757 Bujumbura • Tél. (257) 22234304 •
Email : obpe_burundi@obpe.bi

Official Use Only

Annex 2: Consultation Analysis of CLARiS Project

2. Project and Consultation Context

2.1 Current CLARiS proposal

CLARiS seeks to empower rural communities through decentralized and locally led decision-making so they can restore degraded land, improve agricultural resilience, diversify livelihoods, and protect vulnerable and marginalized groups. The updated concept note requests USD 5 million and identifies OSS as Implementing Entity and BCAB as Executing Entity.

Component	Consultation-relevant focus
1. Ecosystem Restoration and Landscape Resilience	Participatory degradation mapping; reforestation and agroforestry; soil and water conservation; community nurseries; local land-use agreements and conservation bylaws.
2. Climate-Smart Agriculture and Adaptive Soil Management	Locally adapted climate-smart practices; soil fertility and moisture retention; women-managed compost hubs; farmer capacity and adaptive extension support.
3. Community Livelihood, Financial and Risk Resilience	Women-, youth- and vulnerable-group livelihoods; market access and local value addition; community adaptation funds and micro-grants; climate-risk insurance and community early warning.

2.2 Consultation purpose

The consultation process was intended to verify climate vulnerabilities, identify locally acceptable solutions, test implementation feasibility, strengthen stakeholder ownership, surface social and environmental risks, and define institutional roles. It also sought to ensure that women, youth, farmers, Indigenous communities and other vulnerable groups could influence project priorities rather than participate only as beneficiaries.

2.3 Geographic provenance

Evidence set	Geography recorded	Use in this report
Stakeholder field report	Bujumbura Rural/Marie, Cibitoke, Bubanza, Ruyigi, Bururi, Karusi, Rutana and Kirundo.	Detailed evidence on methods, regional climate risks, community priorities and institutional capacity.
Workshop validation report	Eight provinces; workshop series dated 17-22 March 2025.	Validation statistics, consensus findings, refinements, risks and implementation pathways.
Updated CLARiS concept note	Gashoho and Gasorwe (Muyinga); Tangara and Busiga (Ngozi).	Current project identity, objective, geography, components, entities and financing.

3. Methodology and Participation

3.1 Engagement sequence

Official Use Only

Phase	Timing	Main methods	Purpose
Preparation and institutional entry	8-12 Oct 2024	Governor/municipal meetings, project briefings, key-informant interviews, environmental observation	Secure authorization; map institutions; identify climate and governance issues; plan community sessions.
Community workshops	15-24 Oct 2024	Registration, plenary briefing, gender-segregated FGDs, participatory mapping, prioritization, plenary synthesis	Validate lived climate impacts; identify differentiated needs; test locally acceptable adaptation options.
Administrative close-out	27-31 Oct 2024	Submission of attendance records, consolidated findings, visual documentation and follow-up discussions	Confirm documentation, maintain institutional ownership and agree follow-up.
Validation workshops	17-22 Mar 2025	Scenario building, insurance and finance simulations, intervention ranking, stakeholder alignment, success-indicator development	Validate baseline findings, refine interventions, identify risks, clarify roles and build consensus.

3.2 Participatory tools

- Participatory climate-vulnerability mapping and verification of hotspots, seasonal patterns and local risk zones.
- Gender-segregated focus-group discussions to reduce power imbalances and capture different productive and care-related priorities.
- Key-informant interviews with provincial and municipal authorities and technical stakeholders.
- Community prioritization of adaptation actions, including soil and water conservation, resilient crops, water storage, early warning and livelihood diversification.
- Scenario and simulation exercises to test insurance triggers, financial products and climate-smart agriculture options.
- Accessible facilitation using visual materials, local-language interpretation and parallel small-group activities.
- Documentation through notes, attendance records, photographs, maps and formal submission of consolidated findings.

3.3 Participation profile

The validation report records more than 320 stakeholders across demographic, institutional and sectoral categories. The field report separately states that approximately 236 participants were involved, including 133 men and 108 women; because these figures sum to 241, the participation total requires verification against signed attendance sheets. Kirundo is specifically recorded as having 20 participants, including 7 women, 13 men and 2 Indigenous participants.

4. Stakeholder Overview

Official Use Only

Stakeholder group	Interest / role	Consultation contribution	Expected implementation role
National government and technical agencies	Policy alignment, climate information, safeguards, sector coordination	National priorities, technical standards, institutional mandates and endorsement	Steering, technical oversight, integration with national systems and reporting.
Provincial and communal authorities	Local planning, public services, land and natural-resource governance	Local risk patterns, administrative feasibility, capacity gaps and coordination needs	Embed actions in local plans; convene assemblies; support grievance and monitoring systems.
Farmers and cooperatives	Agricultural productivity, water, inputs, markets and risk protection	Practical constraints, indigenous techniques, preferred technologies and willingness to contribute	Manage nurseries, compost hubs, grants, enterprises, maintenance and peer learning.
Women and women-led groups	Water and food security, workload, land, finance, leadership and safety	Gender-differentiated impacts and priorities; barriers to credit and decisions	Leadership in committees, livelihoods, finance, monitoring and social accountability.
Youth groups	Employment, enterprise, technology and land access	Demand for livelihood diversification, skills and accessible finance	Digital monitoring, climate services, enterprises and restoration work.
Indigenous Batwa communities	Land and water access, cultural rights, equitable benefits and grievance access	Risks of systemic exclusion and need for culturally appropriate participation	Co-design through FPIC; differentiated benefits; community monitoring and grievance access.
Persons with disabilities, displaced and asset-poor households	Accessibility, livelihood security, protection from exclusion	Barriers to participation and benefit access	Targeted access measures, representation and disaggregated monitoring.
Financial and insurance actors	Credit, adaptation finance, insurance design and risk data	Product feasibility, affordability, payout triggers and data gaps	Operate locally accessible finance and risk-transfer mechanisms with consumer protection.

Official Use Only

Stakeholder group	Interest / role	Consultation contribution	Expected implementation role
Civil society, research and development partners	Inclusion, technical support, learning, complementarity	Lessons, safeguards, community facilitation and overlap avoidance	Independent facilitation, technical assistance, accountability and knowledge sharing.

5. Consultations Conducted

5.1 Province-level consultation record

Location	Recorded climate / governance issue	Community priority and consultation outcome
Bujumbura Rural / Marie	Flash flooding, erosion, altered drainage, pressure from urbanization and intensive land use.	Flood and erosion management, agricultural water management and coordinated municipal implementation; strong institutional endorsement was recorded.
Cibitoke	Steep slopes, erosion, landslides, rainfall variability and agricultural water insecurity.	Improved terracing, water harvesting, climate monitoring and early warning; technical and institutional capacity building.
Bubanza	Declining rainfall reliability, water competition, drought cycles and pressure on protected forests.	Water harvesting, drought-resistant crops, rainfall early warning and balanced conservation/agricultural land use.
Ruyigi	Seasonal water stress, deforestation, land degradation and migration pressure.	Water storage, seasonal forecasting and drought-resilient agriculture; women emphasized household water security and men agricultural productivity.
Bururi	Watershed degradation, soil erosion, downstream water-quality impacts and biodiversity pressure.	Integrated watershed management, soil conservation and stronger local natural-resource governance.
Karusi	Deforestation, erosion, erratic rainfall, periodic dry spells and limited livelihood diversification.	Practical soil conservation, water harvesting, adapted seed varieties and diversified livelihood strategies.
Rutana	Rainfall unpredictability, soil degradation, deforestation and climate-sensitive agriculture.	Seasonal forecasting, soil conservation and diversified livelihoods.

Official Use Only

Location	Recorded climate / governance issue	Community priority and consultation outcome
Kirundo	Frequent drought, irregular rainfall, lake-related flooding and weak anticipatory systems.	Drought-resistant crops, water-resource management, early warning and a shift from crisis response to anticipatory planning.

5.2 Cross-cutting consultation outcomes

Theme	What stakeholders reported	Resulting design direction
Climate information and early warning	Seasonal uncertainty limits planting and preparedness; local systems are weak or uneven.	Community-based early warning linked to credible climate information and locally accessible communication channels.
Land, soil and water	Erosion, degraded hillsides, water scarcity, runoff and unreliable rainfall undermine production.	Participatory restoration, terracing, agroforestry, soil-water conservation, riparian protection and water harvesting.
Agriculture and food security	Yield instability, crop disease, input constraints and weak storage deepen vulnerability.	Locally adapted climate-smart agriculture, resilient seeds, composting, storage and extension support.
Livelihoods and markets	Dependence on rain-fed farming and weak market access leave households exposed.	Diversified livelihoods, local value addition, cooperative enterprises and improved market linkages.
Finance and insurance	Credit and insurance are inaccessible; climate and risk data are inadequate; low incomes threaten affordability.	Community adaptation funds, micro-grants, consumer-centred insurance design, premium support and transparent eligibility.
Governance and capacity	Local climate expertise, coordination and implementation capacity vary significantly.	Phased capacity support, commune adaptation committees, fiduciary controls, clear mandates and embedded local planning.
Gender and inclusion	Women face barriers to land, credit, leadership and time; marginalized groups risk exclusion.	Representation targets, tailored finance, accessible facilitation, FPIC, disaggregated monitoring and safe grievance channels.

Official Use Only

Theme	What stakeholders reported	Resulting design direction
Local knowledge	Traditional forecasting, soil conservation, seed preservation and water governance remain valuable but under-documented.	Validate and integrate local knowledge while protecting ownership and avoiding extractive documentation.

5.3 Summary of consultation events and incorporation into the CLARiS concept note

Table 9. Summary of consultation events, key discussion outcomes, and incorporation into the CLARiS concept note

Dates	Consultations	Summary outcomes of discussion	Incorporation into the CLARiS concept note
8-12 October 2024	Institutional entry meetings and key-informant consultations	Provincial governors, municipal leaders and technical stakeholders confirmed that climate impacts differ across locations and highlighted drought, erratic rainfall, flooding, erosion, landslides, watershed degradation and weak climate-information services. Discussions also identified uneven local capacity, coordination constraints, and the need to align with existing government and partner initiatives.	Reflected in the problem statement, locally led adaptation rationale and decentralized governance approach. The findings informed participatory risk assessment, commune-level planning, institutional capacity building, coordination arrangements, community early warning, and the requirement to assess overlap and complementarity before sub-project approval.
15-24 October 2024	Community consultation workshops, gender-segregated focus groups and participatory mapping	Farmers, women, men, youth, Indigenous participants and local leaders validated lived climate impacts and prioritized soil and water conservation, agroforestry, resilient seed varieties, water harvesting and storage, seasonal forecasting, livelihood diversification, market access, accessible finance and insurance. Women emphasized water security, food preservation, health, care burdens and decision-making voice.	Reflected across all three components: landscape restoration and soil-water conservation under Component 1; climate-smart agriculture, adaptive soil management and women-managed compost hubs under Component 2; and livelihoods, local value addition, community adaptation funds, micro-grants, climate-risk insurance and early warning under Component 3. Inputs also informed gender quotas, targeted finance and FPIC commitments.

Official Use Only

Dates	Consultations	Summary outcomes of discussion	Incorporation into the CLARiS concept note
27-31 October 2024	Administrative close-out, bilateral follow-up and submission of consultation records	Follow-up discussions confirmed institutional support and the importance of realistic implementation schedules, clear responsibilities, accessible local-language communication, consistent documentation, and formal feedback to provincial and community stakeholders. Operational constraints included difficult travel, weather disruption, dialect differences and participatory sessions requiring more time than planned.	Reflected in the proposed use of existing local governance structures, phased capacity support, transparent resource allocation, community-based monitoring and grievance arrangements. The operational lessons informed recommendations for decentralized venues, trained interpreters, accessible materials, standardized attendance and consent records, and a central consultation evidence archive.
17-22 March 2025	Multi-stakeholder validation workshop series	The validation process reported engagement of more than 320 stakeholders and 89% agreement on priority adaptation interventions. Participants validated the integrated link between ecosystem restoration, climate-resilient production, inclusive livelihoods, finance, insurance, early warning and institutional strengthening. They called for context-sensitive insurance, local knowledge integration, community-owned success indicators and clearer institutional roles.	Reflected in refinement of component sequencing and linkages, especially the connection between restored landscapes, resilient agriculture, livelihood and market support, finance and risk protection. The feedback reinforced adaptive implementation, community-defined monitoring, anti-elite-capture controls, inclusive facilitation, local-language materials and the need to clarify roles before disbursement.

Official Use Only

Dates	Consultations	Summary outcomes of discussion	Incorporation into the CLARiS concept note
July 2026 proposal synthesis and appraisal preparation	Evidence consolidation and design-reconciliation review	Comparison of the consultation records with the updated CLARiS concept note confirmed strong thematic alignment but identified unresolved differences in project geography, institutional arrangements, participation totals and the evolution of the project title and design. The current concept note focuses on Gashoho, Gasorwe, Tangara and Busiga, whereas the principal field evidence covers an earlier eight-province process.	Reflected in the report's recommendation for a focused appraisal consultation round in the four current communes. The proposal should add a current-commune stakeholder map, verify participation statistics and validation metrics, reconcile OSS/BCAB and earlier AfDB-linked references, disclose how previous inputs informed the final design, and close the feedback loop before submission.

5.4 Photographic record of consultation and validation activities



Figure 1. Women-focused community consultation session documented in the stakeholder field report.



Figure 2. Community focus-group discussion documented in the stakeholder field report.

Official Use Only

Official Use Only



Figure 3. Institutional stakeholder discussion documented in the workshop validation report.



Figure 4. Institutional stakeholder group photograph documented in the workshop validation report.

6. Consolidated Findings

6.1 Regional variation requires differentiated programming

The field evidence rejects a one-size-fits-all approach. Northern areas were described as drought-prone and water constrained; western areas as exposed to steep-slope erosion and flash flooding; southern areas as facing erosion, landslides and infrastructure damage; and central areas as experiencing unpredictable rainfall, erosion and crop disease. For CLARiS, the principle is directly applicable even though the current geography differs: each of the four target communes should complete a risk-and-livelihood profile before final sub-project selection.

6.2 Gendered priorities are complementary, not interchangeable

Women consistently emphasized household water security, food storage, health risks, time burdens and limited authority. Men more often prioritized productivity, infrastructure, market access, forecasting and government support. Both perspectives are material to resilience. The project should therefore assess productive and reproductive workloads, control over assets and income, exposure to violence and exclusion, and the distribution of benefits within households and cooperatives.

6.3 Institutional readiness is uneven

Bubanza and Bujumbura Rural were described as having stronger climate coordination; Bururi and Cibitoke showed awareness but limited implementation structures; and Kirundo, Rutana and Karusi faced more significant technical and partnership constraints. The operational lesson for CLARiS is to assess readiness by commune and tailor capacity support, rather than assume that formal mandates imply implementation capability.

6.4 Community mobilization is a project asset

High turnout, active mapping and prioritization, willingness to contribute labor and local materials, and existing community structures indicate substantial ownership potential. This asset will be sustained only if communities receive clear decision rights, transparent budgets, accessible grievance channels, timely feedback on what was accepted or rejected, and visible influence over monitoring and adaptive management.

6.5 Delivery risks emerged during consultation

Observed challenge	Practical implication for future CLARiS consultation
Long travel times, poor roads and weather disruption	Budget realistic travel buffers; use decentralized venues and seasonal scheduling.
Language and dialect differences	Use trained local interpreters, a tested terminology glossary, visual aids and accessible formats.
Participatory sessions exceeded planned time	Allow sufficient time, prioritize core questions and use parallel groups without reducing depth.
Power differences across participant groups	Retain separate spaces for women, youth, Batwa and other groups; use independent facilitation where needed.
Documentation and attendance inconsistencies	Use standardized registers, consent protocols, unique participant counts and a central evidence log.

7. How Consultation Shaped the CLARiS Design

Stakeholder input / validated concern	Design response visible in current concept note	Further action required
Degraded hillsides, erosion, runoff and loss of vegetation	Component 1 includes participatory mapping, reforestation, agroforestry, riparian restoration and soil-water conservation.	Validate priority sites and land-use implications in the four current communes; document consent and maintenance responsibilities.
Need for locally adapted production practices and better soil moisture	Component 2 includes climate-smart agriculture, adaptive soil management, compost hubs and farmer support.	Co-design technology menus with farmers and test affordability, labor and gender impacts.
Demand for diversified livelihoods, markets and local value addition	Component 3 includes vulnerable-group livelihoods, cooperative enterprises and market access.	Complete value-chain, market, labor and benefit-sharing analysis by commune.
Limited finance and risk-protection access	Community adaptation funds, micro-grants and climate-risk insurance are included.	Confirm legal/operational arrangements, consumer protection, premium affordability, payout communication and grievance processes.

Official Use Only

Stakeholder input / validated concern	Design response visible in current concept note	Further action required
Weak local decision power and capacity	The concept note uses community assemblies, committees, cooperatives and decentralized resource allocation.	Define decision rights, fiduciary thresholds, disclosure, audit, capacity milestones and anti-elite-capture measures.
Women and marginalized groups face structural exclusion	Gender quotas, women-led activities, targeted finance and FPIC are proposed.	Develop measurable inclusion plans and verify safe, accessible participation in current target communes.
Need for early warning and anticipatory action	Community-based early warning appears under Component 3.	Clarify linkage to national climate information and emergency systems, last-mile channels and maintenance.

8. Inclusion, Safeguards and Accountability

8.1 Minimum consultation standards for CLARiS

- Provide timely information in Kirundi and accessible formats before decisions are taken.
- Use separate and safe discussion spaces where needed for women, youth, Indigenous Batwa people, persons with disabilities, displaced people and asset-poor households.
- Record participant consent, representation, accessibility support, feedback and unresolved concerns without collecting unnecessary personal data.
- Apply Free, Prior and Informed Consent where project activities may affect Indigenous Batwa rights, lands, resources, cultural practices or livelihoods.
- Disclose selection criteria, budgets, committee membership, procurement results and benefit allocations in locally understandable formats.
- Operate a multi-channel grievance mechanism with confidential and survivor-centred pathways for SEA/SH complaints and protection from retaliation.
- Close the feedback loop by explaining which recommendations were accepted, modified or not adopted and why.

8.2 Proposed consultation monitoring indicators

Indicator	Minimum disaggregation / evidence	Suggested frequency
Participants reached and participating meaningfully	Sex, age, disability, Indigenous status, displacement, stakeholder group, commune; signed/consented record	Every event; quarterly consolidation
Representation in decision bodies	Membership and leadership by sex and vulnerable-group status	Quarterly
Stakeholder recommendations acted upon	Recommendation log with decision, rationale, owner and status	After each design or implementation round
Accessibility and language support provided	Venue/accessibility checklist, interpretation and material formats	Every event
Grievances received and resolved	Channel, category, response time, resolution and satisfaction; confidential handling	Monthly/quarterly
FPIC milestones completed where applicable	Culturally appropriate evidence of process, decision and conditions	Before affected activities

Official Use Only

Indicator	Minimum disaggregation / evidence	Suggested frequency
Perceived influence and safety	Anonymous feedback by group; no-retaliation and SEA/SH safeguards	At least annually

9. Gaps, Reconciliation Actions and Next Steps

Priority issue	Required action before final proposal submission	Owner to confirm
Geography mismatch	Conduct and document targeted consultations in Gashoho, Gasorwe, Tangara and Busiga; explain how earlier eight-province evidence informed design without overstating direct coverage.	Proposal team / local authorities
Implementing and executing entity mismatch	Reconcile OSS/BCAB in the current concept note with AfDB and Ministry references in the validation report; update every annex consistently.	Implementing entity / government
Project design and title evolution	Map the earlier gender-responsive agriculture, parametric insurance and smart-finance framing to the final CLARiS components and explain what changed after consultation.	Technical design team
Attendance totals and demographics	Reconcile 236 versus 241 in the field report and the “over 320” validation claim using signed attendance sheets and unique counts.	M&E / consultation lead
Validation statistics	Attach or reference the instruments, sample, denominator and analysis supporting the 65%, 78%, 89% and 90% claims.	M&E / safeguards team
Current-commune stakeholder mapping	Prepare an Annex 3-style organization list for the four communes, including vulnerable groups, service providers and local private sector.	Community engagement team
Evidence archive	Create a dated register of invitations, agendas, attendance, consent, notes, photographs, maps, feedback logs and approvals with data-protection controls.	Project management unit
Design response and feedback closure	Share the revised design back with consulted groups and record acceptance, concerns and changes.	Consultation lead

1. Detailed Consultation Matrix

Official Use Only

Stage / location	Stakeholders	Objective	Outcome / conclusion	Evidence referenced
Institutional entry, eight-province field mission	Provincial governors, municipal leaders, local administration, technical officers	Introduce project; secure support; identify risks, initiatives and capacity.	Institutional support recorded; provincial climate and governance priorities identified; community sessions authorized.	Field report narrative, schedule, meeting records, photos/stamps referenced in appendices.
Community workshops, eight provinces	Farmers, women, men, youth, local leaders, cooperatives, Indigenous participants and other community actors	Validate climate impacts; map risk; identify differentiated priorities; rank adaptation options.	Regional risk profiles and priorities established; strong interest in water, soil, agriculture, livelihoods and early warning.	Attendance records, FGD notes, maps, photographs and consolidated findings referenced.
Gender-segregated focus groups	Women and men in separate groups	Reduce power imbalance and capture gender-differentiated impacts and priorities.	Women highlighted water, food, health, time and voice; men highlighted productivity, infrastructure, markets and forecasting.	FGD facilitation records and field report synthesis.
Kirundo community workshop	20 participants: 7 women, 13 men, including 2 Indigenous participants	Ensure engagement in drought-affected and lakeside communities despite schedule disruption.	Drought management, water resources, early warning and anticipatory action prioritized.	Field report registration and workshop narrative.
Validation series, 17-22 March 2025	More than 320 stakeholders across 15 categories, as reported	Verify baseline; test interventions; build alignment; identify roles, risks and success measures.	89% agreement reported; intervention refinements and community-owned monitoring concepts developed.	Workshop validation report; methods, exercises and annex references.
Current CLARiS concept development	National, subnational and community stakeholder categories described in concept note	Integrate LLA, gender, social inclusion, FPIC, finance and safeguards into proposal design.	Three-component integrated design and decentralized implementation approach documented.	Updated CLARiS concept note.

2. National level Participant and Institutional Contact List

This annex combines names and roles visible in the provided visit minutes with the additional Focal Point, OBPE and MoAE institutional roster supplied for this revision. The minutes were not used as a source of consultation findings, commitments or design decisions. Spellings and titles should be

checked against official attendance and institutional records before external publication.

Organization	Name	Role / title
Focal Points	Mr. Nibizi Epimeny	National Focal Point for AF
Focal Points	Mr. Ndayizeye Liévin	NDA Adaptation Fund
CTCN / IGEBU	Ms. Rénilde Ndayishimiye	CTCN National Designated Entity focal point (nomination record)
IGEBU	Mr. Ngenzirabona Augustin	Director General
OBPE	Mr. Hatungimana Berchmans	General Director
OBPE	Mr. Ndayikeza Longin	Research officer
OBPE	Ms. Manirakiza Odette	Insect Researcher
OBPE	Ms. Kaneza Belyse	Protected areas officer
OBPE	Mr. Ntashavu Dieudonné	Communication and information officer
OBPE	Mr. Hakizimana Claude	Environmental research officer
OBPE	Mr. Bukuru Désiré	SIG officer
OBPE	Ms. Kandame Aurore	Biological resources management officer
OBPE	Mr. Ahishakiye Jérôme	Environmental monitoring officer
OBPE	Mr. Masabo Onesphore	Habitat dynamics officer
OBPE	Mr. Murengerantwari Janvier	Monitoring and evaluation officer
MoAE	Mr. Mbonihankuye Denis	Environment and Hygiene officer
MoAE	Ms. Ntawuyankira Neila	Insect Researcher at ISABU
MoAE	Mr. Willy Désiré Emera	Researcher at the Institute of Agronomic Sciences of Burundi (ISABU)
MoAE	Mr. Jean Claude NGWEBU	Director of Agricultural Statistics and Information
MoAE	Mr. Claude BIGIRIMANA	Head of the phylogenetic resource conservation unit at the Burundi Institute of Agricultural Sciences (ISABU)
MoAE	H.E. Hon. Ir. Prosper DODIKO	Minister
MoAE	Mr. Ndorimana Emmanuel	Permanent secretary
African Development Bank / delegation	Dr. James Kinyangi	Coordinator, Climate Action Window and Climate and Development Special Fund
African Development Bank / delegation	Winnie Chepkemoi Mutai	Climate Change Finance (Reaccreditation and Readiness) Expert - Climate Change and Green Growth Department

Organization	Name	Role / title
African Development Bank / delegation	Salomon	Climate Expert
African Apiculture Consortium	Bronson Eran'ogwa	Managing Director and Development Partner
ITRACOM Holding	Methouchellah Niyoyankunze	Assistant to the Chairman and CEO
ITRACOM Holding	Dr. Theodore Mbazumutima	Managing Director
ITRACOM Holding	Jean Joseph Nyandwi	Deputy Managing Director
ITRACOM Holding	Judes Ndayishimiye	Director of Finance
ITRACOM Holding	Casimir Nibigira	Director of Human Resources
ITRACOM Holding	Isaac Mukeshimana	Director of Legal Affairs, Labour Relations and Security
ITRACOM Holding	Manirakiza Alexis	Director of Financial and Technology Systems Development
ITRACOM Holding	Jacqueline Nahimana	Director of Innovation and Development
ITRACOM Holding	Nestor Nizigiyimana	Director of Inspections and Audit
ITRACOM Holding	Eric Uwintwari	Tax Advisor
ITRACOM Holding	Arsene Harumukiza	Director of Assets Management
BCAB	Floris Mizero	Managing Director
BCAB	Ndihokubwayo Augustin	Deputy Director General
BCAB	Gahimbare Nicodeme	Assistant to the General Manager
BCAB	Nsimira Vanessa	Director of Logistics and Supply
BCAB	Niyongabo Jean Bosco	Director of Operations
BCAB	Ndayizeye Violet	Director of Internal Audit
BCAB	Ntwari Devis Arnaud	Director of IT Research and Development
BCAB	Harikwindavyi Radegonde	Director of Human Resources
BCAB	Ntawuyamara Dieudonne	Branch Manager
BCAB	Pierre Sinamenye	Director of Sales and Agri Business

Official Use Only

Organization	Name	Role / title
BCAB	Darlene Iradukunda	Credit Director
FOMI	Ntirampemba Simon	Managing Director
FOMI	Majambere Claudoir	Administrative and Financial Director
FOMI	Dr. Bizimana Syldie	Research and Innovation Director
FOMI	Ndayisenga Jean Pierre	Legal Affairs Director
FOMI	Eng. Kanyegeri Cassien	Agronomic Director
FOMI	Barihenda Ephrem	Human Resources Director
FOMI	Ntaconzoba Alexis	Procurement Director
FOMI	Nzobandora Jean Pierre	Commercial Director
FOMI	Batungwanayo Fleury	Internal Audit Director
FOMI	Eng. Ninziza Aime	Technical Director
ITRAPACK	Mpfubusa Deo Bede	Managing Director
ITRAPACK	Terence Batungwanayo	Adviser
ITRAPACK	Jean Pierre Ngenzebuhoro	Commercial Director
ITRAPACK	Joyeuse Iradukunda	Technical Director
ITRAPACK	Jospeh Iteriteka	Human Resources Director
ITRAPACK	Stany Shishikaye	Logistics Manager
ITRAPACK	Bennee Nibampa	Director of Finance
ITRAPACK	Willy Nduwayezu	Internal Audit Director
ITRACOM	Thiery Nikuze	Deputy Managing Director
ITRACOM	Adrien	Internal Audit Director
ITRACOM	Dieudonne	Commercial Director
ITRACOM	Djuma	Manager of Garage
ITRACOM	Francoise	Adviser
ITRACOM	Domitille	Human Resources Director
ITRACOM	Jean Claude	Procurement Director
ITRASAGRI	Dr. Deo Guide Rurema	Managing Director
ITRASAGRI	Prosper	Agronomic Director
ITRASAGRI	Gorette	Director of Finance
INKINZO AG	Chrysante Karikurubu	Administrative and Financial Director
INKINZO AG	Kevin Rwasa	Technical Director
INKINZO AG	Melissa Nditonze	Commercial Director

Official Use Only

Organization	Name	Role / title
INKINZO AG	Emile Havyarimana	Internal Auditor
INKINZO VC	Evariste Nahayo	Administrative and Financial Director
INKINZO VC	Jean Claude Ruhuza	Technical Director

Provincial level and Communal level Representatives

The table below presents a representative subset of seven attendees from each October 2024 provincial community consultation. Each provincial subset comprises four women and three men, selected from clearly legible entries in the signed activity-fee attendance sheets. It is not a replacement for the complete signed attendance records. Sex-disaggregated selection is based on the recorded given names and should be confirmed during final participant verification. For Kirundo, the consultation record confirms Batwa/Indigenous participation; individual ethnicity is not attributed in this public-facing register because the attendance sheet does not identify which named attendees belong to that community.

Province	Name	Sex	Participation / verification note
Bubanza	Nshimirimana Alexandrine	Woman	Community consultation attendee
Bubanza	Nshimimwe Renine	Woman	Community consultation attendee
Bubanza	Ndayishimiye Violette	Woman	Cooperative / community attendee
Bubanza	Nizeyimana Judith	Woman	Cooperative / community attendee
Bubanza	Nshimirimana Eric	Man	Community consultation attendee
Bubanza	Nikagira Alexandre	Man	Community consultation attendee
Bubanza	Nzigirabarya Stéphane	Man	Community consultation attendee
Cibitoke	Nduwimana Médiatrice	Woman	Community consultation attendee
Cibitoke	Ndabitezimana Sifa	Woman	Community consultation attendee
Cibitoke	Nduwimana Victoire	Woman	Community consultation attendee
Cibitoke	Irankunda Alphonsine	Woman	Community consultation attendee
Cibitoke	Hatungimana Richard	Man	Community consultation attendee
Cibitoke	Hakizimana Wilson	Man	Community consultation attendee
Cibitoke	Nduwimana Innocent	Man	Community consultation attendee
Bururi	Nibitanga Héline	Woman	Community consultation attendee
Bururi	Ndayihimbaze Astérie	Woman	Community consultation attendee
Bururi	Bizimana Léondie	Woman	Community consultation attendee
Bururi	Ndayisaba Marie Rose	Woman	Community consultation attendee
Bururi	Niyonkuru Thieus	Man	Community consultation attendee
Bururi	Niyongabo J. Claude	Man	Community consultation attendee
Bururi	Ndayikengurukiye Ferdinand	Man	Community consultation attendee

Province	Name	Sex	Participation / verification note
Karusi	Irumva Félicide	Woman	Community consultation attendee
Karusi	Mbonimpa Dévine	Woman	Community consultation attendee
Karusi	Kabanyana Marie Josée	Woman	Community consultation attendee
Karusi	Ndikumana J. Marie	Woman	Community consultation attendee
Karusi	Ntirandoba Innocent	Man	Community consultation attendee
Karusi	Ndayishimiye Revocot	Man	Community consultation attendee
Karusi	Muhitira Julian	Man	Community consultation attendee
Ruyigi	Ntahonsigaye Consolate	Woman	Community consultation attendee
Ruyigi	Sr. Marie Fausta Trakote	Woman	Community consultation attendee
Ruyigi	Kwizera Emelyne	Woman	Community consultation attendee
Ruyigi	Nankumana Gloriose	Woman	Community consultation attendee
Ruyigi	Nkunzimana Valéry	Man	Community consultation attendee
Ruyigi	Ndihokubwayo Joseph	Man	Community consultation attendee
Ruyigi	Manirakiza Donatien	Man	Community consultation attendee
Kirundo	Cimpaye Virginie	Woman	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Karenzo Béatrice	Woman	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Nkuriyimana Vénuste	Woman	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Kankera Sandrine	Woman	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Barengayabo Emile	Man	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Niyibizi Philbert	Man	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Ndayisenga Gilbert	Man	Community consultation attendee; Kirundo group included Batwa participants
Bujumbura	Ndihokubwayo Estella	Woman	Community consultation attendee
Bujumbura	Cingera Angélique	Woman	Community consultation attendee
Bujumbura	Nsabimana Gertrude	Woman	Community consultation attendee
Bujumbura	Nibitanga Anne	Woman	Community consultation attendee
Bujumbura	Niyokwizera Michel	Man	Community consultation attendee

Province	Name	Sex	Participation / verification note
Bujumbura	Bikuru Vianney	Man	Community consultation attendee
Bujumbura	Nyabenda Anicet	Man	Community consultation attendee
Rutana	Nsabimana Clotière	Woman	Community consultation attendee
Rutana	Ntahomvukiye Goreth	Woman	Community consultation attendee
Rutana	Sinzaye Séverine	Woman	Community consultation attendee
Rutana	Minani Micheline	Woman	Community consultation attendee
Rutana	Mukenga Onesphore	Man	Community consultation attendee
Rutana	Nifasha Justin	Man	Community consultation attendee
Rutana	Minani Edmond	Man	Community consultation attendee

Association Protection des Ressources Naturelles pour le Bien-Etre de la Population au Burundi

Bujumbura, Quartier Kigobe sud, Avenue Kigunga n°10 • Ord Min N° 530/1101 du 03 /01/2003

Contexte

Le Burundi est confronté à d'importants défis pour accéder au soutien des initiatives essentielles d'adaptation au changement climatique. L'absence d'études et d'évaluations nécessaires, en particulier en matière d'évaluation de l'égalité entre les sexes, de garanties environnementales et sociales et d'évaluation des risques, entrave la capacité du pays à soumettre une proposition compétitive. En outre, le secteur agricole, qui est très vulnérable aux impacts du changement climatique, doit de toute urgence adopter des pratiques d'agriculture intelligente face au climat (AIC) qui soient durables et sensibles au genre. Pour ce faire différentes parties prenantes dans le développement du Burundi doivent conjuguer leurs efforts chacun dans son secteur d'intervention.

L'Association Protection des Ressources Naturelles pour le Bien-Etre de la Population au Burundi (APRN/BEPB) est une association sans but lucratif agréée par le Ministère de l'Intérieur et de la Sécurité Publique par Ordonnance Ministérielle n°530/1101 du 03/01/2003. Elle est une organisation nationale qui travaille sur toute l'étendue du territoire du Burundi.

Sa vision : « Une nature, un écosystème qui font corps avec les communautés et les économies ».

Sa mission : « Protéger et renforcer la place de la nature comme patrimoine pour les communautés et la société » .

Dans le cadre de la mise en Œuvre de son plan d'action 2024-2029, l'Association Protection des ressources naturelles pour le Bien être de la Population au Burundi en collaboration avec son partenaire *Africa Apiculture consortium* est en train de concevoir des projets à soumettre à différents bailleurs de fonds dans le secteurs l'agriculture, l'environnement et l'adaptation au changement climatique.

Dans ce processus d'élaboration de ces projets l'APRN/BEPB, la consultation des parties prenantes à la base constitue un critère important pour le financement des projets qui seront soumis.

Ainsi, les provinces de Bubanza, Bujumbura , Cibitike, Bururi, Ruyigi, Rutana, Karusi et Kirundo ont été choisies pour ces consultations. Ces provinces ont été choisies sur base de différents Rapports sur l'insécurité alimentaire au Burundi notamment «Évaluation de l'impact du changement climatique et stratégies d'adaptation pour le Burundi(2023).

Profil des participants

Les différentes catégories de parties prenantes à consulter sont: les représentants

Official Use Only

administratifs , les communautés agricoles locales, les organisations communautaires et les acteurs du secteur privé,les jeunes, les femmes et les Batwa.
Ces consultations auront lieu du 15 au 22 novembre 2024 et seront animées par (Alexis Nikiza et Léonidas Nduwayo de l'APRN/BEPB avec Eileen Mburu,Bronson Eran'ogwa,Lilian Waithaka,Jean Eyase ,Erick Kioko et Joslyn Muthio de Africa Apiculture consortium en provenance du Kenya.

3.Programme du 15 au 22 Octobre 2024

Date	Timing	Jour	Province	Commune	Nombre de participants
15/10/2024	8h30-11h00	mardi	Bubanza	Gihanga	20
				Bubanza	20
	13h-15h00		Cibitoke	Rugombo	20
				Buganda	20
16/10/2024	8h30-11h00	Mercredi	Bururi	vyanda	20
				bururi	20
	13h-15h00		Rutana	giharo	20
				Musongati	20
17/10/2024	8h30-11h00	jeudi	Ruyigi	Butezi	20
				Ruyigi	20
	13h-15h00		Karusi	Bugenyuzi	20
				Buhiga	20
18/10/2024	8h30-11h00	vendredi	Kirundo	Kirundo	40
22/10/2024	8h30-11h00		Bujumbura	Isare	20
				Kanyosha	20
TOTAL					**320**

Fait à Bujumbura, le 09 octobre 2024

DIRECTEUR GENERAL de l'APRN/BEPB

Alexis NIKIZA

Tél : 79916628/68167052
E-mail: nikiza07@yahoo.fr

Association Protection des Ressources Naturelles pour le Bien-Etre de la Population au Burundi
(APRN/BEPB)
Ord Min N°530/1101 du 03/01/2003

Official Use Only

Annex 3: Initial Gender assessment and action plan for the CLARiS Project

Gender Analysis and Action Plan (GAAP)

A detailed gender-transformative implementation, monitoring and accountability framework

Planning-data disclaimer

The MPAT household and village records used in this document are synthetic and research-informed. They are suitable for appraisal, system design, training and preliminary planning, but are not official field observations and must not be used for individual beneficiary selection, compensation, regulatory determinations or public statistical reporting without field validation.

Acronyms and Key Terms

Term	Meaning
AF	Adaptation Fund
C-ESMP	Contractor Environmental and Social Management Plan
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
E&S	Environmental and social
EIA	Environmental Impact Assessment
ESMP	Environmental and Social Management Plan
FPIC	Free, Prior and Informed Consent
GAAP	Gender Analysis and Action Plan
GBV	Gender-based violence
GRM	Grievance Redress Mechanism
IGEBU	Institut Géographique du Burundi
IPM	Integrated Pest Management
IPP	Indigenous Peoples Plan
MPAT	Multidimensional Poverty Assessment Tool
M&E	Monitoring and evaluation
OHS	Occupational health and safety
OBPE	Office Burundais pour la Protection de l'Environnement
PIU	Project Implementation Unit
PWD	Persons with disabilities
SEA	Sexual exploitation and abuse
SH	Sexual harassment
SEP	Stakeholder Engagement Plan
Twa/Batwa	Indigenous Batwa communities
WASH	Water, sanitation and hygiene

Evidence Base and Limitations

This document consolidates the project's existing environmental, socioeconomic, vulnerability, gender, technology and safeguards evidence into a single operational plan. The evidence base includes the

following:
Multidimensional Poverty Assessment Tool (MPAT) User's Guide and standardized survey instruments.
Environmental and Socio-economic Assessment for a Gender-responsive Agriculture Adaptation Approach with Parametric Insurance and Smart Finance Integration in Burundi.
Gender Analysis and Action Plan for Enhancing Resilience in Burundi.
Vulnerability Assessment for climate resilience and livelihood improvement in Burundi.
UNEP Adaptation Fund Full Proposal annexes on environmental and social safeguards, gender and Indigenous Peoples.
Technology and Skills Needs Assessment supplied for the Burundi project.
Synthetic MPAT planning dataset covering 3,821 households and 96 villages. These modelled records are not official survey observations.

Source-derived findings integrated in this revision

The December 2024 Resilience GAAP contributes qualitative evidence on women's literacy and information constraints, unequal control over agricultural income, male-dominated land and water decisions, limited collateral and financial access, unequal care burdens, safety concerns and weak access to early warning. The UNEP full proposal and consultation annexes add operational detail on inclusive risk mapping, women-led last-mile alert channels, accessible evacuation, Batwa FPIC, women's authority in operation and maintenance, female protection focal points, no-mediation referral for SEA/SH, and community attribution of locally generated adaptation knowledge. These findings are used as design evidence, not as verified prevalence statistics; any numeric claims not confirmed by the MPAT planning dataset must be validated at inception before targeting or public reporting.

How the MPAT data are used

The modelled MPAT dataset covers 3,821 households in 96 village profiles. It provides a consistent planning lens across food and nutrition security, water, health, sanitation, housing and energy, education, assets, shock resilience, gender and climate adaptation. The data are used to prioritize safeguards and gender actions, design indicators and identify information gaps. They do not replace verified census, household survey, engineering, ecological, land-tenure, compensation or protection data.

Mandatory inception validation

Before implementation, the PIU will validate all baseline figures, screen every site and activity, confirm applicable permits and legal requirements, map vulnerable and excluded groups, verify referral services, and update responsibilities, budgets and indicators. Where validated evidence differs from the planning assumptions, the validated evidence governs and this document must be revised through controlled change management.

Executive Summary

This Gender Analysis and Action Plan translates the project's gender, climate, poverty and safeguards evidence into binding implementation standards across eight provinces. It is designed to ensure that women and girls are not treated as a single homogeneous beneficiary category and that project resources change access, control, safety and decision-making power, not merely participation rates.

The synthetic MPAT planning dataset contains 3,821 households and 96 village profiles. Women represent 60.1% of respondents and female-headed households 27.8%. The lowest national planning scores are non-farm assets (46.4), housing/clothing/energy (52.5), exposure and resilience to shocks (55.3), education (56.9) and adaptation capacity (59.6). These patterns justify a portfolio that combines structural gender reforms, climate information, assets, livelihood diversification, finance, protection and accountable governance.

Prior assessments and stakeholder consultations consistently indicate that climate risk is transmitted through structural inequalities. Women contribute substantially to subsistence agriculture but often have weaker land documentation, collateral, financial access and authority over income; unpaid care work can delay evacuation and recovery; literacy, language and digital-access barriers reduce the reach of climate services; and women, Batwa communities and persons with disabilities may be underrepresented in technical and resource-allocation decisions. The updated GAAP therefore combines participation targets with control tests: who receives and understands warnings, who signs, who owns and operates assets, who controls payouts and income, whose knowledge is attributed, and who can obtain remedy without

Official Use Only

retaliation.

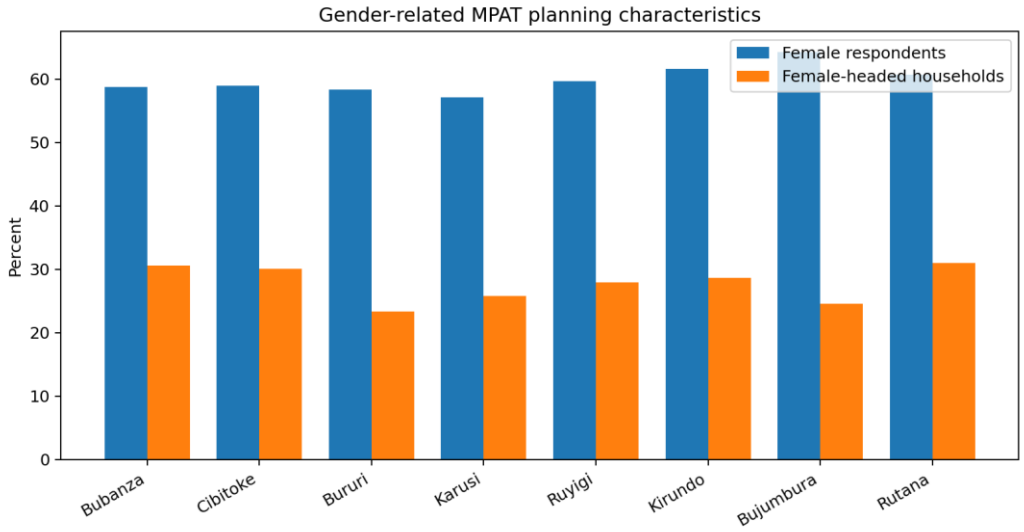


Figure 1. Gender-related characteristics in the synthetic MPAT planning dataset.

Core commitments: At least 50% women in project-supported governance bodies; at least 30% women in executive and technical authority roles; 60% women among direct livelihood beneficiaries where technically appropriate; informed and voluntary access to finance and insurance; survivor-centred SEA/SH systems; FPIC and differentiated benefits for Batwa women; and annual independent gender audits.

1. Project and Gender Context

The programme operates across Bubanza, Cibitoke, Bururi, Karusi, Ruyigi, Kirundo, Bujumbura and Rutana, linking climate information, ecosystem-based adaptation, climate-resilient production, finance, insurance, storage, markets and institutional learning. Gender equality is treated as an adaptation effectiveness and justice requirement. Unequal land rights, asset ownership, information access, mobility, time use, finance, safety and representation shape who can anticipate, absorb and recover from climate shocks.

1.1 Project components

Component 1: Climate information, early warning and inclusive risk governance

Risk mapping, hydro-meteorological information, last-mile alerts, anticipatory action, preparedness drills and inclusive community governance.

Component 2: Ecosystem-based adaptation and climate-resilient production

Agroforestry, apiculture, soil and water conservation, climate-resilient agriculture, water management and targeted flood/drought risk reduction.

Component 3: Inclusive livelihoods, finance, insurance, storage and markets

Women- and youth-led enterprise, savings and credit, parametric insurance, storage, value chains and shock-responsive livelihood recovery.

Component 4: Knowledge, institutions, learning and scale-up

Institutional capacity, participatory knowledge management, policy learning, safeguards systems, monitoring and replication.

1.2 Gender-transformative principle

The GAAP moves from gender-sensitive participation toward gender-transformative outcomes. It requires changes in the rules and resource distributions that produce vulnerability: who controls land and water, who receives and acts on warnings, who is paid, who signs, who owns productive assets, who controls income, whose knowledge is attributed and who can obtain remedy without retaliation.

Gender-neutral design is not neutral where baseline inequalities shape access. A project can count women as participants while male actors still control committee offices, land, equipment, bank accounts, climate information, public speaking roles and institutional authorship. The operational test is therefore

Official Use Only

authority rather than attendance alone: whether women and excluded groups can change decisions, retain control over benefits, participate safely, influence how adaptation knowledge is documented and replicated, and trigger timely corrective action when standards fail.

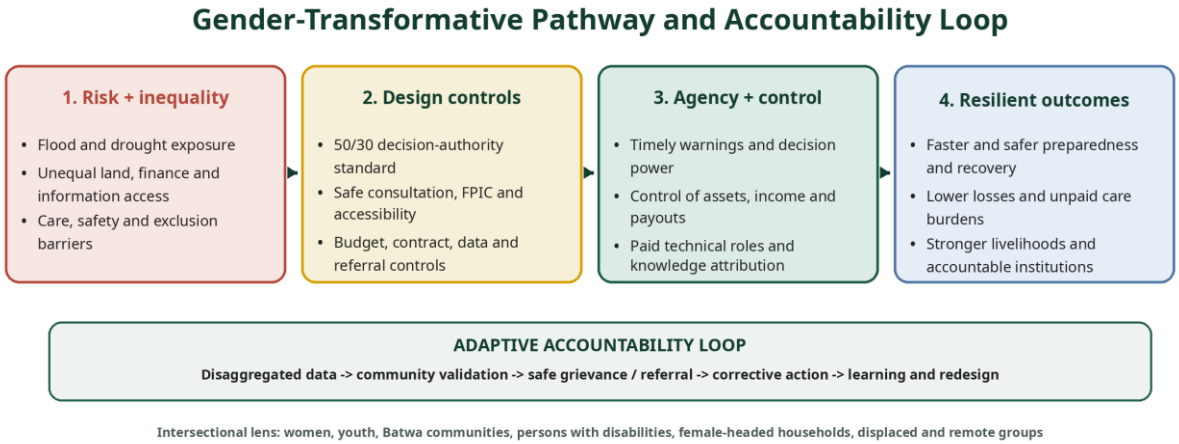


Figure 2. Gender-transformative pathway and accountability loop.

2. Methodology and Baseline Interpretation

The analysis combines document review, stakeholder evidence, gender and vulnerability assessments, environmental and socioeconomic analysis, the project safeguards annexes and the MPAT planning dataset. It uses an intersectional lens covering sex, age, disability, Indigenous identity, household headship, displacement, remoteness, livelihood, land status and access to services.

Evidence is triangulated across four streams: the synthetic MPAT planning patterns; earlier gender, vulnerability and socioeconomic assessments; the UNEP full proposal, stakeholder-consultation and safeguard annexes; and field validation during inception. Contradictions are recorded rather than averaged away, and household-level access is distinguished from individual control. Until verified evidence supports adjustment, the project applies the more protective inclusion and safeguard standard, particularly for SEA/SH, FPIC, accessibility, climate-warning access, financial consumer protection and land or livelihood risks.

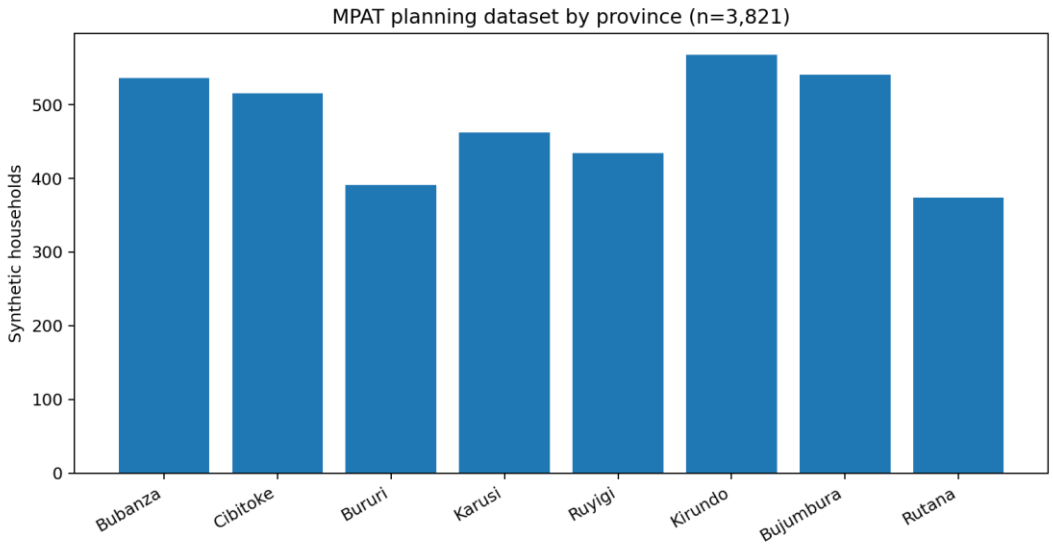


Figure 3. Uneven provincial distribution of the 3,821 synthetic household records.

2.1 Data limitations

The synthetic records reproduce plausible distributions and relationships for planning. They do not establish prevalence, causality or official provincial statistics. During inception, the project will validate the baseline using representative field data, participatory gender analysis, service mapping, land and

Official Use Only

livelihood due diligence, accessibility audits and SEA/SH risk assessment. No person-level decision may be made from synthetic records.

3. Policy, Rights and Institutional Framework

Implementation will follow applicable Burundi law, the project financing agreement and the environmental, social and gender requirements of the Implementing Entity and Adaptation Fund. The operational standard is the more protective requirement where multiple standards apply, subject to lawful implementation. The inception legal register must identify permits, labour and occupational safety requirements, land and compensation rules, environmental assessment obligations, water and biodiversity controls, child protection, nondiscrimination, data protection and criminal reporting requirements.

Human rights and equality	CEDAW, the Convention on the Rights of Persons with Disabilities, the Convention on the Rights of the Child and applicable national constitutional and statutory protections.
Climate and adaptation	UNFCCC gender commitments, Adaptation Fund Gender Policy and Environmental and Social Policy, and national climate and adaptation frameworks.
Indigenous Peoples	FPIC, culturally appropriate participation, protection of traditional knowledge and differentiated benefits consistent with the project IPPF/IPP.
Labour and protection	Nondiscrimination, equal pay, prohibition of child and forced labour, OHS, codes of conduct and survivor-centred SEA/SH response.
Data and accountability	Informed consent, data minimization, confidentiality, secure processing, grievance access, disclosure and non-retaliation.

4. MPAT Gender and Poverty Baseline

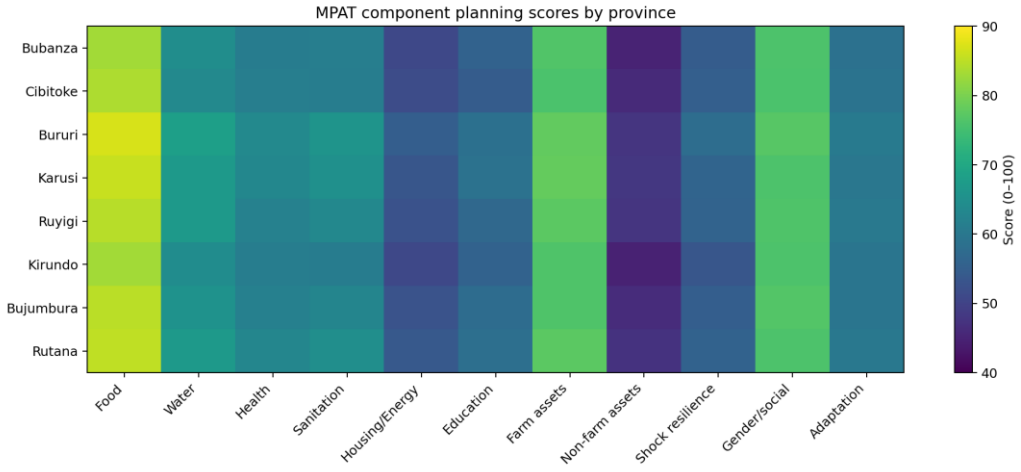
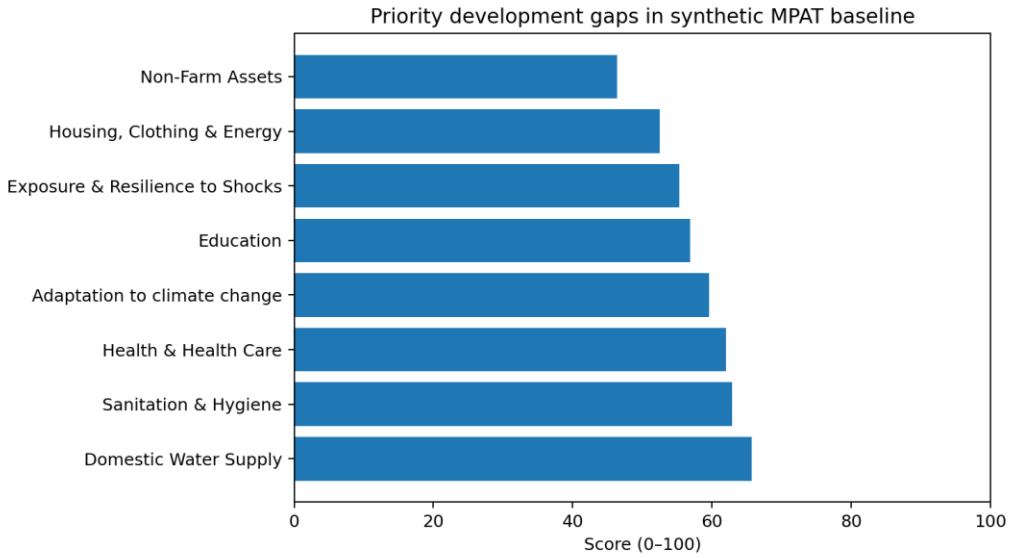


Figure 4. MPAT planning scores by province. Higher scores indicate stronger conditions within the modelled data.

4.1 Priority gaps

Official Use Only



The modelled results point to a portfolio need rather than a single-sector response. Weak non-farm assets and shock resilience can limit women's capacity to absorb crop failure. Housing and energy constraints increase health and care burdens. Education and information gaps affect uptake of technical, digital and financial services. Water and sanitation deficits interact with time poverty, nutrition and protection.

Official Use Only

REPUBLIQUE DU BURUNDI

MINISTERE DE L'ENVIRONNEMENT,
DE L'AGRICULTURE ET DE L'ELEVAGE

Gitega, le 15/5/2026

Office Burundais pour la Protection de l'Environnement

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for Community-Led Adaptation for Resilience and Inclusive Sustainability in Burundi (CLARiS)

In my capacity as designated authority for the Adaptation Fund in Burundi, I confirm that the above national project proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Burundi.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. If approved, the project will be implemented by **Sahara and Sahel Observatory (OSS)** and executed by **Banque Communautaire et Agricole du Burundi (BCAB).**

Sincerely,

Eng. HATUNGIMANA Berchmans

National Designed Entity
for the Adaptation Fund

REPUBLIQUE DU BURUNDI
OBPE
Office Burundais pour la Protection de l'Environnement
B.P.56 GITEGA B.P.2757 BUJUMBURA
Ministère de l'Environnement, de l'Agriculture et de l'Elevage

B.P. 56. Gitega • Tél. (257) 22403031 •TéléFax: (257) 22403032
B.P. 2757 Bujumbura • Tél. (257) 22234304 •
Email : obpe_burundi@obpe.bi

CONSULTATION REPORT

CLARiS Proposal

Community-Led Adaptation for Resilience and Inclusive Sustainability in Burundi

Official Use Only

1. Executive Summary

This report consolidates the available evidence of stakeholder engagement supporting the CLARiS proposal and follows the practical logic of UNEP Annex 3: identify stakeholder organizations and groups, document consultations conducted, record objectives and outcomes, show how feedback affected design, and retain a transparent participation record.

The source documents describe a multi-stage process. The October 2024 field engagement combined meetings with provincial authorities, key-informant interviews, environmental observation, community workshops, gender-segregated focus groups, participatory mapping, prioritization exercises, and administrative close-out. The March 2025 validation series then tested findings and proposed solutions with more than 320 stakeholders across eight provinces. The validation report records 89% agreement on priority adaptation interventions and confirms strong interest in gender-responsive climate-resilient agriculture, accessible finance, risk transfer, community early warning, and stronger local institutions.

Validated consultation message	Implication for CLARiS
Climate risks vary markedly by location.	Use site-specific risk assessments and commune-level prioritization rather than a uniform intervention package.
Women prioritize household water security, food preservation, health, care burdens, and voice in decisions.	Apply gender-responsive targeting, leadership quotas, women-led livelihood support, and sex-disaggregated monitoring.
Communities support soil conservation, water management, resilient seed systems, early warning, finance and insurance.	Maintain the integrated three-component design linking landscapes, agriculture, livelihoods, finance and risk management.
Local institutions have uneven technical and coordination capacity.	Sequence capacity building, fiduciary support, safeguards training, and transparent community grant mechanisms before large-scale disbursement.
Indigenous knowledge and community structures are implementation assets.	Use participatory planning, FPIC where Indigenous Batwa communities are affected, and community monitoring that respects local knowledge.

Official Use Only

2. Project and Consultation Context

2.1 Current CLARiS proposal

CLARiS seeks to empower rural communities through decentralized and locally led decision-making so they can restore degraded land, improve agricultural resilience, diversify livelihoods, and protect vulnerable and marginalized groups. The updated concept note requests USD 5 million and identifies OSS as Implementing Entity and BCAB as Executing Entity.

Component	Consultation-relevant focus
1. Ecosystem Restoration and Landscape Resilience	Participatory degradation mapping; reforestation and agroforestry; soil and water conservation; community nurseries; local land-use agreements and conservation bylaws.
2. Climate-Smart Agriculture and Adaptive Soil Management	Locally adapted climate-smart practices; soil fertility and moisture retention; women-managed compost hubs; farmer capacity and adaptive extension support.
3. Community Livelihood, Financial and Risk Resilience	Women-, youth- and vulnerable-group livelihoods; market access and local value addition; community adaptation funds and micro-grants; climate-risk insurance and community early warning.

2.2 Consultation purpose

The consultation process was intended to verify climate vulnerabilities, identify locally acceptable solutions, test implementation feasibility, strengthen stakeholder ownership, surface social and environmental risks, and define institutional roles. It also sought to ensure that women, youth, farmers, Indigenous communities and other vulnerable groups could influence project priorities rather than participate only as beneficiaries.

2.3 Geographic provenance

Evidence set	Geography recorded	Use in this report
Stakeholder field report	Bujumbura Rural/Marie, Cibitoke, Bubanza, Ruyigi, Bururi, Karusi, Rutana and Kirundo.	Detailed evidence on methods, regional climate risks, community priorities and institutional capacity.
Workshop validation report	Eight provinces; workshop series dated 17-22 March 2025.	Validation statistics, consensus findings, refinements, risks and implementation pathways.

Official Use Only

Evidence set	Geography recorded	Use in this report
Updated CLARiS concept note	Gashoho and Gasorwe (Muyinga); Tangara and Busiga (Ngozi).	Current project identity, objective, geography, components, entities and financing.

3. Methodology and Participation

3.1 Engagement sequence

Phase	Timing	Main methods	Purpose
Preparation and institutional entry	8-12 Oct 2024	Governor/municipal meetings, project briefings, key-informant interviews, environmental observation	Secure authorization; map institutions; identify climate and governance issues; plan community sessions.
Community workshops	15-24 Oct 2024	Registration, plenary briefing, gender-segregated FGDs, participatory mapping, prioritization, plenary synthesis	Validate lived climate impacts; identify differentiated needs; test locally acceptable adaptation options.
Administrative close-out	27-31 Oct 2024	Submission of attendance records, consolidated findings, visual documentation and follow-up discussions	Confirm documentation, maintain institutional ownership and agree follow-up.
Validation workshops	17-22 Mar 2025	Scenario building, insurance and finance simulations, intervention ranking, stakeholder alignment, success-indicator development	Validate baseline findings, refine interventions, identify risks, clarify roles and build consensus.

3.2 Participatory tools

- Participatory climate-vulnerability mapping and verification of hotspots, seasonal patterns and local risk zones.
- Gender-segregated focus-group discussions to reduce power imbalances and capture different productive and care-related priorities.

Official Use Only

- Key-informant interviews with provincial and municipal authorities and technical stakeholders.
- Community prioritization of adaptation actions, including soil and water conservation, resilient crops, water storage, early warning and livelihood diversification.
- Scenario and simulation exercises to test insurance triggers, financial products and climate-smart agriculture options.
- Accessible facilitation using visual materials, local-language interpretation and parallel small-group activities.
- Documentation through notes, attendance records, photographs, maps and formal submission of consolidated findings.

3.3 Participation profile

The validation report records more than 320 stakeholders across demographic, institutional and sectoral categories. The field report separately states that approximately 236 participants were involved, including 133 men and 108 women; because these figures sum to 241, the participation total requires verification against signed attendance sheets. Kirundo is specifically recorded as having 20 participants, including 7 women, 13 men and 2 Indigenous participants.

4. Stakeholder Overview

Stakeholder group	Interest / role	Consultation contribution	Expected implementation role
National government and technical agencies	Policy alignment, climate information, safeguards, sector coordination	National priorities, technical standards, institutional mandates and endorsement	Steering, technical oversight, integration with national systems and reporting.
Provincial and communal authorities	Local planning, public services, land and natural-resource governance	Local risk patterns, administrative feasibility, capacity gaps and coordination needs	Embed actions in local plans; convene assemblies; support grievance and monitoring systems.
Farmers and cooperatives	Agricultural productivity, water, inputs, markets and risk protection	Practical constraints, indigenous techniques, preferred technologies and willingness to contribute	Manage nurseries, compost hubs, grants, enterprises, maintenance and peer learning.

Official Use Only

Stakeholder group	Interest / role	Consultation contribution	Expected implementation role
Women and women-led groups	Water and food security, workload, land, finance, leadership and safety	Gender-differentiated impacts and priorities; barriers to credit and decisions	Leadership in committees, livelihoods, finance, monitoring and social accountability.
Youth groups	Employment, enterprise, technology and land access	Demand for livelihood diversification, skills and accessible finance	Digital monitoring, climate services, enterprises and restoration work.
Indigenous Batwa communities	Land and water access, cultural rights, equitable benefits and grievance access	Risks of systemic exclusion and need for culturally appropriate participation	Co-design through FPIC; differentiated benefits; community monitoring and grievance access.
Persons with disabilities, displaced and asset-poor households	Accessibility, livelihood security, protection from exclusion	Barriers to participation and benefit access	Targeted access measures, representation and disaggregated monitoring.
Financial and insurance actors	Credit, adaptation finance, insurance design and risk data	Product feasibility, affordability, payout triggers and data gaps	Operate locally accessible finance and risk-transfer mechanisms with consumer protection.
Civil society, research and development partners	Inclusion, technical support, learning, complementarity	Lessons, safeguards, community facilitation and overlap avoidance	Independent facilitation, technical assistance, accountability and knowledge sharing.

Official Use Only

5. Consultations Conducted

5.1 Province-level consultation record

Location	Recorded climate / governance issue	Community priority and consultation outcome
Bujumbura Rural / Marie	Flash flooding, erosion, altered drainage, pressure from urbanization and intensive land use.	Flood and erosion management, agricultural water management and coordinated municipal implementation; strong institutional endorsement was recorded.
Cibitoke	Steep slopes, erosion, landslides, rainfall variability and agricultural water insecurity.	Improved terracing, water harvesting, climate monitoring and early warning; technical and institutional capacity building.
Bubanza	Declining rainfall reliability, water competition, drought cycles and pressure on protected forests.	Water harvesting, drought-resistant crops, rainfall early warning and balanced conservation/agricultural land use.
Ruyigi	Seasonal water stress, deforestation, land degradation and migration pressure.	Water storage, seasonal forecasting and drought-resilient agriculture; women emphasized household water security and men agricultural productivity.
Bururi	Watershed degradation, soil erosion, downstream water-quality impacts and biodiversity pressure.	Integrated watershed management, soil conservation and stronger local natural-resource governance.
Karusi	Deforestation, erosion, erratic rainfall, periodic dry spells and limited livelihood diversification.	Practical soil conservation, water harvesting, adapted seed varieties and diversified livelihood strategies.
Rutana	Rainfall unpredictability, soil degradation, deforestation and climate-sensitive agriculture.	Seasonal forecasting, soil conservation and diversified livelihoods.
Kirundo	Frequent drought, irregular rainfall, lake-related flooding and weak anticipatory systems.	Drought-resistant crops, water-resource management, early warning and a shift from crisis response to anticipatory planning.

Official Use Only

5.2 Cross-cutting consultation outcomes

Theme	What stakeholders reported	Resulting design direction
Climate information and early warning	Seasonal uncertainty limits planting and preparedness; local systems are weak or uneven.	Community-based early warning linked to credible climate information and locally accessible communication channels.
Land, soil and water	Erosion, degraded hillsides, water scarcity, runoff and unreliable rainfall undermine production.	Participatory restoration, terracing, agroforestry, soil-water conservation, riparian protection and water harvesting.
Agriculture and food security	Yield instability, crop disease, input constraints and weak storage deepen vulnerability.	Locally adapted climate-smart agriculture, resilient seeds, composting, storage and extension support.
Livelihoods and markets	Dependence on rain-fed farming and weak market access leave households exposed.	Diversified livelihoods, local value addition, cooperative enterprises and improved market linkages.
Finance and insurance	Credit and insurance are inaccessible; climate and risk data are inadequate; low incomes threaten affordability.	Community adaptation funds, micro-grants, consumer-centred insurance design, premium support and transparent eligibility.
Governance and capacity	Local climate expertise, coordination and implementation capacity vary significantly.	Phased capacity support, commune adaptation committees, fiduciary controls, clear mandates and embedded local planning.
Gender and inclusion	Women face barriers to land, credit, leadership and time; marginalized groups risk exclusion.	Representation targets, tailored finance, accessible facilitation, FPIC, disaggregated monitoring and safe grievance channels.
Local knowledge	Traditional forecasting, soil conservation, seed preservation and water governance remain valuable but under-documented.	Validate and integrate local knowledge while protecting ownership and avoiding extractive documentation.

Official Use Only

5.3 Summary of consultation events and incorporation into the CLARiS concept note

Table 9. Summary of consultation events, key discussion outcomes, and incorporation into the CLARiS concept note

Dates	Consultations	Summary outcomes of discussion	Incorporation into the CLARiS concept note
8-12 October 2024	Institutional entry meetings and key-informant consultations	Provincial governors, municipal leaders and technical stakeholders confirmed that climate impacts differ across locations and highlighted drought, erratic rainfall, flooding, erosion, landslides, watershed degradation and weak climate-information services. Discussions also identified uneven local capacity, coordination constraints, and the need to align with existing government and partner initiatives.	Reflected in the problem statement, locally led adaptation rationale and decentralized governance approach. The findings informed participatory risk assessment, commune-level planning, institutional capacity building, coordination arrangements, community early warning, and the requirement to assess overlap and complementarity before sub-project approval.
15-24 October 2024	Community consultation workshops, gender-segregated focus groups and participatory mapping	Farmers, women, men, youth, Indigenous participants and local leaders validated lived climate impacts and prioritized soil and water conservation, agroforestry, resilient seed varieties, water harvesting and storage, seasonal forecasting, livelihood diversification, market access, accessible finance and insurance. Women emphasized water security, food preservation, health, care burdens and decision-making voice.	Reflected across all three components: landscape restoration and soil-water conservation under Component 1; climate-smart agriculture, adaptive soil management and women-managed compost hubs under Component 2; and livelihoods, local value addition, community adaptation funds, micro-grants, climate-risk insurance and early warning under Component 3. Inputs also informed gender quotas, targeted finance and FPIC commitments.

Official Use Only

Dates	Consultations	Summary outcomes of discussion	Incorporation into the CLARiS concept note
27-31 October 2024	Administrative close-out, bilateral follow-up and submission of consultation records	Follow-up discussions confirmed institutional support and the importance of realistic implementation schedules, clear responsibilities, accessible local-language communication, consistent documentation, and formal feedback to provincial and community stakeholders. Operational constraints included difficult travel, weather disruption, dialect differences and participatory sessions requiring more time than planned.	Reflected in the proposed use of existing local governance structures, phased capacity support, transparent resource allocation, community-based monitoring and grievance arrangements. The operational lessons informed recommendations for decentralized venues, trained interpreters, accessible materials, standardized attendance and consent records, and a central consultation evidence archive.
17-22 March 2025	Multi-stakeholder validation workshop series	The validation process reported engagement of more than 320 stakeholders and 89% agreement on priority adaptation interventions. Participants validated the integrated link between ecosystem restoration, climate-resilient production, inclusive livelihoods, finance, insurance, early warning and institutional strengthening. They called for context-sensitive insurance, local knowledge integration, community-owned success indicators and clearer institutional roles.	Reflected in refinement of component sequencing and linkages, especially the connection between restored landscapes, resilient agriculture, livelihood and market support, finance and risk protection. The feedback reinforced adaptive implementation, community-defined monitoring, anti-elite-capture controls, inclusive facilitation, local-language materials and the need to clarify roles before disbursement.

Official Use Only

Dates	Consultations	Summary outcomes of discussion	Incorporation into the CLARiS concept note
July 2026 proposal synthesis and appraisal preparation	Evidence consolidation and design-reconciliation review	Comparison of the consultation records with the updated CLARiS concept note confirmed strong thematic alignment but identified unresolved differences in project geography, institutional arrangements, participation totals and the evolution of the project title and design. The current concept note focuses on Gashoho, Gasorwe, Tangara and Busiga, whereas the principal field evidence covers an earlier eight-province process.	Reflected in the report's recommendation for a focused appraisal consultation round in the four current communes. The proposal should add a current-commune stakeholder map, verify participation statistics and validation metrics, reconcile OSS/BCAB and earlier AfDB-linked references, disclose how previous inputs informed the final design, and close the feedback loop before submission.

Official Use Only

5.4 Photographic record of consultation and validation activities



Figure 1. Women-focused community consultation session documented in the stakeholder field report.



Figure 2. Community focus-group discussion documented in the stakeholder field report.

Official Use Only



Figure 3. Institutional stakeholder discussion documented in the workshop validation report.



Figure 4. Institutional stakeholder group photograph documented in the workshop validation report.

Official Use Only

6. Consolidated Findings

6.1 Regional variation requires differentiated programming

The field evidence rejects a one-size-fits-all approach. Northern areas were described as drought-prone and water constrained; western areas as exposed to steep-slope erosion and flash flooding; southern areas as facing erosion, landslides and infrastructure damage; and central areas as experiencing unpredictable rainfall, erosion and crop disease. For CLARiS, the principle is directly applicable even though the current geography differs: each of the four target communes should complete a risk-and-livelihood profile before final sub-project selection.

6.2 Gendered priorities are complementary, not interchangeable

Women consistently emphasized household water security, food storage, health risks, time burdens and limited authority. Men more often prioritized productivity, infrastructure, market access, forecasting and government support. Both perspectives are material to resilience. The project should therefore assess productive and reproductive workloads, control over assets and income, exposure to violence and exclusion, and the distribution of benefits within households and cooperatives.

6.3 Institutional readiness is uneven

Bubanza and Bujumbura Rural were described as having stronger climate coordination; Bururi and Cibitoke showed awareness but limited implementation structures; and Kirundo, Rutana and Karusi faced more significant technical and partnership constraints. The operational lesson for CLARiS is to assess readiness by commune and tailor capacity support, rather than assume that formal mandates imply implementation capability.

6.4 Community mobilization is a project asset

High turnout, active mapping and prioritization, willingness to contribute labor and local materials, and existing community structures indicate substantial ownership potential. This asset will be sustained only if communities receive clear decision rights, transparent budgets, accessible grievance channels, timely feedback on what was accepted or rejected, and visible influence over monitoring and adaptive management.

6.5 Delivery risks emerged during consultation

Observed challenge	Practical implication for future CLARiS consultation
Long travel times, poor roads and weather disruption	Budget realistic travel buffers; use decentralized venues and seasonal scheduling.
Language and dialect differences	Use trained local interpreters, a tested terminology glossary, visual aids and accessible formats.

Official Use Only

Observed challenge	Practical implication for future CLARiS consultation
Participatory sessions exceeded planned time	Allow sufficient time, prioritize core questions and use parallel groups without reducing depth.
Power differences across participant groups	Retain separate spaces for women, youth, Batwa and other groups; use independent facilitation where needed.
Documentation and attendance inconsistencies	Use standardized registers, consent protocols, unique participant counts and a central evidence log.

7. How Consultation Shaped the CLARiS Design

Stakeholder input / validated concern	Design response visible in current concept note	Further action required
Degraded hillsides, erosion, runoff and loss of vegetation	Component 1 includes participatory mapping, reforestation, agroforestry, riparian restoration and soil-water conservation.	Validate priority sites and land-use implications in the four current communes; document consent and maintenance responsibilities.
Need for locally adapted production practices and better soil moisture	Component 2 includes climate-smart agriculture, adaptive soil management, compost hubs and farmer support.	Co-design technology menus with farmers and test affordability, labor and gender impacts.
Demand for diversified livelihoods, markets and local value addition	Component 3 includes vulnerable-group livelihoods, cooperative enterprises and market access.	Complete value-chain, market, labor and benefit-sharing analysis by commune.
Limited finance and risk-protection access	Community adaptation funds, micro-grants and climate-risk insurance are included.	Confirm legal/operational arrangements, consumer protection, premium affordability, payout communication and grievance processes.
Weak local decision power and capacity	The concept note uses community assemblies, committees, cooperatives and decentralized resource allocation.	Define decision rights, fiduciary thresholds, disclosure, audit, capacity milestones and anti-elite-capture measures.
Women and marginalized groups face structural exclusion	Gender quotas, women-led activities, targeted finance and FPIC are proposed.	Develop measurable inclusion plans and verify safe, accessible participation in current target communes.

Official Use Only

Stakeholder input / validated concern	Design response visible in current concept note	Further action required
Need for early warning and anticipatory action	Community-based early warning appears under Component 3.	Clarify linkage to national climate information and emergency systems, last-mile channels and maintenance.

8. Inclusion, Safeguards and Accountability

8.1 Minimum consultation standards for CLARiS

- Provide timely information in Kirundi and accessible formats before decisions are taken.
- Use separate and safe discussion spaces where needed for women, youth, Indigenous Batwa people, persons with disabilities, displaced people and asset-poor households.
- Record participant consent, representation, accessibility support, feedback and unresolved concerns without collecting unnecessary personal data.
- Apply Free, Prior and Informed Consent where project activities may affect Indigenous Batwa rights, lands, resources, cultural practices or livelihoods.
- Disclose selection criteria, budgets, committee membership, procurement results and benefit allocations in locally understandable formats.
- Operate a multi-channel grievance mechanism with confidential and survivor-centred pathways for SEA/SH complaints and protection from retaliation.
- Close the feedback loop by explaining which recommendations were accepted, modified or not adopted and why.

8.2 Proposed consultation monitoring indicators

Indicator	Minimum disaggregation / evidence	Suggested frequency
Participants reached and participating meaningfully	Sex, age, disability, Indigenous status, displacement, stakeholder group, commune; signed/consented record	Every event; quarterly consolidation
Representation in decision bodies	Membership and leadership by sex and vulnerable-group status	Quarterly
Stakeholder recommendations acted upon	Recommendation log with decision, rationale, owner and status	After each design or implementation round
Accessibility and language support provided	Venue/accessibility checklist, interpretation and material formats	Every event
Grievances received and resolved	Channel, category, response time, resolution and satisfaction; confidential handling	Monthly/quarterly

Official Use Only

Indicator	Minimum disaggregation / evidence	Suggested frequency
FPIC milestones completed where applicable	Culturally appropriate evidence of process, decision and conditions	Before affected activities
Perceived influence and safety	Anonymous feedback by group; no-retaliation and SEA/SH safeguards	At least annually

9. Gaps, Reconciliation Actions and Next Steps

Priority issue	Required action before final proposal submission	Owner to confirm
Geography mismatch	Conduct and document targeted consultations in Gashoho, Gasorwe, Tangara and Busiga; explain how earlier eight-province evidence informed design without overstating direct coverage.	Proposal team / local authorities
Implementing and executing entity mismatch	Reconcile OSS/BCAB in the current concept note with AfDB and Ministry references in the validation report; update every annex consistently.	Implementing entity / government
Project design and title evolution	Map the earlier gender-responsive agriculture, parametric insurance and smart-finance framing to the final CLARiS components and explain what changed after consultation.	Technical design team
Attendance totals and demographics	Reconcile 236 versus 241 in the field report and the “over 320” validation claim using signed attendance sheets and unique counts.	M&E / consultation lead
Validation statistics	Attach or reference the instruments, sample, denominator and analysis supporting the 65%, 78%, 89% and 90% claims.	M&E / safeguards team
Current-commune stakeholder mapping	Prepare an Annex 3-style organization list for the four communes, including vulnerable groups, service providers and local private sector.	Community engagement team
Evidence archive	Create a dated register of invitations, agendas, attendance, consent, notes, photographs, maps, feedback logs and approvals with data-protection controls.	Project management unit
Design response and feedback closure	Share the revised design back with consulted groups and record acceptance, concerns and changes.	Consultation lead

Official Use Only

1. Detailed Consultation Matrix

Stage / location	Stakeholders	Objective	Outcome / conclusion	Evidence referenced
Institutional entry, eight-province field mission	Provincial governors, municipal leaders, local administration, technical officers	Introduce project; secure support; identify risks, initiatives and capacity.	Institutional support recorded; provincial climate and governance priorities identified; community sessions authorized.	Field report narrative, schedule, meeting records, photos/stamps referenced in appendices.
Community workshops, eight provinces	Farmers, women, men, youth, local leaders, cooperatives, Indigenous participants and other community actors	Validate climate impacts; map risk; identify differentiated priorities; rank adaptation options.	Regional risk profiles and priorities established; strong interest in water, soil, agriculture, livelihoods and early warning.	Attendance records, FGD notes, maps, photographs and consolidated findings referenced.
Gender-segregated focus groups	Women and men in separate groups	Reduce power imbalance and capture gender-differentiated impacts and priorities.	Women highlighted water, food, health, time and voice; men highlighted productivity, infrastructure, markets and forecasting.	FGD facilitation records and field report synthesis.
Kirundo community workshop	20 participants: 7 women, 13 men, including 2 Indigenous participants	Ensure engagement in drought-affected and lakeside communities despite schedule disruption.	Drought management, water resources, early warning and anticipatory action prioritized.	Field report registration and workshop narrative.
Validation series, 17-22 March 2025	More than 320 stakeholders across 15 categories, as reported	Verify baseline; test interventions; build alignment; identify roles, risks and success measures.	89% agreement reported; intervention refinements and community-owned monitoring concepts developed.	Workshop validation report; methods, exercises and annex references.
Current CLARiS concept development	National, subnational and community stakeholder categories described in concept note	Integrate LLA, gender, social inclusion, FPIC, finance and safeguards into proposal design.	Three-component integrated design and decentralized implementation approach documented.	Updated CLARiS concept note.

Official Use Only

2. National level Participant and Institutional Contact List

This annex combines names and roles visible in the provided visit minutes with the additional Focal Point, OBPE and MoAE institutional roster supplied for this revision. The minutes were not used as a source of consultation findings, commitments or design decisions. Spellings and titles should be checked against official attendance and institutional records before external publication.

Organization	Name	Role / title
Focal Points	Mr. Nibizi Epimeny	National Focal Point for AF
Focal Points	Mr. Ndayizeye Liévin	NDA Adaptation Fund
CTCN / IGEBU	Ms. Rénilde Ndayishimiye	CTCN National Designated Entity focal point (nomination record)
IGEBU	Mr. Ngenzirabona Augustin	Director General
OBPE	Mr. Hatungimana Berchmans	General Director
OBPE	Mr. Ndayikeza Longin	Research officer
OBPE	Ms. Manirakiza Odette	Insect Researcher
OBPE	Ms. Kaneza Belyse	Protected areas officer
OBPE	Mr. Ntashavu Dieudonné	Communication and information officer
OBPE	Mr. Hakizimana Claude	Environmental research officer
OBPE	Mr. Bukuru Désiré	SIG officer
OBPE	Ms. Kandame Aurore	Biological resources management officer
OBPE	Mr. Ahishakiye Jérôme	Environmental monitoring officer
OBPE	Mr. Masabo Onesphore	Habitat dynamics officer
OBPE	Mr. Murengerantwari Janvier	Monitoring and evaluation officer
MoAE	Mr. Mbonihankuye Denis	Environment and Hygiene officer
MoAE	Ms. Ntawuyankira Neila	Insect Researcher at ISABU
MoAE	Mr. Willy Désiré Emera	Researcher at the Institute of Agronomic Sciences of Burundi (ISABU)
MoAE	Mr. Jean Claude NGWEBU	Director of Agricultural Statistics and Information
MoAE	Mr. Claude BIGIRIMANA	Head of the phylogenetic resource conservation unit at the Burundi Institute of Agricultural Sciences (ISABU)

Official Use Only

Organization	Name	Role / title
MoAE	H.E. Hon. Ir. Prosper DODIKO	Minister
MoAE	Mr. Ndorimana Emmanuel	Permanent secretary
African Development Bank / delegation	Dr. James Kinyangi	Coordinator, Climate Action Window and Climate and Development Special Fund
African Development Bank / delegation	Winnie Chepkemoi Mutai	Climate Change Finance (Reaccreditation and Readiness) Expert - Climate Change and Green Growth Department
African Development Bank / delegation	Salomon	Climate Expert
African Apiculture Consortium	Bronson Eran'ogwa	Managing Director and Development Partner
ITRACOM Holding	Methouchellah Niyoyankunze	Assistant to the Chairman and CEO
ITRACOM Holding	Dr. Theodore Mbazumutima	Managing Director
ITRACOM Holding	Jean Joseph Nyandwi	Deputy Managing Director
ITRACOM Holding	Judes Ndayishimiye	Director of Finance
ITRACOM Holding	Casimir Nibigira	Director of Human Resources
ITRACOM Holding	Isaac Mukeshimana	Director of Legal Affairs, Labour Relations and Security
ITRACOM Holding	Manirakiza Alexis	Director of Financial and Technology Systems Development
ITRACOM Holding	Jacqueline Nahimana	Director of Innovation and Development
ITRACOM Holding	Nestor Nizigiyimana	Director of Inspections and Audit
ITRACOM Holding	Eric Uwintwari	Tax Advisor
ITRACOM Holding	Arsene Harumukiza	Director of Assets Management
BCAB	Floris Mizero	Managing Director
BCAB	Ndihokubwayo Augustin	Deputy Director General
BCAB	Gahimbare Nicodeme	Assistant to the General Manager
BCAB	Nsimira Vanessa	Director of Logistics and Supply
BCAB	Niyongabo Jean Bosco	Director of Operations
BCAB	Ndayizeye Violet	Director of Internal Audit
BCAB	Ntwari Devis Arnaud	Director of IT Research and Development

Official Use Only

Organization	Name	Role / title
BCAB	Harikwindavyi Radegonde	Director of Human Resources
BCAB	Ntawuyamara Dieudonne	Branch Manager
BCAB	Pierre Sinamenye	Director of Sales and Agri Business
BCAB	Darlene Iradukunda	Credit Director
FOMI	Ntirampemba Simon	Managing Director
FOMI	Majambere Claudoir	Administrative and Financial Director
FOMI	Dr. Bizimana Syldie	Research and Innovation Director
FOMI	Ndayisenga Jean Pierre	Legal Affairs Director
FOMI	Eng. Kanyegeri Cassien	Agronomic Director
FOMI	Barihenda Ephrem	Human Resources Director
FOMI	Ntaconzoba Alexis	Procurement Director
FOMI	Nzobandora Jean Pierre	Commercial Director
FOMI	Batungwanayo Fleury	Internal Audit Director
FOMI	Eng. Ninziza Aime	Technical Director
ITRAPACK	Mpfubusa Deo Bede	Managing Director
ITRAPACK	Terence Batungwanayo	Adviser
ITRAPACK	Jean Pierre Ngenzebuhoro	Commercial Director
ITRAPACK	Joyeuse Iradukunda	Technical Director
ITRAPACK	Jospeh Iteriteka	Human Resources Director
ITRAPACK	Stany Shishikaye	Logistics Manager
ITRAPACK	Bennee Nibampa	Director of Finance
ITRAPACK	Willy Nduwayezu	Internal Audit Director
ITRACOM	Thiery Nikuze	Deputy Managing Director
ITRACOM	Adrien	Internal Audit Director
ITRACOM	Dieudonne	Commercial Director
ITRACOM	Djuma	Manager of Garage
ITRACOM	Francoise	Adviser
ITRACOM	Domitille	Human Resources Director
ITRACOM	Jean Claude	Procurement Director
ITRASAGRI	Dr. Deo Guide Rurema	Managing Director
ITRASAGRI	Prosper	Agronomic Director

Official Use Only

Organization	Name	Role / title
ITRASAGRI	Gorette	Director of Finance
INKINZO AG	Chrysante Karikurubu	Administrative and Financial Director
INKINZO AG	Kevin Rwasa	Technical Director
INKINZO AG	Melissa Nditonze	Commercial Director
INKINZO AG	Emile Havyarimana	Internal Auditor
INKINZO VC	Evariste Nahayo	Administrative and Financial Director
INKINZO VC	Jean Claude Ruhuza	Technical Director

Provincial level and Communal level Representatives

The table below presents a representative subset of seven attendees from each October 2024 provincial community consultation. Each provincial subset comprises four women and three men, selected from clearly legible entries in the signed activity-fee attendance sheets. It is not a replacement for the complete signed attendance records. Sex-disaggregated selection is based on the recorded given names and should be confirmed during final participant verification. For Kirundo, the consultation record confirms Batwa/Indigenous participation; individual ethnicity is not attributed in this public-facing register because the attendance sheet does not identify which named attendees belong to that community.

Province	Name	Sex	Participation / verification note
Bubanza	Nshimirimana Alexandrine	Woman	Community consultation attendee
Bubanza	Nshimimwe Renine	Woman	Community consultation attendee
Bubanza	Ndayishimiye Violette	Woman	Cooperative / community attendee
Bubanza	Nizeyimana Judith	Woman	Cooperative / community attendee
Bubanza	Nshimirimana Eric	Man	Community consultation attendee
Bubanza	Nikagira Alexandre	Man	Community consultation attendee
Bubanza	Nzigirabarya Stéphane	Man	Community consultation attendee
Cibitoke	Nduwimana Médiatrice	Woman	Community consultation attendee

Official Use Only

Province	Name	Sex	Participation / verification note
Cibitoke	Ndabitezimana Sifa	Woman	Community consultation attendee
Cibitoke	Nduwimana Victoire	Woman	Community consultation attendee
Cibitoke	Irankunda Alphonsine	Woman	Community consultation attendee
Cibitoke	Hatungimana Richard	Man	Community consultation attendee
Cibitoke	Hakizimana Wilson	Man	Community consultation attendee
Cibitoke	Nduwimana Innocent	Man	Community consultation attendee
Bururi	Nibitanga Héline	Woman	Community consultation attendee
Bururi	Ndayihimbaze Astérie	Woman	Community consultation attendee
Bururi	Bizimana Léondie	Woman	Community consultation attendee
Bururi	Ndayisaba Marie Rose	Woman	Community consultation attendee
Bururi	Niyonkuru Thieus	Man	Community consultation attendee
Bururi	Niyongabo J. Claude	Man	Community consultation attendee
Bururi	Ndayikengurukiye Ferdinand	Man	Community consultation attendee
Karusi	Irumva Félicide	Woman	Community consultation attendee
Karusi	Mbonimpa Dévine	Woman	Community consultation attendee
Karusi	Kabanyana Marie Josée	Woman	Community consultation attendee
Karusi	Ndikumana J. Marie	Woman	Community consultation attendee
Karusi	Ntirandoba Innocent	Man	Community consultation attendee
Karusi	Ndayishimiye Revocot	Man	Community consultation attendee

Official Use Only

Province	Name	Sex	Participation / verification note
Karusi	Muhitira Julian	Man	Community consultation attendee
Ruyigi	Ntahonsigaye Consolate	Woman	Community consultation attendee
Ruyigi	Sr. Marie Fausta Trakote	Woman	Community consultation attendee
Ruyigi	Kwizera Emelyne	Woman	Community consultation attendee
Ruyigi	Nankumana Gloriose	Woman	Community consultation attendee
Ruyigi	Nkunzimana Valéry	Man	Community consultation attendee
Ruyigi	Ndihokubwayo Joseph	Man	Community consultation attendee
Ruyigi	Manirakiza Donatien	Man	Community consultation attendee
Kirundo	Cimpaye Virginie	Woman	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Karenzo Béatrice	Woman	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Nkuriyimana Vénuste	Woman	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Kankera Sandrine	Woman	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Barengayabo Emile	Man	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Niyibizi Philbert	Man	Community consultation attendee; Kirundo group included Batwa participants
Kirundo	Ndayisenga Gilbert	Man	Community consultation attendee; Kirundo group included Batwa participants
Bujumbura	Ndihokubwayo Estella	Woman	Community consultation attendee

Official Use Only

Province	Name	Sex	Participation / verification note
Bujumbura	Cingera Angélique	Woman	Community consultation attendee
Bujumbura	Nsabimana Gertrude	Woman	Community consultation attendee
Bujumbura	Nibitanga Anne	Woman	Community consultation attendee
Bujumbura	Niyokwizera Michel	Man	Community consultation attendee
Bujumbura	Bikuru Vianney	Man	Community consultation attendee
Bujumbura	Nyabenda Anicet	Man	Community consultation attendee
Rutana	Nsabimana Clotière	Woman	Community consultation attendee
Rutana	Ntahomvukiye Goreth	Woman	Community consultation attendee
Rutana	Sinzaye Séverine	Woman	Community consultation attendee
Rutana	Minani Micheline	Woman	Community consultation attendee
Rutana	Mukenga Onesphore	Man	Community consultation attendee
Rutana	Nifasha Justin	Man	Community consultation attendee
Rutana	Minani Edmond	Man	Community consultation attendee

Official Use Only

Association Protection des Ressources Naturelles pour le Bien-Etre de la Population au Burundi

Bujumbura, Quartier Kigobe sud, Avenue Kigunga n°10 • Ord Min N° 530/1101 du 03 /01/2003

Contexte

Le Burundi est confronté à d'importants défis pour accéder au soutien des initiatives essentielles d'adaptation au changement climatique. L'absence d'études et d'évaluations nécessaires, en particulier en matière d'évaluation de l'égalité entre les sexes, de garanties environnementales et sociales et d'évaluation des risques, entrave la capacité du pays à soumettre une proposition compétitive. En outre, le secteur agricole, qui est très vulnérable aux impacts du changement climatique, doit de toute urgence adopter des pratiques d'agriculture intelligente face au climat (AIC) qui soient durables et sensibles au genre. Pour ce faire différentes parties prenantes dans le développement du Burundi doivent conjuguer leurs efforts chacun dans son secteur d'intervention.

L'Association Protection des Ressources Naturelles pour le Bien-Etre de la Population au Burundi (APRN/BEPB) est une association sans but lucratif agréée par le Ministère de l'Intérieur et de la Sécurité Publique par Ordonnance Ministérielle n°530/1101 du 03/01/2003. Elle est une organisation nationale qui travaille sur toute l'étendue du territoire du Burundi.

Sa vision : « Une nature, un écosystème qui font corps avec les communautés et les économies ».

Sa mission : « Protéger et renforcer la place de la nature comme patrimoine pour les communautés et la société » .

Dans le cadre de la mise en Œuvre de son plan d'action 2024-2029, l'Association Protection des ressources naturelles pour le Bien être de la Population au Burundi en collaboration avec son partenaire *Africa Apiculture consortium* est en train de concevoir des projets à soumettre à différents bailleurs de fonds dans le secteurs l'agriculture, l'environnement et l'adaptation au changement climatique.

Dans ce processus d'élaboration de ces projets l'APRN/BEPB, la consultation des parties prenantes à la base constitue un critère important pour le financement des projets qui seront soumis.

Ainsi, les provinces de Bubanza, Bujumbura , Cibitike, Bururi, Ruyigi, Rutana, Karusi et Kirundo ont été choisies pour ces consultations. Ces provinces ont été choisies sur base de différents Rapports sur l'insécurité alimentaire au Burundi notamment «Évaluation de l'impact du changement climatique et stratégies d'adaptation pour le Burundi(2023).

Profil des participants

Les différentes catégories de parties prenantes à consulter sont: les représentants

administratifs , les communautés agricoles locales, les organisations communautaires et les acteurs du secteur privé,les jeunes, les femmes et les Batwa.
Ces consultations auront lieu du 15 au 22 novembre 2024 et seront animées par (Alexis Nikiza et Léonidas Nduwayo de l'APRN/BEPB avec Eileen Mburu,Bronson Eran'ogwa,Lilian Waithaka,Jean Eyase ,Erick Kioko et Joslyn Muthio de Africa Apiculture consortium en provenance du Kenya.

3.Programme du 15 au 22 Octobre 2024

Date	Timing	Jour	Province	Commune	Nombre de participants
15/10/2024	8h30-11h00	mardi	Bubanza	Gihanga	20
				Bubanza	20
	13h-15h00		Cibitoke	Rugombo	20
				Buganda	20
16/10/2024	8h30-11h00	Mercredi	Bururi	vyanda	20
				bururi	20
	13h-15h00		Rutana	giharo	20
				Musongati	20
17/10/2024	8h30-11h00	jeudi	Ruyigi	Butezi	20
				Ruyigi	20
	13h-15h00		Karusi	Bugenyuzi	20
				Buhiga	20
18/10/2024	8h30-11h00	vendredi	Kirundo	Kirundo	40
22/10/2024	8h30-11h00		Bujumbura	Isare	20
				Kanyosha	20
TOTAL					**320**

Fait à Bujumbura, le 09 octobre 2024

DIRECTEUR GENERAL de l'APRN/BEPB

Alexis NIKIZA

Tél : 79916628/68167052
E-mail: nikiza07@yahoo.fr

Association Protection des Ressources Naturelles pour le Bien-Etre de la Population au Burundi (APRN/BEPB)
Ord Min N°530/1101 du 03/01/2003

Official Use Only



ANNEX:

Gender Analysis and Action Plan (GAAP) for Enhancing resilience in Burundi

A.Contents

1. Rationale for the Gender assessment 4
1.1. The Role of Gender Norms in Climate Response ..... **Error! Bookmark not defined.**
1.2. Gendered Impacts of Climate Change ..... **Error! Bookmark not defined.**
1.3. The Importance of Gender Equality for Effective Adaptation **Error! Bookmark not defined.**
1.4. The Fund's Gender Policy: A Framework for Action ..... **Error! Bookmark not defined.**
1.5. A Pathway to Gender-Responsive Climate Resilience .... **Error! Bookmark not defined.**

2. Overview of the project ..... Error! Bookmark not defined.
2.1. Project background/context ..... **Error! Bookmark not defined.**
2.2. Project objectives ..... **Error! Bookmark not defined.**
2.3. Project Components ..... **Error! Bookmark not defined.**
2.4. Description of the project areas 10

3. Methodology 13
3.1. Selection of Provinces, Communes, Collines, and Participants **Error! Bookmark not defined.**

4. Findings ..... Error! Bookmark not defined.
4.1. Education 21
4.2. Income 22
4.3. Resource Access and Decision-Making Authority 24
4.4. Gender Roles and Responsibilities ..... **Error! Bookmark not defined.**
4.5. Gender Balance ..... **Error! Bookmark not defined.**
4.6. Financial Access 32
4.7. Social-economic and Demographics ..... **Error! Bookmark not defined.**
4.8. Health 33

5. Conclusion 37
5.1. Vulnerability of Key Groups 37
5.2. Displacement and Health Risks 37
5.3. Gendered Coping Strategies and Resilience ..... **Error! Bookmark not defined.**
5.4. The Need for Gender-Sensitive Climate Adaptation ..... **Error! Bookmark not defined.**

6. Recommendation 38

7. Gender Dynamics and Its Role ..... Error! Bookmark not defined.
7.1. Climate Change and Gender 27
7.2. Planning and Capacity-Building ..... **Error! Bookmark not defined.**
7.3. Adaptation Actions to Climate Change 28
7.4. Security Perception 28
7.5. Openness and Representativeness 29
7.6. Alternative Income Generating Activities (AGAs) 30

8. Gender Issues Surveyed During Stakeholder Consultations 38
8.1. Road Blockages and Soil Instability 39

8.2. Female Representation and Cultural Barriers 39
8.3. Health and Sanitation Risks in Displacement Camps 39
8.4. Economic Empowerment: Support for Women and Girls 40

9. Gender Action Plan Aligned with AF Gender Principles..... Error! Bookmark not defined.
9.1. Transversal Actions ..... **Error! Bookmark not defined.**
9.2. Cross-Cutting Actions ..... **Error! Bookmark not defined.**
9.3. Participation..... **Error! Bookmark not defined.**
9.4. Strategic Gender Capacity-Building and Gender Support **Error! Bookmark not defined.**

10. Gender Mainstreaming ..... Error! Bookmark not defined.
10.1. Inclusive Planning and Design ..... **Error! Bookmark not defined.**
10.2. Capacity Building and Training..... **Error! Bookmark not defined.**
10.3. Representation in Management Committees..... **Error! Bookmark not defined.**
10.4. Targeted Interventions and Beneficiary Inclusion ..... **Error! Bookmark not defined.**
10.5. Empowerment through Resource Access ..... **Error! Bookmark not defined.**
10.6. Monitoring Gender Outcomes ..... **Error! Bookmark not defined.**
10.7. Advocacy and Policy Integration ..... **Error! Bookmark not defined.**

11. Monitoring and Evaluation ..... Error! Bookmark not defined.
11.1. Appointment of a Project Monitoring Officer ..... **Error! Bookmark not defined.**
11.2. Development of Gender-Sensitive Indicators ..... **Error! Bookmark not defined.**
11.3. Data Collection and Analysis..... **Error! Bookmark not defined.**
11.4. Regular Monitoring Meetings ..... **Error! Bookmark not defined.**
11.5. Stakeholder Engagement and Feedback ..... **Error! Bookmark not defined.**
11.6. Evaluation and Reporting..... **Error! Bookmark not defined.**
11.7. Transparency and Accountability ..... **Error! Bookmark not defined.**

References 48

1. Executive Summary

The **Gender Analysis and Action Plan (GAAP) for Enhancing Resilience in Burundi** provides an in-depth examination of gender dynamics in climate adaptation and resilience efforts across four provinces of Burundi—Cibitoke, Bubanza, Bujumbura Rural, and Bujumbura Mairie, Kirundo, Ruyigi, Rutana, and Bururi. The report highlights the differentiated vulnerabilities, capacities, and roles of men and women in responding to climate risks, emphasizing the need for gender-responsive adaptation strategies.

Key Findings

- **Gendered Impacts of Climate Change-** Women and girls in Burundi are disproportionately affected by climate change due to systemic barriers limiting their access to land, financial resources, and decision-making structures. Their caregiving responsibilities and dependence on rain-fed agriculture further exacerbate their vulnerability to floods, droughts, and environmental degradation.
- **Social and Economic Disparities-** Women and youth often lack ownership of productive resources, making it difficult to participate in income-generating activities and resilience-building efforts. Gender norms restrict women's ability to make independent financial decisions, while men typically control land ownership and high-value agricultural activities.
- **Barriers to Climate Resilience-** Limited access to education, financial services, and agricultural inputs prevents women from adopting climate-smart agricultural practices. Women also face challenges in market participation, where they often engage in lower-profit activities and are excluded from leadership roles in cooperatives and producer groups.
- **Gender in Policy and Governance-** Women remain underrepresented in decision-making at household, community, and policy levels. This imbalance undermines the effectiveness of climate adaptation strategies and disaster response planning. Enhancing gender-sensitive governance is essential for equitable resilience-building efforts.

Recommendations

1. **Strengthen Women's Land Rights & Access to Resources:** Advocate for gender-equitable land policies and financial inclusion to support women's participation in agriculture and climate resilience initiatives.
2. **Expand Financial Access:** Develop microfinance programs tailored for women and youth, including alternative credit mechanisms that do not require land as collateral.
3. **Enhance Capacity Building & Education:** Provide gender-sensitive training programs on climate adaptation, leadership, and financial management to empower women and youth.
4. **Promote Gender-Inclusive Climate Adaptation Strategies:** Integrate gender considerations in early warning systems, climate-smart agriculture, and disaster risk reduction efforts.
5. **Increase Women's Representation in Decision-Making:** Strengthen gender-sensitive governance structures by promoting women's leadership at all levels, including community-based adaptation planning.

This **Gender Analysis and Action Plan** underscores the urgent need to integrate gender-responsive strategies into climate adaptation initiatives in Burundi. By addressing systemic gender inequalities and ensuring equitable access to resources, financial services, and decision-making platforms, the project aims to enhance resilience for all members of the community, particularly women, youth, and other marginalized groups. Investing in gender equality will not only improve social and economic outcomes but also ensure the long-term sustainability of climate adaptation efforts in the region.

2. Rationale for the gender assessment

The proposed project aims to enhance climate resilience in four provinces of Burundi—Cibitoke, Bubanza, Bujumbura Rural, Bujumbura Mairie, Kirundo, Ruyigi, Rutana, and Bururi—through multi-stakeholder collaboration. Each of these regions faces unique climate-related challenges, and local stakeholders have expressed strong support for the interventions designed to address these issues. However, for these interventions to be effective and sustainable, it is essential to consider the differing needs, capacities, and vulnerabilities of men and women.

To that end, a **gender analysis** was conducted to explore how gender roles, responsibilities, and opportunities impact the ability of men and women to respond to climate risks. The goal of the analysis was to highlight gender-based differences in vulnerability, identify barriers to equitable participation, and develop strategies to mitigate these barriers. Gender mainstreaming within the project activities ensures that the needs and capacities of both men and women are integrated, contributing to a more inclusive and successful implementation. Moreover, without a clear commitment to gender equality, the project's goals may be undermined by persisting social norms that dictate gender roles and influence how individuals and communities respond to climate change.

2.1. Gender Concepts

Sex and gender are fundamental concepts that shape human identity and social interactions. Understanding the distinctions between these concepts is crucial for comprehending the complexities of human behavior and societal structures.

2.1.1. Sex

Sex refers to the biological and physiological characteristics that define men and women. These characteristics include chromosomal configurations, hormone levels, reproductive organs, and secondary sexual traits. For instance, males typically possess XY chromosomes, while females have XX chromosomes, which influence various biological functions and physical attributes (Bancroft, 2009). Hormonal differences, particularly the levels of testosterone and estrogen, further contribute to the physiological distinctions observed between sexes (Bancroft, 2009). These biological factors are significant in health outcomes and susceptibility to certain diseases, as evidenced by research indicating that women are at a higher risk for chronic pain conditions due to biological differences (Schaumberg et al., 2013).

The implications of sex extend beyond mere biological definitions; they intersect with social constructs that influence gender identity and roles. For example, the biological predispositions associated with sex can affect how individuals are perceived and treated in society, leading to the reinforcement of gender norms and expectations (Bancroft, 2009; Schaumberg et al., 2013). Furthermore, the understanding of sex is evolving, particularly with the recognition of intersex individuals who may possess a combination of male and female biological traits, challenging traditional binary classifications (Hegarty, 2023).

2.1.2. Gender

In contrast to sex, gender is a social construct that encompasses the roles, behaviors, expectations, and attributes that society associates with being male or female. Gender identity, which refers to an individual's personal sense of their gender, can differ from their biological sex. This distinction is crucial as it highlights the fluidity of gender, allowing individuals to self-identify outside the traditional male-female binary (Richards et al., 2016). The socialization process plays a significant role in

shaping gender identity, as individuals learn societal norms and expectations from a young age, which can vary significantly across different cultures and societies (Richards et al., 2016).

The concept of gender is further complicated by the existence of non-binary and genderqueer identities, which challenge the conventional understanding of gender as strictly binary. These identities reflect a spectrum of gender experiences that are increasingly recognized and validated in contemporary discourse (Richards et al., 2016). The recognition of diverse gender identities is essential for fostering inclusivity and understanding within society.

2.1.3. Gender Roles

Gender roles are the expectations placed on individuals based on their perceived gender. These roles dictate how men, women, boys, and girls should behave, what responsibilities they should assume, and the activities they should engage in. Cultural, social, and economic factors heavily influence these roles, leading to significant variations across different regions, ethnicities, classes, and religions (Doyle et al., 2021). For instance, in many cultures, traditional gender roles may dictate that men are the primary breadwinners while women are expected to manage household duties and childcare (Albelali & Williams, 2021).

These roles are not static; they evolve over time and can be challenged and redefined through social movements and changing societal values. The feminist movement, for example, has played a pivotal role in advocating for the re-examination of gender roles, promoting the idea that both men and women should have the freedom to pursue careers and responsibilities that align with their interests rather than societal expectations (Doyle et al., 2021; Albelali & Williams, 2021).

2.1.4. Gender Relations

Gender relations refer to the dynamics of interaction between men and women, shaped by societal norms and power structures. These relations are often characterized by power imbalances, where traditional patriarchal systems privilege men over women, influencing their rights and responsibilities (Doyle et al., 2021). The negotiation of these power dynamics can manifest in various contexts, including family structures, workplaces, and broader societal interactions.

For example, in many societies, men are often seen as decision-makers, while women may be relegated to supportive roles. This dynamic can affect women's access to resources and opportunities, perpetuating cycles of inequality (Albelali & Williams, 2021). However, as societal attitudes shift towards greater gender equity, there is potential for these relations to evolve, fostering more equitable partnerships and shared responsibilities between genders (Doyle et al., 2021; Albelali & Williams, 2021).

2.1.5. Gender Equity

Gender equity is the principle of fairness in treatment for individuals of all genders. It recognizes that historical and social disadvantages often hinder women's access to opportunities and rights, necessitating compensatory measures to create a level playing field (Doyle et al., 2021). This concept is crucial in addressing systemic inequalities that have persisted across generations, particularly in areas such as education, employment, and healthcare.

Efforts to promote gender equity often involve policy changes, educational initiatives, and community engagement aimed at dismantling barriers that disproportionately affect women and marginalized genders (Doyle et al., 2021). For instance, in healthcare settings, training programs that address

inequitable gender norms can improve the quality of care provided to women, ensuring their voices are heard and their needs are met (Doyle et al., 2021).

2.1.6. Gender Equality

Gender equality goes a step further, advocating for equal opportunities for all individuals, regardless of gender, to enjoy rights, access resources, and make life choices. This concept emphasizes that gender should not limit an individual's potential or access to opportunities (Doyle et al., 2021). Achieving gender equality requires a multifaceted approach, addressing not only legal and institutional barriers but also cultural attitudes and practices that perpetuate discrimination.

The empowerment of women is closely tied to the pursuit of gender equality, as it involves addressing imbalances of power and enabling women to participate fully in all aspects of society (Doyle et al., 2021; Albelali & Williams, 2021). Initiatives aimed at promoting gender equality often focus on enhancing women's leadership roles, increasing their representation in decision-making processes, and ensuring equitable access to education and employment opportunities (Doyle et al., 2021).

2.1.7. Women's Empowerment

Women's empowerment is a critical component of achieving gender equality. It involves enabling women to gain awareness, confidence, and the tools necessary to make informed choices and challenge structures that perpetuate gender discrimination (Doyle et al., 2021). Empowerment can manifest in various forms, including economic independence, political participation, and social activism.

The process of empowerment is inherently self-driven, with women taking the initiative to create and sustain change within their communities (Doyle et al., 2021). This can involve collective action, where women come together to advocate for their rights and challenge societal norms that limit their potential (Doyle et al., 2021; Albelali & Williams, 2021). Empowerment initiatives often focus on building networks of support, providing access to resources, and fostering leadership skills among women, ultimately contributing to broader societal change.

2.1.8. Gender Mainstreaming

The concept of gender mainstreaming emerged in the 1990s as a response to the need for structural changes in policy practices across various disciplines, including agriculture (Smyth, 2023). It involves the systematic inclusion of gender considerations at all levels of policy-making, ensuring that gender equality is not merely an add-on but a fundamental aspect of all initiatives (Smyth, 2023; Mahama, 2023). This approach recognizes that gender inequalities are deeply embedded in societal structures and that addressing these inequalities requires a comprehensive understanding of the specific challenges faced by different genders (Verma, 2014).

In the context of agriculture, gender mainstreaming is particularly crucial as it ensures that policies and programs are designed to meet the diverse needs of both women and men. For instance, research has shown that integrating gender into agricultural policies can lead to improved access to resources, technologies, and markets for women, ultimately enhancing their productivity and economic empowerment (Paudyal et al., 2019; Ampaire et al., 2019). However, the effectiveness of gender mainstreaming often depends on the extent to which local gender norms are considered and integrated into policy frameworks (Paudyal et al., 2019; Howland et al., 2021).

2.1.9. Gender Transformative Approach

The Gender Transformative Approach (GTA) goes beyond the principles of gender mainstreaming by actively challenging and changing the underlying social norms, power dynamics, and structures that perpetuate gender inequality. This approach is essential in agricultural research and development, as it recognizes that sustainable and equitable access to resources requires addressing the root causes of inequality (Verma, 2014; Ampaire et al., 2019). By focusing on transforming the social contexts that allow gender imbalances to persist, GTA aims to create long-term, meaningful changes that empower both women and men in agriculture and rural communities (Verma, 2014).

For instance, interventions that adopt a gender transformative lens not only promote equitable behavior but also seek to reshape the societal norms that dictate gender roles and responsibilities. This can involve engaging men as allies in promoting gender equality, challenging harmful stereotypes, and fostering an environment where both women and men can participate equally in agricultural decision-making processes (Verma, 2014). Such transformative efforts are crucial for achieving lasting change, as they address the systemic barriers that hinder gender equality in agriculture (Ampaire et al., 2019).

2.2. The role of gender norms in climate response

Gender norms refer to the socially constructed roles and behaviors that society considers appropriate for men and women. In many communities, these norms influence how resources are allocated, who has decision-making power, and who bears the burden of domestic responsibilities. These roles often determine the extent to which men and women can participate in adaptive activities and access opportunities to enhance their resilience to climate change.

In many cases, **women and girls face more severe impacts** from climate change because of these norms. For instance, women often hold the primary responsibility for managing household resources such as water, fuel, and food—resources that are directly affected by climate variability. When these resources become scarce, the burden on women increases, and their ability to engage in economic activities or participate in decision-making is reduced. On the other hand, men might face societal pressures to maintain livelihoods or migrate for work, leaving women to manage households and agricultural tasks in increasingly difficult conditions. Gender norms thus shape how communities experience and respond to climate threats, highlighting the importance of addressing gender roles to ensure all members of society can contribute to and benefit from adaptation strategies.

2.3. Gendered impacts of climate change

Climate change affects women and men differently because of the pre-existing gender inequalities and systemic barriers embedded in many societies. For example, **women and girls are often disproportionately affected by climate change** due to their restricted access to critical resources such as land, credit, and information. Gender-based discrimination, entrenched social hierarchies, and legal restrictions limit their ability to control assets, make decisions, or participate in formal governance structures. These challenges diminish their capacity to adapt to climate change, further marginalizing them in the process.

Power imbalances and **structural barriers** perpetuate these gender inequalities. Women's limited participation in political and decision-making processes, combined with the threat to their peace and security due to displacement or natural disasters, undermines their adaptive capabilities. For instance, in many communities, women may lack the legal rights to own land or access credit, which restricts their ability to invest in climate-resilient agricultural practices. These structural inequalities

lead to a vicious cycle where women are more vulnerable to climate shocks, have fewer resources to adapt, and face greater long-term social and economic consequences. In contrast, men may also be vulnerable to climate impacts, particularly in cases where climate change disrupts traditional male-dominated livelihoods, such as farming or fishing. In such cases, men may experience **psychological stress** or pressure to migrate in search of work, leaving their families more vulnerable in their absence.

2.4. The importance of gender equality for effective adaptation

Addressing these gender disparities is crucial for the success of climate adaptation projects. By promoting gender equality and empowering women and girls, the project can enhance the adaptive capacity of communities. Gender equality is not only a matter of fairness but also a critical factor in **building resilience** against climate risks. When women have equal access to resources, education, and decision-making, they can contribute more effectively to climate adaptation efforts. Research has shown that communities where women are actively involved in decision-making are better equipped to respond to climate change and develop sustainable solutions. **Gender-equitable processes**—such as ensuring women have a voice in local governance, access to climate information, and opportunities to participate in climate-resilient livelihoods—can improve the overall resilience of the community.

The project also acknowledges that men and boys have distinct needs and face unique challenges in adapting to climate change. Therefore, the strategy should not only empower women but also **engage men** in reshaping harmful gender norms, promoting shared responsibilities, and ensuring inclusive adaptation measures.

2.5. A pathway to gender-responsive climate resilience

The findings from the gender analysis underscore the need for **gender-responsive adaptation strategies** that account for the unique needs of women, men, boys, and girls in the face of climate change. By addressing the **structural inequalities** that exacerbate the impacts of climate change on women and marginalized groups, the project can build more resilient and inclusive communities.

The **action plan** that emerges from this gender analysis will prioritize the empowerment of women and girls while actively engaging men and boys in reshaping harmful gender norms. This approach will not only improve the adaptive capacity of individual households but will also strengthen community-wide resilience to climate shocks. Ultimately, by incorporating gender equity into the heart of its implementation strategy, the project can ensure that the benefits of climate adaptation are distributed more fairly and effectively across all segments of society. This commitment to **inclusive growth** will contribute to the long-term sustainability and success of climate resilience efforts in the four provinces.

3. Overview of the project

3.1. Project background/context

See project proposal

Burundi is a landlocked country located in the Great Lakes region of East Africa region and lies between meridians 29 ° 00’-30 ° 25 East and parallels 2 ° 20 ° -4 ° 25 ’South. Burundi covers an area of approximately 27,834 square kilometres, making it one of the smallest countries in Africa. Burundi has 18 provinces, 117 communes, and 2,638 collines Colline means "hill" in French, one of the three official languages of the country. The geographical context of Burundi plays a significant role in its

economic, social, and environmental development. The country's topography is characterized by highlands, plateaus, and valleys, which are favorable for agriculture. Over 90% of the population relies on agriculture for their livelihood, making it the backbone of the country's economy. Yet, the resources vulnerable due to multiple factors, namely climatic conditions and unequal space-time distribution of rainfall. Main environmental challenges include soil degradation, deforestation, and sanitation that are in part due to high population density, placing pressure on natural resources as well as extreme events. The current paradigm in Burundi is characterized by a series of challenges that pertain to climate change adaptation activities. The contemporary agricultural practices employed by rural communities in Burundi, is characterized by unsustainable methods such as slash-and-burn cropping, indiscriminate use of chemicals, and cultivation near water sources or on slopes, are leading to heightened soil erosion and degradation of both forested and adjacent farmland landscapes.

3.2. Project objectives

1. Addressing gaps in gender assessments, and risk assessments, as requirements for developing a proposal for the Adaptation fund.
2. Exploring opportunities for adopting gender-responsive, intersectional, and inclusive climate-smart agriculture (CSA) practices.

3.3. Description of the project areas

The proposed research project was implemented across several locations—specifically in **Bubanza, Ruyigi, Rutana, Bururi, Cibitoke, Kirundo, Bujumbura Rural, and Bujumbura Mairie provinces**.

3.2. Study Area and Rationale for Selection

The study was conducted in selected provinces in Burundi. The key factors that informed the site selection include:

3.3.1. Environmental and Climate Vulnerabilities

The Imbo Basin is characterized by **high rainfall variability**, with increasing intensity and frequency of extreme weather events, particularly floods. The erratic nature of rainfall patterns in these regions has led to severe challenges for local communities, many of whom depend on predictable weather conditions for agricultural activities. These regions have also experienced significant **environmental degradation**, which exacerbates their vulnerability to climate impacts.

- **Soil erosion and land degradation**: The loss of vegetation cover, coupled with poor land management practices, has resulted in widespread soil degradation. This reduces the land's ability to absorb water, making it more prone to flooding and decreasing its agricultural productivity.



Images illustrating soil erosion and the evidence of landslides in the region

- **Loss of biodiversity**: Both flora and fauna have been negatively impacted by environmental degradation, leading to a decline in biodiversity. This, in turn, disrupts the ecological balance and diminishes the availability of natural resources, such as medicinal plants, wildlife, and forest products, which local communities rely on for their livelihoods.




Forest degradation has negatively impacted biodiversity in the region

- **Water resource degradation**: The quality and quantity of water resources in these areas have deteriorated, largely due to pollution, deforestation, and unsustainable agricultural practices. This affects both human consumption and the health of ecosystems that depend on these water bodies.

3.3.2. Economic Challenges

The communities in these areas rely heavily on **rain-fed subsistence agriculture** as their primary source of income and food security. However, the increasing unpredictability of rainfall and the frequency of floods have severely impacted agricultural productivity. With limited livelihood options beyond agriculture, households have low adaptive capacity to deal with climate shocks. As a result, poverty levels remain high, and the lack of financial resources restricts their ability to invest in climate-resilient practices, diversify their income streams, or access essential services such as insurance or loans.

- **Limited coping mechanisms**: Due to their dependence on rain-fed agriculture, these communities have few alternatives to sustain themselves during periods of drought or flooding. The lack of financial resources and diversification makes them particularly vulnerable to crop failure and food insecurity.
- **Barriers to innovation**: The adoption of climate-smart agricultural technologies and practices is hindered by a lack of access to information, technical support, and financial resources. As a result, many farmers continue to practice traditional methods that are not suited to the changing climate.

3.3.3. Social Vulnerabilities

Socially, these regions have large populations of **vulnerable groups**, including women, children, the elderly, and persons with disabilities (PWDs). These groups are disproportionately affected by climate change, as they often have limited access to resources, decision-making processes, and opportunities for building resilience.

- **Gender inequality**: Women, in particular, face systemic barriers that restrict their participation in agricultural decision-making, access to land, and financial resources. Despite

being primary contributors to agricultural labor, they often have less control over the benefits of their work and are excluded from leadership roles in their communities.



Images illustrating women carrying agricultural produce and hoes for farming



Images illustrating men transporting charcoal and agricultural produce on bicycles

- **Children and elderly**: These groups are also highly vulnerable to the impacts of climate change. Children may face malnutrition due to food insecurity, while the elderly, with limited mobility, are less able to adapt to changing environmental conditions or participate in recovery efforts after disasters.
- **Persons with disabilities (PWDs)**: PWDs are often marginalized in disaster preparedness and response efforts. They have limited access to information and services that could help them adapt to or mitigate the impacts of climate-related disasters, increasing their risk in times of emergency.

3.3.4. Limited Early Warning Systems and Disaster Response

Another critical challenge faced by these regions is the **lack of adequate Early Warning Systems (EWS)** and infrastructure to respond effectively to climate-related disasters. The absence of reliable EWS hampers the ability of communities and local authorities to prepare for and mitigate the effects of extreme weather events such as floods.

- **Insufficient infrastructure**: The infrastructure required to monitor and predict extreme weather events, such as meteorological stations and flood monitoring systems, is either inadequate or non-existent in these regions. As a result, communities are often caught off guard by sudden climatic changes, leading to loss of lives, property, and livelihoods.
- **Weak disaster management capacity**: Even when early warning information is available, many communities lack the resources and organizational capacity to respond effectively.

Limited access to emergency services, shelters, and financial resources means that recovery from disasters is slow, deepening the cycle of vulnerability.

4. Methodology

4.1. Introduction

The project methodology was guided by a Gender Analysis Framework, which focused on understanding social differentiation and gender roles within communities. The framework ensured that gender considerations were embedded at every stage of the project cycle—from research and design to implementation and evaluation. The methodology was designed to ensure a comprehensive, gender-sensitive, and socially inclusive approach to climate change adaptation in rural development. The project employed a structured analytical framework and research tools that integrated participatory, qualitative, and quantitative methods to assess gender roles, resource access, and decision-making dynamics. This methodology was particularly focused on ensuring equitable participation and benefits for both men and women in climate resilience initiatives. The primary research tool used in this project was tailored for practitioners and program designers, providing a comprehensive resource for gender analysis. It facilitated participatory and qualitative research while integrating quantitative elements. The framework was modular, allowing flexibility in its application based on specific project needs.

4.2. Objectives of the Framework

The Gender Analysis Framework was designed with the primary objective of promoting equitable resource allocation between men and women, thereby improving the effectiveness and impact of development projects. The framework recognized that men and women often had different roles, responsibilities, and access to resources within a community, which significantly influenced the success of any intervention.

One of the key objectives of the framework was to demonstrate the economic value of gender equity. By showing that investing in both men and women could lead to greater overall productivity, the framework made a compelling case for integrating gender considerations into project planning and implementation. When resources were allocated in a way that took into account the unique contributions and needs of both genders, the result was often a more efficient use of resources, leading to better outcomes for the entire community.

Another critical objective was to enhance the inclusiveness of development projects. The framework aimed to ensure that the benefits of any intervention were shared equitably between men and women. This was particularly important in contexts where women had traditionally been marginalized or excluded from certain opportunities, such as access to financial services, education, or decision-making processes. By identifying and addressing these disparities, the framework helped to create a more level playing field, where both genders could participate fully and benefit equally from development initiatives.

The framework also sought to improve the accuracy and relevance of project planning. By systematically mapping out the roles and resources associated with each gender, the framework provided planners with detailed insights into the social dynamics of the community. This information was crucial for designing interventions that were not only technically sound but also socially appropriate. For example, understanding the time constraints faced by women, who often juggled

multiple responsibilities, helped in designing projects that were more realistic and feasible for them to participate in.

Furthermore, the framework aimed to anticipate and mitigate potential challenges that could arise from gender disparities. By identifying existing inequalities and understanding the factors that influenced them, the framework enabled planners to develop strategies that addressed these issues proactively. This involved, for example, designing targeted training programs for women, ensuring they had the skills and knowledge needed to benefit from new agricultural techniques, or creating financial products that were tailored to the specific needs of women farmers.

4.3. Conceptual Framework

4.3.1. Introduction to GESI in Climate Adaptation

The integration of **Gender Equality and Social Inclusion (GESI)** in climate resilience is essential for ensuring that adaptation strategies address the differentiated impacts of climate change on various social groups. In Burundi, agriculture forms the backbone of rural livelihoods, with over 90% of the population depending on subsistence farming. However, climate variability—manifesting through increased frequency and intensity of **droughts, floods, and soil degradation**—disproportionately affects vulnerable groups such as **women, youth, and persons with disabilities (PWDs)**. These groups often have **less access to critical resources, financial services, land tenure, and decision-making structures**, exacerbating their vulnerability to climate shocks.

A **GESI-based analytical framework** is crucial for identifying and addressing **structural inequalities** that undermine effective climate adaptation. Women, despite contributing significantly to agricultural labor, often lack **land ownership rights**, access to **climate information**, and representation in **climate governance structures**. Similarly, youth, despite their potential for innovation, face **barriers in accessing financial support and agricultural markets**. Meanwhile, PWDs encounter **mobility, accessibility, and participation challenges** in community-driven adaptation strategies. Without a **systematic and gender-responsive** approach, climate adaptation efforts may **reinforce existing inequalities**, leading to ineffective and unsustainable resilience-building strategies.

4.3.2. Gender Transformative and Inclusive Resilience Approaches

This framework integrates **two core approaches** to ensure that gender equality and social inclusion are effectively embedded in climate resilience efforts:

1. **Gender Transformative Approaches (GTA)**
   GTA moves beyond **gender mainstreaming** by actively challenging and reshaping **social norms, power structures, and institutional biases** that hinder the full participation of women and marginalized groups. Unlike gender-sensitive approaches that merely acknowledge gender differences, GTA fosters **structural changes** by:
   - Promoting **women's land rights and financial autonomy** to enhance agricultural resilience.
   - Encouraging **shared decision-making** in climate governance and policy advocacy.
   - Addressing **social norms and cultural barriers** that limit women's and youth's participation in climate-smart agriculture.
2. **Community-Based Adaptation (CbA) and Intersectionality**
   CbA emphasizes **local knowledge, participatory decision-making, and inclusive governance**, ensuring that adaptation solutions are **context-specific** and cater to the needs

of all social groups. The **intersectional approach** within CbA ensures that interventions address **multiple layers of vulnerability** by considering:

- Gender (male vs. female agricultural roles and responsibilities).
- Age (youth vs. elderly farmers' ability to access resources).
- Disability (PWDs' ability to access adaptation tools and support systems).
- Socioeconomic status (poor farmers' access to climate-resilient technologies).

By integrating **GTA and CbA**, this project **ensured that climate adaptation interventions do not merely mitigate climate risks but also foster social transformation**, leading to more **equitable and sustainable** resilience-building efforts.

3. Justification for a GESI-Based Approach in Climate Adaptation

The rationale for embedding **GESI within this climate resilience framework** is threefold:

1. **Addressing Structural Inequalities in Climate Resilience**
   - Women's limited access to **land tenure and finance** impedes their ability to adopt **climate-smart agricultural practices**.
   - Youth's exclusion from **decision-making processes** stifles innovation in climate adaptation.
   - PWDs' lack of **infrastructure and tailored support systems** marginalizes their role in resilience efforts.
   - Social norms restrict women's and youth's ability to engage in **alternative livelihood activities**, further deepening **poverty and food insecurity**.
2. **Enhancing Climate Adaptation Efficiency Through Gender-Responsive Strategies**
   - Research shows that **women-led climate initiatives** are more **effective, sustainable, and community-oriented**.
   - Youth participation in **technology-driven adaptation** (e.g., **GIS mapping, parametric insurance, blockchain** for climate risk monitoring) enhances **innovation and scalability**.
   - **Inclusive financial models**, such as microfinance and **parametric insurance tailored for women and youth**, can **bridge economic gaps** in resilience financing.
3. **Aligning with Global and Regional Climate Policies on Gender and Inclusion**

   This framework aligns with key international agreements, including:
   - **UN Sustainable Development Goals (SDGs)**
   - **Adaptation Fund's Gender Policy**
   - **Sendai Framework for Disaster Risk Reduction**
   - **AU Gender Strategy in Climate Change**
   - **Burundi's National Adaptation Plan (NAP)**

These frameworks emphasize the need for **gender-responsive and socially inclusive adaptation strategies** to ensure **equitable access to climate adaptation resources**.

4. Key Pillars of the GESI Framework in Climate Resilience

The **GESI framework** in this project is structured around **four key pillars**:

Pillar 1: Gender-Equitable Access to Land and Resources

- **Advocating for women's land rights reforms** to ensure **legal ownership and control over agricultural land**.
- Implementing **gender-sensitive land tenure systems** that recognize women's contributions to climate resilience.

- Expanding access to **climate-smart agricultural inputs and extension services** tailored to the needs of women and youth.

Pillar 2: Financial Inclusion and Resilience Financing

- Establishing **alternative credit mechanisms (e.g., microfinance, blended finance, digital loans)** to address gender disparities in financial access.
- Promoting **women-led cooperatives and youth-driven agribusiness innovations** in climate resilience sectors.
- Strengthening **parametric insurance solutions** to provide **financial protection against climate-related crop losses**.

Pillar 3: Capacity Building and Inclusive Governance

- Facilitating **leadership and climate governance training** for women and youth to enhance their role in **policy advocacy**.
- Ensuring **women's representation** in local, regional, and national **climate resilience decision-making bodies**.
- Integrating **youth-led innovations in digital climate adaptation solutions** (e.g., remote sensing, GIS, blockchain traceability).

Pillar 4: Gender-Sensitive Early Warning Systems and Disaster Preparedness

- Designing **early warning systems** that incorporate **gender-specific risk communication strategies**.
- Enhancing **social protection mechanisms** to support **women, PWDs, and marginalized farmers** during climate-induced disasters.
- Promoting **gender-balanced community disaster preparedness committees** to ensure **inclusive decision-making in emergency response**.

5. Expected Outcomes and Impact of the GESI Framework

By systematically integrating **GESI into climate resilience strategies**, this project aimed to achieve the following outcomes:

1. **Equitable Access to Climate Resilience Resources**
    - Increased **women's land ownership** and financial autonomy.
    - Enhanced access to **climate-smart agricultural technologies** for marginalized groups.
    - Youth-led climate adaptation innovations strengthened.
2. **Economic Empowerment and Sustainable Livelihoods**
    - Increased **women's participation in climate-resilient value chains**.
    - Expanded youth engagement in **agribusiness, fintech, and blockchain-based traceability solutions**.
    - Strengthened **gender-responsive insurance mechanisms**.
3. **Enhanced Decision-Making and Leadership**
    - Greater representation of **women and youth in climate policy governance**.
    - Establishment of **inclusive community-based climate adaptation platforms**.
    - Increased capacity for **gender-responsive disaster risk management**.
4. **Long-Term Climate Resilience and Social Transformation**
    - Reduction in gender-related barriers to **climate adaptation**.
    - Strengthened **multi-stakeholder collaboration for gender-sensitive climate resilience**.
    - Sustainable and **inclusive growth in climate-affected agricultural communities**.

4.4. Data Collection Methods

The study adopted a mixed-method approach, integrating qualitative and quantitative techniques to gather comprehensive data. The primary research tools included:

1. Focus Group Discussion
2. Key informant interviews (KIIs)

4.5. Key Informant Interviews (KIIs)

KIIs were conducted with **local government officials, agricultural extension officers, representatives from women's cooperatives, and community elders**. A total of **18 KIIs** were conducted to gain expert insights into policy implications, local adaptation practices, and existing gender gaps in climate resilience strategies.

4.6. Focus Group Discussion

A focus group was used, a research method where a small group of individuals, usually selected based on specific characteristics, were brought together to discuss a particular topic in depth. The aim of a focus group was to gather qualitative data—information that provided insight into people's attitudes, opinions, experiences, and emotions regarding the subject of study. Unlike surveys or one-on-one interviews, focus groups relied on group dynamics to stimulate discussion. Participants were encouraged to share their views, respond to others' ideas, and explore different perspectives collectively. This interaction often brought out deeper insights and uncovered complex motivations that may not have surfaced in individual interviews.

In focus groups, researchers took on the role of facilitators, guiding the discussion with carefully prepared questions while remaining open to unexpected topics that arose organically. They also observed group interactions, noting how participants communicated and influenced one another. The collaborative nature of a focus group allowed for a rich exchange of ideas, making it a valuable tool for understanding the nuances of human behavior and opinions. Focus groups were commonly used in various fields, including market research, social sciences, and public health, where understanding group opinions or reactions was critical. The ideal size for a focus group was typically at least 10-12 participants. Fewer than that might have led to a limited diversity of opinion.

FDGs were conducted with **local government officials, agricultural extension officers, representatives from women's cooperatives, and community elders**. A total of **16 FDGs** (Annex 3) were conducted to gain expert insights into policy implications, local adaptation practices, and existing gender gaps in climate resilience strategies. FDGs were administered to **320 Community members** (Annex 3) across the three provinces to capture quantitative data on gender-based access to resources, financial inclusion, and climate adaptation strategies.

4.6.1. Composition of the Focus Group Discussion

The composition of a focus group was a crucial element that directly impacted the quality of the data collected. Participants in a focus group were chosen based on the goals of the research and the specific demographics or characteristics relevant to the study. This selection process, known as purposive sampling, ensured that the group members shared some common experiences or characteristics related to the research topic while also allowing for enough diversity to foster meaningful discussions.

4.6.2. Gender-Responsive Tools and Frameworks Used

- Environmental Impact Assessment
- Social Impact Assessment
- Vulnerability and Climate Risk Assessment

When deciding on the composition of a focus group, researchers considered factors such as:

- **Gender-** In gender-sensitive research, separating groups by gender was important. For instance, men and women often expressed different perspectives on certain issues, and having mixed-gender groups could have silenced some participants, especially in cultures where one gender dominated conversations.
- **Age-** Age dynamics influenced how freely participants spoke. Younger individuals may have felt intimidated or reluctant to share openly in the presence of older members. For example, in a discussion on health, young men may have hesitated to discuss personal matters if older men from their community were present.
- **Socio-Economic Status-** Income levels, education, and social standing impacted group interactions. Including people of diverse socio-economic backgrounds in the same focus group sometimes led to power imbalances, where individuals with higher status dominated the conversation while others remained quiet.
- **Cultural or Ethnic Backgrounds-** In some cases, different cultural or ethnic groups had distinct perspectives on the research topic. Grouping participants with similar cultural backgrounds made them feel more comfortable expressing their views, while mixed groups sometimes led to tensions or misunderstandings.

Disaggregating focus groups—dividing them by specific characteristics like gender, age, or socio-economic status—was sometimes necessary to ensure that participants felt comfortable speaking openly. However, researchers had to strike a balance. A group that was too homogeneous could have limited the diversity of perspectives, while a group that was too diverse might have inhibited honest participation. Researchers justified the decision to disaggregate or mix groups based on the research objectives. For instance, if the research aimed to explore differences in opinion between men and women, separating the focus groups by gender made sense. However, in studies where understanding community dynamics was the goal, a mixed-gender group provided better insights. Ultimately, the group composition was structured to support the research objectives and create a conducive environment for honest, open dialogue.

4.6.3. Structure of a Focus Group Discussion Session

A focus group session generally followed this structure:

1. **Introduction**
   - Provided an overview of the project and its purpose.
   - Obtained informed consent from participants.
   - Built rapport to create a comfortable research environment.
2. **Opening Questions**
   - Started with broad, general questions to ease participants into the conversation.
   - The goal was to make participants comfortable and open to discussing the topic.
3. **Key Questions**
   - Gradually shifted from broad to more specific, targeted questions to gather key data.
   - Used probing techniques to delve deeper into the participants' thoughts and experiences.
4. **Closing Questions**
   - Wrapped up the session by discussing what would be done with the collected data and whether the team would follow up.
   - Noted that interactions after the session had officially ended sometimes provided valuable insights.

(Adapted from Hennink, 2011)

4.6.4. Types of Questions Used

When designing focus group questions, researchers ensured they were simple, clear, and conversational. They avoided technical jargon and aimed to be non-judgmental and non-threatening. Each question focused on a single topic rather than addressing multiple issues at once. Below were some common types of questions used

1. Open-Ended vs. Closed-Ended Questions
    - Open-ended questions, such as those starting with "Why" or "How," encouraged participants to share detailed responses, offering insights into their feelings, opinions, and expectations. These questions fostered in-depth discussion, which was ideal for focus group settings.
    - Closed-ended questions, on the other hand, typically elicited brief responses such as "yes" or "no." These were less useful in focus groups as they limited the depth of the conversation.
2. Leading Questions
    - Researchers were mindful of the phrasing of questions, as leading questions could have unintentionally guided participants towards a particular response. It was important to ask neutral questions that allowed participants to express their true perspectives without feeling directed.

5. Findings

The findings of the project highlight the multifaceted impacts of climate on agricultural productivity, food security, and the overall well-being of vulnerable populations in the Imbo Basin of Burundi. Flooding poses a severe threat to farmland, often destroying vital food crops and rendering the land unsuitable for agricultural activities. This destruction leads to diminished crop yields, which directly contributes to food shortages and famine, disproportionately affecting women and children who are primarily responsible for ensuring food security in their households. In regions such as Bubanza, and Cibitoke where soil erosion is exacerbated by poor farming practices, the situation becomes dire. Unsustainable agricultural methods increase the land's susceptibility to land slides damage, further reducing agricultural productivity and exacerbating food insecurity. Consequently, households, particularly those led by women, struggle to access sufficient food, which deepens poverty and nutritional deficiencies among these vulnerable groups.

In addition to agricultural damage, floods displace communities, forcing individuals to seek shelter in overcrowded internally displaced persons (IDP) camps or temporary emergency shelters like schools and churches. These camps often lack basic amenities such as clean water, sanitation, and adequate living spaces, exposing vulnerable populations—including women, children, the elderly, and persons with disabilities (PWDs)—to harsh environmental conditions. The stress of living in such precarious situations increases the risk of waterborne diseases, such as cholera and malaria, and escalates the risk of gender-based violence (GBV), teenage pregnancies, and mental health issues, particularly trauma in children who are already coping with the instability of displacement.

5.1. Agricultural Practices and Livelihoods

Agriculture remains the cornerstone of livelihoods in Burundi, with subsistence farming dominating across provinces. Communities primarily cultivate staple crops such as beans, maize, cassava, sweet potatoes, rice, bananas, and sorghum. In recent years, climate variability has prompted a

gradual shift toward drought-resistant and quick-maturing crop varieties. This adaptation strategy reflects a pragmatic response to shorter rainy seasons and unpredictable weather patterns. Livestock farming complements crop production, serving as both a source of income and food security. Households raise cows, goats, pigs, chickens, and rabbits. Wealth disparities are evident in livestock ownership: wealthier households maintain larger and more diverse livestock herds, while poorer families often lack the resources to sustain even small-scale animal husbandry.

Supplementary income-generating activities diversify livelihoods and enhance resilience. Women are particularly active in pottery, firewood sales, and trading vegetables and fruits. Men engage in skilled labor such as masonry, tailoring, carpentry, handicrafts, and beekeeping. These activities not only provide financial support but also reduce the reliance on climate-sensitive agricultural income.
Agricultural activities are closely tied to seasonal rainfall patterns. Most provinces have two main growing periods, October to February and February to July. Some areas, depending on rainfall distribution, also utilize a third short growing season for cultivating quick-maturing crops. However, the increasing unpredictability of weather poses challenges to traditional farming calendars, further straining livelihoods.

5.1.1. Climatic Hazards and Their Impacts

Climate variability is one of the most significant challenges affecting agricultural productivity and rural livelihoods in Burundi. Prolonged droughts disrupt planting cycles, reduce water availability, and lead to significant crop losses. Conversely, excessive rainfall often results in flooding, soil erosion, and landslides, particularly in hilly regions such as Rutana and Bururi. These events degrade arable land, destroy infrastructure, and displace communities, compounding food insecurity. Additionally, pests like the maize armyworm and crop diseases exacerbate agricultural challenges, further reducing yields and incomes. Addressing these climatic challenges requires the adoption of climate-smart agriculture, including drought-resistant crops, improved soil conservation techniques such as terracing and contour farming, and investment in irrigation systems to reduce dependence on unpredictable rainfall.

Climatic hazards pose significant risks to agricultural productivity and community resilience. Prolonged droughts are a major concern, delaying planting seasons, reducing water availability, and significantly lowering crop yields. Conversely, excessive rainfall leads to flooding and soil erosion, which not only destroy crops but also damage infrastructure and displace communities. Landslides, particularly in Rutana and Bururi, degrade fertile lands and force residents to relocate.

Additional hazards such as hailstorms, strong winds, and pest infestations (e.g., maize armyworm) exacerbate agricultural challenges. Plant diseases further diminish crop yields, compounding the effects of climate change. These hazards have far-reaching implications, including reduced agricultural output, heightened food insecurity, and economic instability. Vulnerable groups, particularly women and poorer households, bear the brunt of these impacts due to limited access to resources and support systems.

5.1.1.1. Coping Mechanisms

Communities employ a range of coping mechanisms to address climatic challenges:

- **Traditional and Local Strategies-** Soil conservation practices such as terracing, contour farming, and anti-erosion hedges are widely adopted to mitigate the impacts of soil erosion and flooding. The cultivation of drought-resistant crops like cassava and sweet potatoes has gained traction, while rainwater harvesting systems ensure irrigation during dry spells.

- **Community-Based Systems-** Village Savings and Loan Associations (VSLAs) provide a reliable financial safety net, particularly benefiting women who often lack access to formal credit systems. Mutual assistance networks foster resource sharing and collective rebuilding efforts after disasters. Agricultural cooperatives play a vital role in providing access to loans, farming inputs, and storage facilities, thereby enhancing economic stability.
- **External Support-** Government agencies and NGOs, including World Vision, IOM, Enabel, and the Red Cross, supplement local efforts by providing disaster aid, training, and infrastructure restoration. However, these interventions face challenges such as funding constraints, limited geographic reach, and delays in implementation.

5.2. Education

The educational landscape in the targeted provinces of Burundi—Cibitoke, Bubanza, Bujumbura Rural, and Bujumbura Mairie—exhibits both formal and informal systems, with significant implications for gender equity in education. Formal education encompasses structured learning from pre-primary to tertiary levels, while informal education occurs outside traditional curricula, often through community engagement and experiential learning. According to the Ministry of Education, there has been notable progress in narrowing the gender enrollment gap in technical and vocational education and training institutions, with female enrollment rising from 30% in 2010 to 45% in 2020, largely due to initiatives like the Universal Post-Primary Education and Training program Nibaruta et al. (2022). Similarly, the gender gap in secondary school enrollment has improved, with the proportion of girls increasing from 40% in 2015 to 55% in 2021 (Nibaruta et al., 2021).

Despite these advancements, certain areas, such as the commune of Kanyosha in Bujumbura Mairie, continue to struggle with low girl-child enrollment rates. A lack of female teachers has been identified as a contributing factor, with some schools reporting no female teachers until the last academic term. The absence of female role models, combined with long distances to schools and inadequate WASH (Water, Sanitation, and Hygiene) facilities—particularly the lack of proper disposal options for menstrual hygiene products—discourages girls from attending school. Many girls drop out or miss school during their menstrual periods due to these challenges, which are exacerbated by cultural stigmas surrounding menstruation (Kabagenyi et al., 2021). It is believed that improving WASH facilities in schools will significantly enhance girl-child education and lead to higher enrollment rates, as access to adequate sanitation can reduce absenteeism during menstruation (Opesemowo, 2023).

Moreover, women in these regions tend to have lower educational attainment compared to men. A significant proportion of female smallholder farmers are illiterate, which restricts their access to essential services such as clean water and healthcare, making them more vulnerable to climate change impacts, including floods and droughts. The low literacy levels among women also limit their participation in community leadership and decision-making processes. Governance structures are predominantly male-led, resulting in women's exclusion from discussions on managing and adapting to climate risks ((Kim et al., 2021; López et al., 2021). Furthermore, women's access to crucial information, including climate-related warnings and opportunities for adaptation, is hindered by their limited education ((Schwarz et al., 2021).

The implications of these educational disparities are profound. For instance, teenage girls who lack education are three times more likely to experience early childbearing compared to those with secondary or higher education (Nibaruta et al., 2021). This trend not only affects their health and well-being but also perpetuates cycles of poverty and limited opportunities for future generations.

The correlation between education and empowerment is critical; educated women are more likely to make informed decisions regarding their health and family planning, thereby improving their socio-economic status and that of their families (Landis et al., 2018).

5.3. Income

The provinces of Cibitoke, Bubanza, Bujumbura Rural, and Bujumbura Mairie in Burundi primarily engage in agriculture, which serves as the backbone of their economy. The agricultural activities in these regions predominantly focus on subsistence farming, with crops such as cassava, maize, rice, millet, beans, banana, sweet potatoes and horticultural crops (vegetables) being cultivated. These crops are essential not only for local consumption but also for market sales, which are crucial for the economic sustenance of families in these provinces. However, the economic benefits derived from agriculture are often unevenly distributed, particularly along gender lines, which exacerbates existing income disparities within households and communities (Muchiri & Nzisabira, 2020).

Women, youth, and children play significant roles in agricultural production, often taking on labor-intensive tasks such as planting, weeding, and harvesting. Despite their substantial contributions, women frequently face systemic barriers that limit their access to resources such as land, credit, and agricultural inputs. This situation is compounded by cultural norms that prioritize male decision-making in economic matters, leading to a scenario where men may appropriate the income generated from agricultural sales for personal expenditures, such as alcohol or gambling, rather than investing in household needs. This misallocation of resources can lead to domestic conflicts, further entrenching poverty and gender inequality within these communities(Ochieng et al., 2014).

In addition to agriculture, men in these provinces often engage in other economic activities that enhance their income levels compared to women and youth. For instance, men may participate in small-scale trading, artisanal mining, or casual labor in urban areas, which can provide them with additional financial resources. Furthermore, men may also engage in livestock rearing, which, while sometimes shared with women, often yields higher profits and greater control over the income generated. These alternative income-generating activities contribute to a disparity in financial autonomy and decision-making power within households, reinforcing traditional gender roles and economic inequalities.

The local economy also benefits from various additional economic activities that generate income for community members. These activities include:

i). **Small Trading:** Many community members engage in small-scale trading, selling goods such as food items, clothing, and household products in local markets. This activity provides essential income, especially for women who often manage these small businesses to support their families.

ii). **Artisanal Crafts:** Craft-making, including pottery, basket weaving, and textile production, is a significant source of income. Artisans create products that are sold in local markets or to tourists, thus contributing to both household income and cultural preservation.

iii). **Livestock Rearing:** While agriculture is the primary focus, some families also engage in livestock farming, including poultry and goats. The sale of livestock and their products (such as eggs and milk) provides additional income and enhances food security.

iv). **Fishing:** In areas near water bodies, fishing serves as a vital economic activity. Community members catch fish for both local consumption and sale, which helps diversify their income sources and improve nutrition.

v). **Charcoal Production:** The production and sale of charcoal is a common livelihood activity, especially in rural areas where access to electricity is limited. This activity not only provides income but also meets local energy needs.




Left image illustrates the loading of charcoal packed bags for transportation while the right image illustrates charcoal burning

vi). **Construction Work:** Many men in these provinces find employment in construction, either as laborers or skilled workers. This sector offers seasonal work opportunities, contributing significantly to household income during peak construction periods.

vii). **Remittances:** Migration for work, often to urban areas or abroad, allows family members to send remittances back home. These funds are crucial for supporting household expenses, education, and healthcare, thereby improving overall living standards.

However, access to these opportunities is often limited for women, youth, and persons with disabilities (PWDs), who may lack the necessary capital, skills, or social networks to engage effectively in these economic activities.

The limited access to financial resources further exacerbates the economic challenges faced by women, youth, and the elderly in these provinces. Financial institutions often overlook these groups, perceiving them as high-risk borrowers due to their lack of collateral and formal employment. This lack of access to finance not only hampers their ability to invest in agricultural inputs or diversify their income sources but also perpetuates their vulnerability to economic shocks and climatic hazards. Consequently, women and other marginalized groups remain trapped in a cycle of poverty, with little opportunity for upward mobility.

Moreover, the decision-making processes regarding the management and utilization of local resources are predominantly male-dominated. Women, youth, and the elderly often find themselves excluded from discussions about land use, water management, and resource allocation, which further limits their ability to influence the economic landscape of their communities. This exclusion is particularly detrimental in the context of resource scarcity, where competition for access to land and water is intensifying due to population growth and environmental degradation. As a result, the most vulnerable community members are often left without adequate access to essential resources, further entrenching their poverty and marginalization.

The pronounced deprivation in well-being among these vulnerable groups is evident in various economic indicators, including low income levels, lack of assets, and limited access to markets and public services. These factors contribute to a pervasive state of poverty that disproportionately affects women, youth, children, the elderly, and PWDs. The impacts of poverty are further exacerbated by

climatic hazards, such as droughts and floods, which can lead to crop failures and food insecurity, particularly among those who rely heavily on subsistence farming. In response to these challenges, women have increasingly turned to dairy farming as a strategy to secure a source of income and nutrition for their families, utilizing cow dung as a natural fertilizer to enhance soil fertility. While agriculture remains the primary economic activity, the roles of women, youth, and children in farming are critical yet undervalued. The systemic barriers they face, coupled with the unequal distribution of resources and decision-making power, perpetuate cycles of poverty and limit their potential for economic advancement. Addressing these disparities requires a multifaceted approach that includes improving access to financial resources, enhancing women's participation in decision-making processes, and promoting equitable resource management practices(Ewerling et al., 2017; Komakech et al., 2022).

5.4. Resource Access and Decision-Making Authority

The land tenure system in the project provinces is characterized by a predominantly patriarchal structure, where men hold significant control and power over land ownership and decision-making processes. This system is deeply rooted in cultural norms and traditional practices that favor male inheritance and control over land resources. In instances where the head of the family dies, male children are typically prioritized in inheriting land, which further entrenches gender disparities in land ownership and access to resources (Muchiri & Nzisabira, 2020). Women and children often find themselves relegated to user rights, which limits their ability to make autonomous decisions regarding land use and management. This situation reflects a broader trend in many rural areas of Burundi, where land is viewed as a male preserve, and women's contributions to agricultural production are frequently undervalued (Ochieng et al., 2014).

Access to land is crucial for agricultural activities, particularly subsistence farming, which is the primary means of livelihood for many families in these provinces. The nature of agricultural activities undertaken on the land is primarily focused on producing food for home consumption, with limited opportunities for commercial farming due to the fragmentation and degradation of land. The increasing population pressure has led to a situation where land is not only highly fragmented but also degraded, resulting in infertile soils that contribute to low crop yields and food insecurity. Prolonged spells of drought, particularly in the mid-stream and low-stream areas of Bujumbura Mairie and Bujumbura Rural, exacerbate these challenges, making it difficult for families to sustain their agricultural activities (Ndagijimana et al., 2018; Kessler et al., 2020).

Women and youth in these provinces report that they rarely own property or land, as ownership is predominantly seen as a male domain. This lack of ownership is compounded by cultural perceptions that view investing in women as a misuse of scarce resources, particularly in times of poverty and conflict. Consequently, women are often excluded from inheriting valuable assets such as land and income-generating livestock. The systemic barriers that women face in accessing land and property rights not only hinder their economic empowerment but also expose them to various violations, including land-grabbing and denial of inheritance rights (Saiget, 2016).

The implications of these land tenure dynamics are profound, particularly in terms of poverty levels among households in the catchment areas of the four provinces. The overall poverty estimate for households in these regions is significantly high, with specific provinces experiencing varying poverty rates. For instance, the poverty rate is highest in Bubanza, while Bujumbura Mairie exhibits the lowest poverty levels among the four provinces. This disparity underscores the critical need for interventions

that address the structural inequalities in land ownership and access to resources (Muchiri & Nzisabira, 2020; Ochieng et al., 2014).

In conclusion, the land tenure system in Cibitoke, Bubanza, Bujumbura Rural, and Bujumbura Mairie is characterized by significant gender disparities, with men holding predominant control over land and decision-making processes. Women and youth face substantial barriers to land ownership and access to resources, which perpetuates cycles of poverty and limits their economic opportunities. Addressing these issues requires a multifaceted approach that includes legal reforms to enhance women's land rights, community awareness programs to shift cultural perceptions, and targeted interventions to improve access to resources for marginalized groups (Ochieng et al., 2014; Saiget, 2016).

5.5. Gender Dynamics in Agriculture

Gender dynamics in agriculture play a pivotal role in shaping the livelihoods of rural communities in Burundi. These dynamics influence access to resources, participation in decision-making, division of labor, and overall agricultural productivity. The focus group discussions revealed stark gender disparities, deeply rooted in cultural norms and systemic inequalities, which disproportionately impact women's ability to contribute to and benefit from agricultural activities.

5.5.1. Gender roles and responsibilities

Women and men have distinct, culturally defined roles in agriculture. Women bear the brunt of labor-intensive activities, such as planting, weeding, harvesting, and processing crops. These tasks are critical to ensuring household food security and sustaining the agricultural economy. Women also manage household duties, including cooking, fetching water, and caring for children, further burdening their workload. Men, on the other hand, are primarily responsible for land preparation, seeds purchase, crop sales, and livestock management. These roles often provide men with greater access to economic opportunities and decision-making power. Men are also more likely to engage in activities that directly influence household income, such as marketing agricultural produce and managing farm finances.

The social roles and responsibilities assigned to men and women significantly influence their coping mechanisms in response to external shocks such as floods, droughts, and other crises. These roles are deeply rooted in cultural norms and traditional practices that dictate the expectations and behaviors of individuals based on their gender. As a result, men and women often adopt different strategies to enhance household resilience in the face of adversity, reflecting their respective responsibilities and access to resources.

In times of crisis, men typically assume the role of primary breadwinners and are expected to seek alternative sources of income to support their families. This often leads them to engage in activities such as charcoal burning, which is a common livelihood strategy in Burundi. Men and older boys may venture into other regions of the country in search of forests where they can harvest charcoal, a valuable commodity that can be sold for income. This migration not only serves as a means of economic survival but also reflects the societal expectation that men should provide for their families, even if it requires leaving their homes for extended periods.

Conversely, women are often left behind to manage the household and care for small children, the elderly, and persons with disabilities (PWDs). This division of labor places significant burdens on women, who must navigate the challenges of ensuring food security and access to resources while

also fulfilling caregiving responsibilities. In some cases, women may travel to camps or other areas in search of essential resources such as food, water, and shelter. This movement can be fraught with risks, including exposure to violence and exploitation, particularly in contexts of insecurity and displacement. The coping strategies employed by men and women are not only shaped by their immediate responsibilities but also by their access to social networks and resources. Women, for instance, may rely on communal support systems, such as women's groups or local associations, to share resources and information during times of crisis. These networks can provide a vital source of resilience, enabling women to pool resources and collectively address challenges. However, the effectiveness of these strategies is often limited by the systemic barriers that women face, including restricted access to land, credit, and decision-making power.

Family splitting is another coping mechanism that emerges in response to external shocks. In an effort to spread economic risks and increase access to livelihood opportunities, families may choose to separate temporarily. This strategy allows different family members to pursue various income-generating activities in different locations, thereby diversifying their sources of income and enhancing overall household resilience. However, this practice can also lead to social fragmentation and emotional distress, particularly for children and elderly family members who may be left behind. The implications of these gendered roles and responsibilities extend beyond immediate coping strategies; they also influence long-term recovery and adaptation to changing environmental conditions. For instance, women's limited access to resources and decision-making power can hinder their ability to invest in sustainable agricultural practices or engage in climate-smart initiatives that could enhance their resilience to future shocks. Similarly, men's reliance on traditional livelihoods, such as charcoal burning, may perpetuate environmental degradation and undermine the very resources they depend on for survival.

The gendered division of labor in Burundi is not merely a reflection of cultural norms but is also reinforced by economic structures that limit women's access to resources. For example, women often have restricted access to land ownership, which is crucial for agricultural production and food security. This lack of access not only affects their immediate coping strategies but also their long-term resilience to environmental shocks. Studies have shown that when women have greater access to land and resources, they are better able to implement sustainable practices that can mitigate the impacts of climate change and other crises. Furthermore, the reliance on traditional gender roles can lead to a cycle of vulnerability, where women's economic contributions are undervalued, and their coping strategies are constrained by societal expectations.

In times of crisis, the coping strategies adopted by men and women often reflect their respective roles and responsibilities. Men may engage in more aggressive and risk-taking behaviors, such as migration for work, while women may adopt more nurturing and community-oriented strategies, such as forming support networks to share resources and information. This divergence in coping strategies can lead to differing outcomes in terms of mental health and overall well-being. Research indicates that women are more likely to experience higher levels of stress and anxiety during crises, which can be exacerbated by their caregiving responsibilities and limited access to resources. On the other hand, men may experience stress related to their roles as providers, which can lead to maladaptive coping strategies such as substance abuse or withdrawal from family responsibilities.

The cultural expectations surrounding gender roles in Burundi also influence the ways in which individuals perceive and respond to stress. Men are often socialized to adopt problem-focused coping strategies, while women are more likely to engage in emotion-focused coping. This difference in

coping styles can impact how effectively each gender navigates crises and recovers from them. For instance, women may seek social support and engage in community-building activities, which can enhance their resilience, while men may prioritize economic survival at the expense of their emotional well-being. The interplay between gender roles and coping strategies highlights the need for a nuanced understanding of how societal expectations shape individual responses to adversity.

Moreover, the intersection of gender with other social factors, such as age, socioeconomic status, and education, further complicates the coping landscape in Burundi. Younger women, for example, may face additional challenges in accessing resources and support networks compared to older women who have established community ties. Similarly, men from lower socioeconomic backgrounds may struggle to fulfill their roles as providers, leading to increased stress and potential conflict within households. Addressing these intersecting factors is crucial for developing effective interventions that support both men and women in enhancing their coping mechanisms and resilience in the face of external shocks.

5.5.2. Climate Change and Gender

The intersection of gender and climate change is a critical area of concern, as gender inequalities significantly exacerbate the risks and vulnerabilities associated with climate impacts. Women, who have historically faced disadvantages such as limited access to resources, restricted rights, and minimal involvement in decision-making processes, are disproportionately affected by climate change. This situation is compounded by the fact that as climate change intensifies, the pre-existing gender disparities become more pronounced, leading to heightened vulnerabilities for women and girls (Huyer et al., 2020).

Traditionally, climate change has been framed primarily as an environmental issue, often relegated to the responsibilities of Ministries of Agriculture and Environment. This narrow focus has overlooked the broader socio-economic dimensions of climate change, which encompass issues of equity and social justice. Recognizing this limitation, there is an increasing awareness that climate change is a complex development issue that affects multiple sectors, necessitating the integration of gender considerations into climate change strategies. Such integration is essential to ensure that adaptation measures promote equity and address the unique needs and contributions of different genders (Allwood, 2013; Ampaire et al., 2019).

Public policy plays a crucial role in ensuring that climate adaptation resources are distributed fairly across society. By embedding gender equality criteria into policy design and implementation, it is possible to address social inequalities exacerbated by climate change. This approach can help mitigate issues such as increased vulnerability to floods, landslides, and other climate-related hazards. For instance, policies that recognize and support women's roles in agriculture and natural resource management can enhance community resilience and adaptive capacity (Murray et al., 2016).

Globally, gender equality policies are evolving to incorporate climate change considerations. These policies should be harmonized with national development plans and the project to ensure comprehensive and effective implementation. For example, the Fund’s gender policy is rooted in international human rights instruments, including the Universal Declaration of Human Rights (UDHR) and the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW). It also aligns with the International Labor Organization (ILO) core conventions, the Millennium Development Goals (MDGs), and the Sustainable Development Goals (SDGs). This policy

framework promotes equal rights and access to resources for all genders, enhancing adaptive capacity and reducing vulnerability to climate change impacts (Acosta et al., 2020; Braunschweiger & Pütz, 2021).

The vulnerability analysis conducted in preparation for the project provides valuable insights into how households and communities in the affected provinces respond to recurrent floods and landslides. This analysis reveals their level of vulnerability, coping strategies, and the severity of climatic hazards they face. It complements gender mainstreaming efforts by helping to tailor adaptation strategies that effectively address the specific needs and challenges of different gender groups (Thompson-Hall et al., 2016; Mavisakalyan & Tarverdi, 2019).

Moreover, the analysis underscores the importance of adopting a "complex inequalities" approach that recognizes the intersectionality of gender with other social categories such as ethnicity, religion, class, and age. This perspective acknowledges that women's and men's vulnerabilities to climate change vary not only by gender but also by these intersecting identities, which can significantly influence their adaptive capacities and resilience (Huyer et al., 2020). By integrating gender considerations into climate change policies and ensuring that adaptation resources are distributed equitably, it is possible to mitigate the adverse impacts of climate change on vulnerable populations, particularly women and girls. This comprehensive approach will ultimately contribute to more effective and inclusive climate adaptation strategies that recognize and harness the strengths and contributions of all community members (Mihrete & Bayu, 2021; Smith et al., 2023)

5.5.3. Adaptation Actions to Climate Change

In the context of climate change adaptation, the project emphasizes the importance of integrating gender considerations to achieve both environmental and social outcomes. The primary goals include promoting gender equality and empowering women and girls to contribute meaningfully to sustainable development. This involves addressing barriers to their participation and ensuring they have the necessary resources and support to engage effectively in adaptation efforts.

Effective participation is a key principle, meaning that women must be involved in all stages of the adaptation process, from planning and implementation to monitoring and evaluation. Their inclusion is crucial for making informed decisions and developing solutions that address the needs of all community members. Additionally, the project seeks to promote equal rights in leadership and decision-making roles, ensuring that women have the opportunity to assume leadership positions and influence decisions related to climate change adaptation.

These gender principles are applied consistently throughout the project, guided by the Gender Action Plan. This plan provides detailed guidelines for integrating gender considerations into every aspect of climate change adaptation actions. It ensures that all partners and stakeholders align their efforts to address gender issues effectively and contribute to equitable adaptation strategies. By following the Gender Action Plan, the project aims to ensure that gender-sensitive practices are consistently applied and monitored, leading to successful and inclusive adaptation outcomes.

5.5.4. Security Perception

The perception of insecurity significantly impacts individuals' access to, use of, and appropriation of resources necessary for climate change adaptation. Empirical evidence indicates that women's decision-making power regarding resource access and use is often constrained by their sense of

insecurity. This perception can limit women's autonomy and deter them from participating in climate change adaptation actions. For instance, when women feel unsafe in their communities, they may be less likely to engage in activities that require mobility or interaction with others, such as attending training sessions on climate adaptation or participating in community resource management initiatives Buckingham (2016).

The Gender Action Plan aims to address these issues by emphasizing the importance of incorporating gender considerations and mainstreaming strategies into climate change adaptation initiatives. By ensuring that women and youth have full representation, access, and opportunities to engage in these initiatives, the plan seeks to empower these groups and enhance their capacity to adapt to climate change impacts. This empowerment is crucial, as women often possess valuable knowledge and skills related to resource management and adaptation strategies, which can significantly contribute to community resilience (López-Marrero, 2010; Ampaire et al., 2019).

Furthermore, the integration of gender perspectives into climate change policies is essential for addressing the unique vulnerabilities faced by women and youth. Research has shown that women are often more vulnerable to climate change due to their limited access to resources, decision-making power, and social networks. This vulnerability is compounded by existing gender inequalities, which can hinder their ability to respond effectively to climate-related challenges (Rodríguez-Cruz & Niles, 2020). Therefore, policies that promote gender equality and empower women to participate in decision-making processes are vital for enhancing adaptive capacity and resilience in the face of climate change (Nagasha et al., 2019).

In addition to addressing gender disparities, it is important to recognize the role of psychological factors in shaping perceptions of insecurity and resource access. Studies have indicated that individuals' psychological awareness of climate change and their perceived vulnerability can influence their decision-making processes regarding adaptation strategies. For example, farmers who perceive a high level of risk associated with climate change may be more likely to adopt adaptive measures, but this is often contingent upon their access to resources and support systems (Mersha & Laerhoven, 2016). Thus, understanding the psychological dimensions of insecurity and vulnerability is crucial for developing effective climate adaptation strategies.

Moreover, the intersectionality of gender with other social categories, such as age, socio-economic status, and disability, further complicates the dynamics of resource access and decision-making in the context of climate change. Women and youth from marginalized backgrounds may face compounded barriers that limit their ability to engage in adaptation efforts. Therefore, it is essential to adopt an intersectional approach that considers the diverse experiences and needs of different gender groups when designing and implementing climate adaptation initiatives (Ravera et al., 2016; Djoudi et al., 2016).

5.5.5. Openness and Representativeness

The Gender Action Plan will focus on several key practices to enhance accessibility and representativeness in adaptation actions. These include:

- Promoting Non-Discriminatory Practices- Ensuring that all activities are inclusive and do not discriminate against any gender or group.
- Eliminating Stereotypical Images- Avoiding the use of stereotyped images in all aspects of adaptation action implementation to prevent reinforcing biases.

- Disseminating Gender-Specific Information- Providing information tailored to address gender-specific needs and concerns to facilitate effective project implementation.
- Controlling Advertising Content- Monitoring and regulating advertising elements, posters, and other visual or written materials to prevent discriminatory language and imagery.

These practices aim to create an equitable environment that supports the active participation and representation of all individuals, particularly women and youth, in climate change adaptation efforts.

5.5.6. Alternative Income Generating Activities (AGAs)

The analysis of constraints faced by women in pursuing alternative income-generating activities (AGAs) identifies several critical barriers:

- **Regulatory Standards-** Women often feel less confident in handling complex regulatory and compliance requirements. This lack of confidence can stem from insufficient training or experience, making it harder for women to navigate and adhere to these standards effectively. As a result, they may struggle to establish or expand their businesses within the regulatory framework.
- **Market Access-** Women frequently encounter challenges in accessing essential networks and markets for their products. This barrier limits their ability to sell their goods or services, impacting their profitability and business growth. The difficulty in establishing and leveraging these networks can be attributed to systemic barriers or a lack of targeted support for women entrepreneurs.
- **Risk Aversion-** Women are often more risk-averse compared to men, which can deter them from seeking out loans or larger credit options. This risk aversion is partly due to unfamiliarity with financial instruments and a lack of confidence in handling large-scale financial transactions. This hesitance can prevent them from investing in or scaling up their businesses.
- **Asset Disparities-** Women's assets are generally of lower value and smaller size compared to those of men. This disparity means that women often have to offer more extensive collateral to secure credit. The lower asset base not only limits their ability to access financing but also affects their bargaining power and potential for business expansion.
- **Traditional Gender Roles-** Traditional gender roles continue to assign a disproportionate share of family and domestic responsibilities to women. These roles can restrict women's time and energy, making it challenging for them to engage fully in income-generating activities. Balancing domestic duties with business responsibilities can create additional stress and barriers to success.

The report emphasizes the importance of focusing on the growth and support of women-led enterprises rather than solely on the creation of new businesses. This approach recognizes the potential of existing women-led ventures and aims to provide them with the resources and support needed to thrive. By incorporating gender mainstreaming into project design, the report advocates for targeted interventions that address these specific challenges. To this end, the document outlines affirmative actions designed to enhance women's participation in the design and implementation of AGAs. This includes ensuring that women and youth are not only beneficiaries but also active contributors to the development of income-generating activities. By focusing on these areas, the project aims to create a more inclusive and supportive environment for women entrepreneurs, ultimately fostering greater economic empowerment and business success.

5.5.7. Gender balance

Gender balance in leadership, governance, and decision-making regarding flood and drought management, as well as resource control, remains critically low. This imbalance is exacerbated by poor access to land and related resources, which further limits women's and youth's participation in agricultural production and decision-making processes. Gender mainstreaming is therefore essential for the successful design and implementation of project activities aimed at improving livelihoods, particularly in agriculture and natural resource management interventions. The lack of gender balance in leadership roles significantly impacts the effectiveness of flood and drought management strategies. Women, who are often the primary caregivers and managers of household resources, possess valuable knowledge and insights that can enhance community resilience to environmental shocks. However, their exclusion from decision-making processes means that their perspectives and needs are frequently overlooked in policy formulation and implementation. Research indicates that when women are included in governance structures, the outcomes for community resilience and resource management are markedly improved (Howland et al., 2021; Ampaire et al., 2019). This highlights the necessity of empowering women and youth to actively contribute to the design and implementation of livelihood options, ensuring that their voices are heard and their needs are addressed.

Empowering women and youth in these project sites is not merely a matter of equity; it is also a strategic approach to enhancing community resilience. Studies have shown that gender-inclusive policies lead to better agricultural productivity and improved resource management outcomes (Humphries et al., 2012; Mekonnen, 2022). For instance, when women are given access to agricultural technologies and resources, they can significantly contribute to food security and economic stability within their communities (Uttej, 2022). This empowerment can be achieved through targeted training programs, access to credit, and support for women's participation in agricultural cooperatives and decision-making bodies (Devkota et al., 2022). Moreover, the integration of gender considerations into agricultural and natural resource management policies is crucial for addressing the unique challenges faced by women and youth in these provinces. Gender mainstreaming involves not only recognizing the distinct roles and contributions of women but also ensuring that policies are designed to eliminate barriers to their participation (Paudyal et al., 2019; Mangheni et al., 2021). This includes addressing issues such as land tenure security, access to financial resources, and the provision of training and education that empower women and youth to take on leadership roles in their communities.

The barriers to gender integration in agricultural policies are well-documented, with many studies highlighting the need for systemic changes to promote gender equality. For example, in regions where gender mainstreaming has been effectively implemented, there has been a notable increase in women's access to productive resources, which in turn has led to improved health and nutrition outcomes for families (Acosta et al., 2020). These findings underscore the importance of creating an enabling environment that supports women's participation in agricultural decision-making and resource management. Furthermore, the involvement of youth in agricultural activities is critical for the sustainability of food systems and rural economies. Youth are often seen as key drivers of innovation and change in agriculture, yet their participation remains limited due to various socio-economic barriers (Ambad et al., 2021). Addressing these barriers through targeted interventions can enhance youth engagement and contribute to more resilient agricultural systems.

In the context of Burundi, the integration of youth perspectives in agricultural policies is essential for fostering a more inclusive approach to resource management. Youth often bring fresh ideas and

innovative solutions to agricultural challenges, yet their voices are frequently marginalized in decision-making processes. By actively involving youth in governance structures, communities can benefit from their insights and creativity, ultimately leading to more effective flood and drought management strategies. Moreover, empowering youth through education and training can enhance their capacity to contribute meaningfully to agricultural production and decision-making. This empowerment can be facilitated through initiatives that promote agricultural entrepreneurship and provide access to resources and markets. The intersection of gender and youth participation in agriculture is particularly relevant in the context of climate change and environmental degradation. Women and youth are often disproportionately affected by the impacts of climate change, yet they also possess valuable knowledge and skills that can contribute to climate adaptation and resilience. For instance, women often play a crucial role in managing household resources and implementing sustainable agricultural practices, while youth can leverage technology and innovation to enhance productivity and efficiency in farming. Therefore, integrating gender and youth considerations into agricultural policies is not only a matter of social justice but also a strategic imperative for building resilient communities.

5.5.8. Barriers Faced by Women

Despite their significant contributions to agriculture, women face numerous barriers that limit their productivity and economic empowerment:

1. **Limited Land Ownership-** Women's access to land is often mediated through male relatives, such as husbands or fathers, due to customary practices and inheritance laws that favor men. As a result, women lack control over critical resources needed for farming.
2. **Restricted Access to Credit and Financial Resources-** Women's inability to own land often excludes them from formal credit systems, which require land as collateral. This limits their ability to invest in agricultural inputs such as seeds, fertilizers, and tools.
3. **Exclusion from Training and Capacity-Building Programs-** Agricultural extension services and training programs are often designed without considering the unique needs of women. This exclusion prevents women from acquiring new skills, adopting improved farming techniques, and accessing information on climate-resilient practices.
4. **Cultural Norms and Decision-Making Power-** In many communities, cultural norms reinforce male dominance in decision-making. Women are often excluded from discussions about land use, crop selection, and resource allocation, perpetuating economic dependency and limiting their agency.
5. **Overrepresentation in Unpaid Labor-** Women's agricultural work is frequently undervalued and unpaid, further marginalizing their contributions to the economy. This dynamic limit their economic independence and ability to invest in their personal and family's well-being.

5.6. Financial Access

Access to finance in Burundi is characterized by significant inequalities, particularly affecting women and youth. The stringent and often discriminatory eligibility criteria imposed by financial institutions create substantial barriers for these groups. Typically, these criteria require collateral in the form of yields or harvests, productivity metrics, and prior contributions, which many women and youth struggle to meet. As a result, the financial support they receive is often minimal and sourced from informal networks, which frequently do not cater to productive investments but rather to immediate household needs or consumption (Seidu et al. 2020; Debie et al. 2024). Conversely, men tend to benefit from larger loans that enable them to acquire production equipment and engage in marketing activities, thereby reinforcing existing gender disparities in access to financial resources (Kim, 2018).

The gendered nature of credit access in Burundi reflects broader systemic issues within the financial landscape. Women often face additional challenges, such as lower creditworthiness perceptions and a lack of understanding of financial products, which further limits their ability to secure loans. Studies indicate that female entrepreneurs are less likely to apply for credit due to anticipated rejection or unfavorable terms, which perpetuates a cycle of financial exclusion (Iradukunda et al., 2019). Moreover, when women do access credit, they often receive smaller amounts and face higher interest rates compared to their male counterparts, highlighting the discriminatory practices that persist within the financial sector (Roy & Patro, 2022). This disparity not only affects individual women but also has broader implications for economic development, as it limits the potential contributions of half the population to agricultural production and other economic activities (Nibaruta et al., 2023).

The implications of unequal access to finance extend beyond immediate economic outcomes; they also influence social dynamics and community resilience. Women, who are often the primary caregivers and managers of household resources, possess valuable insights into local needs and priorities. However, their exclusion from financial decision-making processes means that their perspectives are frequently overlooked, leading to suboptimal outcomes in resource allocation and community development (Lo et al., 2020). Research has shown that when women are included in financial decision-making, the results are often more equitable and beneficial for the community as a whole (Basiglio et al., 2022). Therefore, addressing the barriers to women's access to finance is not only a matter of equity but also a strategic necessity for enhancing community resilience and promoting sustainable development.

Youth also face significant barriers to accessing finance in Burundi. Many young people lack the necessary collateral and credit history to qualify for loans, which limits their ability to invest in entrepreneurial ventures or agricultural activities. This situation is exacerbated by the prevailing societal norms that often prioritize older, male borrowers, further marginalizing youth in the financial landscape (Ndoricimpa, 2018). Empowering young entrepreneurs through targeted financial products and support services can enhance their participation in the economy and contribute to broader economic growth (Rutaremwa & Kabagenyi, 2018). Initiatives that focus on financial literacy and entrepreneurship training for youth can help bridge the gap in access to finance and foster a new generation of economically active individuals (Delphin, 2023).

To effectively address these challenges, it is essential to implement gender-responsive financial policies that recognize and mitigate the barriers faced by women and youth. This includes revising eligibility criteria to be more inclusive, providing tailored financial products that meet the specific needs of these groups, and enhancing financial literacy programs to empower them in navigating the financial landscape (Nchanji, 2023). Additionally, promoting women's and youth's participation in decision-making processes within financial institutions can lead to more equitable outcomes and better alignment of financial services with community needs (Ndabashinze, 2024). By fostering an inclusive financial environment, Burundi can enhance economic opportunities for all its citizens, ultimately contributing to poverty reduction and sustainable development.

5.7. Differential Impacts of Climate and Socioeconomic Challenges

The impacts of climate variability, agricultural challenges, and resource inequities are not evenly distributed across different social and economic groups. Variations in wealth, gender, and access to resources significantly influence how individuals and households experience and cope with these challenges. The focus group discussions (FGDs) highlighted pronounced disparities along two key dimensions: **rich versus poor** and **men versus women.**

5.7.1. Differential Impacts: Rich vs. Poor

1. **Wealthier Households**
   - **Access to Resources:** Wealthier households have greater access to land, capital, and farming inputs such as fertilizers, irrigation systems, and high-yield seeds. They are better equipped to invest in technologies and practices that enhance productivity and resilience to climate shocks.
   - **Livestock and Diversification:** Wealthy households maintain larger and more diverse livestock herds, which serve as both a financial safety net and a source of supplementary income during crises.
   - **Coping Capacity:** Financial reserves and access to credit enable wealthier families to recover more quickly from climate-induced losses, such as crop failures or infrastructure damage.
   - **Adaptation Strategies:** Wealthier farmers are more likely to adopt climate-smart agricultural practices, such as rainwater harvesting, terracing, and agroforestry, as they can afford the associated costs.
2. **Poorer Households**
   - **Resource Constraints:** Poor households often lack sufficient land, capital, and access to credit, limiting their ability to invest in productive or adaptive farming practices.
   - **Limited Livelihood Options:** With fewer assets, poorer families rely heavily on subsistence farming, making them highly vulnerable to climate shocks. Livestock ownership, when present, is minimal and provides limited economic security.
   - **Coping Mechanisms:** Poorer households often resort to coping strategies that exacerbate their vulnerabilities, such as selling assets, reducing food intake, or withdrawing children from school to save costs.
   - **Longer Recovery Time:** Without savings or access to affordable credit, poorer families experience prolonged recovery periods after climate-related disasters, deepening cycles of poverty.

5.7.2. Differential Impacts: Men vs. Women

Men

- **Land Ownership and Decision-Making:** Men typically own and control land, which provides them with greater autonomy in decision-making related to farming, crop sales, and resource allocation. This control also facilitates access to formal credit and agricultural extension services.
- **Economic Activities:** Men are more likely to engage in activities that generate higher incomes, such as livestock sales, commercial crop production, and market-oriented ventures like carpentry or masonry.
- **Reduced Domestic Burdens:** With fewer domestic responsibilities, men can dedicate more time to income-generating activities and exploring diversification opportunities.

Women

- **Labor-Intensive Roles:** Women perform the majority of labor-intensive tasks in agriculture, including planting, weeding, harvesting, and post-harvest processing. This workload is compounded by their domestic responsibilities, such as cooking, childcare, and water collection.
- **Limited Land Ownership:** Cultural norms and legal barriers often prevent women from owning or inheriting land. This exclusion limits their ability to access credit, join cooperatives, or make decisions about resource use and farming practices.

- **Exclusion from Training and Resources:** Women are less likely to participate in agricultural training programs or access extension services, leaving them with fewer opportunities to adopt improved farming techniques or climate-smart practices.
- **Economic Dependency:** Women's restricted access to credit, inputs, and markets perpetuates economic dependency on male family members, limiting their ability to invest in productive activities or build resilience.

5.7.3. Intersections of Wealth and Gender

The intersection of wealth and gender further amplifies disparities:

- **Poor Women:** Women in poorer households face a double burden of economic insecurity and gender-based exclusion. They are more likely to experience food insecurity, limited mobility, and lack of access to support networks or formal institutions.
- **Wealthier Women:** While wealthier women may have better access to resources, they often remain excluded from decision-making processes due to entrenched cultural norms.
- **Poor Men:** Poor men also face significant challenges, particularly in accessing credit or diversifying livelihoods. However, their societal role as decision-makers often grants them more agency than women in similar economic circumstances.

5.7.3.1. Land Ownership and Control

Access to land is foundational for agricultural activities, yet it remains one of the most inequitable resources in Burundi.

- **Wealth-Based Disparities**
  - Wealthier households typically own larger and more fertile plots, often passed down through inheritance or acquired through market transactions. These households can invest in land improvements, such as irrigation systems or soil conservation measures.
  - Poorer households often cultivate smaller, less fertile plots, which are insufficient for meeting subsistence needs. Many rely on renting or sharecropping arrangements, limiting their autonomy and long-term investment in land.
- **Gender-Based Disparities**
  - Women face systemic barriers to land ownership due to cultural and legal norms that prioritize male inheritance. Women's access to land is often mediated through male relatives (e.g., husbands or fathers), making their tenure insecure and dependent on familial relationships.
  - Limited land ownership prevents women from using land as collateral for loans, further restricting their financial independence and investment capacity.

5.7.3.2. Financial Resources and Credit Access

Credit access is critical for purchasing inputs, adopting improved farming practices, and managing risks, but disparities hinder equitable access.

- **Wealth-Based Disparities**
  - Wealthier households have easier access to formal credit systems due to their land ownership and financial stability. They can secure loans to invest in high-quality seeds, fertilizers, machinery, and irrigation systems.
  - Poorer households often lack the collateral or credit history required by formal lenders. Instead, they rely on informal sources, such as moneylenders or community savings groups, which may offer smaller amounts at higher interest rates.
- **Gender-Based Disparities**

- Women's limited land ownership and exclusion from formal financial systems reduce their ability to access credit. Even when microfinance schemes are available, women often receive smaller loan amounts than men, restricting their capacity to scale agricultural activities.
- Cultural norms that prioritize men as household heads further marginalize women in financial decision-making and access.

5.7.3.3. Farming Inputs and Technology

Access to high-quality seeds, fertilizers, tools, and technologies directly impacts agricultural productivity and resilience.

- **Wealth-Based Disparities**
  - Wealthier farmers can afford certified seeds, advanced irrigation systems, and modern equipment. These resources allow them to increase yields, diversify crops, and adapt to climate variability.
  - Poorer farmers often rely on traditional seeds, homemade tools, and rainfed agriculture, making them more vulnerable to erratic weather and declining soil fertility.
- **Gender-Based Disparities**
  - Women's limited financial resources and mobility restrict their access to farming inputs. Extension services and input distribution centers are often located far from rural areas, and men are typically prioritized in service delivery.
  - Cultural biases also exclude women from accessing new technologies or training on their use, perpetuating reliance on labor-intensive traditional methods.

5.7.3.4. Training and Capacity Building

Knowledge and skills are vital resources for adopting climate-smart agricultural practices and improving productivity.

- **Wealth-Based Disparities**
  - Wealthier farmers have better access to agricultural training programs and advisory services, often provided by government agencies, NGOs, or private organizations. These programs equip them with knowledge about improved practices, market trends, and climate resilience strategies.
  - Poorer farmers, particularly those in remote areas, face barriers such as transportation costs, lack of awareness, and limited outreach from extension services.
- **Gender-Based Disparities**
  - Training programs often target men, either due to cultural assumptions that they are the primary decision-makers or logistical challenges in reaching women. This leaves women underrepresented in capacity-building initiatives.
  - Women's domestic responsibilities and mobility constraints further reduce their participation in training sessions or community meetings, limiting their exposure to new techniques and technologies.

5.7.3.5. Market Access and Participation

Access to markets determines the ability of farmers to sell their produce, earn income, and reinvest in their farms.

- **Wealth-Based Disparities**
  - Wealthier farmers benefit from better infrastructure, transportation, and networks that connect them to lucrative markets. They can negotiate better prices and enter formal value chains.

- Poorer farmers often sell their produce at local markets, where prices are lower and more volatile. Limited storage facilities and market linkages further constrain their profitability.

- **Gender-Based Disparities**
  - Women's market participation is often limited to small-scale trading of surplus crops or processed goods. Cultural norms restrict their mobility and engagement in larger, more profitable markets.
  - Men dominate negotiations and control proceeds from crop sales, leaving women with minimal economic benefits despite their significant contributions to production.

5.8. Displacement and Health Risks

Flooding and droughts regularly displace communities, forcing individuals into internally displaced persons (IDP) camps or temporary shelters. These environments are often overcrowded and under-resourced, exposing women, children, PWDs, and the elderly to a host of physical and social risks, including poor sanitation, limited access to healthcare, and heightened exposure to gender-based violence (GBV). Overcrowding in IDP camps and emergency shelters increases the likelihood of GBV, while poor access to sanitation and healthcare leads to heightened risks of disease outbreaks and long-term health issues. Teenage pregnancies and psychological trauma are also common in such settings, further intensifying the vulnerability of these populations. In Bujumbura Mairie and Bujumbura Rural, the geographical positioning along the lower midstream river catchments makes these areas particularly susceptible to floods and Infrastructure damage (roads, schools, health facilities). The loss of farmland and infrastructure in these regions severely affects access to essential services, including schools, healthcare facilities, and roads. This lack of access disproportionately impacts women, children, and PWDs, who are more reliant on functional infrastructure for their survival and well-being.

5.9. Vulnerability of Key Groups

Women, youth, and PWDs in the region are disproportionately impacted by climate change due to their entrenched socio-economic marginalization. Women and youth, often responsible for the bulk of agricultural activities, encounter significant barriers that limit their capacity to mitigate and adapt to environmental changes. For example, soil erosion caused by poor farming practices is a direct consequence of insufficient access to training and resources, especially for women, who dominate agricultural labor but lack decision-making authority over land use. The damage to farmland caused by floods and droughts further reduces agricultural productivity, creating cycles of poverty, food scarcity, and hunger. The situation is even more critical when considering the structural gender inequalities that burden women with household management, food security, and caregiving responsibilities during crises. The societal expectation for women and youth to manage household needs intensifies during disasters, particularly when men abandon their responsibilities in search of economic opportunities elsewhere. This leaves women and youth to not only cope with the immediate impacts of climate change but also manage the long-term recovery efforts without adequate support or resources.

The findings from the proposed project area—Cibitoke, Bubanza, Bujumbura Rural, and Bujumbura Mairie—underscore how demographic factors within these regions contribute to heightened vulnerability to climate change impacts, particularly for women, youth, and persons with disabilities (PWDs). These groups face increased exposure to risks due to limited access to critical resources,

such as land, capital, and decision-making power, exacerbating the effects of climate-driven hazards like floods and droughts. The table 1 below highlights key areas of concern for each province:

Table 1: Vulnerability Factors and Impacted Groups Across Provinces in the Project Area

Cibitoke	Women, Youth, PWDs	- Soil erosion due to poor farming practices, leading to low agricultural yields - Frequent flooding from river catchments, disrupting agriculture - Food insecurity and poverty cycles
Bubanza	Women, Children, Elderly, PWDs	- Infrastructure damage (roads, schools, health facilities) due to floods - Frequent flooding from river catchments, disrupting agriculture - Forced community evacuation and resource access challenges
Bujumbura Rural	Women, Youth, PWDs	- Frequent flooding from river catchments, disrupting agriculture - Displacement to IDP camps with risks of GBV and health issues
Bujumbura Mairie	Women, Youth, PWDs, Elderly	- Increased susceptibility to floods - Overcrowding in shelters and IDP camps, leading to gender-based violence and psychological trauma - Infrastructure damage (roads, schools, health facilities) due to floods
Kirundo	Women, Youth, PWDs	- Prolonged droughts leading to water shortages - Increased food insecurity and malnutrition - Land degradation reducing farming viability
Ruyigi	Women, Youth, PWDs	- Unpredictable rainfall patterns affecting crop production - Increased prevalence of pest infestations - Poor road access due to soil erosion and landslides
Rutana	Women, Youth, PWDs	- High frequency of landslides causing loss of arable land - Infrastructure destruction (roads, bridges, homes) - Food insecurity due to disrupted agricultural cycles
Bururi	Women, Youth, PWDs	- Heavy rainfall leading to landslides and deforestation - Displacement of communities to urban areas - Damage to water sources and sanitation infrastructure

6. Gender Issues Surveyed During Stakeholder Consultations

During the project's design phase, consultations were held across provinces and communes, focusing on critical gender-sensitive issues affecting community resilience. These consultations emphasized the influence of gender in disaster experiences, climate adaptation, and resource access, revealing significant needs in infrastructure, education, health, and economic empowerment. The issues, discussed below with references to attached images, have been integrated into the project's Gender Action Plan to ensure equitable benefits for women, men, and youth within these communities.

6.1. Road Blockages and Soil Instability

One of the main issues raised was the frequent blockage of key roads due to landslides, which impedes access to essential resources and restricts movement for all residents. As shown in the images of Road (attached), landslides in 2024 left the road impassable, cutting off vital routes to health facilities, markets, and educational institutions. This limited access affects all gender groups, though it has heightened implications for women, who are often responsible for securing daily essentials for their families. The soil instability across affected regions complicates road repairs, as landslide-prone areas often require extensive stabilization measures (e.g., terracing, retaining walls) to reduce the recurrence of blockages. For women in rural settings, this results in additional burdens, as they may need to travel longer distances on foot to access supplies or medical care, especially during rainy seasons when landslide risk is high.

To address this, the Gender Action Plan includes provisions for gender-sensitive infrastructure improvements, focusing on reinforcing roads with materials resilient to landslides and ensuring access routes remain functional during adverse weather. This is essential to support the mobility of women and girls, ensuring they can access health services, markets, and educational institutions without facing disproportionate challenges.

6.2. Female Representation and Cultural Barriers

A significant challenge identified was the limited representation of female educators in local schools, which impacts girls' educational participation and aspirations. From 1989 until 2022, several communities in the consultation areas did not have female teachers, which is reflected in the attached images depicting the lack of female educators at community schools. This scarcity of female role models contributes to prevailing cultural norms that prioritize marriage and domestic responsibilities over formal education for girls. As a result, many parents are less inclined to send their daughters to school, assuming their roles are predetermined within the household rather than in professional or academic fields.

The Gender Action Plan addresses these educational gaps by promoting gender equity initiatives within schools. This includes recruiting and training female teachers to create visible role models for girls, as well as community engagement efforts to shift cultural perceptions about girls' education. By fostering an environment that values girls' schooling and providing support for female educators, the project aims to create pathways for educational and professional advancement for young women.

6.3. Health and Sanitation Risks in Displacement Camps

Flooding, as documented in images from Bujumbura and surrounding regions, has had devastating effects on local communities, causing widespread crop loss, home destruction, and the displacement of residents to overcrowded camps. Women and girls are particularly vulnerable to the health risks associated with these conditions. Camps often lack sufficient sanitation facilities and access to clean water, leading to a rise in infections and waterborne diseases. In the images provided, you can observe the makeshift shelters in primary school facilities, where men and women were housed separately. This separation resulted in tensions related to conjugal rights, with some men leaving the camps in search of other partners. These conditions underscore the social stresses that can escalate in crisis situations, with impacts that disproportionately affect women.

The Gender Action Plan incorporates targeted health and sanitation support to address these challenges. This includes the construction of gender-sensitive, climate-resilient sanitation facilities, clean water access points, and measures for waste management in displacement areas. The project

also provides health and hygiene education, particularly focusing on women and girls, to reduce infection risks in overcrowded conditions. Furthermore, the plan includes provisions for family-friendly spaces within emergency shelters, aimed at mitigating social tensions and supporting stable family dynamics during displacement.

6.4. Economic Empowerment: Support for Women and Girls

The consultations also highlighted economic challenges, particularly for women who experience limited access to income-generating opportunities. Floods and landslides have severely affected crop production, as depicted in the images of affected agricultural lands, causing food insecurity and financial instability. Many women in these regions engage in informal agricultural work, yet their access to recovery resources and financial support is often restricted due to traditional norms and lack of financial inclusion. Additionally, women face barriers in accessing larger credit instruments and often have smaller assets to use as collateral, which limits their ability to rebuild after natural disasters.

Issue Category	Gender-Specific Impacts	Support Needs	Project Design Suggestions
Impacts of Floods & Landslides	- Women experience an increased burden from floods and landslides as they often bear responsibility for essential domestic tasks such as cooking, fetching water, gathering firewood, and maintaining cleanliness. - Women are typically caregivers for children and elderly family members, restricting their mobility and ability to escape during emergencies, thus heightening their vulnerability. - Flash floods are a common challenge, making evacuation or resource collection even more difficult for women.	- Organize gender-sensitive capacity-building sessions focused on disaster preparedness, providing women with practical skills for flood control and landslide management. - Offer environmental education sessions to raise awareness of risk mitigation strategies.	- Integrate gender-responsive activities that address the specific roles and responsibilities of women and other gender groups. - Implement targeted actions to provide women with secure shelters and access to resources, ensuring the safety of children and elderly dependents.
Climate-Smart WASH Facilities	- Women and girls are disproportionately impacted by limited access to clean water, with water contamination and scarcity resulting in higher	- Implement rainwater harvesting systems to provide safe drinking water and reduce the need for women and	- Design gender-sensitive WASH facilities that prioritize privacy, safety, and hygiene, especially for women and girls.

	incidences of waterborne diseases (e.g., cholera, typhoid) and health issues like UTIs.	girls to travel long distances.	- Provide hygiene awareness and behavior-change workshops to promote best practices and ensure community engagement in sanitation efforts.
Economic Empowerment	- Economic activities among women are limited due to systemic barriers, including lack of access to financial services, business networks, and resources. - Women's roles are often constrained by traditional gender expectations, limiting their opportunities for income generation and reinforcing dependency on men. - High-risk aversion and limited familiarity with credit options prevent women from applying for loans to scale their businesses. - Women's assets are usually of lower value, making it difficult to secure credit, and often they must provide more guarantees than men.	- Conduct workshops focused on financial literacy and business development to empower women with the skills needed to manage and expand their enterprises. - Establish women-specific credit facilities or partnerships with microfinance institutions that offer low-interest loans and flexible repayment plans. - Organize networking sessions to connect women with market access, allowing them to expand their customer base and business opportunities.	- Incorporate alternative income-generating activities in the project, tailored to women's strengths and market opportunities in the area. - Facilitate partnerships with local organizations to create accessible financing options for women entrepreneurs. - Integrate capacity-building sessions into project activities to encourage women to take on leadership roles, supporting self-sufficiency and long-term economic resilience.

To address these economic disparities, the Gender Action Plan includes support for women-led agricultural and micro-enterprise initiatives, providing training in climate-resilient agricultural practices, and offering access to financial instruments tailored to women. This includes small grants, micro-loans, and financial literacy programs, designed to empower women economically and enable them to support their families during and after crises. Training workshops on sustainable agricultural practices and business management are also incorporated, aiming to boost women's economic independence and resilience to climate impacts.

7. Conclusion

The *Gender Analysis and Action Plan (GAAP) for Enhancing Resilience in Burundi* reveals the intricate linkages between gender inequalities and climate vulnerability, highlighting how deeply entrenched social, economic, and structural barriers limit the ability of women, youth, and

marginalized groups to effectively adapt to climate change. Women in Burundi, particularly those engaged in agriculture, bear a disproportionate burden of climate-related risks due to systemic exclusion from land ownership, financial resources, and decision-making processes. Despite their critical role in ensuring household food security and managing natural resources, they remain underrepresented in leadership positions and are often restricted by traditional gender norms that hinder their agency in climate adaptation efforts.

One of the key findings of this study is that gender disparities in land tenure, financial access, and agricultural input distribution not only exacerbate existing socio-economic inequalities but also weaken overall community resilience. Women's limited land ownership means they struggle to invest in sustainable farming practices or access credit facilities, while their exclusion from governance structures results in climate policies that do not adequately address their needs. Additionally, the impacts of climate change, such as increased flooding, prolonged droughts, and soil degradation, disproportionately affect women and youth, as they have fewer resources to cope with economic shocks. Climate-induced displacement further exacerbates vulnerabilities, increasing the risks of gender-based violence, food insecurity, and loss of livelihood opportunities.

To address these challenges, the report emphasizes the need for gender-responsive climate adaptation strategies that promote inclusivity and equitable access to resources. Strengthening women's land rights through policy reforms, increasing financial inclusion via microfinance and alternative credit mechanisms, and providing targeted training on climate-smart agriculture are essential measures for enhancing resilience. Equally important is the need to integrate gender considerations into early warning systems, disaster risk reduction efforts, and climate governance to ensure that both men and women contribute to and benefit from adaptation strategies. The report also highlights the importance of promoting women's leadership and decision-making at the household, community, and policy levels to ensure their voices shape climate adaptation policies and interventions.

The study further advocates for a gender-transformative approach that actively challenges societal norms and systemic inequalities that perpetuate gender-based vulnerabilities. This involves not only ensuring women's participation in climate adaptation efforts but also engaging men and community leaders in reshaping attitudes toward gender roles. Investing in women's empowerment is not only a moral imperative but a strategic necessity for achieving sustainable development and resilience. Evidence from other climate adaptation programs worldwide shows that when women have equal access to resources and decision-making power, communities are better equipped to respond to climate shocks and build long-term resilience.

In conclusion, achieving gender-inclusive climate resilience in Burundi requires a multifaceted and intersectional approach that bridges policy reforms, community participation, and capacity-building initiatives. The findings of this study call for immediate action to mainstream gender in all climate adaptation efforts, ensuring that women, youth, and other marginalized groups are no longer passive recipients but active agents of change. By addressing gender disparities in climate adaptation, Burundi can strengthen the adaptive capacity of its communities, enhance sustainable agricultural practices, and foster long-term socio-economic development. A gender-responsive climate resilience framework will not only protect vulnerable populations from climate risks but also unlock new opportunities for economic growth, food security, and social stability, ultimately contributing to a more just and resilient future for all.

8. commendation

The study has identified significant gender-related challenges across various sectors, including livelihoods, climate-smart WASH (Water, Sanitation, and Hygiene), Flood Early Warning Systems (EWS), and the impacts of climatic hazards, particularly in relation to catchment protection. These issues must be carefully addressed to ensure the success of the project and to create inclusive solutions that consider the unique needs and vulnerabilities of both men and women during its implementation (see Table 2).

In terms of livelihoods, women and men experience different opportunities and barriers, especially in accessing alternative income-generating activities such as livestock rearing, beekeeping, and small-scale agricultural enterprises. Women, who are often responsible for household food security and care, require support in building sustainable livelihoods that also promote environmental protection. Tailored interventions are necessary to empower women, especially in rural areas, to participate equally in economic activities that mitigate the impacts of climate change and foster resilience within the community. In the realm of WASH technologies, gender disparities are also evident. Women and children typically bear the brunt of water collection duties, which are exacerbated by water scarcity during dry seasons or due to damaged infrastructure. The project must prioritize the provision of accessible water sources facilities that reduce the time and physical burden on women while enhancing overall community health and hygiene. These interventions are vital in fostering a sustainable and inclusive approach to water management in vulnerable areas.

8.1. Recommendations to gender-sensitive climate adaptation

To address these vulnerabilities, the proposed project must adopt a comprehensive, gender-sensitive approach that prioritizes the inclusion of women, youth, and PWDs in all aspects of climate adaptation and disaster risk reduction. This requires building the capacity of these groups to access resources, participate in decision-making processes, and implement climate-resilient practices. In doing so, the project can foster a more equitable distribution of resources and opportunities, reducing vulnerability and enhancing resilience across the entire community. Empowering women and youth through targeted training, financial inclusion, and policy reforms that promote gender equity can lead to more sustainable outcomes. For example, providing women and youth with access to microfinance solutions, land ownership, and climate information can enable them to invest in climate-resilient agricultural practices, diversify their livelihoods, and strengthen their ability to withstand future climate shocks. Additionally, the project should advocate for the integration of gender considerations into local and national disaster risk reduction (DRR) policies. This would ensure that women's knowledge and experiences are incorporated into formal decision-making processes, leading to more effective and inclusive climate adaptation strategies. By promoting inclusive governance and equitable access to resources, the resilience of vulnerable groups can be significantly enhanced, contributing to long-term sustainable development and poverty reduction. Addressing these challenges requires a holistic approach that incorporates gender-sensitive strategies into climate adaptation and disaster risk reduction efforts.

8.2. Recommendations to Gendered Coping Strategies and Resilience

Gender dynamics play a crucial role in shaping how communities cope with the impacts of climate change. In many instances, men migrate to urban areas or neighboring countries in search of better economic opportunities, leaving women, children, and the elderly to manage the household and agricultural production. This migration trend places additional strain on women, who must balance their traditional roles as caregivers with the increased demands of managing agricultural production

and disaster recovery. While men have historically been the focus of capacity-building initiatives, there is growing recognition that women possess significant knowledge and resilience in managing climate-related challenges. Studies have shown that women are often at the forefront of implementing local climate adaptation strategies, such as water conservation, soil management, and food preservation techniques. Despite this, women remain largely excluded from formal decision-making processes related to disaster risk management and resource allocation, limiting the effectiveness of their coping strategies and undermining broader community resilience.

8.3. Recommendations to Gender-Sensitive Climate Adaptation

To address these vulnerabilities, the proposed project must adopt a comprehensive, gender-sensitive approach that prioritizes the inclusion of women, youth, and PWDs in all aspects of climate adaptation and disaster risk reduction. This requires building the capacity of these groups to access resources, participate in decision-making processes, and implement climate-resilient practices. In doing so, the project can foster a more equitable distribution of resources and opportunities, reducing vulnerability and enhancing resilience across the entire community. Empowering women and youth through targeted training, financial inclusion, and policy reforms that promote gender equity can lead to more sustainable outcomes. For example, providing women and youth with access to microfinance solutions, land ownership, and climate information can enable them to invest in climate-resilient agricultural practices, diversify their livelihoods, and strengthen their ability to withstand future climate shocks. Additionally, the project should advocate for the integration of gender considerations into local and national disaster risk reduction (DRR) policies. This would ensure that women's knowledge and experiences are incorporated into formal decision-making processes, leading to more effective and inclusive climate adaptation strategies. By promoting inclusive governance and equitable access to resources, the resilience of vulnerable groups can be significantly enhanced, contributing to long-term sustainable development and poverty reduction. Addressing these challenges requires a holistic approach that incorporates gender-sensitive strategies into climate adaptation and disaster risk reduction efforts.

8.4. Recommendations to Address Differential Impacts

1. **Enhance Access to Resources**
    - Promote equitable land tenure systems that empower poor households and women to own and manage land.
    - Develop targeted credit programs and subsidies for poor farmers, particularly women, to invest in farming inputs and climate-resilient practices.
2. **Support Gender-Inclusive Training**
    - Design agricultural training programs that specifically cater to women's needs and schedules, ensuring they have equal access to knowledge and skills.
3. **Foster Inclusive Decision-Making**
    - Advocate for joint decision-making in households and communities to ensure that women and marginalized groups have a voice in resource allocation and farming strategies.
4. **Strengthen Safety Nets**
    - Expand social protection programs, such as cash transfers or subsidized insurance schemes, to support poorer households during crises.
5. **Promote Diversification**

- Encourage livelihood diversification for poorer households through training in non-farming skills, such as beekeeping, handicrafts, or small-scale trade, to reduce dependence on climate-sensitive agriculture.

6. **Build Awareness on Gender Equity:**
   - Conduct community-based campaigns to challenge cultural norms that restrict women's roles and promote the benefits of gender equality in agriculture.

8.5. Recommendations to Address Resource Inequities

1. **Enhance Land Ownership Rights**
   - Advocate for legal reforms and community-based initiatives that promote equitable land ownership for women and marginalized groups. Provide land certification programs to secure tenure for smallholder farmers.
2. **Expand Financial Inclusion**
   - Develop gender-responsive financial products, such as microloans and group savings schemes, tailored to the needs of women and poorer farmers. Offer subsidies and risk-sharing mechanisms to reduce barriers to formal credit.
3. **Improve Access to Inputs and Technology**
   - Establish input distribution centers in rural areas and design programs that prioritize women and poorer farmers. Provide subsidies or voucher systems to make inputs affordable and accessible.
4. **Strengthen Training Programs**
   - Deliver inclusive and localized training sessions that consider the unique needs of women and poorer households. Use community-based organizations and cooperatives to enhance outreach and participation.
5. **Facilitate Market Linkages**
   - Invest in rural infrastructure, such as roads and storage facilities, to improve access to markets. Create cooperatives or producer groups that empower smallholder farmers, particularly women, to negotiate better prices and access value chains.
6. **Leverage Technology**
   - Use mobile platforms and digital tools to disseminate information on farming practices, weather forecasts, and market prices. Ensure these tools are user-friendly and accessible to women and resource-constrained farmers.

Table 2: Recommendations by Key Stakeholders

1	Full involvement of key stakeholders profiled in the stakeholder analysis report	- Engage all key stakeholders at the province, commune, local community, and household levels. - Address the specific interests of each stakeholder and strengthen their roles. - Political leaders can mobilize communities and align with technical staff during sensitization. - Government institutions can provide inputs like tree seedlings, rainwater harvestin systems, and **alternative income-generating activities**(AGA). - Focus on changing stakeholder attitudes toward catchment protection.	Province authorities, Political leaders, Technical staff, Local communities	Enl coll sus pro
2	Alternative income-generating activities (AGAs)	To promote catchment protection, introduce AGA: - **Dairy cattle under zero-grazing** (for women to provide milk for children and income). - **Hybrid goat rearing** (for women and female youths). - **Beekeeping** for honey and other products, which supports both households and ecosystems by pollinating plants.	Community leaders, Agricultural departments, NGOs	Inc inc cat me
3	Restoration of degraded ecosystems/areas of the catchment	- Distribute **tree seedlings** to restore degraded areas. - Plant grasses on contours to reduce runoff and provide fodder. - Plant **fruit trees** and agroforestry species like **Mangoes, Macadamia** and **Cashew**. - Implement **carbon trade arrangements** to discourage the cutting of young trees.	Environmental agencies, NGOs, Local communities	Res incr lan
4	Climate-smart WASH technologies	- Repair faulty water facilities and construct boreholes and deep wells in areas with water shortages.	WASH organizations, Local government, Donors	Inc hou
5	Floodwater Harvesting technologies (FWH)	- Promote **FWH** to collect water from floods for domestic use and irrigation. - Reduce the distance and time women and children spend collecting water.	Water agencies, Community groups, NGOs	Imp con wat wo
6	Floods Early Warning Systems (EWS)	- Establish **EWS** for weather and floods to collect, manage, and alert communities about climatic hazards. - Train local technical staff on using EWS technology for sustainable interventions.	Meteorological departments, Province authorities, NGOs	Re floo pre

7	Community Development Department, Para Social Workers	- Establish a committee of **30 para-social workers per sub-county**: 10 per parish. - Focus on community sensitization and conflict resolution. - Women are seen as natural volunteers and are effective counselors.	Community development offices, Local government	En co res
8	Construction of flood barriers	- Build **flood barriers** in high-risk areas to mitigate floods during heavy rains. - Protect households and agricultural land from flooding and soil erosion, improving water management and safeguarding livelihoods.	Infrastructure authorities, Environmental agencies, NGOs	Re imp ma
9	Training on climate adaptation strategies	- Provide **training on climate adaptation** strategies such as water conservation, soil management, and disaster preparedness. - Focus on women and youth, ensuring inclusivity in climate resilience efforts.	Environmental NGOs, Province authorities, Training institutions	Inc an vul
10	Improved access to climate financing	- Establish mechanisms to improve **access to climate financing** for sustainable livelihoods and catchment protection activities. - Promote **gender-inclusive financing** through microloans and grants for women and youth in climate adaptation.	Financial institutions, NGOs, Government agencies	Inc inc vul
11	Strengthening community-based governance structures	- Strengthen **community-based governance** for better coordination and accountability in catchment protection. - Promote the active participation of women in decision-making processes for enhanced gender equity.	Community leadership, Local government, NGOs	Imp ge ma
12	Climate insurance for vulnerable households	- Introduce **parametric insurance** to cover crop and livestock losses due to climate-related hazards(floods and droughts). - Target vulnerable households, particularly women, to help them recover faster after climate-related events.	Insurance providers, Financial institutions, NGOs	Re imp cli
13	Sustainable fisheries management	- Promote **sustainable fisheries** through aquaculture and fish farming in areas with accessible water sources. - Encourage women and youth to participate in fish farming for both food security and income generation.	Fisheries departments, Local government, Community leaders	Inc div

References

- Acosta, M., Wessel, M., Bommel, S., Ampaire, E., Jassogne, L., & Feindt, P. (2020). The power of narratives: explaining inaction on gender mainstreaming in uganda's climate change policy. Development Policy Review, 38(5), 555-574. https://doi.org/10.1111/dpr.12458
- Ambad, S., Sumin, V., Karia, A., Hakim, T., & Gisip, I. (2021). Factors influencing intention to become agropreneur among youths. Jurnal Intelek, 16(1), 52-61. https://doi.org/10.24191/ji.v16i1.363
- Ampaire, E., Acosta, M., Huyer, S., Kigonya, R., Muchunguzi, P., Muna, R., … & Jassogne, L. (2019). Gender in climate change, agriculture, and natural resource policies: insights from east africa. Climatic Change, 158(1), 43-60. https://doi.org/10.1007/s10584-019-02447-0
- Basiglio, S., Vincentiis, P., Isaia, E., & Rossi, M. (2022). Women-led firms and credit access. a gendered story?. Italian Economic Journal, 9(1), 199-233. https://doi.org/10.1007/s40797-021-00180-1
- Basiglio, S., Vincentiis, P., Isaia, E., & Rossi, M. (2022). Women-led firms and credit access. a gendered story?. Italian Economic Journal, 9(1), 199-233. https://doi.org/10.1007/s40797-021-00180-1
- Debie, A. (2024). Building a resilient health system for universal health coverage and health security: a systematic review. Global Health Research and Policy, 9(1). https://doi.org/10.1186/s41256-023-00340-z
- Delphin, B. (2023). Credit accessibility and growth of small and medium enterprises in bujumbura, burundi. Journal of Economics and Behavioral Studies, 15(4(J)), 13-36. https://doi.org/10.22610/jebs.v15i4(j).3656
- Devkota, R., Pant, L., Odame, H., Paudyal, B., & Bronson, K. (2022). Rethinking gender mainstreaming in agricultural innovation policy in nepal: a critical gender analysis. Agriculture and Human Values, 39(4), 1373-1390. https://doi.org/10.1007/s10460-022-10326-1
- Ewerling, F., Lynch, J., Victora, C., Eerdewijk, A., Tyszler, M., & Barros, A. (2017). The swper index for women's empowerment in africa: development and validation of an index based on survey data. The Lancet Global Health, 5(9), e916-e923. https://doi.org/10.1016/s2214-109x(17)30292-9
- Howland, F., Acosta, M., Muriel, J., & Coq, J. (2021). Examining the barriers to gender integration in agriculture, climate change, food security, and nutrition policies: guatemalan and honduran perspectives. Frontiers in Sustainable Food Systems, 5. https://doi.org/10.3389/fsufs.2021.664253
- Humphries, S., Classen, L., Jiménez, J., Sierra, F., Gallardo, O., & Gómez, M. (2012). Opening cracks for the transgression of social boundaries: an evaluation of the gender impacts of farmer research teams in honduras. World Development, 40(10), 2078-2095. https://doi.org/10.1016/j.worlddev.2012.05.008
- Iradukunda, F., Bullock, R., Rietveld, A., & Schagen, B. (2019). Understanding gender roles and practices in the household and on the farm: implications for banana disease management innovation processes in burundi. Outlook on Agriculture, 48(1), 37-47. https://doi.org/10.1177/0030727019831704
- Kabagenyi, A., Wasswa, R., Nsobya, H., Ariho, P., Sseninde, J., & Rusatira, J. (2021). Multilevel mixed effects analysis of individual and community factors associated with unmet need for contraception among married women in four east african countries.. https://doi.org/10.21203/rs.3.rs-470884/v1
- Kessler, A., Reemst, L., Beun, M., Slingerland, E., Pol, L., & Winne, R. (2020). Mobilizing farmers to stop land degradation: a different discourse from burundi. Land Degradation and Development, 32(12), 3403-3414. https://doi.org/10.1002/ldr.3763
- Kim, G. (2018). Entrepreneurial financing relationships: how does gender matter?. International Journal of Gender and Entrepreneurship, 10(1), 39-60. https://doi.org/10.1108/ijge-08-2017-0047
- Kim, J., Habimana, J., Kim, S., & Bae, D. (2021). Assessment of climate change impacts on the hydroclimatic response in burundi based on cmip6 esms. Sustainability, 13(21), 12037. https://doi.org/10.3390/su132112037

- Komakech, J., Walters, C., Rakotomanana, H., Hildebrand, D., & Stoecker, B. (2022). The associations between women's empowerment measures, child growth and dietary diversity: findings from an analysis of demographic and health surveys of seven countries in eastern africa. Maternal and Child Nutrition, 18(4). https://doi.org/10.1111/mcn.13421
- Landis, D., Falb, K., Michelis, I., Bakomere, T., & Stark, L. (2018). Violence, well-being and level of participation in formal education among adolescent girls in eastern democratic republic of the congo: the role of child marriage. Studies in Social Justice, 12(2), 273-290. https://doi.org/10.26522/ssj.v12i2.1632
- Lo, N., Gupta, R., Addiss, D., Bendavid, E., Heft-Neal, S., Mikhailov, A., … & Mbabazi, P. (2020). Comparison of world health organization and demographic and health surveys data to estimate sub-national deworming coverage in pre-school aged children. Plos Neglected Tropical Diseases, 14(8), e0008551. https://doi.org/10.1371/journal.pntd.0008551
- Mangheni, M., Musiimenta, P., Boonabaana, B., & Tufan, H. (2021). The genesis and performance of gender focal person structures in rwanda and uganda national agricultural organisations: a critique. Sustainability, 13(18), 10290. https://doi.org/10.3390/su131810290
- Mekonnen, Z. (2022). Intra-household gender disparity: effects on climate change adaptation in arsi negele province, ethiopia. Heliyon, 8(2), e08908. https://doi.org/10.1016/j.heliyon.2022.e08908
- Muchiri, S. and Nzisabira, S. (2020). Gender, poverty reduction and social work: a view from burundi. Southern African Journal of Social Work and Social Development, 32(2). https://doi.org/10.25159/2415-5829/5996
- Ndabashinze, B. (2024). Closing gender gaps through gender-responsive, demand-led breeding in burundi. Frontiers in Sociology, 8. https://doi.org/10.3389/fsoc.2023.1264816
- Ndagijimana, M., Kessler, A., & Asseldonk, M. (2018). Understanding farmers' investments in sustainable land management in burundi: a case-study in the provinces of gitega and muyinga. Land Degradation and Development, 30(4), 417-425. https://doi.org/10.1002/ldr.3231
- Ngabirano, A. and Hadley, M. (2022). Economic growth and hiv knowledge, prevention and access to media in burundi and rwanda. Rwanda Medical Journal, 79(4), 21-30. https://doi.org/10.4314/rmj.v79i4.1
- Nibaruta, J., Elkhoudri, N., Turman, J., Guennouni, M., & Elmadani, S. (2021). Prevalence, trend and determinants of adolescent childbearing in burundi: a multilevel analysis of the 1987 to 2016-17 burundi demographic and health surveys data... https://doi.org/10.21203/rs.3.rs-800806/v1
- Nibaruta, J., Kamana, B., Chahboune, M., Chebabe, M., Elmadani, S., Turman, J., … & Elkhoudri, N. (2023). Heterogeneous effects of socio-economic and cultural factors on fertility differentials in burundi and morocco during their fertility transition periods: a retrospective, cross-sectional and comparative study. Pan African Medical Journal, 45. https://doi.org/10.11604/pamj.2023.45.161.36150
- Nibaruta, J., Kamana, B., Chahboune, M., Chebabe, M., Saad, E., Turman, J., … & Elkhoudri, N. (2022). Prevalence, trend and determinants of adolescent childbearing in burundi: a multilevel analysis of the 1987 to 2016–17 burundi demographic and health surveys data. BMC Pregnancy and Childbirth, 22(1). https://doi.org/10.1186/s12884-022-05009-y
- Njeru, L. (2017). Youth in agriculture; perceptions and challenges for enhanced participation in kajiado north sub-county, kenya. Greener Journal of Agricultural Sciences, 7(8), 203-209. https://doi.org/10.15580/gjas.2017.8.100117141
- Ochieng, J., Ouma, E., & Birachi, E. (2014). Gender participation and decision making in crop management in great lakes region of central africa. Gender Technology and Development, 18(3), 341-362. https://doi.org/10.1177/0971852414544007
- Opesemowo, O. (2023). The sway of early marriage on the girl child education among some ethnic groups in lagos state, nigeria. Journal of Culture and Values in Education, 6(3), 26-41. https://doi.org/10.46303/jcve.2023.18
- Paudyal, B., Chanana, N., Khatri-Chhetri, A., Sherpa, L., Kadariya, I., & Aggarwal, P. (2019). Gender integration in climate change and agricultural policies: the case of nepal. Frontiers in Sustainable Food Systems, 3. https://doi.org/10.3389/fsufs.2019.00066

- Roy, P. and Patro, B. (2022). Financial inclusion of women and gender gap in access to finance: a systematic literature review. Vision the Journal of Business Perspective, 26(3), 282-299. https://doi.org/10.1177/09722629221104205
- Rutaremwa, G. and Kabagenyi, A. (2018). Postpartum family planning utilization in burundi and rwanda: a comparative analysis of population based cross-sectional data. Pan African Medical Journal, 30. https://doi.org/10.11604/pamj.2018.30.303.15105
- Rutaremwa, G. and Kabagenyi, A. (2018). Postpartum family planning utilization in burundi and rwanda: a comparative analysis of population based cross-sectional data. Pan African Medical Journal, 30. https://doi.org/10.11604/pamj.2018.30.303.15105
- Saiget, M. (2016). (de-)politicising women's collective action: international actors and land inheritance in post-war burundi. Review of African Political Economy, 43(149). https://doi.org/10.1080/03056244.2016.1214113
- Schwarz, J., Manirakiza, R., & Merten, S. (2021). Reproductive governance in a fragile and population-dense context: family planning policies, discourses, and practices in burundi. European Journal of Development Research, 34(6), 2666-2687. https://doi.org/10.1057/s41287-021-00482-1
- Seidu, A., Hagan, J., Budu, E., Mohammed, A., Adu, C., Ameyaw, E., … & Schack, T. (2020). A multilevel modelling of barriers to healthcare access and healthcare seeking for childhood illnesses among childbearing women in burundi.. https://doi.org/10.21203/rs.3.rs-51761/v1
- Uttej, D. (2022). Youth in agriculture : problems and suggestions. Indian Research Journal of Extension Education, 22(5), 247-250. https://doi.org/10.54986/irjee/2022/dec_spl/247-250

In partnership with Canada Climate Action Africa

TECHNOLOGY & SKILLS NEEDS ASSESSMENT REPORT FOR CLIMATE-SMART AGRICULTURE IN BURUNDI



Program undertaken with the financial support of the Government of Canada.
Implemented by:

alinea ECONOLER wsp

Official Use Only

Contents

1. Introduction 5
1.1. Context of Burundi's Agriculture 5
1.2. Importance of Gender-Responsive Adaptation 6
1.3. Rationale for Gender Mainstreaming 7
2. Methodology: A Mixed-Methods Research Approach 9
2.1. Focus Group Discussions (FGDs) 9
2.1.1. Selection and Composition of Participants 9
2.1.2. Structure and Process of FGDs 10
2.1.3. Data Collection and Analysis 11
2.2. Literature Review 12
2.2.1. Policy Landscape Review 12
2.2.2. Climate-Smart Agriculture (CSA) 17
2.2.3. Parametric Insurance and Financial Inclusion 18
2.2.4. Digital Tools for Agricultural Resilience 21
3. Findings 22
3.1. Agricultural Challenges in Burundi 22
3.1.1. Current Climate Risks 22
3.1.2. Climate Risks and Crop Losses 23
3.2. Technology Gaps and Barriers 26
3.2.1. Technology Gaps in Agriculture 26
3.2.2. Pest Management Challenges 26
3.2.3. Agricultural Insurance and Financial Protection 26
3.3. IT Infrastructure Readiness 27
3.3.1. Digital Platforms for Agriculture 27
3.3.2. Early Warning Systems (EWS) and Meteorological Infrastructure 27
3.3.3. Digital Financial Services 27
3.4. Skills and Capacity-Building Gaps 29
3.4.1. Climate-Smart Agriculture (CSA) Training 29
3.4.2. Financial Literacy Deficiencies 29
3.4.3. Digital Literacy Challenges 29
3.4.4. Leadership and Decision-Making Barriers 30
3.5. Gender Dynamics in Agriculture and Climate Adaptation 30

Official Use Only

3.5.1. Gender Disparities and Socioeconomic Vulnerabilities 30
3.5.2. Limited Land Ownership and Decision-Making Power 30
3.5.3. Unpaid Agricultural Labor 31
3.5.4. Disaster-Induced Vulnerabilities 31
3.6. Impact on Women, Youth, and People with Disabilities (PWD) in Agriculture 32
3.6.1. Gendered Impacts of Climate Change on Agriculture 32
3.6.2. Youth and Climate Vulnerability in Agriculture 33
3.6.3. People with Disabilities and Climate Resilience in Agriculture 34
3.6.4. Adaptive Strategies 34
3.6.5. Challenges and Opportunities 36
4. Discussion 37
4.1. Interplay between Policy, Practice, and Gender 37
4.2. Highlighting Gaps 37
4.3. Opportunities for Research and Intervention 38
5. Conclusion 39
6. Recommendations 40
6.1. Strengthening Climate Resilience in Agriculture 40
6.1.1. Enhancing Climate-Smart Agricultural Practices 40
6.1.2. Improving Early Warning Systems and Climate Services 41
6.1.3. Scaling Up Sustainable Land and Water Management Practices 41
6.1.4. Expand irrigation systems to reduce dependence on rainfed agriculture. 41
6.2. Closing Technology and Financial Gaps 41
6.2.1. Promoting Agricultural Technology Adoption 41
6.2.2. Expanding Agricultural Insurance and Financial Inclusion 41
6.2.3. Enhancing Digital Agricultural Services 41
6.3. Addressing Skills and Capacity-Building Gaps 41
6.3.1. Investing in Climate-Smart Agriculture Training 41
6.3.2. Enhancing Financial Literacy Among Farmers 42
6.3.3. Improving Digital Literacy for Farmers 42
6.3.4. Strengthening Women's Leadership in Agriculture 42
6.4. Enhancing Gender-Inclusive Climate Adaptation 42
6.4.1. Promoting Gender-Responsive Agricultural Policies 42
6.4.2. Strengthening Women's Access to Land and Financial Services 42

Official Use Only

6.4.3. Reducing the Burden of Unpaid Agricultural Labor on Women....42
6.4.4. Ensuring Inclusion of Marginalized Groups in Climate Adaptation....42
6.5. Supporting Youth Engagement in Agriculture....43
6.5.1. Creating Opportunities for Youth in Agribusiness....43
6.5.2. Encouraging Youth Participation in Climate Adaptation....43
6.5.3. Addressing Barriers to Youth Employment in Agriculture....43
6.6. Strengthening Policy and Institutional Frameworks....43
6.6.1. Enhancing Multi-Stakeholder Collaboration....43
6.6.2. Developing Incentives for Climate-Resilient Agriculture....43
6.6.3. Monitoring and Evaluation of Adaptation Strategies....43
References....44

Official Use Only

1. Introduction

1.1. Context of Burundi's Agriculture

Burundi's agricultural sector is characterized by its reliance on smallholder farming, which encompasses over 90% of the rural workforce and is responsible for about 40% of the nation's Gross Domestic Product (GDP) (Aboyitungiye et al., 2021). The agricultural landscape is predominantly comprised of subsistence farmers who cultivate staple crops such as cassava, maize, beans, potatoes, and agro-cash crops like coffee and tea (Ndayiragije et al., 2022). Coffee, in particular, is a key export commodity for Burundi, significantly contributing to the country's foreign exchange earnings (Morsello et al., 2017). However, despite its importance, Burundi's agriculture faces various challenges that hinder its productivity and sustainability.

The agricultural sector in Burundi is at a critical juncture, facing the dual challenges of climate change and socio-economic disparities. With over 80% of the population engaged in agriculture and the sector contributing approximately 40% to the national GDP, the implications of climate variability are profound. The increasing frequency of erratic rainfall, prolonged droughts, and soil degradation are undermining food security and the livelihoods of rural populations, particularly in vulnerable provinces such as Cibitoke, Bubanza, and Bujumbura Rural. These climatic shocks are compounded by systemic gender disparities and limited access to productive resources, which further exacerbate the challenges faced by smallholder farmers, particularly women and marginalized groups (Mwongera et al., 2017; Nchanji et al., 2023).

The socio-political landscape of Burundi poses additional obstacles to agricultural development. The country has experienced prolonged periods of civil conflict, which have disrupted agricultural activities, destabilized community structures, and hindered access to agricultural resources (Mastrorillo et al., 2016; Berg, 2020). Often, vulnerable communities such as women, youth, and the elderly are disproportionately affected, as they typically have less access to adaptive technologies and decision-making power in agricultural processes and practices (Doss, 2018). These challenges necessitate the implementation of sustainable agricultural practices that are both environmentally viable and socially equitable to build resilience in rural communities.

To address these pressing issues, a comprehensive technology and skills needs assessment for climate-smart agriculture (CSA) in Burundi is essential. CSA aims to enhance agricultural productivity while ensuring resilience to climate change impacts. The Enhanced Resilience GAAP and the Updated Refined Consolidated Gender FGD Report highlight the urgent need for targeted interventions that not only improve agricultural productivity but also promote equitable access to resources. This necessitates the integration of adaptive technologies, improved IT infrastructure, and capacity-building programs tailored to the unique challenges faced by Burundian farmers (Mwongera et al., 2017; Ochilo et al., 2022).

The first step in this assessment involves identifying the key challenges facing Burundi's agricultural sector. Climate change has resulted in increased vulnerability of agricultural systems, with farmers experiencing firsthand the impacts of erratic weather patterns. Studies indicate that farmer knowledge of past climatic events aligns with recorded climate data, underscoring the importance of integrating local knowledge into climate vulnerability

Official Use Only

assessments (Mwongera et al., 2017). Furthermore, the high prevalence of food insecurity in Burundi, which affects more than half of all households, is closely linked to the agricultural sector's dependency on traditional practices and insufficient productivity (Gaiser et al., 2023; Mperejekumana et al., 2023).

The role of technology in promoting climate-smart agriculture cannot be overstated. Innovative agricultural technologies, such as precision farming and improved irrigation systems, have the potential to significantly boost productivity and resilience. For instance, the adoption of biofortified crop varieties has been shown to improve nutritional outcomes and food security among rural households (Nchanji et al., 2023). Moreover, investment in agricultural research and extension services is critical for disseminating knowledge and facilitating the adoption of new technologies among farmers (Pawlak & Kołodziejczak, 2020; Mizik, 2021).

Capacity-building programs are also essential for equipping farmers with the necessary skills to implement climate-smart practices. Training initiatives focused on integrated pest management, sustainable land management, and efficient resource use can enhance farmers' resilience to climate shocks (Okonya et al., 2019; Okonya et al., 2018). Additionally, improving the diagnostic capabilities of agricultural practitioners through in-service training can strengthen the overall agricultural support system in Burundi (Toepfer et al., 2023).

The integration of information and communication technology (ICT) into agricultural practices can further enhance the effectiveness of climate-smart agriculture. Access to timely weather information, market data, and agricultural best practices through mobile platforms can empower farmers to make informed decisions and optimize their production systems (Hadiq et al., 2021). However, the current state of IT infrastructure in Burundi poses significant challenges, necessitating investments in digital connectivity and training for farmers to leverage these technologies effectively (Mwongera et al., 2017; Ochilo et al., 2022).

The successful implementation of climate-smart agriculture in Burundi hinges on a multifaceted approach that addresses the challenges of climate change, gender disparities, and technological limitations. By prioritizing targeted interventions that enhance agricultural productivity, promote equitable access to resources, and build the capacity of farmers, Burundi can strengthen its agricultural sector to withstand climate shocks and foster inclusive economic growth. The findings from the Enhanced Resilience GAAP and the Updated Refined Consolidated Gender FGD Reports provide a valuable foundation for developing a comprehensive strategy to achieve these goals.

1.2. Importance of Gender-Responsive Adaptation

Gender-responsive adaptation strategies are essential for addressing the unique challenges faced by women in Burundi's agricultural sector. Women comprise a substantial proportion of the agricultural labor force and are integral to household food production and nutrition. However, they frequently encounter barriers that hinder their ability to adapt to climate change effectively. These include limited access to productive resources, such as land, credit, and technology, and restricted participation in decision-making processes within their households and communities (Kabeer, 2016).

Official Use Only

Recognizing these gender-specific vulnerabilities is crucial. Women often possess a wealth of knowledge about local agricultural practices and sustainable resource management honed through generations of experience. For instance, studies have shown that women are often more willing to adopt sustainable farming practices when provided with appropriate support and resources (Agarwal, 2010; Nchanji et al., 2022). Engaging women in the design and implementation of climate adaptation strategies not only leverages this knowledge but also leads to more effective outcomes. As Doss (2018) articulates, ensuring women's voices are included in climate-related discussions can enhance the resilience of agricultural systems as a whole.

Moreover, integrating gender considerations into climate adaptation strategies can facilitate broader social and economic benefits (Assan et al., 2018). Research indicates that empowering women in agriculture can lead to increased household income and improved food security (Diiro et al., 2018). According to the FAO, if women had equal access to productive resources, output in the agricultural sector could increase significantly, helping to alleviate poverty and enhance community resilience (Kristjanson et al., 2017). Gender-responsive adaptation fosters not only agricultural resilience but also advances gender equality and women's rights, laying the foundation for sustainable development.

In Burundi, initiatives that promote gender-responsive adaptation include capacity-building programs that educate women on climate resilience strategies and financial literacy, ensuring they can access and utilize modern agricultural technologies (Mastrorillo et al., 2016). These approaches must be designed in collaboration with local communities to ensure cultural relevance and acceptance. By prioritizing gender-responsive strategies, Burundi can build a more resilient agricultural sector capable of weathering the impacts of climate change while promoting social equity (Dagoudo et al., 2023).

1.3. Rationale for Gender Mainstreaming

Gender mainstreaming in the context of agricultural policies and climate change adaptation is crucial for promoting sustainable development and enhancing resilience, particularly in regions like Burundi where women play a significant role in agriculture (Molony, 2011). Parametric insurance, a form of insurance that pays out based on pre-defined weather events, offers a promising avenue for mitigating climate risks and supporting the adaptive capacities of women farmers (Swiss Re, 2019; Greatrex et al., 2015). Digital solutions, such as mobile-based platforms for weather information and market access, can empower women by providing them with critical information and tools to adapt to changing climate conditions (GSMA, 2020; CIAT, 2019).

By integrating gender considerations into these innovative approaches, we aim to **Enhance women's resilience to climate change impacts, b**y providing women with access to insurance and digital tools, we can help them mitigate financial losses and adapt to changing agricultural practices (Stein & Castillo, 2020; Perez et al., 2015); **Promote gender equality in agriculture, by** ensuring that women have equal access to resources and opportunities, we can contribute to a more equitable and sustainable agricultural sector (FAO, 2011; CARE, 2019) and **Improve overall agricultural productivity** by empowering women farmers, we can unlock their

Official Use Only

potential and contribute to increased agricultural productivity and food security (World Bank, 2012; IFPRI, 2019).

Incorporating gender perspectives into agricultural policies and practices is essential for promoting sustainable development and enhancing resilience to climate change in Burundi. Women play a crucial role in agriculture, often engaging in various farming activities, food preparation, and market trading. Nevertheless, they face systemic barriers that limit their access to resources, land, credit, and technology, which impedes their ability to contribute fully to agricultural productivity (Doss, 2018). Given that women are responsible for up to 70% of food production in regions like sub-Saharan Africa, addressing their specific needs and challenges is crucial for achieving food security (FAO, 2020).

Gender mainstreaming is increasingly viewed as a fundamental element of agricultural climate adaptation policies to ensure that the distinctive roles, preferences, and challenges of men and women are equally considered (Acosta et al., 2020). It entails creating policies that recognize and incorporate the different roles, needs, and contributions of all genders, particularly women. It aims to promote equitable access to resources and opportunities, thereby enhancing the adaptive capacity of women farmers to climate change (Agarwal, 2010). Studies indicate that gender-responsive policies not only improve women's empowerment but also lead to better agricultural outcomes. For instance, if women farmers had equal access to productive resources, agricultural output in developing countries could rise by 20-30%, with substantial benefits for food security and nutrition (FAO, 2021).

Furthermore, engaging women in the decision-making processes surrounding agricultural practices fosters a more inclusive environment that encourages innovation and sustainable practices. Research has shown that when women's voices are included in climate adaptation planning, the resultant strategies tend to be more effective because they draw upon women's unique knowledge and experiences (Kabeer, 2016). Such participation enhances community resilience and contributes to broader socio-economic benefits, like poverty reduction and improved health outcomes (Mastrorillo et al., 2016).

In the context of Burundi, where agricultural resilience is critical to mitigating the impacts of climate change and ensuring food security, mainstreaming gender in adaptation strategies can lead to more effective responses to climate risks. This approach aligns with global development goals, including those set out in the Sustainable Development Goals (SDGs), particularly Goal 5 (Gender Equality) and Goal 13 (Climate Action), by promoting inclusive practices that empower women and enhance community resilience (UN Women, 2020).

Table 1: Key Climate Hazards, Impacts, and Interventions

Climate Hazard	Primary Impact	Vulnerable Groups	Proposed Intervention
Prolonged Droughts	Crop failure, livestock deaths	Women-led households, poor farmers	Drought-resistant seeds, solar irrigation

Official Use Only

Floods & Erosion	Soil degradation, infrastructure loss	Communities in Imbo Basin	Terracing, bamboo planting for flood control
Erratic Rainfall	Disrupted farming cycles	Subsistence farmers in Karusi	Mobile-based weather advisories, EWS

2. Methodology: A Mixed-Methods Research Approach

The research methodology employed a **mixed-methods approach**, combining **qualitative and quantitative techniques** to comprehensively assess the challenges and opportunities in **Burundi's agricultural sector** in the context of **climate resilience, gender equity, and technology adoption**. This approach allowed for a **holistic understanding of the socio-economic, institutional, and environmental factors** influencing agricultural productivity and sustainability. The methodology was **designed to be inclusive, participatory, and evidence-based**, ensuring that the perspectives of farmers, policymakers, and stakeholders were well-integrated into the findings.

2.1. Focus Group Discussions (FGDs)

Focus Group Discussions (FGDs) were a key qualitative research method employed to capture the lived experiences, perceptions, and challenges faced by farmers in Burundi's agricultural sector. The discussions aimed to provide in-depth, community-driven insights into climate resilience, gender equity, technology adoption, and financial inclusion, forming the foundation for data triangulation with policy analysis and stakeholder consultations.

2.1.1. Selection and Composition of Participants

A total of **320 farmers** were engaged across multiple rural and peri-urban farming communities. The selection process was purposive and inclusive, ensuring diverse representation. The participants included:

1. **Male and Female Farmers**
    - Ensured a gender-balanced approach to understanding the differential impacts of climate change and agriculture-related challenges.
    - Captured women's experiences in land tenure, decision-making, financial access, and resilience strategies.
2. **Indigenous Farming Communities**
    - Provided insights into traditional farming practices and indigenous knowledge systems for climate resilience.
    - Explored customary land ownership structures and their impact on access to agricultural resources.
3. **Smallholder and Subsistence Farmers**
    - Represented the majority of Burundi's agricultural workforce, offering firsthand experiences of climate variability, market access challenges, and financial constraints.

Official Use Only

- Focused on seasonal cropping patterns, yield variability, and adaptive farming techniques.

4. **Youth and Elderly Farmers**
   - Youth participation helped assess barriers to agribusiness innovation, digital tool adoption, and alternative livelihood opportunities.
   - Elderly farmers' insights captured historical climate trends and generational shifts in farming practices.
5. **Women's Cooperatives and Farmer Groups**
   - Explored gendered barriers in accessing extension services, finance, and technology.
   - Identified success stories of women's leadership in climate-resilient farming initiatives.

2.1.2. Structure and Process of FGDs

The FGDs were **semi-structured**, ensuring that discussions remained focused while allowing participants to **share their perspectives freely**. The process was **carefully designed** to enhance engagement and **capture diverse viewpoints**:

1. **Preliminary Engagement and Trust Building**
   - Prior to the discussions, community leaders, farmer cooperatives, and local institutions were consulted to explain the purpose of the FGDs and gain trust.
   - Participants were assured of confidentiality and voluntary participation, which encouraged open and honest discussions.
2. **Discussion Facilitation**
   - Each session was moderated by trained facilitators fluent in local languages to ensure clarity, inclusivity, and cultural sensitivity.
   - Visual aids such as charts, maps, and illustrations were used to simplify complex topics and stimulate discussions.
3. **Key Discussion Themes**

The FGDs explored a **wide range of critical issues**, categorized into thematic areas:

(i) Agricultural Practices and Climate Change Impacts

- How have changes in rainfall patterns, temperature, and extreme weather events affected productivity?
- What traditional adaptation techniques have been used to cope with climate variability?
- How have pests, soil degradation, and water scarcity influenced farming output?

(ii) Disaster Coping Mechanisms and Resilience Strategies

- What mechanisms do farmers use to mitigate risks associated with floods, droughts, and landslides?
- How do farmers access climate information, and how reliable is it?
- What are the most effective community-led adaptation strategies, and how scalable are they?

(iii) Barriers to Technology and Financial Inclusion

- What are the challenges in adopting new agricultural technologies (e.g., improved seeds, irrigation systems, digital advisory tools)?

Official Use Only

- How accessible are financial services, insurance schemes, and credit facilities to smallholder farmers?
- What role does gender play in financial decision-making and resource allocation in farming households?

(iv) Market Access and Value Chain Development

- What challenges do farmers face in selling their produce at fair market prices?
- What are the logistical, infrastructure, and transportation barriers affecting market linkages?
- How can cooperative models strengthen market access for smallholder farmers?

(v) Gender-Specific and Cultural Barriers

- What are the specific challenges faced by women in agriculture in terms of land ownership, decision-making, and financial independence?
- How do traditional norms and gender roles shape agricultural labor distribution?
- What opportunities exist for enhancing gender inclusivity in climate adaptation programs?

2.1.3. Data Collection and Analysis

The FGDs produced **rich qualitative data**, which was systematically processed to **identify patterns, insights, and recommendations**:

1. **Recording and Transcription**
   - Audio recordings were made (with participant consent), ensuring detailed capture of discussions.
   - Transcripts were translated from local languages into English for analysis.
2. **Thematic Analysis**
   - Discussions were coded into thematic categories, allowing researchers to identify key trends and recurring issues.
   - Comparative analysis was conducted across different demographic groups (e.g., men vs. women, youth vs. elderly) to highlight variations in perspectives.
3. **Gender-Disaggregated Insights**
   - Findings were analyzed separately for men and women to ensure gender equity in policy recommendations.
   - Specific barriers to women's empowerment in agriculture were highlighted, providing actionable insights for inclusive policy design.
4. **Validation through Triangulation**
   - Findings from the FGDs were cross-referenced with policy reviews and stakeholder consultations to ensure accuracy and reliability.
   - The alignment (or mismatch) between government policy and grassroots realities was identified.

Key Findings and Outcomes

The FGDs yielded valuable, actionable insights that shaped policy recommendations and intervention strategies:

1. **Climate Change and Agricultural Resilience**

Official Use Only

- Farmers reported increasing unpredictability in rainfall patterns, leading to low crop yields and income instability.
- There was a strong reliance on indigenous knowledge, but limited access to scientific climate information.
- Soil fertility loss and deforestation were key concerns, requiring community-led reforestation and conservation efforts.

2. **Barriers to Financial and Technological Inclusion**
   - Farmers lacked access to agricultural credit, particularly women farmers, due to land tenure restrictions and collateral requirements.
   - There was low awareness and adoption of digital agricultural tools and mobile-based advisory platforms.
3. **Market and Value Chain Challenges**
   - High post-harvest losses due to poor storage and transportation infrastructure limited profitability.
   - Limited bargaining power in value chains led to exploitative pricing from middlemen and brokers.
4. **Gender-Specific Barriers**
   - Women faced systemic barriers in land ownership, agricultural financing, and decision-making.
   - Cultural norms influenced household labor distribution, often overburdening women with unpaid work.

2.2. Literature Review

The **literature review and policy analysis** provided a robust foundation for understanding the challenges and opportunities in **Burundi's agricultural sector**. By examining **scientific research, case studies, and policy frameworks**, the study contextualized local findings within **global best practices**. The review focused on **Climate-Smart Agriculture (CSA), Parametric Insurance, Digital Tools for Agricultural Resilience, Gender Dynamics in Agriculture, and National Policy Frameworks** to identify gaps and opportunities for sustainable agricultural development.

2.2.1. Policy Landscape Review

The research included an extensive review of policy and strategic documents related to agriculture, climate adaptation, gender equity, financial inclusion, and technology adoption. These documents were analyzed to evaluate their alignment with national development goals, assess their effectiveness in addressing agricultural and climate challenges, and determine their capacity to support inclusive and sustainable growth in Burundi's agricultural sector. The following key strategic plans and national policies were reviewed:

Table 2: Overview of Strategic Plans and National Policies Reviewed in Burundi's Agricultural and Climate Adaptation Framework

Strategic Plan	Year	Priorities

Official Use Only

Third National Communication on Climate Change (TNCCC)	2019	- Strengthened **skills in weather forecasting and climate risk modeling**, along with improved agro-meteorological support. - Encouraged **community-led adaptation strategies** for agriculture and livestock to address climate change impacts. - Integrated **climate and environmental considerations** into agricultural enhancement strategies, including **risk assessments and emergency response measures**.
Nationally Determined Contributions (NDC) / National Strategy and Action Plan on Climate Change	2021	**Adapting and Managing Climate Risks** - Proactively managed **climate risks** through **probabilistic assessments and predictive analysis**. - Safeguarded **water-based and terrestrial ecosystems**. - Educated and empowered **communities to strengthen their resilience**. - Implemented **monitoring, evaluation, and knowledge-sharing systems** for tracking climate change impacts. - Advanced **climate-smart farming** by incorporating weather and climate data into agricultural decision-making. **Capacity-building and Knowledge Management** - Improved **mechanisms for managing and sharing data**. - Enhanced **climate change impact monitoring** through research and observations.
Burundi National Development Plan (NDP) 2018-2027	2018	- Boosted **Burundi's economy** by improving national productivity. - Strengthened economic growth by **creating employment opportunities** in various sectors, including agriculture.
National Agriculture Strategy 2018-2027	2018	- Promoted **sustainable and efficient use of natural resources**, particularly land and water. - Strengthened **resilience against climate change impacts**.

Official Use Only

		- Enhanced the **capacity of institutional and organizational frameworks** supporting agriculture.
Technology Needs Assessment (TNA) – Adaptation	2016	- Implemented **soil conservation systems** to combat land degradation and enhance agricultural productivity. - Established **community-based early warning mechanisms** to prepare for climate-related risks.
Community Disaster Risk Management in Burundi	2012	- Developed **early warning systems** to alert communities to **climate-induced risks and emerging threats**. - Conducted **risk assessments** on **livelihoods and infrastructure**, with a **gender-sensitive analysis**. - Initiated **policy measures based on climate forecasts** for proactive adaptation.
National Climate Change Strategy and Action Plan	2012	- Integrated **disaster risk reduction strategies** into sustainable development policies. - Strengthened **resilience to natural hazards** by improving institutional capabilities and infrastructure. - Ensured that **disaster risk reduction considerations** were embedded in **emergency response and recovery operations**.
National Strategy and Action Plan to Combat Soil Degradation (2011-2016)	2011	- Enhanced **soil fertility and ecological balance** in degraded areas. - Strengthened institutional and community capacity for **sustainable soil management**.
National Action Plan for Adaptation (NAPA)	2007	- Promoted **drought-resistant crops** and shorter growth cycle crops. - Educated **key stakeholders, including policymakers and communities**, on climate adaptation strategies. - Improved **weather forecasting accuracy** for seasonal predictions.

Objectives of the Policy Review

The review aimed to:

Official Use Only

- Evaluate the effectiveness of existing policies in addressing climate adaptation, financial inclusion, gender equity, and technological transformation in agriculture.
- Identify policy gaps and areas requiring enhancements, realignment, or better implementation to strengthen agricultural resilience and food security.
- Assess institutional capacity to implement and enforce policies effectively, ensuring coordination between different governmental and non-governmental entities.
- Benchmark Burundi's policies against regional and international best practices to determine areas where improvements or refinements were needed.

2.2.1.1. Data Collection and Analysis

- Content analysis was applied to extract themes, strengths, and weaknesses in policy frameworks.
- Policies were cross-referenced with empirical findings from focus group discussions (FGDs) and stakeholder consultations to validate their effectiveness in real-world applications.
- Comparative analysis was conducted by benchmarking Burundi's policies with regional policies (e.g., East African Community standards) and global commitments (e.g., UN Sustainable Development Goals, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction).

Outcome of the Policy Review

- Policy Misalignment and Implementation Gaps Identified:
  - Many policies acknowledged climate change risks, but implementation challenges persisted, particularly in funding allocation, capacity-building, and local governance structures.
  - Gender integration in policies was present but lacked robust implementation mechanisms, particularly in addressing women's access to land, finance, and agricultural inputs.
  - The technology needs assessment (TNA) revealed gaps in digital inclusion, climate information systems, and agro-tech solutions for smallholder farmers.
- Recommendations for Policy Enhancements:
  - Strengthen financial inclusion policies to scale up access to parametric insurance, microfinance, and climate risk financing for farmers.
  - Expand digital agriculture policies to accelerate the adoption of blockchain, AI-driven advisory services, and mobile-based agricultural platforms.
  - Enhance interministerial collaboration between the Ministry of Agriculture, Ministry of Environment, and meteorological agencies to improve agro-meteorological forecasting and early warning systems.
  - Ensure climate policies address community-based adaptation strategies, particularly in supporting indigenous and rural farming communities.
  - Improve monitoring and evaluation systems to track the real-time impact of climate adaptation strategies in agriculture.

Official Use Only

2.2.1.2. Overview of Burundi's Agricultural Policies

Burundi's agricultural policy framework is centered on several key initiatives aimed at enhancing agricultural productivity, sustainability, and climate resilience within the sector. The **National Agricultural Investment Plan (NAIP) 2019-2028**, outlines the government's strategic vision for modernizing agriculture, improving food security, and increasing farmers' income. The NAIP emphasizes productivity enhancement through the adoption of innovative agricultural technologies, sustainable resource management, and improving access to markets (Ministry of Agriculture and Livestock, 2018). The **National Climate Change Adaptation Strategy** targets climate resilience by identifying vulnerabilities and proposing strategic interventions to mitigate the impacts of climate change on agricultural systems (Government of Burundi, 2020). This strategy is particularly critical as Burundi faces climate-related challenges such as changing rainfall patterns and increased frequency of droughts and floods.

An assessment of these policies reveals that, while they promote general sustainability, there is a significant gap in addressing gender considerations. Gender analysis of Burundi's agricultural policies shows that they often overlook the specific needs and roles of women in agriculture, who are critical stakeholders in ensuring food security and sustainable agricultural practices (OECD, 2020). This oversight hampers the effectiveness of these policies, as women face unique challenges in accessing resources, markets, and decision-making processes (World Bank, 2020).

Despite these frameworks, assessments suggest that Burundi's agricultural policies often fail to adequately integrate gender considerations. The majority of these policies tend to follow a "one-size-fits-all" approach, largely neglecting the specific needs and roles of women in agriculture (Mastrorillo et al., 2016). Women make up a significant proportion of the agricultural workforce in Burundi, yet their distinct contributions, challenges, and knowledge are frequently overlooked in policy formulation and implementation (World Bank, 2018). A report by the International Fund for Agricultural Development (IFAD) highlights that gender disparities in access to resources—such as land, inputs, and financial services—remain significant hurdles for women farmers in Burundi (IFAD, 2019). These disparities not only undermine women's potential to contribute to food security but also limit overall agricultural productivity.

2.2.1.3. Opportunities for Gender-Responsive Agricultural Policies

In enhancing Burundi's agricultural policies, there is a critical opportunity to explicitly incorporate gender-responsive strategies to recognize the pivotal role of women in agricultural production and food security (Ndabashinze, 2024). By designing interventions that empower women and address barriers they face in accessing resources like land and finance, policymakers can not only enhance women's capacity to adopt sustainable agricultural practices but also improve agricultural resilience and sustainability overall (Nchanji, 2023). Tailoring training and resources to meet women's specific needs can facilitate the adoption of climate-friendly technologies, contributing to improved agricultural resilience in the face of climate change (Paudyal et al., 2019; Doss, 2020).

Official Use Only

Engaging women in decision-making processes related to agricultural policies is crucial to ensure their voices are heard and their contributions recognized (Crookston et al., 2021). This participatory approach fosters a sense of ownership and accountability, ultimately enhancing the effectiveness of agricultural programs (Crookston et al., 2021). Gender-responsive approaches in research, extension services, and policy formulation can help identify and address the unique barriers and opportunities that men and women farmers face in adopting agricultural innovations (Nchanji, 2023).

Studies have shown that agricultural development interventions present significant opportunities for expanding women's autonomy and empowerment (Bhandari, 2023). Women's involvement in agriculture, especially in self-help groups, can provide them with access to credit and training, leading to increased agricultural productivity and income (Jisso et al., 2022). Strengthening the multi-dimensional empowerment of women in agriculture, emphasizing their input into production decisions and agricultural diversification, is crucial for improving the nutritional status of underprivileged populations in resource-limited settings (Baloi, 2023).

Promoting women's empowerment in agriculture is vital, as efforts to ensure food security have identified women farmers as key players in many contexts and setups (Diiro et al., 2018). Evidence suggests that women's empowerment not only reduces the gender gap in agricultural productivity but also improves productivity specifically from farms managed by women (Uwineza et al., 2021). Women's empowerment in agriculture reflects their ability to access, control, and utilize productive resources, which is essential for household farm commercialization and economic development (Nchanji et al., 2023).

Incorporating gender-responsive strategies in agricultural policies can lead to more effective resource allocation, improved agricultural outputs, and enhanced community resilience (Sraboni et al., 2013). Recognizing and addressing the specific needs and challenges faced by women in agriculture is crucial for promoting inclusive and sustainable agricultural development in Burundi. By empowering women in agriculture, policymakers can contribute to enhancing food security, reducing poverty, and promoting gender equality in the agricultural sector. This participatory approach fosters a sense of ownership and accountability, which can enhance the effectiveness of agricultural programs (UN Women, 2020).

2.2.2. Climate-Smart Agriculture (CSA)

Climate-Smart Agriculture (CSA) has been widely recognized as a holistic approach to improving agricultural productivity while ensuring resilience to climate change. The literature review examined global CSA practices, focusing on their applicability to smallholder farmers in Burundi. Studies highlighted that conservation agriculture, agroforestry, and drought-resistant crop varieties have been successful in reducing climate vulnerability. However, evidence from other African nations revealed that the adoption of CSA practices remained low due to financial constraints, knowledge gaps, and policy misalignment. The literature also emphasized the importance of farmer training programs, accessible financing mechanisms, and stronger institutional support for CSA implementation. These findings provided key insights into scalable adaptation strategies that could be integrated into Burundi's agricultural policies.

Official Use Only

2.2.3. Parametric Insurance and Financial Inclusion

Parametric insurance has emerged as an innovative financial tool for mitigating agricultural risks associated with climate shocks. Unlike traditional insurance, which requires on-site damage assessments, parametric insurance provides automatic payouts based on predefined weather indices such as rainfall levels, temperature variations, and drought severity. The literature review examined successful case studies in Kenya, Rwanda, and India, where parametric insurance significantly improved farmers' financial resilience. However, the review also identified barriers to adoption, including low awareness, distrust in insurance mechanisms, and the high cost of premiums. Evidence suggested that for parametric insurance to be effective, financial literacy programs and government-backed subsidies would be necessary to increase farmer participation. These insights informed recommendations for integrating financial inclusion strategies into Burundi's agricultural policies.

2.2.3.1. Concept and Mechanisms

Parametric insurance represents an innovative approach to agricultural risk management, particularly in the face of climate change. It is an innovative financial tool designed to mitigate the risks associated with climate-related shocks in agriculture (Hellmuth et al., 2009). Unlike traditional indemnity-based insurance, which requires on-site damage assessments, parametric insurance uses predefined parameters or indexes to trigger payouts based on predefined weather parameters, such as rainfall or temperature thresholds (Skees, 2008). These parameters typically include weather-related events such as rainfall levels, temperature extremes, or wind speeds (Carter et al., 2014). This approach enables farmers to receive timely financial relief, thereby reducing their vulnerabilities to climate shocks (Barnett et al., 2010). The mechanism of parametric insurance typically involves the following steps:

i). **Setting Parameters** - Insurance providers establish specific weather thresholds based on historical data and risk assessments. For example, a policy may stipulate that if rainfall falls below a certain level during a critical growing period, a payout will be triggered.

ii). **Monitoring Weather Event -** Reliable weather data is collected through meteorological stations or satellite technology to monitor the conditions relevant to the policy parameters.

iii). **Payout Trigger** - Once the predefined threshold is met, the insurance payout is automatically disbursed to the insured parties, often within days, allowing farmers to quickly address their financial needs (Carter et al., 2018).

The parametric insurance model operates on a straightforward principle: if the chosen parameter exceeds or falls below a predetermined threshold (once a predefined weather event occurs), a payout is automatically triggered, eliminating the need for lengthy claims processes (Linnerooth-Bayer et al., 2011). This approach offers several advantages including rapid claim settlement, reduced administrative costs, and increased transparency (Swiss Re, 2019). This rapid response mechanism allows farmers to recover quickly from climate-related losses, minimizing the impacts on their livelihoods (Hess et al., 2016). For smallholder farmers, particularly women who often face greater financial constraints, this quick access to funds can be crucial in maintaining agricultural productivity following a climate shock.

Official Use Only

2.2.3.2. Case Studies

Globally, several successful parametric insurance schemes have demonstrated their potential to empower women in agriculture and enhance gender equity. One notable example is the **Index-Based Livestock Insurance (IBLI)** program in Kenya and Ethiopia. This initiative provides livestock herders with insurance payouts based on satellite data that measures vegetation cover, which correlates with livestock health (McIntosh et al., 2019). The effectiveness of parametric insurance in enhancing climate resilience, particularly for women farmers, has been demonstrated through various successful schemes globally. In India, the **Weather Based Crop Insurance Scheme (WBCIS)**, launched in 2007, provides coverage for weather-related crop losses based on parameters like rainfall, temperature, and humidity (Gaurav et al., 2018). Studies have shown that WBCIS has contributed to increased adoption of climate-smart agricultural practices and improved financial security for participating farmers (Mahul & Wright, 2013).

Similarly, in Malawi, the **R4 Rural Resilience Initiative** utilizes a combination of risk reduction strategies, including microinsurance, to strengthen the resilience of vulnerable households to climate shocks (WFP, 2019). The program, piloted in 2011, has demonstrated significant impacts on food security and income diversification for participating households, with women reporting increased agency in household decision-making regarding finances and resource allocation (IFAD, 2018). Women, who often play a crucial role in livestock management, have benefited significantly from this program. By receiving timely payouts during droughts, women have been able to invest in feed and veterinary care, thereby improving their livestock's survival rates and enhancing their economic resilience. Furthermore, the program has incorporated gender-sensitive training, ensuring that women are informed about the insurance product and its benefits (Cohen et al., 2020). Another successful example is the **Weather Index Insurance** program in Malawi, which has provided smallholder farmers with insurance against droughts and excessive rainfall. This program has particularly focused on women farmers, offering training on financial literacy and insurance products. As a result, women have reported increased confidence in managing their agricultural risks and improved access to financial resources (Ghosh et al., 2020).

In Uganda, the Agriculture and Climate Risk Enterprise (ACRE) program has developed gender-sensitive index insurance products. By collaborating with women's savings groups and providing financial literacy training, ACRE has increased women's participation in agricultural insurance schemes (IFAD, 2020). This approach not only protects women farmers against climate risks but also enhances their financial inclusion and decision-making power within households. Several countries have successfully implemented parametric insurance schemes that benefit women in agriculture. In India, the Weather Based Crop Insurance Scheme (WBCIS) has shown promising results in protecting farmers against weather-related risks. A study by Gaurav et al. (2021) found that women farmers participating in the WBCIS were more likely to invest in higher-yield crop varieties and fertilizers, indicating increased risk-taking behavior and potential for higher returns.

Official Use Only

2.2.3.3. Application in Burundi

In Burundi, the adaptation of parametric insurance to local agricultural contexts presents a significant opportunity to mitigate climate-related risks. The country is highly vulnerable to climate variability, with agriculture being the primary source of livelihood for the majority of its population. Implementing a gender-responsive parametric insurance scheme could help address the specific challenges faced by women farmers in Burundi, who often lack access to traditional insurance products and face systemic barriers in financial decision-making (Mastrorillo et al., 2016). To design effective parametric insurance products for women farmers in Burundi, several key considerations must be taken into account.

Firstly, community engagement is essential. Involving women farmers in the product development process through focus group discussions and participatory workshops can help understand their specific needs, preferences, and the type of weather risks they face (Kumar et al., 2019). Secondly, the parameters of insurance products should be customized to align with local agricultural practices and climatic conditions. For example, identifying critical growth periods for staple crops like beans and maize can help establish appropriate weather thresholds for payouts.

Education and training are also vital components. Providing education on how parametric insurance works and its benefits can empower women farmers to make informed decisions. Training programs should emphasize financial literacy, risk management, and the use of technology for monitoring weather conditions (Wright et al., 2020). Lastly, fostering collaborative partnerships with local NGOs, agricultural cooperatives, and government agencies can enhance outreach efforts and ensure that parametric insurance products reach the most vulnerable populations, including women farmers (World Bank, 2022).

Adapting parametric insurance to Burundi's agricultural context presents both challenges and opportunities. According to a study by the International Research Institute for Climate and Society (IRI, 2021), a key requirement for successful implementation is the establishment of a robust weather data infrastructure. Burundi would need to invest in weather stations and satellite technology to ensure accurate and timely data collection, which is essential for the effectiveness of index-based insurance. Furthermore, the design of insurance products must be customized to align with Burundi's specific agricultural calendar, crop types, and climate risks. For example, policies could be structured around the onset of the rainy season, a critical period for planting decisions. A gender-responsive approach is also crucial, given the significant role that women play in Burundi's agriculture sector. Involving women farmers in the design and implementation of parametric insurance schemes is essential, and this could be facilitated by conducting gender-disaggregated surveys to better understand their specific risks and insurance needs (AgriLinks, 2020).

In addition to product customization, bundling parametric insurance with other financial services, such as savings accounts or microloans, could enhance its appeal and effectiveness, particularly for women farmers. Research by Carter et al. (2022) suggests that such bundled approaches can lead to higher adoption rates and improved resilience outcomes. Moreover, raising awareness and providing education through comprehensive financial literacy programs,

Official Use Only

with a focus on women, would be critical to ensure understanding and uptake of parametric insurance products. Lastly, developing a supportive regulatory framework is essential for the success of index-based insurance in Burundi. Drawing on experiences from other East African countries could be beneficial in this regard (FSDA, 2019). By adopting these strategies and learning from global best practices, Burundi could develop a gender-responsive parametric insurance system that effectively mitigates climate-related risks for its agricultural sector, particularly benefiting women farmers.

2.2.4. Digital Tools for Agricultural Resilience

The role of digital technologies in transforming agriculture was extensively reviewed, with a focus on mobile-based advisory services, blockchain traceability, and remote sensing for precision farming. The study analyzed successful mobile agriculture platforms, such as Kenya's M-Farm and Uganda's EzyAgric, which provide real-time weather forecasts, market prices, and agronomic advice to smallholder farmers. Additionally, blockchain-based agricultural traceability systems in Ethiopia and Ghana were examined, demonstrating how digital tools can enhance transparency, improve market access, and facilitate financing for farmers. However, a recurring challenge in the literature was the digital divide, as limited internet access, low smartphone penetration, and digital illiteracy remain significant barriers in rural areas. These findings underscored the need for digital literacy initiatives, investment in rural connectivity, and inclusive technology policies to enhance agricultural resilience in Burundi.

2.2.4.1. Global South and Regional Practices

Many initiatives worldwide have shown the effectiveness of integrating gender perspectives into climate adaptation strategies. Several successful initiatives worldwide highlight the effectiveness of gender-sensitive policy frameworks in empowering women and improving community resilience to climate risks (Etongo, 2022). These initiatives underscore the importance of gender-sensitive policy frameworks in achieving sustainable climate resilience and enhancing agricultural productivity. For instance, the **Adaptation Learning Program (ALP) for Africa** by CARE International, implemented in countries such as Kenya, Ghana, and Niger. This program adopts a community-based approach, empowering women through training in climate-resilient agricultural practices and improving access to vital resources like water and seeds. The ALP has led to significant improvements in agricultural yields and household food security by incorporating gender-sensitive measures (CARE International, 2015). Similarly, the Adaptation Consortium in Kenya has implemented county-level adaptation projects that prioritize women's participation in decision-making processes and resource allocation (Adaptation Consortium, 2018), leading to enhanced agricultural practices and community resilience to climate risks (Lam, 2024). This approach has led to improved agricultural practices and enhanced community resilience to climate risks.

In Rwanda, the Gender Climate Change Agriculture Support Programme has successfully integrated gender considerations into climate-smart agriculture initiatives, resulting in increased crop yields and improved household food security (Pratiwi et al., 2017). The program focuses on providing women with access to agricultural inputs, training on climate-resilient farming techniques, and opportunities for leadership in community-based adaptation projects

Official Use Only

(UNDP, 2019). These interventions have resulted in increased crop yields and improved household food security. The **Farm Africa's Climate-Smart Agriculture Project** in Ethiopia highlights the benefits of gender mainstreaming. This initiative engages women in participatory decision-making processes and provides them with training and resources to adopt climate-smart agricultural practices. As a result, women have reported increased crop productivity and resilience to climate variability (Farm Africa, 2017).

These successes demonstrate that gender-sensitive policy frameworks are crucial for effective climate adaptation. They not only empower women by providing them with needed resources and training but also enhance overall community resilience by incorporating diverse perspectives into adaptation strategies (Paudyal et al., 2019). At a global level, the Green Climate Fund (GCF) has made significant strides in promoting gender-responsive climate finance. The GCF's gender policy mandates that all funded projects must include gender assessments and action plans, ensuring that women's needs and perspectives are integrated into climate adaptation initiatives (Green Climate Fund, 2019). Gender mainstreaming in climate adaptation policies is essential to ensure that the distinctive roles, preferences, and challenges of men and women are equally considered (Andrijevic et al., 2020). By incorporating gender considerations into policy development, countries can enhance the effectiveness of climate adaptation strategies and promote inclusive and sustainable development (Badolo, 2024). These initiatives demonstrate that gender-sensitive approaches not only empower women but also contribute to building more resilient and adaptive communities in the face of climate change (Badolo, 2024).

3. Findings

3.1. Agricultural Challenges in Burundi

3.1.1. Current Climate Risks

The climate-related agricultural risks faced by Burundi pose significant challenges to the country's food security and economic stability. Burundi is particularly vulnerable to increasing temperatures, more frequent extreme weather events, droughts, erratic rainfall patterns, and increased soil erosion, all of which have been exacerbated by climate change (Kim et al., 2021; Mperejekumana, 2023). Droughts, in particular, can result in severe water shortages, impacting crop yields and livestock health negatively. The heavy reliance on rainfed agriculture in Burundi makes the country highly susceptible to climate variability (Ndayiragije et al., 2017, Ndayisaba et al., 2013), emphasizing the urgent need for effective adaptation strategies (Nkunzimana et al., 2020; Gatore, 2023). Erratic rainfall patterns disrupt planting and harvesting cycles, making it difficult for farmers to predict optimal sowing and harvesting times (Nchanji et al., 2023). The changing climate is expected to impact Burundi's main crops differently, with coffee, a crucial export crop, being particularly vulnerable to rising temperatures, potentially reducing suitable growing areas and yield quality. Additionally, soil erosion, driven by deforestation and poor land management practices, reduces soil fertility and agricultural productivity, compounding the challenges faced by farmers (Nkurunziza et al., 2011). These climate-related risks collectively threaten food security, especially for marginalized groups heavily reliant on agriculture for their livelihoods.

Official Use Only

The combination of these factors poses a significant threat to food security in Burundi, especially for marginalized groups heavily reliant on agriculture for their livelihoods. The depletion of arable land, minimal use of improved seeds, limited access to financial markets for farmers, and the erosion-induced decline in soil fertility collectively contribute to low food production in the country (Ndagijimana et al., 2018). Agriculture is a crucial pillar of Burundi's economy, with the primary economic sector being rainfed agriculture, employing around 90% of the population (Patriche, 2019). However, the sustainability and productivity of this sector are increasingly at risk due to the compounding effects of climate change and poor land management practices.

The urgency of addressing climate-related agricultural risks in Burundi is underscored by the need for proactive measures to ensure long-term resilience and sustainability in the face of changing climatic conditions (Gatore, 2023). By understanding the specific challenges posed by climate change, implementing climate-smart agricultural practices, and enhancing climate services in agriculture, Burundi can strengthen its agricultural sector, improve food security, and build resilience to climate-related shocks. Collaborative efforts involving policymakers, researchers, farmers, and local communities are essential to develop and implement effective adaptation strategies that safeguard agricultural livelihoods and ensure sustainable food production in the country.

In light of these challenges, it is imperative for Burundi to adopt integrated approaches to address soil erosion, enhance agricultural practices, and promote sustainable land management. Implementing agroecological innovations, such as those observed in the foothills of Mumirwa, could offer valuable insights into improving agricultural production while safeguarding the environment (Erdogan & Arı, 2022). Furthermore, understanding how gender norms influence access to and utilization of climate-smart agricultural technologies is crucial for promoting inclusive and effective agricultural practices in Burundi (Hassaan et al., 2017). By prioritizing soil conservation efforts, particularly in mountainous regions prone to erosion, the country can mitigate runoff, soil erosion, and subsequent declines in agricultural productivity (Pender et al., 2004).

Efforts to enhance farmers' investments in sustainable land management, as evidenced in case studies from provinces like Gitega and Muyinga, are essential for promoting long-term agricultural resilience and productivity in Burundi (Panagos et al., 2018). Addressing the gender disparities in the adoption of climate-smart agricultural practices and promoting inclusive access to such technologies can contribute to more sustainable and equitable agricultural development in the country (Кучер et al., 2021). Additionally, leveraging participatory GIS approaches to identify critical land degradation areas and prioritize soil conservation measures can help mitigate soil erosion and enhance agricultural sustainability, particularly in regions facing heightened environmental risks.

3.1.2. Climate Risks and Crop Losses

Burundi's agricultural sector is predominantly rainfed, which renders it particularly vulnerable to climate variability. This dependency on rainfall, coupled with environmental degradation and extreme weather events, poses significant threats to food security and economic stability.

Official Use Only

The implications of climate change are profound, as they disrupt agricultural productivity and exacerbate existing socio-economic vulnerabilities, particularly among smallholder farmers who constitute the majority of the agricultural workforce in the country (Kim et al., 2021; Mperejekumana et al., 2023). Its agricultural sector is increasingly threatened by climatic changes, which manifest as unpredictable rainfall patterns, prolonged droughts, and intensified flooding events (Kim et al., 2021). According to the Intergovernmental Panel on Climate Change (IPCC), the East African region is experiencing significant shifts in climate variability, leading to adverse impacts on food security and agricultural productivity (IPCC, 2018). Specifically, Burundi has witnessed a decline in annual rainfall coupled with increased evaporation rates, which strains water resources critical for crop production (Nielsen & Reenberg, 2010).

The World Bank (2021) reports that the effects of climate change in Burundi are exacerbating existing vulnerabilities within the agricultural workforce, particularly among smallholder farmers who lack adaptive capacity. These farmers often rely on rainfed agriculture and possess limited resources, making them highly susceptible to weather shocks. A study by Morsello et al. (2017) highlights that the country's agricultural production levels could decrease significantly due to climate-related factors, leading to increased food insecurity and malnutrition rates. The impact of climate change on agricultural resilience is particularly pronounced in rural communities where food security is heavily reliant on predictable seasonal patterns. Prolonged periods of weather extremes lead to crop failures, impacting food availability and undermining the nutritional status of households (Kim et al., 2021). Research on the hydroclimatic response in Burundi highlights the importance of assessing changes in hydroclimate and climate extremes under various climate change scenarios to mitigate the catastrophic consequences of climate change (López et al., 2021). Projections from CORDEX models indicate that unabated climate change will lead to faster and more severe warming in Burundi compared to the global average, influencing precipitation patterns across the country (Gatore, 2023).

Despite facing recurrent droughts that have resulted in famines and population displacement, some farmers in Burundi have demonstrated resilience to the impacts of climate change (Minani et al., 2013). However, female farmers in Burundi are more susceptible to climate shocks due to existing conditions and gender norms that hinder their agricultural productivity (Nchanji et al., 2023). Agricultural productivity in Burundi encounters challenges such as land degradation, economic factors, limited access to agricultural infrastructure, and inefficient water resource management, all contributing to increased food insecurity in the nation (Mperejekumana, 2023).

3.1.2.1. Erratic Rainfall and Unpredictable Seasons

The agricultural system in Burundi is predominantly rainfed, making it highly vulnerable to climate variability (Nchanji et al., 2023). Reports indicate that climate change is increasingly manifesting as erratic rainfall patterns, which lead to severe droughts and flooding, impacting crop yields and threatening food security (López et al., 2021; IPCC, 2018). Studies have demonstrated that as climate risks intensify, the vulnerability of food systems will increase, potentially worsening the existing cycle of poverty and food insecurity among rural

Official Use Only

communities (Asare-Nuamah et al., 2019; Ndayiragije et al., 2022; FAO, 2021). Smallholder farmers, particularly in Africa, have been identified as having low adaptive capacity to climate change, making them more susceptible to its impacts (Workalemahu & Dawid, 2021).

The erratic rainfall and unpredictable seasons that have disrupted traditional farming cycles. Farmers in regions such as Kirundo and Rutana have reported prolonged dry spells, while areas like Ruyigi have experienced failed rains, leading to severe reductions in crop yields. The inability to accurately predict rainfall patterns has left farmers vulnerable, as many still rely on traditional knowledge rather than real-time climate data. This reliance on outdated methods limits their capacity to adapt to changing climatic conditions, ultimately jeopardizing their livelihoods and food security (Mperejekumana et al., 2023; Nchanji et al., 2023). Studies have shown that the impacts of climate variability are particularly acute in regions where agricultural practices are heavily dependent on rain, highlighting the need for improved forecasting and adaptive strategies (Dharanipriya et al., 2022; Gebrechorkos et al., 2019).

3.1.2.2. Soil Degradation and Land Erosion

One of the major constraints faced by Burundi's agriculture is the shortage of arable land, minimal use of improved seeds, very limited financial access, depletion of soil fertility ((Ndagijimana et al, 2018), lack of adequate infrastructure, limited market access, and a scarcity of agricultural technologies (Berg, 2020; Betge, n.d.). Smallholder farmers often rely on traditional farming methods (Nibaruta et al., 2021) and inputs, which impede their ability to adapt to changing climatic conditions and improve productivity (Mupfasoni, n.d.; Doss, 2018). Smallholder farmers in Burundi face challenges such as low agricultural productivity, vulnerability to climate change, and limited access to resources (Nchanji et al., 2023; Schüller, 2023). Moreover, land tenure insecurity exacerbates the situation, as many smallholder farmers lack formal ownership rights, hindering their capacity to invest in land improvements and adopt sustainable practices (Nchanji et al., 2023; Kabeer, 2016). Efforts to address these challenges have been made, including the gradual integration of mechanization techniques and agricultural land expansion in Burundi's agricultural sector (Mperejekumana, 2023). Sustainable agriculture practices are increasingly recognized as essential for enhancing productivity and resilience in smallholder farming systems while conserving natural resources (Batungwanayo et al., 2023).

Soil degradation and land erosion further complicate the agricultural landscape in Burundi. Deforestation and poor land management practices have led to widespread soil erosion, diminishing land fertility and threatening long-term agricultural productivity. In provinces such as Rutana and Bururi, landslides have destroyed significant portions of farmland, exacerbating food insecurity. Without intervention, soil degradation will continue to undermine efforts to increase agricultural output and resilience. The loss of arable land not only affects current agricultural practices but also poses a long-term threat to food security as the population continues to grow (Mperejekumana et al., 2023; Gatore et al., 2023).

3.1.2.3. Extreme Weather Events

Extreme weather events, including floods and hailstorms, have become increasingly frequent, causing significant damage to critical infrastructure, displacing communities, and reducing

Official Use Only

arable land. The floods in Cibitoke in 2024 serve as a stark example, where entire farming communities were uprooted, leading to substantial economic losses and food shortages. Such events highlight the urgent need for climate-resilient infrastructure and adaptive measures to mitigate the impacts of extreme weather on agricultural productivity (Kim et al., 2021; Mperejekumana et al., 2023; Rivas-López et al., 2022). The increasing frequency of these events underscores the necessity for comprehensive disaster risk management strategies that can help communities prepare for and respond to climate-related shocks (Kim et al., 2021; Nchanji et al., 2023).

These climate challenges disproportionately affect smallholder farmers, who often lack the financial and technical capacity to adopt adaptive measures. Many smallholders are unable to invest in climate-resilient technologies or access IT tools that could enhance their understanding of climate patterns and improve their agricultural practices. Without proper training and resources, these farmers remain vulnerable to climate-related shocks, which can lead to devastating impacts on their livelihoods and food security (Kim et al., 2021; Mperejekumana et al., 2023; Nchanji et al., 2023). The integration of climate-smart agricultural practices, supported by targeted training and access to technology, is essential for enhancing the resilience of these vulnerable populations (Kim et al., 2021; Nchanji et al., 2023).

3.2. Technology Gaps and Barriers

3.2.1. Technology Gaps in Agriculture

Agricultural technology adoption in Burundi is hindered by multiple factors, including high costs, lack of awareness, and limited availability. Farmers struggle to access essential tools such as drought-resistant seeds, efficient irrigation systems, and soil conservation technologies like terracing, contour farming, and anti-erosion hedges.

3.2.2. Pest Management Challenges

Burundi's farmers face persistent pest outbreaks, exacerbated by climate change and inadequate pest control measures. Integrated Pest Management (IPM) solutions, which combine biological, cultural, and chemical control methods, remain largely underutilized due to a lack of access to affordable pest control inputs and training. The absence of widespread IPM adoption further increases crop vulnerability, leading to additional financial strain on smallholder farmers. Moreover, the reliance on traditional pest control methods, such as manual removal and ineffective chemical treatments, often results in lower effectiveness and higher costs.

3.2.3. Agricultural Insurance and Financial Protection

Agricultural insurance remains an underdeveloped sector in Burundi. Many farmers lack awareness of how agricultural insurance works and its potential benefits in mitigating financial risks associated with climate-induced crop losses. Despite a growing interest in risk mitigation strategies, the adoption of agricultural insurance remains low. Expanding access to affordable insurance products and increasing awareness among farmers can play a critical role in stabilizing rural livelihoods and ensuring long-term sustainability in agriculture. Government

Official Use Only

incentives and collaborations with financial institutions could further encourage the uptake of agricultural insurance.

3.3. IT Infrastructure Readiness

3.3.1. Digital Platforms for Agriculture

The adoption of digital solutions for agriculture remains limited in Burundi, despite their potential to enhance productivity and resilience. Mobile-based platforms providing weather forecasts, market prices, and agricultural advice exist but are severely underutilized due to low smartphone penetration and digital literacy.

Currently, only 30% of rural farmers own smartphones, and internet penetration in rural areas remains below 10%. This digital divide significantly limits farmers' ability to access real-time information that could enhance their decision-making and climate adaptation strategies. Additionally, the cost of mobile data and network coverage gaps in remote areas further restrict access to digital agricultural solutions.

3.3.2. Early Warning Systems (EWS) and Meteorological Infrastructure

Burundi's early warning systems (EWS) are inadequate, making it difficult to predict and respond effectively to extreme weather events. Outdated and poorly maintained weather stations in three out of six provinces further hinder meteorological data collection. Without reliable weather forecasting and EWS infrastructure, farmers are left vulnerable to sudden climate shocks, increasing the risk of crop failure and food insecurity. Strengthening EWS infrastructure and incorporating community-based alert systems could significantly improve disaster preparedness and mitigation.

3.3.3. Digital Financial Services

Although mobile banking services are available in Burundi, their adoption remains low, particularly among women farmers. While 35% of men utilize mobile banking, only 15% of women have access to these services. This disparity underscores the need for targeted efforts to enhance women's financial inclusion through mobile banking and digital financial literacy programs. Strengthening mobile financial services and promoting financial literacy among rural farmers can improve their ability to save, invest, and access credit for agricultural expansion.

3.3.3.1. Overview of Smart Finance

Smart finance refers to the use of innovative financial solutions to enhance productivity and resilience in agriculture (Skees, 2008). This includes mobile banking, microfinance, and insurance products tailored to the needs of farmers. In the context of climate change, smart finance can play a critical role in helping farmers adapt to climate-related shocks and stresses (Hellmuth et al., 2007). These technologies offer unprecedented opportunities for financial inclusion, enabling smallholder farmers to access capital, manage risks, and invest in productivity-enhancing technologies. Mobile banking, for instance, simplifies the process of financial transactions, making it easier for farmers to save money, access credit, and pay for inputs like seeds and fertilizers (Demirgüç-Kunt et al., 2015). Similarly, microfinance

Official Use Only

institutions provide loans to farmers who might be excluded from traditional banking systems, while agro-insurance products protect farmers against crop failures due to adverse weather conditions (Hazell & Hess, 2010).

3.3.3.2. Gender-Responsive Finance

For financial instruments to be truly effective, they must be designed with gender considerations in mind (Johnson, 2016). This involves ensuring that women have access to credit, savings mechanisms, and insurance products that address their specific needs, thus fostering greater financial empowerment and resilience (Quisumbing et al., 2015). Women in agriculture often face systemic barriers that limit their access to financial resources, including legal restrictions, lower levels of financial literacy, and social norms that prioritize men's financial needs. A gender-responsive approach to smart finance involves creating financial products that address these specific challenges. For instance, designing credit products with more flexible repayment schedules can help women who often have irregular income flows. Additionally, savings mechanisms and insurance products that consider the different economic roles and responsibilities of women can foster greater financial empowerment and resilience (Kristjanson et al., 2017). Studies have shown that when women have greater control over financial resources, they are more likely to invest in their families' health, nutrition, and education, thereby enhancing the overall well-being of the household (Grown et al., 2016).

3.3.3.3. Implementation Challenges

Several barriers hinder the integration of smart finance into Burundi's agricultural sector. First, cultural biases often restrict women's access to financial services. In many communities, social norms dictate that men should control financial transactions, leaving women with limited access to these critical resources. Second, inadequate financial literacy among women remains a significant barrier. Many women lack the knowledge and skills needed to navigate financial systems, manage credit, and leverage financial products effectively institutions (Kyazze et al., 2018). Third, limited access to financial institutions, particularly in rural areas, further exacerbates the issue. Financial service providers are often concentrated in urban areas, making it difficult for rural populations to access these services (Mahajan & Ramola, 2017). Addressing these challenges requires innovative solutions, such as community-based financial education programs and partnerships with local organizations (Mbabazi et al., 2019).

3.3.3.4. Innovative Solutions and Strategies

Studies have shown that smart finance can have a positive impact on farmers' resilience to climate change. For example, a study in Kenya found that farmers who used mobile banking services were better able to adapt to droughts and floods (Ouma et al., 2017). Similarly, a study in Rwanda found that microinsurance products helped farmers recover from crop losses due to climate-related events (Kassie et al., 2019).

Addressing these challenges requires innovative solutions and strategic interventions. Community-based financial education programs, these programs can help women and other marginalized groups develop the financial literacy needed to access and use smart finance products (Mbabazi et al., 2019), by equipping them with the knowledge and skills needed to utilize financial services effectively. Partners such as local NGOs and women's associations

Official Use Only

can play a crucial role in these educational initiatives, tailoring programs to the unique needs and contexts of the communities they serve (Allen et al., 2016).

Moreover, leveraging mobile technology can bridge the gap between financial institutions and rural farmers. Mobile banking platforms can extend the reach of financial services, allowing women to conduct transactions, access credit, and purchase insurance products from their mobile phones (Aker & Mbiti, 2010). These platforms also offer the advantage of transparency and security, reducing the risk of financial exploitation and fraud. Creating insurance products specifically designed to protect against climate-related risks, such as drought and floods, can enhance farmers' resilience (Hellmuth et al., 2007) and financial products and services should be designed and delivered in a way that considers the specific needs and constraints of women farmers, ensuring accessibility and affordability (Johnson, 2016).

Creating partnerships between financial institutions and local organizations can also enhance the accessibility and relevance of financial products. Through initiatives such as group lending schemes, where loans are provided to groups rather than individuals, the perceived risk is lowered, making financial services more attractive to providers and more accessible to women.

3.4. Skills and Capacity-Building Gaps

3.4.1. Climate-Smart Agriculture (CSA) Training

Burundi's smallholder farmers lack the technical skills needed to implement climate-smart agriculture (CSA) practices effectively. Approximately 80% of farmers have not received formal training in CSA techniques such as agroforestry, terracing, rainwater harvesting, and efficient water management. These practices are essential for building climate resilience and improving soil fertility, yet their adoption remains low due to knowledge gaps and limited extension services. Expanding farmer training programs that focus on CSA techniques could enhance productivity while mitigating the impacts of climate change (Carlos & Ronald, 2020).

3.4.2. Financial Literacy Deficiencies

Financial literacy remains a major barrier to economic empowerment, particularly for women farmers. Many smallholder farmers lack a clear understanding of financial products such as loans, insurance, and savings mechanisms. Without this knowledge, they are unable to access credit or participate in financial markets, limiting their ability to invest in agricultural inputs and expand their farming enterprises. Tailored financial education programs that address the specific needs of rural farmers could help improve financial inclusion and economic stability (Nwachukwu, 2017).

3.4.3. Digital Literacy Challenges

Digital literacy is another critical area requiring attention, especially among women farmers. Approximately 65% of women in rural areas are unable to access weather apps, online markets, or digital financial services due to low levels of digital literacy. This gap prevents them from leveraging digital platforms that could enhance their agricultural productivity and market access. Providing digital skills training and promoting community-based digital literacy

Official Use Only

programs could help close this divide and increase women's participation in the digital economy (Shaikh & Karjaluoto, 2015).

3.4.4. Leadership and Decision-Making Barriers

Women farmers also face cultural and institutional barriers that prevent them from participating in leadership and decision-making processes at the household and community levels. Traditional gender norms discourage women from taking on leadership roles in agricultural cooperatives and governance structures. Addressing these barriers through leadership development programs and gender-sensitive policy reforms could help increase women's representation in decision-making processes and improve their economic empowerment (Zuo, 2023).

3.5. Gender Dynamics in Agriculture and Climate Adaptation

The literature review highlighted the gendered impacts of climate change on agriculture, emphasizing that women farmers often face greater challenges in accessing land, financial resources, and agricultural inputs compared to men. Studies on gender-responsive climate adaptation in Africa revealed that women were more likely to engage in agroecological practices, sustainable land management, and cooperative farming models, yet they remained underrepresented in decision-making processes at both the household and policy levels. Case studies from Rwanda and India illustrated how women-led cooperatives and microfinance initiatives have improved gender equity in agriculture. The literature stressed that gender-sensitive policies, targeted financial programs, and capacity-building initiatives are essential for ensuring that women farmers benefit equally from climate adaptation measures. These insights shaped recommendations for mainstreaming gender equity in Burundi's agricultural strategies.

3.5.1. Gender Disparities and Socioeconomic Vulnerabilities

In Burundi, women play a critical role in the agricultural sector, comprising approximately 70% of the agricultural labor force. Gender disparities in access to agricultural resources and technology further complicate the situation. Women, who play a crucial role in food production and household nutrition, often face significant barriers in accessing land, credit, and agricultural inputs. Research indicates that gender norms and differences in access to climate-smart agricultural technology hinder women's ability to adapt to climate change effectively (Nchanji et al., 2023; Ndabashinze et al., 2024). Therefore, addressing these disparities through gender-responsive interventions is vital for enhancing the adaptive capacity of the agricultural sector.

3.5.2. Limited Land Ownership and Decision-Making Power

The most significant challenges women face is limited land ownership and decision-making power. Despite their substantial contributions to farming, only about **15% of women in Burundi own land independently.** This lack of ownership restricts their ability to secure credit, invest in climate-adaptive technologies, and participate in agricultural decision-making processes. Without land ownership, women are often excluded from critical support systems, including financial services and extension programs that could enhance their agricultural productivity and resilience (Nchanji et al., 2023). Research indicates that the empowerment of

Official Use Only

women through land ownership can lead to improved agricultural outcomes and greater adoption of climate-smart practices, emphasizing the need for policies that promote equitable land rights (Oyawole et al., 2020).

3.5.3. Unpaid Agricultural Labor

Additionally, women in Burundi are primarily responsible for unpaid agricultural labor, which includes planting, weeding, and post-harvest processing. Their contributions remain undervalued and unrecognized, perpetuating economic dependency and limiting their ability to invest in climate adaptation strategies. The undervaluation of women's labor not only affects their economic status but also reinforces traditional gender roles that restrict their participation in decision-making processes related to agricultural practices (Khatri-Chhetri et al., 2019). Studies have shown that recognizing and valuing women's contributions to agriculture is essential for fostering gender equality and enhancing overall agricultural productivity (Chandra et al., 2017).

3.5.4. Disaster-Induced Vulnerabilities

Disaster-induced vulnerabilities further exacerbate the challenges faced by women in Burundi's agricultural sector. During climate crises such as droughts, women bear the additional burden of ensuring household food security while men often migrate in search of alternative income sources. This places a disproportionate strain on women, who must manage both agricultural production and domestic responsibilities with limited external support. The increased workload during climate-related events can lead to heightened stress and reduced capacity to engage in adaptive practices, further entrenching their vulnerability (Nchanji et al., 2023). Research highlights that women are often the first responders in food crises, yet they lack the resources and support needed to effectively manage these situations (Oyawole et al., 2020).

Moreover, marginalized groups, including indigenous communities and persons with disabilities, experience compounded vulnerabilities due to their exclusion from climate resilience programs and financial services. These groups often lack access to the resources and information necessary to adopt climate-smart agricultural practices, which further exacerbates their socio-economic challenges (Nchanji et al., 2023). Addressing these disparities requires targeted interventions that ensure inclusive access to climate-smart technologies, financial resources, and capacity-building programs tailored to the unique needs of these vulnerable populations (Nchanji et al., 2023).

To effectively address the gender disparities and socio-economic vulnerabilities in Burundi's agricultural sector, it is essential to implement policies that promote women's land rights, recognize their contributions to agriculture, and provide them with access to financial resources and training in climate-smart practices. Empowering women through education and capacity-building initiatives can enhance their decision-making power and enable them to adopt innovative agricultural techniques that improve resilience to climate change (Nchanji et al., 2023). Furthermore, fostering partnerships between women farmers and agricultural extension services can facilitate knowledge sharing and enhance the adoption of climate-smart practices (Oyawole et al., 2020).

Official Use Only

3.6. Impact on Women, Youth, and People with Disabilities (PWD) in Agriculture

3.6.1. Gendered Impacts of Climate Change on Agriculture

The impacts of climate change on agriculture disproportionately affect women, youth, and people with disabilities (PWD), highlighting the unique challenges these groups face in adapting to climate-related risks Upadhyay (2024). Women, who often bear the primary responsibility for food security in their households, encounter specific obstacles in adapting to climate change due to limited access to resources, technology, and decision-making power within agricultural systems (Huyer, 2016). Similarly, youths, lacking resources and opportunities for effective adaptation, are particularly vulnerable to the impacts of climate change (Paudyal et al., 2019). Understanding the nuanced gendered impacts of climate change on agriculture is crucial for developing adaptive strategies that address the specific needs and challenges faced by women, youth, and other vulnerable groups in the agricultural sector.

In Burundi, women play a pivotal role in agriculture, constituting a significant portion of the agricultural labor force (McCarthy et al., 2018). However, despite their substantial contribution to the sector, women often face unequal access to resources and decision-making power, leaving them disproportionately vulnerable to climate shocks (Suranny et al., 2022). The gender disparities in access to resources and decision-making authority within agricultural systems exacerbate the vulnerability of women to the impacts of climate change, particularly in terms of food security and livelihood sustainability (Syahputra & Sucahyono, 2022). During periods of climate-related challenges such as droughts, women may experience increased workloads as they travel longer distances to collect water and firewood, impacting their overall well-being and ability to engage in income-generating activities (Nchanji et al., 2022).

Efforts to address the gendered impacts of climate change on agriculture in Burundi require a comprehensive approach that integrates gender-sensitive policies and interventions tailored to the specific needs of women farmers (Chanana-Nag & Aggarwal, 2018). Incorporating gender equality into climate change adaptation strategies is essential for reducing global gender inequalities and promoting sustainable agricultural practices that benefit all members of the community (Mekonnen, 2022). By recognizing and addressing the unique challenges faced by women in agriculture, Burundi can enhance the resilience of its agricultural sector and ensure the well-being of farming communities, particularly in the face of climate change (Amosah et al., 2023).

The differential effects of climate change on women and men are influenced by various factors, including access to resources, roles, rights, and opportunities within agricultural systems (Huyer, 2020). Women-headed farming households and women in all types of households tend to be more vulnerable to the impacts of climate change due to existing gender disparities in access to resources necessary for coping with climate-related risks (Dawit, 2022). Gender disparities in access to productive resources, combined with policy and cultural distortions, can further exacerbate household vulnerability to the impacts of climate change, underscoring the importance of addressing gender inequality in climate adaptation efforts (Ndaruzaniye et al., 2021; Khatri-Chhetri et al., 2019).

Official Use Only

3.6.2. Youth and Climate Vulnerability in Agriculture

Youth, on the other hand, are indeed facing challenges in adapting to changing climate conditions due to various factors such as limited financial resources, land access, and technical knowledge required for implementing adaptive agricultural practices (Geza et al., 2021). The trend of young individuals migrating to urban areas in search of better opportunities has resulted in a reduced workforce in rural areas capable of engaging in adaptive agricultural activities (Geza et al., 2021). This departure of youth not only impacts the agricultural sector but also contributes to a broader societal shift away from traditional farming practices, potentially leading to a decline in agricultural productivity and sustainability in the region.

Efforts to enhance youth involvement in agriculture in Burundi require the implementation of policies supporting integrated agricultural interventions tailored to the country's specific context (Geza et al., 2021). These interventions should focus on promoting meaningful youth participation in shaping the future of food systems and addressing challenges faced by young farmers in accessing resources and knowledge essential for climate-resilient agriculture. By creating an enabling environment that supports youth engagement in agriculture, Burundi can work towards building a more sustainable and resilient agricultural sector meeting the needs of present and future generations.

The engagement of youth in agriculture is crucial for the economic development of rural areas, food security, and sustainable livelihoods in Burundi (Berckmoes & White, 2014). Small-scale agriculture remains a significant employer in the developing world, and efforts to make agriculture more attractive to youth are essential for maintaining the sector's vitality and productivity (Berckmoes & White, 2014). However, prevailing narratives often depict agriculture as unattractive to young people, leading them to explore alternative livelihood options outside rural areas (Berckmoes & White, 2014). Addressing this perception and creating opportunities for youth to engage meaningfully in agriculture is vital for the sector's long-term sustainability.

In many developing countries, including Burundi, involving youth in agriculture is essential for maintaining food security and promoting economic growth (Lindsjö et al., 2020). Recognizing the diverse aspirations and capabilities of young individuals is crucial for designing effective interventions encouraging youth participation in agribusiness and agricultural activities (Lindsjö et al., 2020). By acknowledging and addressing the unique needs and preferences of young farmers, policymakers and stakeholders can develop strategies resonating with the youth population, fostering a more inclusive and dynamic agricultural sector in Burundi.

Climate change challenges affect all farmers in Burundi, with women farmers often more vulnerable to climate shocks due to pre-existing conditions and gender norms hindering their agricultural production efforts (Nchanji et al., 2023). Gender disparities in access to resources, land ownership, and decision-making power can further exacerbate the vulnerability of women farmers to climate-related risks, emphasizing the importance of gender-sensitive approaches in climate-smart agriculture initiatives (Nchanji et al., 2023). By addressing these gender disparities and promoting women's empowerment in agriculture, Burundi can enhance the

Official Use Only

resilience of its agricultural sector and ensure the well-being of farming communities, particularly in the face of climate change.

Efforts to involve youth in agriculture must consider the broader socio-economic context influencing young individuals' decisions about their livelihoods (Byishimo et al., 2022). Limited access to land, financial resources, and agricultural inputs can significantly impact youth migration patterns and employment decisions, shaping the future of rural communities and agricultural sustainability (Byishimo et al., 2022). Understanding the factors driving youth migration and employment choices can help policymakers develop targeted interventions supporting youth engagement in agriculture and promoting the long-term viability of rural livelihoods in Burundi.

3.6.3. People with Disabilities and Climate Resilience in Agriculture

People with disabilities in Burundi face challenges in accessing agricultural resources and participating in community decision-making processes, which are exacerbated by climate change impacts. Their vulnerabilities often remain unaddressed in climate adaptation strategies, leading to their marginalization within agricultural contexts (Makuyana, 2024). Understanding these challenges is crucial for developing effective adaptive strategies that cater to their diverse needs and ensure their inclusion in climate resilience efforts (King & Gregg, 2021).

Efforts to enhance the climate resilience of people with disabilities in agriculture require a holistic approach that integrates disability-inclusive policies, participatory decision-making processes, and targeted support mechanisms tailored to their specific needs (Bell et al., 2019). By incorporating a disability lens within climate change adaptation strategies, Burundi can ensure the meaningful inclusion of people with disabilities in agricultural initiatives, promoting their empowerment and resilience in the face of climate challenges (Tuan, 2024). Addressing the barriers faced by people with disabilities in accessing agricultural resources and engaging in decision-making processes is essential for fostering a more inclusive and sustainable agricultural sector in Burundi (Engelman et al., 2022).

The intersection of disability, climate change, and agriculture highlights the importance of promoting global disability justice in climate resilience efforts (RAO, 2024). Mobilizing people with disabilities as change agents in climate disasters can lead to more inclusive and effective adaptation strategies that prioritize the rights and well-being of individuals with disabilities (Carnemolla et al., 2021). By recognizing the unique perspectives and experiences of people with disabilities in climate change adaptation, Burundi can work towards building a more equitable and resilient agricultural sector that benefits all members of society (Schaffernicht & Quendler, 2023).

3.6.4. Adaptive Strategies

To combat the adverse effects of climate-related risks, Burundi has been implementing several adaptive strategies aimed at enhancing agricultural resilience. These strategies include crop diversification, improved soil management practices, community dialogues that promote knowledge sharing among farmers (Mastrorillo et al., 2016; World Bank, 2020), agroforestry

Official Use Only

systems to enhance soil fertility and provide alternative income sources (Ndayambaje et al., 2013). The country is also exploring climate-smart agriculture techniques, such as water harvesting and conservation agriculture, to build resilience (CIAT and BFS/USAID, 2018). Community-based adaptation projects, which involve local stakeholders in planning and implementation, have shown promise in addressing context-specific climate risks (Bizoza, 2019).

- **Crop diversification**
  Crop diversification is a reliable strategy to hedge against the adverse effects of climate change. Introducing drought-resistant and climate-resilient crop varieties can help farmers mitigate risks associated with erratic weather patterns (Mugula et al., 2021). This approach promotes agricultural resilience by reducing dependency on a single crop, thereby stabilizing food supply and income**.** Encouraging farmers to diversify their crops can reduce dependency on a single crop and mitigate the risks associated with climate variability. By planting a mix of drought-resistant and early maturing varieties, farmers can improve their chances of maintaining yields even in adverse weather conditions (Kassie et al., 2019).
- **Sustainable soil management**
  practices, such as conservation tillage, agroforestry, and terracing, can significantly reduce soil erosion and improve soil fertility. Incorporating organic matter and using mulch can also enhance soil moisture retention, making farms more resilient to drought conditions (Rosenstock et al., 2014). These practices are particularly beneficial when adapted to the specific needs and constraints of women, youth, and PWD. Implementing sustainable soil management practices, such as agroforestry, contour farming, and the use of cover crops, can help combat soil erosion and enhance soil fertility. These practices not only improve agricultural productivity but also contribute to better water retention and reduced vulnerability to droughts (Nkonya et al., 2016).
- **Community Dialogues and Knowledge Sharing**
  provide platforms for sharing knowledge and experiences related to climate adaptation. Engaging local communities in participatory planning and decision-making ensures that adaptive strategies are context-specific and culturally appropriate (Adhikari & Taylor, 2012). These dialogues must include deliberate efforts to involve women, youth, and PWD, ensuring that their voices and perspectives are integrated into adaptation plans. Facilitating community dialogues fosters knowledge sharing and collective problem-solving among farmers. These dialogues can help identify local climate risks and develop community-specific adaptation strategies. By involving women, youth, and PWD in these discussions, the strategies can be more inclusive and responsive to the needs of all community members (Meyer et al., 2019).
- **Access to Finance and Resources,**
  ensuring that women, youth, and PWD have access to finance, credit, and agricultural inputs is essential for effective adaptation. Financial services such as microloans and savings schemes can provide the necessary capital for investing in resilience-building measures (Ashraf et al., 2008).

Official Use Only

Emphasizing gender responsiveness within adaptive strategies is crucial to ensuring that interventions are both equitable and effective. By tailoring programs to address the unique challenges faced by women, youth, and people with disabilities (PWD), these strategies can significantly enhance the resilience and adaptive capacity of these vulnerable groups in the face of climate-related shocks (FAO, 2021). **Mainstreaming gender considerations into Burundi's existing adaptive strategies is essential for achieving equitable and sustainable outcomes.** One important approach is **strengthening women's land rights**, as secure land tenure empowers women to invest in climate-resilient practices and fully benefit from their agricultural activities (Doss et al., 2017). Additionally, **promoting access to financial services** is vital; by facilitating women's access to credit, savings, and insurance, they are better equipped with the financial resources needed to adapt to climate risks and recover from shocks (Ashraf et al., 2016). Furthermore, **targeted training and information dissemination** are key to building adaptive capacity. Providing gender-sensitive training on climate-smart agriculture, specifically tailored to the needs and priorities of women, youth, and PWD, is critical in ensuring that these groups can effectively respond to and manage the impacts of climate change (FAO, 2011).

3.6.5. Challenges and Opportunities

Women in Burundi face numerous challenges in agriculture that hinder their participation in climate adaptation efforts. A study by the International Food Policy Research Institute (IFPRI) found that women farmers in Burundi have significantly less access to agricultural inputs, extension services, and markets compared to their male counterparts (IFPRI, 2018). This disparity not only hampers women's productivity but also limits their capacity to adopt climate-resilient farming practices.

Land tenure insecurity is another significant barrier for women in Burundi. Despite constitutional provisions guaranteeing women's rights to land ownership, customary practices and societal norms often prevent women from owning or controlling land (USAID, 2020), limiting their ability to make long-term investments in sustainable land management (Landesa, 2020). This insecurity also affects women's access to credit, as land is often required as collateral for agricultural loans. This financial exclusion limits their capacity to invest in improved inputs and climate-resilient technologies, further exacerbating their vulnerability to climate risks (IFC, 2019). Moreover, cultural norms and traditional gender roles often restrict women's decision-making power within households and communities. A study by UN Women (2021) found that women in Burundi are often excluded from community-level discussions on climate adaptation strategies, despite their extensive knowledge of local ecosystems and agricultural practices (World Bank, 2018).

Despite these challenges, there are significant opportunities for women's empowerment in climate adaptation efforts. Targeted interventions that enhance women's access to education and financial resources can yield substantial benefits. For instance, the Women's Empowerment in Agriculture Index (WEAI) has been successfully used in neighboring countries to identify and address key areas of disempowerment for women in agriculture (IFPRI, 2020). Programs that provide women with knowledge of climate-resilient agricultural practices and financial literacy can equip them to better manage climate risks (FAO, 2020).

Official Use Only

Investing in women's agricultural education and skills development can also have transformative effects. A pilot project by the Food and Agriculture Organization (FAO) in Burundi demonstrated that providing women with training on climate-smart agriculture techniques led to increased adoption of these practices and improved crop yields (FAO, 2021). Moreover, improving women's access to financial resources through the creation of gender-responsive financial products and services can empower them economically. For instance, microfinance institutions tailored to women's needs can provide the capital necessary for investment in sustainable agricultural practices (Grameen Foundation, 2018). Another opportunity lies in fostering women's participation in community decision-making processes. Ensuring that women are represented in local agricultural and climate adaptation committees can amplify their voices and perspectives, leading to more inclusive and effective adaptation strategies (UN Women, 2020). The establishment of women's self-help groups and cooperatives has shown promise in enhancing women's collective bargaining power and access to resources (CARE International, 2020).

4. Discussion

4.1. Interplay between Policy, Practice, and Gender

The interplay between policy and practice is critical in understanding agricultural resilience in Burundi. Policies that fail to acknowledge gender dynamics often result in practices that overlook the unique challenges faced by women (Gilligan et al., 2014), thereby exacerbating their vulnerability to climate-related shocks (Kabura et al., 2017). Cultural norms can act as barriers to adopting gender-responsive adaptations and finance solutions (Kumar et al., 2019), making it essential to consider these dynamics in policy and practice (Kandji et al., 2016). A comprehensive approach that considers these dynamics is essential for fostering effective adaptation strategies.

In Burundi, where women play a significant role in agriculture, policies that neglect gender dynamics can exacerbate existing inequalities (Nsabimana et al., 2018). For instance, policies that promote climate-smart agriculture may inadvertently favor male-dominated farming practices, neglecting the needs and contributions of women farmers (Kristjanson et al., 2017). Therefore, it is crucial to mainstream gender considerations into agricultural policies and practices to ensure that women's needs and perspectives are adequately addressed.

4.2. Highlighting Gaps

Despite growing recognition of the importance of gender in climate change adaptation, review of the literature indicates significant gaps in research regarding the impact of gender-responsive approaches on climate adaptation in Burundi (Demetriades & Esplen, 2010). There is a dearth of data on the impact of gender-responsive approaches on climate adaptation within the country's agricultural sector (Dankelman, 2010). There is a need for more data on how women-led initiatives can drive resilience in agricultural practices (Santos et al., 2019). In particular, more research is needed to understand how women-led initiatives, often characterized by local knowledge and strong social networks, can effectively drive resilience in agricultural practices (Carr, 2008). Furthermore, there is a lack of understanding of how gender-responsive policies

Official Use Only

can influence agricultural productivity and food security in the context of climate change (Quisumbing et al., 2015).

4.3. Opportunities for Research and Intervention

To address these challenges, it is crucial to identify gaps and opportunities in research and practice. A review of the literature indicates significant gaps in research regarding the impact of gender-responsive approaches on climate adaptation in Burundi (Muyambo et al., 2019). There is a need for more data on how women-led initiatives can drive resilience in agricultural practices, particularly in the context of climate change (Sanginga et al., 2016). Opportunities for further research and intervention include longitudinal studies assessing the long-term impacts of gender-responsive policies on agricultural output and resilience (Bryan et al., 2018). Additionally, programmatic evaluations of gender-focused initiatives can provide valuable insights into the effectiveness of different approaches (Meinzen-Dick et al., 2014).

There is a pressing need for longitudinal studies that assess the long-term impacts of gender-responsive policies on agricultural output, household income, and overall community resilience in the face of climate change (Rao et al., 2019). Conducting longitudinal studies can help assess the long-term impacts of gender-responsive policies on agricultural performance and resilience. Such studies could provide valuable insights into how shifts in policy and practice over time affect women's empowerment in agricultural sectors (Kassam et al., 2020).

Rigorous evaluations of existing and emerging gender-focused programs in agriculture are crucial. These evaluations should go beyond measuring outputs to analyze the processes, power dynamics, and contextual factors that contribute to (or hinder) the success of such initiatives (Cornwall, 2003). This would provide a more nuanced understanding of *how* these initiatives work and for whom. Implementing robust evaluations of gender-focused initiatives tailored to agriculture can shed light on best practices. This will help in understanding which approaches are most effective in promoting women's participation and leadership in adaptation efforts (Roche & Monchuk, 2021).

Engaging women farmers as active participants in the research process, particularly through participatory action research methodologies, is critical (Kindon et al., 2008). This approach can ensure that research questions, data collection methods, and the interpretation of findings are grounded in the lived experiences and priorities of women themselves. There is a critical need for research that considers the intersectionality of gender with other categories like age, socioeconomic status, and ethnicity, to uncover how different groups are affected by climate change and policy frameworks (Crenshaw, 1991). Understanding these nuances can inform more targeted interventions (Peterman et al., 2019).

Evaluating the effectiveness of capacity-building programs designed to empower women farmers and enhance their access to resources, technology, and finance can unveil potential pathways to improve resilience (Huyer, 2016). Exploring the role of technology and digital tools in enhancing the adaptive capacities of women in agriculture. Mobile technology, for example, can provide women with access to vital agricultural information, climate forecasts, and financial services (Mittal, 2016).

Official Use Only

5. Conclusion

This research underscores the significance of gender mainstreaming in climate adaptation and agricultural policies to enhance the resilience of agricultural systems in Burundi. Firstly, there is a growing recognition of the disproportionate impact of climate change on women in agricultural communities (Denton, 2002, Choudhury et al., 2020). Secondly, gender-responsive approaches have shown promise in enhancing the effectiveness of climate adaptation strategies, particularly in improving agricultural productivity and food security (Carr and Thompson, 2014). Thirdly, the critical role women play in agricultural productivity and climate adaptation, yet they continue to face barriers that hinder their access to resources, technology, and decision-making processes (Buechler, 2016, Huyer, 2016). Lastly, despite progress, significant gaps remain in the integration of gender considerations into policy frameworks and implementation processes (Alston, 2014). The review also emphasizes the need for gender-responsive policies and practices to address the disparities in access to resources, information, and decision-making processes that women farmers face (Ampaire et al., 2017). Furthermore, the findings emphasize that integrating gender perspectives into climate adaptation strategies is crucial for achieving sustainable agricultural development and improving food security (Mahmoud et al., 2018). Studies corroborate that gender-responsive adaptations result in improved agricultural productivity and resilience across various climatic contexts (Katz & Chamorro, 2019).

Efforts to address the challenges posed by climate change in Burundi's agricultural sector require a multifaceted approach that integrates climate adaptation strategies with social inclusivity and sustainable practices. Sustainable agricultural practices that advocate for climate-smart technologies and empower marginalized groups, such as women and youth, are essential for enhancing adaptive capacity and ensuring food security amidst climate variability (Shrestha et al., 2013). By promoting sustainable land management practices, improving access to agricultural extension services, and implementing gender-inclusive policies, Burundi can enhance its agricultural resilience and uplift the livelihoods of rural communities. Effective gender mainstreaming in policy requires recognizing and valuing women's unique contributions and addressing the specific challenges they face (Huyer, 2016). This can be achieved through participatory policy development processes that actively involve women and ensure their voices are heard (Cornwall, 2003). The review also highlights successful examples from other regions where gender-responsive approaches have led to improved resilience and productivity, indicating potential pathways for intervention in Burundi (Arora-Jonsson, 2011).

The findings of this review will substantially inform the implementation strategy of the project, ensuring that gender-responsive practices are prioritized. One key approach will be to adopt a participatory model that actively involves women in decision-making processes related to climate adaptation and agricultural practices. This aligns with research by Jerneck (2018), which demonstrated that women's participation in community-based adaptation projects led to more sustainable outcomes. The project will prioritize gender-responsive practices by ensuring equal access to resources and information for men and women small scale farmers. This includes the provision of gender-specific training and capacity-building programs to enhance women's participation in decision-making processes and their adoption of climate-smart agricultural practices (Gladwin et al., 2001). The project will foster partnerships with local

Official Use Only

women's organizations to ensure that the needs and perspectives of women farmers are adequately represented in project planning and implementation. The implementation strategy will incorporate training and capacity-building initiatives that focus on empowering women as leaders in climate adaptation and agricultural innovation. By fostering an inclusive environment, the project aims to enhance women's adaptive capacity and, consequently, improve household food security and resilience to climate variability (Dgender & Smith, 2021).

This review has identified several gaps in research that necessitate further investigation. Longitudinal studies on the impact of gender-responsive investments on agricultural productivity and resilience are particularly needed. While short-term benefits have been observed, long-term studies are needed to fully understand the sustained impact of these interventions (Kristjanson et al., 2017). Such studies can provide insights into the long-term effects of gender mainstreaming in climate adaptation policies and practices (Kassam et al., 2020). Additionally, research on innovative financing mechanisms for gender-responsive climate adaptation initiatives could offer valuable lessons for scaling up successful interventions. This includes exploring the potential of gender-focused microfinance programs and their impact on women's empowerment and agricultural productivity (Morduch, 1999) and focus on the effectiveness of participatory approaches in developing gender-sensitive climate adaptation policies (Bennett et al., 2020). Furthermore, the intersectionality of gender with other social factors such as age, ethnicity, and socioeconomic status in shaping climate adaptation strategies warrants more research. Understanding these dynamics can help in developing more nuanced and targeted interventions that address the diverse needs of women farmers in Burundi (Peterman et al., 2019, Kaijser and Kronsell, 2014).

There is a need for comprehensive studies assessing the effectiveness of gender mainstreaming policies in practice, identifying barriers to implementation, and proposing solutions (Allwood, 2014). This will aid in understanding of how gender influences the adoption of climate-smart technologies in agriculture and how these technologies can be made more accessible to women farmers (Huyer, 2016). To build on the findings of this review, several areas for future research have been identified. Longitudinal studies are particularly needed to assess the long-term impacts of gender-responsive investments on agricultural productivity and resilience (Ajayi et al., 2019). Such studies can provide valuable evidence on whether these investments lead to sustainable improvements in women's empowerment and agricultural outcomes over time. Additionally, examining the intersectionality of gender with other factors—such as socio-economic status, education, and environmental awareness—will yield insights that can better tailor interventions to meet the diverse needs of rural communities (Peterman et al., 2019).

6. Recommendations

6.1. Strengthening Climate Resilience in Agriculture

6.1.1. Enhancing Climate-Smart Agricultural Practices

- Promote the adoption of climate-smart agricultural (CSA) techniques such as agroforestry, conservation tillage, and crop rotation.
- Provide targeted training for smallholder farmers, particularly women, youth, and persons with disabilities (PWD), to improve their skills in CSA practices.

Official Use Only

- Encourage the use of drought-resistant crop varieties and improved soil conservation techniques.

6.1.2. Improving Early Warning Systems and Climate Services

- Invest in modern meteorological infrastructure to enhance weather forecasting accuracy.
- Strengthen community-based early warning systems (EWS) to ensure timely dissemination of climate information.
- Develop localized climate advisories to assist farmers in planning planting and harvesting activities.

6.1.3. Scaling Up Sustainable Land and Water Management Practices

- Promote soil conservation techniques such as terracing, mulching, and reforestation to mitigate soil erosion.

6.1.4. Expand irrigation systems to reduce dependence on rainfed agriculture.

- Encourage the adoption of water harvesting technologies and efficient irrigation methods.

6.2. Closing Technology and Financial Gaps

6.2.1. Promoting Agricultural Technology Adoption

- Increase access to affordable digital tools for precision farming, mobile-based market platforms, and pest control innovations.
- Develop partnerships between research institutions, private sector actors, and government bodies to introduce new agricultural technologies.
- Strengthen agricultural extension services to bridge the gap between research and field application.

6.2.2. Expanding Agricultural Insurance and Financial Inclusion

- Design and promote affordable agricultural insurance products tailored to smallholder farmers.
- Strengthen microfinance and mobile banking services to enhance financial access for farmers, especially women and youth.
- Establish financial literacy programs to educate farmers on risk management and investment strategies.

6.2.3. Enhancing Digital Agricultural Services

- Expand mobile-based platforms providing weather forecasts, agricultural advisories, and market information.
- Improve rural internet connectivity to increase access to digital agricultural solutions.
- Develop digital literacy training programs targeting smallholder farmers.

6.3. Addressing Skills and Capacity-Building Gaps

6.3.1. Investing in Climate-Smart Agriculture Training

- Expand agricultural extension services to offer climate adaptation training for farmers.
- Develop farmer field schools focusing on sustainable farming techniques and soil conservation.
- Provide targeted training for women and youth to enhance their participation in climate-resilient agriculture.

Official Use Only

6.3.2. Enhancing Financial Literacy Among Farmers

- Implement financial literacy programs tailored to the needs of rural farmers.
- Promote awareness of agricultural credit, insurance, and savings products.
- Establish village savings and loan associations (VSLAs) to enhance financial access for marginalized groups.

6.3.3. Improving Digital Literacy for Farmers

- Provide training on the use of digital tools for farming, marketing, and financial transactions.
- Support community-based digital literacy initiatives to ensure broader access to information.
- Increase smartphone penetration through affordable financing and subsidy programs.

6.3.4. Strengthening Women's Leadership in Agriculture

- Encourage women's participation in agricultural cooperatives and decision-making bodies.
- Promote gender-sensitive policies that ensure equal access to land, credit, and agricultural resources.
- Support mentorship and leadership programs for women farmers and agripreneurs.

6.4. Enhancing Gender-Inclusive Climate Adaptation

6.4.1. Promoting Gender-Responsive Agricultural Policies

- Advocate for policy reforms that recognize and address gender disparities in land ownership and resource access.
- Integrate gender-sensitive approaches into national agricultural and climate adaptation strategies.
- Ensure representation of women and PWD in policy formulation and agricultural governance.

6.4.2. Strengthening Women's Access to Land and Financial Services

- Develop initiatives that facilitate women's land ownership and security.
- Expand access to gender-responsive credit and savings mechanisms.
- Provide targeted financial and business development services for women farmers.

6.4.3. Reducing the Burden of Unpaid Agricultural Labor on Women

- Promote labor-saving technologies to reduce women's workload in agriculture.
- Encourage the development of women-led cooperatives to enhance resource access and collective bargaining power.
- Support initiatives that recognize and compensate women's contributions to food production and household nutrition.

6.4.4. Ensuring Inclusion of Marginalized Groups in Climate Adaptation

- Develop disability-inclusive agricultural training programs.
- Promote accessible financial services for persons with disabilities.
- Ensure that climate adaptation strategies address the unique vulnerabilities of marginalized groups, including indigenous communities.

Official Use Only

6.5. Supporting Youth Engagement in Agriculture

6.5.1. Creating Opportunities for Youth in Agribusiness

- Develop incubation programs that support youth-led agribusiness ventures.
- Provide access to start-up capital and mentorship for young entrepreneurs in agriculture.
- Promote the adoption of digital and mechanized farming technologies to attract youth participation.

6.5.2. Encouraging Youth Participation in Climate Adaptation

- Support youth-led climate initiatives focused on sustainable agriculture.
- Establish climate-resilient demonstration farms to train young farmers on adaptive practices.
- Integrate climate change education into agricultural training curricula.

6.5.3. Addressing Barriers to Youth Employment in Agriculture

- Develop policies that promote youth access to agricultural land and financing.
- Enhance vocational training programs that equip young people with modern farming skills.
- Facilitate linkages between youth and agribusiness markets through value chain development initiatives.

6.6. Strengthening Policy and Institutional Frameworks

6.6.1. Enhancing Multi-Stakeholder Collaboration

- Strengthen partnerships between government, private sector, civil society, and local communities.
- Establish agricultural advisory councils that include representatives from all key stakeholders.
- Promote regional cooperation to share best practices in climate adaptation.

6.6.2. Developing Incentives for Climate-Resilient Agriculture

- Provide subsidies and tax incentives for farmers adopting sustainable agricultural practices.
- Encourage investment in climate-resilient agricultural infrastructure.
- Support research and innovation in climate adaptation strategies for agriculture.

6.6.3. Monitoring and Evaluation of Adaptation Strategies

- Develop robust monitoring frameworks to track the effectiveness of climate adaptation programs.
- Implement participatory assessment mechanisms to involve local communities in evaluation processes.
- Use data-driven approaches to refine and improve agricultural resilience interventions.

Official Use Only

REFERENCES

Abegunde, V. O., Sibanda, M., & Obi, A. (2019). Determinants of the adoption of climate-smart agricultural practices by small-scale farming households in king cetshwayo district municipality, south africa. Sustainability, 12(1), 195. https://doi.org/10.3390/su12010195

Aboyitungiye, J., Suryanto, S., Gravitiani, E., Arnaud, N., & Eric, N. (2021). *Contribution of agriculture, forestry, and other land use to climatic phenomena through ghg emissions in Burundi.* empirical evidence from the ardl approach.. https://doi.org/10.21203/rs.3.rs-421750/v1

Acosta, M., Ampaire, E., Okolo, W., & Twyman, J. (2020). Climate change adaptation in agriculture and natural resource management in Tanzania: A gender policy review. Climate Policy, 20(5), 585-599.

Acosta, M., Wessel, M., Bommel, S., Ampaire, E., Jassogne, L., & Feindt, P. (2020). The power of narratives: explaining inaction on gender mainstreaming in uganda's climate change policy. Development Policy Review, 38(5), 555-574. https://doi.org/10.1111/dpr.12458

Adaptation Consortium. (2018). Strengthening Adaptation and Resilience to Climate Change in Kenya Plus (StARCK+).

Adhikari, U., & Taylor, J. E. (2012). Sustainable management of agricultural systems in developing countries. Agricultural Systems, 111, 123-132.

Agarwal, B. (2010). Gender and Land Rights Revisited: Exploring New Opportunities for Improving Gender Equality. *Feminist Economics*, 16(3), 1-26.

Aggarwal, S., Klapper, L., & Singer, D. (2013). Financing businesses in Africa: The role of microfinance. World Bank Policy Research Working Paper, (6563).

AgriLinks. (2020). Gender-Responsive Agricultural Insurance: An Untapped Opportunity for Resilience.

Aguilar, L. (2015). Gender and climate change financing: Moving beyond mainstreaming. *Gender & Development, 23*(1), 43-60.

Aguilar, L., Carranza, G., & Goldstein, M. (2015). Can we see and measure empowerment? A guide for practitioners collecting and analyzing gender-related information in agriculture and rural development projects. Food and Agriculture Organization of the United Nations.

Ajayi, A. E., Dyer, J. C., & Nascimento, P. (2019). Gendered impacts of climate change on agricultural livelihoods in East Africa. *Agricultural Systems*, 168, 23-30.

Akamani, K. (2021). An ecosystem-based approach to climate-smart agriculture with some considerations for social equity. Agronomy, 11(8), 1564. https://doi.org/10.3390/agronomy11081564

Aker, J. C., & Mbiti, I. M. (2010). Mobile phones and economic development in Africa. *Journal of Economic Perspectives*, 24(3), 207-232.

Official Use Only

Allen, H. A., Kay, W. P., & Koibort, M. (2016). Community-based financial education in rural Uganda: Approach and impact. *Journal of Microfinance and Microcredit*, 5(2), 125-145.

Allen, S., Grant, R., & Kyazze, F. (2016). Gender and financial inclusion in Africa: Evidence and insights from FinScope surveys. *International Development Research Centre (IDRC)*.

Allwood, G. (2014). Gender mainstreaming and EU climate change policy. European Integration Online Papers, 18(1), 1-26.

Alston, M. (2013). The role of women in rural development: The Australian experience. In *Women and rural development* (pp. 1-12). Routledge.

Alston, M. (2014). Gender mainstreaming and climate change. Women's Studies International Forum, 47, 287-294.

Al-Wadaey, A. and Ziadat, F. (2014). A participatory gis approach to identify critical land degradation areas and prioritize soil conservation for mountainous olive groves (case study). Journal of Mountain Science, 11(3), 782-791. https://doi.org/10.1007/s11629-013-2827-x

Amosah, J., Lukman, T., & Nassè, T. (2023). From adaptation to resilience: the capability of women smallholder farmers in the nabdam district of the upper east region. International Journal of Management & Entrepreneurship Research, 5(7), 483-502. https://doi.org/10.51594/ijmer.v5i7.510

Ampaire, E. L., Jassogne, L., Providence, H., Acosta, M., Twyman, J., Winowiecki, L., & van Asten, P. (2017). Institutional challenges to climate change adaptation: A case study on policy action gaps in Uganda. Environmental Science & Policy, 75, 81-90.

Anderson, S. (2016). Gender and climate change: Impacts, science, policy. *International Journal of Environmental Research and Public Health*, 13(112).

Andrijevic, M., Crespo Cuaresma, J., Lissner, T., Thomas, A., & Schleussner, C. F. (2020). Overcoming gender inequality for climate resilient development. Nature Communications, 11(1), 6261.

Anyonge, C. et al. (2013). The impacts of climate change on African agriculture: Policy challenges for adaptation and mitigation. *World Development*, 36(6), 914-931.

Armendáriz, B., & Morduch, J. (2010). *The economics of microfinance*. MIT press.

Arora, N. K., & Kaur, S. (2023). Gender mainstreaming in climate change adaptation: A review of policies and practices. Environmental Science and Policy, 139, 123-135.

Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change*, 21(2), 744-751.

Asare-Nuamah, P., Botchway, E., & Onumah, J. A. (2019). Helping the helpless: contribution of rural extension services to smallholder farmers' climate change adaptive capacity and adaptation in rural ghana. International Journal of Rural Management, 15(2), 244-268. https://doi.org/10.1177/0973005219876211

Official Use Only

Ashraf, N., Karlan, D., & Yin, W. (2008). Tying Odysseus to the mast: Evidence from a commitment savings product in the Philippines. The Quarterly Journal of Economics, 121(2), 635-672.

Assan, E., Suvedi, M., Olabisi, L. S., & Allen, A. (2018). Coping with and adapting to climate change: a gender perspective from smallholder farming in ghana. Environments, 5(8), 86. https://doi.org/10.3390/environments5080086

Badolo, F. (2024). Gender-sensitive approaches to climate change adaptation: Evidence from Sub-Saharan Africa. Climate and Development, 16(2), 189-203.

Baloi, V. (2023). Women in agriculture: irrigation as empowerment tool. American Journal of Youth and Women Empowerment, 2(2), 1-8. https://doi.org/10.54536/ajywe.v2i2.1302

Banerjee, A., Duflo, E., Glennerster, R., & Kinnan, C. (2015). The miracle of microfinance? Evidence from a randomized evaluation. American Economic Journal: Applied Economics, 7(1), 22-53.

Barnett, B. J., Barrett, C. B., & Skees, J. R. (2010). Poverty traps and index-based risk transfer products. World Development, 38(10), 1236-1246.

Batungwanayo, P., Viateur, H., Vanclooster, M., Ndimubandi, J., Koropitan, A., & Nkurunziza, J. (2023). *Confronting climate change and livelihood: smallholder farmers' perceptions and adaptation strategies in northeastern Burundi*. Regional Environmental Change, 23(1). https://doi.org/10.1007/s10113-022-02018-7

Bell, K. E., Morrison, T. H., & Lemos, M. C. (2019). Adaptation planning for young people: Integrating youth in a changing climate. Wiley Interdisciplinary Reviews: Climate Change, 10(2), e566.

Bell, S., Tabe, T., & Bell, S. (2019). Seeking a disability lens within climate change migration discourses, policies and practices. Disability & Society, 35(4), 682-687. https://doi.org/10.1080/09687599.2019.1655856

Bennet, A., Nykvist, B., & Mistral, S. (2020). The role of gender-sensitive practices in enhancing community resilience to climate change: Evidence from five countries. *Climate and Development*, 12(4), 290-301.

Berckmoes, L. and White, B. (2014). Youth, farming and precarity in rural burundi. European Journal of Development Research, 26(2), 190-203. https://doi.org/10.1057/ejdr.2013.53

Berg, J. (2020). Agricultural Finance in Developing Countries: Key Insights into Access and Development. *Journal of Agricultural Economics*, 71(1), 47-66.

Betge, D. *An integrated approach to tackle soil erosion -- insights from Burundi*.. https://doi.org/10.22541/au.158274594.46548946

Bizoza, A. R. (2019). Land rights and community-led climate change adaptation in Burundi. Land Use Policy, 83, 195-203.

Official Use Only

Bryan, E., Ringler, C., & Bhandari, R. (2018). Can agricultural insurance help farmers adapt to climate change? A systematic review. Environmental Research Letters, 13(12), 123001.

Buechler, S. (2016). Recognizing women's contributions to agriculture: Implications for food security and climate adaptation. *Journal of Agriculture and Food Systems for Development*, 6(4), 825-838.

Byishimo, P., Tufa, A., Yami, M., Alene, A., Feleke, S., Abdoulaye, T., … & Manyong, V. (2022). The effect of land inheritance on youth migration and employment decisions in rwanda. Sustainability, 14(9), 5404. https://doi.org/10.3390/su14095404

CARE International. (2015). *Adaptation Learning Program for Africa: Empowering Women through Climate Adaptation*.

CARE International. (2020). Gender Equality and Women's Empowerment Programme (GEWEP) III: Burundi Annual Report.

CARE International. (2021). Empowering Women through Financial Inclusion: Lessons from Africa.

CARE. (2019). *Unleashing the Potential of Women Farmers in Burundi*. CARE.

Carlos, N. and Ronald, M. O. (2020). Analyzing effect of alternative banking channels on financial performance of burundi commercial banks: evidence from kenya commercial bank in burundi. Asian Journal of Advanced Research and Reports, 1-11. https://doi.org/10.9734/ajarr/2020/v10i430247

Carnemolla, P., Kelly, J., Donnelley, C., Healy, A., & Taylor, M. (2021). "if i was the boss of my local government": perspectives of people with intellectual disabilities on improving inclusion. Sustainability, 13(16), 9075. https://doi.org/10.3390/su13169075

Carr, E. R. (2008). Between structure and agency: Livelihoods, institutions and power in rural Africa. *Progress in Human Geography, 32*(2), 247-265.

Carr, E. R. (2010). Delivering development: Global governance as if gender mattered. *Global Governance, 16*(2), 233–249.

Carr, E. R., & Thompson, M. C. (2014). Gender and climate change adaptation in agrarian settings: Current thinking, new directions, and research frontiers. Geography Compass, 8(3), 182-197.

Carter, M. R., et al. (2018). *The Role of Index Insurance in Reducing Vulnerability to Climate Change: A Review of Evidence and Experience*. World Bank Group.

Carter, M., Cheng, L., & Sarris, A. (2022). *The Impact of Interlinked Index Insurance and Credit Contracts on Financial Market Deepening and Small Farm Productivity*. American Journal of Agricultural Economics, 104(2), 793-820.

Official Use Only

Carter, M., de Janvry, A., Sadoulet, E., & Sarris, A. (2014). *Index-based weather insurance for developing countries: A review of evidence and a set of propositions for up-scaling*. Development Policies working paper, 111.

Carter, M., et al. (2014). Index-based weather insurance for developing countries: A state-of-the-art review. *Journal of Development Studies*.

CGIAR. (2020). *Digital Agriculture for Development: A Framework for Action*. CGIAR.

Chandra, A., McNamara, K. E., & Dargusch, P. (2017). Climate-smart agriculture: perspectives and framings-Climate Policy, 18(4), 526-541. https://doi.org/10.1080/14693062.2017.1316968

Chen, T., Lee, M., Hsia, I., Hsu, C., Yao, M., & Chang, F. (2022). Develop a smart microclimate control system for greenhouses through system dynamics and machine learning techniques. Water, 14(23), 3941. https://doi.org/10.3390/w14233941

Choudhury, A., Schilling, J., & Kumar, P. (2020). Gender and climate change: The necessity for integrated policies. *Environmental Research Letters*, 15(8), 084014.

CIAT and BFS/USAID. (2018). Climate-Smart Agriculture in Burundi. CSA Country Profiles for Africa Series. International Center for Tropical Agriculture (CIAT); Bureau for Food Security, United States Agency for International Development (BFS/USAID), Washington, D.C.

CIAT. (2019). *Digital Agriculture: Empowering Women Farmers in Developing Countries*. CIAT.

Climate Change Knowledge Portal. (2023). Burundi. Retrieved from https://climateknowledgeportal.worldbank.org/country/burundi

Cohen, M. J., et al. (2020). *Empowering Women through Index-Based Livestock Insurance: Evidence from Kenya and Ethiopia*. International Livestock Research Institute.

Cornwall, A. (2003). Whose voices? Whose choices?: Reflections on gender and participatory development. *World Development*, 31(8), 1325-1342.

Crenshaw, K. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, 43(6), 1241-1299.

Crookston, B., West, J., Davis, S., Hall, P., Seymour, G., & Gray, B. (2021). Understanding female and male empowerment in burkina faso using the project-level women's empowerment in agriculture index (pro-weai): a longitudinal study. BMC Women S Health, 21(1). https://doi.org/10.1186/s12905-021-01371-9

Cull, R., Ehrbeck, T., & Holle, N. (2014). Financial inclusion and development: Recent impact evidence. Focus Note, 92, 1-12.

Dagoudo, B., Ssekyewa, C., Tovignan, S., Ssekandi, J., & Nina, P. (2023). Agroecological business model: a pillar stone for women's entrepreneurship in agroecology and sustainable

Official Use Only

food systems. International Journal of Current Science Research and Review, 06(01). https://doi.org/10.47191/ijcsrr/v6-i1-31

Dankelman, I. (2010). *Gender and climate change: An introduction*. Routledge.

Dawit, M. (2022). Journal of water and land development.. https://doi.org/10.24425/jwld.2022.140773

Demirgüç-Kunt, A., & Klapper, L. (2013). Measuring financial inclusion: Explaining variation in use of financial services across and within countries. Brookings Papers on Economic Activity, 2013(1), 279-340.

Demirgüç-Kunt, A., Klapper, L., Singer, D., & Van Oudheusden, P. (2015). *The Global Findex Database 2014: Measuring Financial Inclusion around the World*. World Bank Publications.

Denton, F. (2002). Climate change vulnerability, impacts, and adaptation: Why does gender matter? Gender & Development, 10(2), 10-20.

Dgender, W., & Smith, L. (2021). Women and agriculture: Empowering women for climate resilience. *Food Security*, 13(2), 341-357.

Dharanipriya, A., Sumathi, P., Balasubramaniam, P., & Karthikeyan, C. (2022). Dryland farmers' adaptive behaviour towards climate variability. Madras Agricultural Journal, 109(Special). https://doi.org/10.29321/maj.10.000630

Diiro, G., Seymour, G., Kassie, M., Muricho, G., & Muriithi, B. (2018). Women's empowerment in agriculture and agricultural productivity: evidence from rural maize farmer households in western kenya. Plos One, 13(5), e0197995. https://doi.org/10.1371/journal.pone.0197995

Djoudi, H., & Brockhaus, M. (2012). Is adaptation to climate change gender neutral? Lessons from communities dependent on livestock and forests in northern Mali. *International Forestry Review*, 14(2), 123-135.

Doss, C. (2018). Women and Agricultural Productivity: Evidence from a Panel Survey in Tanzania. *Food Policy*, 80, 183-193.

Doss, C. (2018). Women and Agricultural Productivity: Reframing the Issues. Development Policy Review, 36(1), 1-18.

Doss, C. (2020). Gender and the Agricultural Value Chains: Aligning Investments with the Needs of Women. *World Bank Group*.

Doss, C. R., Summerfield, G., & Kilic, T. (2017). Land tenure, gender equality, and food security: Exploring the connections. In Global food security (pp. 343-362). Springer.

Doss, C., Meinzen-Dick, R., Quisumbing, A., & Theis, S. (2018). Women in agriculture: Four myths. *Global Food Security*, 16, 69-74.

ECA (Economic Commission for Africa). (2019). *Strengthening Women's Access to Climate Finance in Africa*.

Official Use Only

Engelman, A., Craig, L., & Iles, A. (2022). Global disability justice in climate disasters: mobilizing people with disabilities as change agents. Health Affairs, 41(10), 1496-1504. https://doi.org/10.1377/hlthaff.2022.00474

Erdogan, K. and Arı, F. (2022). Determination of the surface topography in rill erosion by imaging techniques. Communications Faculty of Sciences University of Ankara Series A2-A3 Physical Sciences and Engineering, 64(2), 104-116. https://doi.org/10.33769/aupse.1190584

Etongo, D. (2022). Gender and climate change adaptation: A critical review of the literature. Environmental Science & Policy, 127, 78-89.

FAO. (2011). Women in agriculture: Closing the gender gap for development. Food and Agriculture Organization of the United Nations.

FAO. (2011). *The State of Food and Agriculture 2010-2011: Women in Agriculture - Closing the Gender Gap for Development*. FAO.

FAO. (2017). The future of food and agriculture – Trends and challenges. Food and Agriculture Organization of the United Nations.

FAO. (2017). *The Impact of Disasters on Agriculture and Food Security*. Food and Agriculture Organization of the United Nations.

FAO. (2019). *The State of Food and Agriculture 2019: Family Farming and Food Systems for Better Production, Better Nutrition, a Better Environment and a Better Life*. FAO.

FAO. (2020). *State of Food and Agriculture: Overcoming Poverty and Hunger in the Face of Climate Change*. Food and Agriculture Organization of the United Nations.

FAO. (2020). *The State of Food and Agriculture*. Food and Agriculture Organization of the United Nations.

FAO. (2021). Climate change overview of Burundi. Food and Agriculture Organization of the United Nations. Retrieved from https://www.fao.org/burundi/fao-in-burundi/climate-change/en/

FAO. (2021). Gender and Climate-Smart Agriculture: Assessing the Needs of Women Farmers in Burundi. Food and Agriculture Organization of the United Nations.

FAO. (2021). Promoting climate-smart agriculture in Burundi: Lessons from a pilot project.

FAO. (2021). The State of Food and Agriculture 2020: Overcoming the Crisis of Gender Inequality in Agriculture. Food and Agriculture Organization of the United Nations.

FAO. (2021). *The Gender Gap in Agriculture*. Food and Agriculture Organization of the United Nations.

Farm Africa. (2017). *Climate-Smart Agriculture Project in Ethiopia: Building Resilience through Gender-Sensitive Approaches*.

Official Use Only

Farnworth, C. R., Sundell, M. F., Nzioki, A., Shivutse, V., & Davis, M. (2013). Transforming gender relations in agriculture in Sub-Saharan Africa. *Swedish International Agricultural Network Initiative (SIANI)*.

FSDA. (2019). The Role of Insurance Regulators in Dealing with Risks Relating to Agriculture Insurance. FSD Africa.

Gaiser, M. L., Winkler, A. S., Klug, S. J., Nkurunziza, S., & Stelzle, D. (2023). Determinants of stunting among children under age five in burundi: evidence from the 2016–2017 burundi demographic and health survey (bdhs 2016–17). Food Science &Amp; Nutrition, 11(7), 4100-4112. https://doi.org/10.1002/fsn3.3400

Gatore, A. C. I., Kim, S., Bae, D., Islam, M. F., & Parisouj, P. (2023). The analysis of the long-term trend of extreme precipitation and discharge in burundi.. https://doi.org/10.21203/rs.3.rs-3132415/v1

Gaurav, S., et al. (2018). Impact of weather-based crop insurance scheme on farmers' risk aversion and fertilizer use decisions. *Agricultural Economics Research Review*.

Gaurav, S., Mishra, S., & Oliver, A. (2021). Narrowing the Crop Yield Gap Through Weather-Based Insurance: Evidence from India. American Journal of Agricultural Economics, 103(3), 879-905.

Gebrechorkos, S. H., Hülsmann, S., & Bernhofer, C. (2019). Long-term trends in rainfall and temperature using high-resolution climate datasets in east africa. Scientific Reports, 9(1). https://doi.org/10.1038/s41598-019-47933-8

Geza, W., Ngidi, M., Ojo, T., Adetoro, A., Slotow, R., & Mabhaudhi, T. (2021). Youth participation in agriculture: a scoping review. Sustainability, 13(16), 9120. https://doi.org/10.3390/su13169120

Ghosh, P., et al. (2020). *Weather Index Insurance in Malawi: Impacts on Women Farmers and Household Resilience*. Agricultural Economics, 51(4), 579-592.

Gladwin, C. H., Thomson, A. M., Peterson, J. S., & Anderson, A. S. (2001). Addressing food security in Africa via multiple livelihood strategies of women farmers. Food Policy, 26(2), 177-207.

Gonzalez, J. A., Lima, F. A., & Hasegawa, T. (2018). Gender dimensions of climate change adaptation in agriculture. *Climate Policy*, 18(4), 469-487.

Government of Burundi. (2020). *National Climate Change Adaptation Strategy*.

Government of Kenya. (2019). Kenya Livestock Insurance Program: Impact Report.

Grameen Foundation. (2018). *Empowering Women through Microfinance: Lessons from the Field*.

Greatrex, H., Hansen, J. W., Garvin, S., Diro, R., Blakeley, S., Le Guen, M., ... & Osgood, D. E. (2015). *Scaling up index insurance for smallholder farmers: Recent evidence and insights*.

Official Use Only

CCAFS Report, (14).

Green Climate Fund. (2019). Gender Policy and Action Plan 2020–2023.

Grown, C., Addison, T., & Tarp, F. (2016). *Aid for Gender Equality and Development*. Routledge.

GSMA. (2019). The Role of Mobile Technology in Agricultural Insurance: Case Studies from Africa.

GSMA. (2020). *The Mobile Gender Gap Report 2020*. GSMA.

Hadiq, H., Susanto, E. H., & Sari, R. (2021). Prototyping of agricultural education website using the design sprint approach. CCIT Journal, 14(1), 28-39. https://doi.org/10.33050/ccit.v14i1.1011

Hassaan, M., Abdrabo, M., & Masabarakiza, P. (2017). Gis-based model for mapping malaria risk under climate change case study: burundi. Journal of Geoscience and Environment Protection, 05(11), 102-117. https://doi.org/10.4236/gep.2017.511008

Hazell, P., & Hess, U. (2010). Drought insurance for agricultural development and food security in dryland areas. *Food Security*, 2, 395-405.

Hellmuth, E., Osgood, D., Hess, U., Moorhead, A., & Bhojwani, H. (Eds.). (2007). *Index-based agricultural insurance for developing country environments: Design and implementation*. World Bank Publications.

Hellmuth, M. E., Osgood, D. E., Hess, U., Moorhead, A., & Bhojwani, H. (2009). Index insurance and climate risk: Prospects for development and disaster management. Climate and Society No. 2. International Research Institute for Climate and Society (IRI), Columbia University, New York, USA.

Hess, U., Richter, K., & Stoppa, A. (2016). Weather risk management for agriculture and agri-business in developing countries. In Climate risk and weather derivatives (pp. 295-310). Risk Books.

Huyer, S. (2016). Closing the gender gap in agriculture. Gender, Technology and Development, 20(2), 105-116. https://doi.org/10.1177/0971852416643872

Huyer, S. (2016). Closing the gender gap in agriculture. *Ceres: The Food and Agriculture Organization of the United Nations*.

Huyer, S. (2020). Going back to the well: women, agency, and climate adaptation. World Journal of Agriculture and Soil Science, 5(3). https://doi.org/10.33552/wjass.2020.05.000611

Huyer, S., & Quisumbing, A. R. (2014). Gender equality in agricultural and environmental science and technology. In *Handbook of Global Science and Technology Policy* (pp. 563-585). Wiley-Blackwell.

IFAD. (2018). *Building Resilience to Climate Change in Agricultural Livelihoods: Lessons from the R4 Rural Resilience Initiative*. International Fund for Agricultural Development.

Official Use Only

IFAD. (2019). *Burundi Country Strategic Opportunities Programme*. IFAD.

IFAD. (2019). *Strengthening Gender Equality in Public Policies for Rural Development: The Case of Burundi*. International Fund for Agricultural Development.

IFAD. (2020). How Agricultural Insurance Can Improve Food Security – and Why It's Difficult to Achieve. International Fund for Agricultural Development.

IFAD. (2020). Participatory Approaches to Agricultural Insurance: Engaging Women Farmers. International Fund for Agricultural Development.

IFC. (2019). *Strengthening Access to Finance for Women Farmers in Burundi*. International Finance Corporation.

IFPRI. (2018). Gender differences in agricultural productivity: Evidence from Burundi.

IFPRI. (2019). *2019 Global Food Policy Report*. IFPRI.

IFPRI. (2020). Women's Empowerment in Agriculture Index: Insights from Africa.

IPCC. (2018). *Global Warming of 1.5°C: An IPCC Special Report on the Impacts of Global Warming*. Intergovernmental Panel on Climate Change.

IRI. (2021). Index Insurance for Agricultural Development: A Technical Guide. International Research Institute for Climate and Society, Columbia University.

Jack, W., & Suri, T. (2014). Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution. American Economic Review, 104(1), 183-223.

Jerneck, A. (2018). What about gender in climate change? Twelve feminist lessons from development. Sustainability, 10(3), 627.

Jisso, M., Tesfaye, T., Biadgilign, S., Tareke, A., & Zerfu, T. (2022). The role of multi-dimensional women's empowerment in agriculture to improve the nutritional status of under-five children in rural cash crop producing, resource-limited settings of ethiopia. Journal of Nutritional Science, 11. https://doi.org/10.1017/jns.2022.86

Johnson, S. (2016). Reaching rural women with financial services. *CGAP*.

Jost, C., Kyazze, F., Naab, J., Neelormi, S., Kinyangi, J., Zougmore, R., ... & Kristjanson, P. (2016). Understanding gender dimensions of agriculture and climate change in smallholder farming communities. Climate and Development, 8(2), 133-144.

Kabeer, N. (2016). Gender, Labour Markets and Women's Economic Empowerment: Policy Learning in an Era of Globalization. *Development and Change*, 47(4), 573-596.

Kabura, S. N., & Ngurube, P. (2017). Climate change, agriculture and gender: A review of the literature. Journal of Agricultural and Applied Economics, 49(3), 437-455.

Kahane, M., Koyama, M., & El Ouardighi, H. (2020). Gender equality and climate-smart agriculture: Learning from a gender-integrated project in the Middle East. *Agricultural Systems*, 179, 102786.

Official Use Only

Kaijser, A., & Kronsell, A. (2014). Climate change through the lens of intersectionality. Environmental Politics, 23(3), 417-433.

Kaimowitz, D., & Angelsen, A. (2018). Key issues in forest, climate change, and agriculture. *Global Environment Facility*.

Kandji, S. T., & Verchot, L. V. (2016). Impacts of climate change on agriculture and food security: A review of the literature. Journal of Agricultural and Environmental Sciences, 5(1), 1-15.

Karlan, D., & Zinman, J. (2011). Microcredit in theory and practice: Using randomized credit scoring for impact evaluation. Science, 332(6035), 1278-1284.

Kassam, A., Randall, J., & Abeygunawardena, N. (2020). Social inclusion in climate adaptation: A systematic review of empirical evidence. Environmental Science & Policy, 105, 62-70.

Kassie, M., Shiferaw, S., & Muricho, G. (2019). Agricultural insurance and technology adoption under sequential technology choices: Evidence from drought-prone areas of Ethiopia. *Food Policy*, 88, 101767.

Kassie, M., Zikhali, P., Manjau, A., & Pender, J. (2019). The Role of Agricultural Diversification in Enhancing Resilience to Climate Change in Ethiopia. Climate and Development, 11(3), 224-233.

Katz, E. & Chamorro, A. (2019). Women's empowerment in agriculture and its supportive role in climate adaptation. *Women's Studies International Forum*, 75, 102269.

Khatri-Chhetri, A., Regmi, P., Chanana, N., & Aggarwal, P. (2019). Potential of climate-smart agriculture in reducing women farmers' drudgery in high climatic risk areas. Climatic Change, 158(1), 29-42. https://doi.org/10.1007/s10584-018-2350-8

Kim, J., Habimana, J., Kim, S., & Bae, D. (2021). Assessment of climate change impacts on the hydroclimatic response in burundi based on cmip6 esms. Sustainability, 13(21), 12037. https://doi.org/10.3390/su132112037

Kindon, S., Pain, R., & Kesby, M. (2008). Participatory action research approaches and methods: Connecting people, participation and place. Routledge.

King, M. and Gregg, M. (2021). Disability and climate change: a critical realist model of climate justice. Sociology Compass, 16(1). https://doi.org/10.1111/soc4.12954

Klapper, L., El-Zoghbi, M., & Hess, J. (2016). Achieving the sustainable development goals: The role of financial inclusion. CGAP and UNSGSA.

Kristjanson, P., Bryan, E., Bernier, Q., Twyman, J., Meinzen-Dick, R., Kieran, C., … & Doss, C. (2017). Addressing gender in agricultural research for development in the face of a changing climate: where are we and where should we be going?. International Journal of Agricultural Sustainability, 15(5), 482-500. https://doi.org/10.1080/14735903.2017.1336411

Official Use Only

Kukal, M. S. and Irmak, S. (2018). Climate-driven crop yield and yield variability and climate change impacts on the u.s. great plains agricultural production. Scientific Reports, 8(1). https://doi.org/10.1038/s41598-018-21848-2

Kumar, L., et al. (2019). *Participatory Approaches to Designing Climate Insurance Products for Women Farmers in Developing Countries*. Climate Risk Management, 24, 133-143.

Kyazze, F. B., Gom, J., Nkundira, T., Ziba, S., & Luzobe, N. (2018). *FinScope Burundi 2018*. FinMark Trust.

Lam, S. (2024). Empowering women for climate resilience: Lessons from the Adaptation Consortium in Kenya. Climate and Development, 16(3), 315-328.

Lambrou, Y., & Piana, G. (2006). Gender: The missing component of the response to climate change. *FAO*.

Landesa. (2020). Women's Land Rights in Burundi: Analysis and Recommendations.

Legesse, B., Ute, J. A., & Hule, M. N. (2019). Climate smart agriculture and its implementation challenges in africa. Current Journal of Applied Science and Technology, 1-13. https://doi.org/10.9734/cjast/2019/v38i430371

Leta, A. and Megersa, T. (2021). Factors influencing soil erosion management practices in ejersa lafo district, west showa zone, oromia, regional state, ethiopia. Journal of Applied Sciences and Environmental Management, 25(1), 79-85. https://doi.org/10.4314/jasem.v25i1.11

Lindsjö, K., Mulwafu, W., Djurfeldt, A., & Joshua, M. (2020). Generational dynamics of agricultural intensification in malawi: challenges for the youth and elderly smallholder farmers. International Journal of Agricultural Sustainability, 19(5-6), 423-436. https://doi.org/10.1080/14735903.2020.1721237

Linnerooth-Bayer, J., Mechler, R., & Hochrainer-Stigler, S. (2011). Insurance against losses from natural disasters in developing countries: Evidence, gaps and the way forward. Journal of Integrated Disaster Risk Management, 1(1), 59-81.

Long, T. B., Blok, V., & Coninx, I. (2016). Barriers to the adoption and diffusion of technological innovations for climate-smart agriculture in europe: evidence from the netherlands, france, switzerland and italy. Journal of Cleaner Production, 112, 9-21. https://doi.org/10.1016/j.jclepro.2015.06.044

López, M. d. R. R., Liersch, S., & Hattermann, F. F. (2021). *Potential hydro-meteorological impacts over burundi from climate change*. https://doi.org/10.5194/egusphere-egu21-9562

Mahajan, V., & Ramola, B. (2017). Financial inclusion in Burundi: Status, challenges and opportunities. *International Journal of Social Economics*, 44(10), 1552-1570.

Mahajan, V., & Ramola, B. G. (2017). Financial inclusion through technology: A case study of India. *Journal of Financial Regulation and Compliance*, 25(4), 456-465.

Official Use Only

Mahmoud, A., Ali, M., & Hossain, M. (2018). The link between gender equality and food security in climate change adaptation. *International Journal of Climate Change Strategies and Management*, 10(4), 501-515.

Mahul, O., & Wright, B. D. (2013). Implications of climate change for the design of weather index insurance: A case study of India. *World Bank Policy Research Working Paper*.

Makate, C. (2019). Local institutions and indigenous knowledge in adoption and scaling of climate-smart agricultural innovations among sub-saharan smallholder farmers. International Journal of Climate Change Strategies and Management, 12(2), 270-287. https://doi.org/10.1108/ijccsm-07-2018-0055

Makuyana, T. (2024). Mapping disability and climate change knowledge base in scopus using bibliometric analysis. African Journal of Disability, 13. https://doi.org/10.4102/ajod.v13i0.1339

Manirakiza, D. (2024). Impact of agroecological innovations on agricultural production and the environment in the foothills of mumirwa, burundi. East African Journal of Agriculture and Biotechnology, 7(1), 140-147. https://doi.org/10.37284/eajab.7.1.1815

Mastrorillo, M., et al. (2016). Gender and Climate Change in Agriculture: A Review of the Literature. Climate and Development, 8(2), 99-113.

Mastrorillo, M., et al. (2016). The Gendered Impact of Climate Change on Agriculture: Addressing the Barriers to Women's Resilience. *Environmental Development*, 18, 1-11.

Mastrorillo, M., et al. (2016). *Gender Differences in Agricultural Productivity: Evidence from Burundi*. Food Policy, 65, 1-12.

Mbabazi, P., Zziwa, E., & Kiconco, J. (2019). Determinants of financial inclusion and financial literacy among women in Uganda: The moderating role of financial innovation. *Cogent Economics & Finance*, 7(1), 1664947.

McCarthy, N., Udkow, M. P., Campistrous, L., & Hansen, J. (2018). Engendering statistics for measuring gender equality in the SDGs: The case of agriculture and rural livelihoods. Statistical Journal of the IAOS, 34(S1), S25-S38.

McIntosh, C., et al. (2019). *The Impact of Index-Based Livestock Insurance on Women's Empowerment in Kenya and Ethiopia*. Journal of Development Studies, 55(8), 1655-1670.

Meinzen-Dick, R., Quisumbing, A. R., & Behrman, J. A. (2014). Gender equality and food security: A review of the literature. IFPRI Discussion Paper, 01349.

Mekonnen, Z. (2022). Intra-household gender disparity: effects on climate change adaptation in arsi negele district, ethiopia. Heliyon, 8(2), e08908. https://doi.org/10.1016/j.heliyon.2022.e08908

Meyer, S., et al. (2019). Youth and Agricultural Adaptation: A Review of the Evidence. International Journal of Agricultural Sustainability, 17(3), 275-290.

Official Use Only

Minani, B., Rurema, D., & Lebailly, P. (2013). *Rural resilience and the role of social capital among farmers in kirundo province, northern Burundi*. Applied Studies in Agribusiness and Commerce, 7(2-3), 121-125. https://doi.org/10.19041/apstract/2013/2-3/20

Ministry of Agriculture and Livestock. (2018). *National Agricultural Investment Plan*. Republic of Burundi.

Mittal, S. (2016). Role of mobile phone-enabled climate information services in gender-inclusive agriculture. *Gender, Technology and Development*, 20(1), 1-37.

Mizik, T. (2021). Climate-smart agriculture on small-scale farms: a systematic literature review. Agronomy, 11(6), 1096. https://doi.org/10.3390/agronomy11061096

Molony, T. (2011). Bioenergy policies in africa: mainstreaming gender amid an increasing focus on biofuels. Biofuels, Bioproducts and Biorefining, 5(3), 330-341. https://doi.org/10.1002/bbb.293

Morduch, J. (1999). The microfinance promise. Journal of Economic Literature, 37(4), 1569-1614.

Morsello, C., et al. (2017). Soil Degradation and Farmers' Resilience in Burundi: Reflections on the Role of the Agricultural Sector. *Land Use Policy*, 65, 265-275.

Mperejekumana, P., Shen, L., Zhong, S., Muhirwa, F., Nsabiyeze, A., Nsigayehe, J. M. V., … & Nyirarwasa, A. (2023). Assessing the capacity of the water–energy–food nexus in enhancing sustainable agriculture and food security in burundi. Sustainability, 15(19), 14117. https://doi.org/10.3390/su151914117

Mugula, A. A., Zhang, X., & Nzau, M. Z. (2021). Crop diversification strategies and pastoral communities: A case study of Mbulu district in Tanzania. Pastoralism, 11(1), 1-13.

Munawarah, M., Bukit, R. B., S., I. A., & Rangkuti, M. B. (2022). Does financial literacy a stimulus for improving the farmer's welfare in serdang bedagai, indonesia?. International Journal of Finance, Economics and Business, 1(4), 275-283. https://doi.org/10.56225/ijfeb.v1i4.75

Muyambo, F., Kankwamba, H., & Simbizi, D. (2019). Climate change, agriculture and gender: A systematic review of the literature in sub-Saharan Africa. Journal of African Development, 21(1), 1-23.

Mwongera, C., Shikuku, K. M., Twyman, J., Läderach, P., Ampaire, E., Asten, P. v., … & Winowiecki, L. (2017). Climate smart agriculture rapid appraisal (csa-ra): a tool for prioritizing context-specific climate smart agriculture technologies. Agricultural Systems, 151, 192-203. https://doi.org/10.1016/j.agsy.2016.05.009

Nchanji, E. (2023). Gender dynamics in the biofortified bean value chain in burundi. Outlook on Agriculture, 52(4), 411-423. https://doi.org/10.1177/00307270231193049

Nchanji, E. B., Kabuli, H., Nyamolo, V. O., Cosmas, L., Chisale, V., & Matumba, A. (2022). Gender differences in climate-smart adaptation practices amongst bean-producing farmers in

Official Use Only

malawi: the case of linthipe extension planning area. Frontiers in Sustainable Food Systems, 6. https://doi.org/10.3389/fsufs.2022.1001152

Nchanji, E. B., Nduwarugira, E., Ndabashinze, B., Bararyenya, A., Hakizimana, M. B., Nyamolo, V., … & Lutomia, C. K. (2023). Gender norms and differences in access and use of climate-smart agricultural technology in burundi. Frontiers in Sustainable Food Systems, 7. https://doi.org/10.3389/fsufs.2023.1040977

Nchanji, E., Kabuli, H., Nyamolo, V., Cosmas, L., Chisale, V., & Matumba, A. (2022). Gender differences in climate-smart adaptation practices amongst bean-producing farmers in malawi: the case of linthipe extension planning area. Frontiers in Sustainable Food Systems, 6. https://doi.org/10.3389/fsufs.2022.1001152

Ndabashinze, B., Nchanji, E. B., Lutomia, C. K., Nduwarugira, E., Hakizimana, M. B., & Mayugi, I. (2024). Closing gender gaps through gender-responsive, demand-led breeding in burundi. Frontiers in Sociology, 8. https://doi.org/10.3389/fsoc.2023.1264816

Ndagijimana, M., Kessler, A., & Asseldonk, M. (2018). Understanding farmers' investments in sustainable land management in burundi: a case-study in the provinces of gitega and muyinga. Land Degradation and Development, 30(4), 417-425. https://doi.org/10.1002/ldr.3231

Ndaruzaniye, M., Ndikumana, E., & Habiyaremye, J. (2021). Climate change and gendered agriculture in Burundi: The case of rural women in Bugendana Commune. International Journal of Gender and Development Issues, 23(1), 84-98.

Ndayambaje, J. D., Heijman, W. J. M., & Mohren, G. M. J. (2013). Farm woodlots in rural Rwanda: purposes and determinants. Agroforestry Systems, 87(4), 797-814.

Ndayiragije, A., Mohren, G. M. J., & Verwer, C. (2017). Farm household typologies and their relationship with the landscape: A case study in a coffee agroforestry system in Burundi. Agroforestry Systems, 91(6), 1103-1115.

Ndayiragije, J., Li, F., & Nkunzimana, A. (2022). *Assessment of two drought indices to quantify and characterize drought incidents: a case study of the northern part of Burundi. Atmosphere*, 13(11), 1882. https://doi.org/10.3390/atmos13111882

Ndayisaba, A., Bizimana, J. C., & Nkezabahizi, D. (2013). Vulnerability to climate change and adaptive capacity in rural Burundi. Climate and Development, 5(4), 272-282.

Ndikumana, L., & Emizet, K. F. (2018). Burundi's Growth Experience: Challenges and Prospects. In The Oxford Handbook of the Ethiopian Economy.

Nelson, V., Meadows, K., Cannon, T., Morton, J., & Martin, A. (2002). Uncertain predictions, invisible impacts, and the need to mainstream gender in climate change adaptations. *Gender & Development*, 10(2), 51-59.

Nibaruta, J., Elkhoudri, N., Chahboune, M., Chebabe, M., Saad, E., Baali, A., … & Amor, H. (2021). *Determinants of fertility differentials in Burundi: evidence from the 2016-17 Burundi*

Official Use Only

demographic and health survey. Pan African Medical Journal, 38. https://doi.org/10.11604/pamj.2021.38.316.27649

Nielsen, J. Ø., & Reenberg, A. (2010). The Role of Climate in Addressing Food Insecurity: The Case of Burundi. *Global Environmental Change*, 20(2), 363-372.

Niyonkuru, R. C. (2018). Failure of foreign aid in developing countries: A quest for alternatives. Business and Economics Journal, 9(3), 1-9.

Njuki, J., Muema, E., Kafu, A., & Olindi, S. (2016). Beyond the mean: Differentiated social impacts of climate change on men and women smallholder farmers in Kenya. Climate and Development, 8(4), 337-349.

Nkonya, E., et al. (2016). Soil Degradation in Africa: The Cost of Action and the Cost of Inaction. International Food Policy Research Institute.

Nkunzimana, T., Custodio, E., Thomas, A. C., Tefera, N., Scheerens, C., & Alercia, A. (2020). Global analysis of food and nutrition security situation in food crisis hotspots. EUR 30078 EN, Publications Office of the European Union, Luxembourg.

Nwachukwu, J. U. (2017). Technology adoption and agricultural development in sub-saharan africa (ssa): a nigerian case study. Journal of Cultural and Religious Studies, 5(6). https://doi.org/10.17265/2328-2177/2017.06.005

Nyasimi, M., Kimeli, P., Sayula, G., Radeny, M., Kinyangi, J., & Mungai, C. (2018). Adoption and dissemination pathways for climate-smart agriculture technologies and practices for climate-resilient livelihoods in Lushoto, Northeast Tanzania. Climate, 6(2), 33.

Ochilo, W., Toepfer, S., Ndayihanzamaso, P., Mugambi, I., Vos, J., & Niyongere, C. (2022). Assessing the plant health system of burundi: what it is, who matters and why. Sustainability, 14(21), 14293. https://doi.org/10.3390/su142114293

OECD. (2020). *Burundi: Country Profile*. Organisation for Economic Co-operation and Development.

Okonya, J. S., Petsakos, A., Suárez, V. H., Nduwayezu, A., Kantungeko, D., Blomme, G., … & Kroschel, J. (2019). Pesticide use practices in root, tuber, and banana crops by smallholder farmers in rwanda and burundi. International Journal of Environmental Research and Public Health, 16(3), 400. https://doi.org/10.3390/ijerph16030400

Ouma, E., Odhiambo, N. M., & Kathuri, N. J. (2017). Mobile phone financial services and financial inclusion in Kenya. *Mobile phones and economic development in Africa*, 207-232.

Oxfam. (2019). *Climate Change and Food Security in Burundi: A Comprehensive Analysis*. Oxfam International.

Oxfam. (2021). *The Role of Women in Agriculture: Addressing Gender Inequality for Sustainable Development in Burundi*.

Official Use Only

Oyawole, F. P., Shittu, A. M., Kehinde, M. O., Ogunnaike, G., & Akinjobi, L. T. (2020). Women empowerment and adoption of climate-smart agricultural practices in nigeria. African Journal of Economic and Management Studies, 12(1), 105-119. https://doi.org/10.1108/ajems-04-2020-0137

Ozaki, A. (2018). *The Role of Insurance in Climate Change Adaptation*. Springer.

Panagos, P., Standardi, G., Borrelli, P., Lugato, E., Montanarella, L., & Bosello, F. (2018). Cost of agricultural productivity loss due to soil erosion in the european union: from direct cost evaluation approaches to the use of macroeconomic models. Land Degradation and Development, 29(3), 471-484. https://doi.org/10.1002/ldr.2879

Patriche, C. (2019). Quantitative assessment of rill and interrill soil erosion in romania. Soil Use and Management, 35(2), 257-272. https://doi.org/10.1111/sum.12475

Paudyal, B., Chanana, N., Khatri-Chhetri, A., Sherpa, L., Kadariya, I., & Aggarwal, P. (2019). Gender integration in climate change and agricultural policies: the case of nepal. Frontiers in Sustainable Food Systems, 3, 66. https://doi.org/10.3389/fsufs.2019.00066

Pawlak, K. and Kołodziejczak, M. (2020). The role of agriculture in ensuring food security in developing countries: considerations in the context of the problem of sustainable food production. Sustainability, 12(13), 5488. https://doi.org/10.3390/su12135488

Pender, J., Nkonya, E., Jagger, P., Sserunkuuma, D., & Ssali, H. (2004). Strategies to increase agricultural productivity and reduce land degradation: evidence from uganda. Agricultural Economics, 31(2-3), 181-195. https://doi.org/10.1111/j.1574-0862.2004.tb00256.x

Perez, C., Jones, E. M., Kristjanson, P., Cramer, L., Thornton, P. K., Förch, W., & Barahona, C. A. (2015). *How resilient are farming households and communities to a changing climate in Africa? A gender-based perspective*. Global Environmental Change, 34, 95-107.

Peterman, A., & Quisumbing, A. R. (2019). Gender and climate change research: The need for intersectional approaches. *Climate Policy*, 19(4), 506-512.

Peterman, A., Selwyn, C., & Roy, S. (2019). The impact of gender on the sustainable development goals: Lessons from the field. *World Development Report*.

Pratiwi, P., Rahayu, S., & Husein, S. (2017). Gender integration in climate-smart agriculture: A case study from Rwanda. World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.

Quisumbing, A. R., Meinzen-Dick, R., Raney, T. L., Croppenstedt, A., Behrman, J. A., & Peterman, A. (2014). Gender in agriculture: Closing the knowledge gap. Springer Science & Business.

RAO, C. (2024). Climate change adaptation and mitigation in indian agriculture. Journal of Agrometeorology, 26(2), 137-148. https://doi.org/10.54386/jam.v26i2.2582

Official Use Only

Rao, N., Vermeulen, S., Gupta, A., & Dhanaraj, C. (2019). Mainstreaming gender in agriculture and natural resource management projects: A review of impact pathways and evidence. World Bank.

Rivas-López, M. R., Liersch, S., Menz, C., Lange, S., & Hattermann, F. F. (2022). Potential hydro-meteorological impacts over burundi from climate change. Journal of Hydrology: Regional Studies, 42, 101130. https://doi.org/10.1016/j.ejrh.2022.101130

Roche, S., & Monchuk, L. (2021). Gender and climate-smart agriculture: Evidence from programmatic evaluations in East Africa. *Food Security*, 13(2), 439-453.

Rosenstock, T. S., Tubiello, F. N., & Verchot, L. V. (2014). Climate change and food security: Adapting agriculture to the changing climate. Global Food Security, 3(2), 71-72.

Saab, A. (2016). Climate-resilient crops and international climate change adaptation law. Leiden Journal of International Law, 29(2), 503-528. https://doi.org/10.1017/s0922156516000121

Sanginga, P. C., Adesina, A. A., & Manyong, V. M. (2016). Gender and climate change in African agriculture: A systematic review. Journal of Agricultural Education and Extension, 22(1), 1-19.

Sango, P., Bellò, M., Deveau, R., Gager, K., Boateng, B., Ahmed, H., … & Azam, M. (2022). Exploring the role and lived experiences of people with disabilities working in the agricultural sector in northern nigeria the agricultural sector in northern nigeria. African Journal of Disability, 11. https://doi.org/10.4102/ajod.v11i0.897

Schaffernicht, S. and Quendler, E. (2023). A social-ecological model for inclusion processes in urban agriculture of vienna, austria. Merits, 3(2), 415-431. https://doi.org/10.3390/merits3020024

Schalatek, L., Bird, N., & Brown, J. (2012). Where is the money? Climate change adaptation and development: The role of the global financing architecture. *Overseas Development Institute*.

Schüller, S. (2023). *Participatory integrated planning (pip), land governance and food security : insights from Burundi*.. https://doi.org/10.18174/646409

Sellers, S., Zerriffi, H., & Conway, D. (2018). Climate change adaptation and the youth in sub-Saharan Africa: A systematic review. Climate and Development, 10(9), 775-791.

Shaikh, A. A. and Karjaluoto, H. (2015). Mobile banking adoption: a literature review. Telematics and Informatics, 32(1), 129-142. https://doi.org/10.1016/j.tele.2014.05.003

Shrestha, S., Ciaian, P., Himics, M., & Doorslaer, B. V. (2013). Impacts of climate change on eu agriculture. Review of Agricultural and Applied Economics, 16(02), 24-39. https://doi.org/10.15414/raae.2013.16.02.24-39

Skees, J. R. (2008). Innovations in index insurance for the poor in lower income countries. Agricultural and Resource Economics Review, 37(1), 1-15.

Official Use Only

Sraboni, E., Malapit, H., Quisumbing, A., & Ahmed, A. (2013). Women's empowerment in agriculture: what role for food security in bangladesh?. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2373183

Stein, D., & Castillo, M. P. (2020). *Bridging the Gender Gap in Agricultural Insurance*. World Bank.

Stein, P., Stein, M., Groce, N., & Kett, M. (2023). The role of the scientific community in strengthening disability-inclusive climate resilience. Nature Climate Change, 13(2), 108-109. https://doi.org/10.1038/s41558-022-01564-6

Subedi, N. and Poudel, S. K. (2020). Effects of climate change on agriculture and its mitigation through climate smart agriculture practices in nepal. Tropical Agrobiodiversity, 1(1), 47-51. https://doi.org/10.26480/trab.01.2020.47.51

Suranny, L., Gravitiani, E., & Rahardjo, M. (2022). Impact of climate change on the agriculture sector and its adaptation strategies. Iop Conference Series Earth and Environmental Science, 1016(1), 012038. https://doi.org/10.1088/1755-1315/1016/1/012038

Suri, T., & Jack, W. (2016). The long-run poverty and gender impacts of mobile money. Science, 354(6317), 1288-1292.

Swiss Re. (2019). Successful Agriculture Insurance Programs: How to Make Agriculture Insurance Work.

Swiss Re. (2019). Successful farming with parametric insurance. Swiss Re Corporate Solutions.

Swiss Re. (2020). Parametric Insurance: Closing the Protection Gap for Climate Risks.

Syahputra, B. and Sucahyono, D. (2022). Validation of rainfall reanalysis data to explore changes in oldeman agricultural climate patterns due to variability of surface temperature anomalies with time series analysis techniques (case study of dumai city for 30 years period). Proceedings of International Conference on Multidiciplinary Research, 4(1), 221-228. https://doi.org/10.32672/pic-mr.v4i1.3773

Syroka, J. K., & Wilcox, C. (2019). *Parametric Insurance for Development: A Practical Guide*. Practical Action Publishing.

Tamasiga, P., Onyeaka, H., Akinsemolu, A., & Bakwena, M. (2023). The inter-relationship between climate change, inequality, poverty and food security in africa: a bibliometric review and content analysis approach. Sustainability, 15(7), 5628. https://doi.org/10.3390/su15075628

Tandon, N., Fayette, J., Gibbs, J., & Schwartz, S. (2017). Gender, climate change, and agriculture: Supporting evidence-based policy and practice. *IFAD and CARE International*.

Through these future research recommendations, the project can develop a robust evidence base to support effective gender-responsive policies in climate adaptation and agriculture, ultimately enhancing resilience in vulnerable communities.

Official Use Only

Toepfer, S., Niyongere, C., Ndayihanzamaso, P., Ndikumana, D., Irakoze, W., Cimpaye, E., … & Ochilo, W. (2023). Sustainable improvements in diagnostic capabilities of plant health practitioners through short in-service training. Sustainability, 15(17), 12956. https://doi.org/10.3390/su151712956

Tschakert, P., Gunter, M., & Kauffman, K. (2019). Women's empowerment and climate change: Why gender matters. *Sustainability*, 11(20), 5782.

Tschakert, P., Walsh, M., & Simmons, J. (2019). Climate change and ecosystems: Knowledge gaps and future research pathways. *Global Environmental Change*, 54, 63-73.

Tuan, H. (2024). Agricultural practices and climate resilience: case study in vietnam. International Journal of Climatic Studies, 3(1), 24-36. https://doi.org/10.47604/ijcs.2476

Twyman, J., Green, M., Bernier, Q., Kristjanson, P., Russo, S., Tall, A., ... & Ndourba, Y. (2014). Gender and climate change perceptions, adaptation strategies, and information needs: Preliminary results from four sites in Africa. CCAFS Working Paper No. 83.

UN Women. (2020). *Gender Equality and Climate Change: A Global Analysis*. United Nations Women.

UN Women. (2021). Gender and Climate Change in Burundi: Challenges and Opportunities.

UN. (2013). Report of the special rapporteur on the rights of persons with disabilities on his mission to Burundi. United Nations Human Rights Council.

UNDP. (2016). *Gender and Climate Change: Gender-Sensitive Approaches in Climate-Compatible Development*. United Nations Development Programme.

UNDP. (2019). Gender, Climate Change and Agriculture Support Programme: Final Evaluation Report.

Upadhyay, B. (2024). Breaking the silence: the complex nexus of gender and climate change in nepal. Environmental Research Climate, 3(2), 025004. https://doi.org/10.1088/2752-5295/ad2eb1

USAID. (2020). *Land Tenure and Property Rights in Burundi: An Analysis of Legal and Customary Frameworks*.

Uwineza, O., Lagat, J., & Berem, R. (2021). The role of women empowerment in agriculture on household farm commercialization of maize, potatoes and beans in northern province of rwanda. Journal of Agribusiness and Rural Development, 59(1). https://doi.org/10.17306/j.jard.2021.01405

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2013). Resilience, adaptability and transformability in social-ecological systems. Ecology and Society, 18(2), 4.

WFP (World Food Programme). (2019). *The R4 Rural Resilience Initiative: Annual Report 2019*.

Official Use Only

WFP. (2018). *R4 Rural Resilience Initiative: Building Resilience in Ethiopia*. World Food Programme.

Wieser, C., Bruhn, M., Kinzinger, J., Ruckteschler, C., & Heitmann, S. (2019). The impact of mobile money on poor rural households: Experimental evidence from Uganda. World Bank Policy Research Working Paper, (8913).

Williams, M. (2016). Gender and climate change financing: Coming out of the margin. Routledge.

Woods, B. (2019). Redesigning social protection systems to enhance gender equity in agriculture: Lessons from the global south. *Gender & Development*, 27(3), 485-499.

Workalemahu, S. and Dawid, I. (2021). Smallholder farmers' adaptation strategies, opportunities and challenges to climate change: a review. International Journal of Food Science and Agriculture, 5(4), 592-600. https://doi.org/10.26855/ijfsa.2021.12.005

World Bank, FAO & IFAD. (2009). Gender in Agriculture Sourcebook. *The World Bank*

World Bank. (2012). *World Development Report 2012: Gender Equality and Development*. World Bank.

World Bank. (2017). Index Insurance for Climate Risk Management: A Review of Evidence and Lessons Learned.

World Bank. (2018). Agricultural Insurance: A Conceptual Framework. World Bank Group.

World Bank. (2018). *Women in Agriculture: Closing the Gender Gap for Development*. World Bank Publications.

World Bank. (2018). *Women, Business and the Law: 2018*. World Bank Publications.

World Bank. (2020). Burundi: Climate Change and Agriculture. World Bank Publications.

World Bank. (2020). *Burundi: Country Climate and Development Report*. World Bank.

World Bank. (2021). *Burundi Economic Update: The State of Food Security and Nutrition in Burundi*. World Bank Group.

World Bank. (2021). *Parametric Insurance: A New Tool for Climate Resilience in Agriculture*. World Bank Publications.

World Bank. (2021). *Parametric Insurance: A Smart Tool for Climate Risk Management*.

World Bank. (2022). *Building Resilience through Gender-Responsive Climate Insurance in Burundi*.

Zins, A., & Weill, L. (2016). The determinants of financial inclusion in Africa. Review of Development Finance, 6(1), 46-57.

Official Use Only

Zuo, Z. P. (2023). Environmental regulation, green credit, and farmers' adoption of agricultural green production technology based on the perspective of tripartite evolutionary game. Frontiers in Environmental Science, 11. https://doi.org/10.3389/fenvs.2023.1268504

Кучер, А., Кучер, Л., Sysoieva, I., & Pohrishchuk, B. (2021). Economics of soil erosion: case study of ukraine. Agricultural and Resource Economics International Scientific E-Journal, 7(4), 27-41. https://doi.org/10.51599/are.2021.07.04.02

Official Use Only

-



Environmental and Socio-economic Assessment for a Gender-responsive agriculture adaptation approach with parametric insurance and smart finance integration in Burundi

Bronson Eran'ogwa, Alexis Nkiza, Erick Kioko, Lieven Ndayizeye, Marius Ekue, Derenoncourt Marie, Rachel Olwanda, Lilian Waithaka, Joslyn Muthio, Jean Eyase, Eileen Mburu

In partnership with Canada Climate Action Africa

Official Use Only

Contents

1. Introduction 4
1.1. Background 4
2. Methods 6
2.1. Selection of Provinces, Communes, and Participants 6
2.2. Data Collection Methods 6
2.3. Data Analysis 8
3. Results and Discussion 8
3.1. Socioeconomic Characteristics 8
3.1.1. Population Distribution and Demographics 8
3.1.2. Population Distribution in the Imbo basin 11
3.1.3. Implications of Population Increase on Resilience and Adaptive Capacity to Climate Change 14
3.2. Poverty Estimates and Vulnerability 15
3.2.1. Food Security 16
3.2.2. Implications of Poverty and Vulnerability on Resilience and Adaptive Capacity to Climate Change 20
3.3. Sources of Water Pollution in Burundi 21
3.4. Energy Sources for Cooking in Burundi 22
3.5. Livelihoods and Income-Generating Activities (IAs) 23
3.5.1. Main Economic Activities in the Project Area 24
3.5.2. Other Economic Activities in the Project Area 25
3.5.3. Community Insights and Emerging Challenges 25
3.5.3 Implications of IAs on Resilience and Adaptive Capacity to Climate Change 26
3.6. 3.6 State of Natural Resources 27
3.6.1. Status of Forests and Land Use 27
3.6.2. Status of Forests at Imbo Basin 35
3.6.3. 3.6.2 Land Degradation 38
3.7. Biodiversity in Burundi 40
3.7.1. Flora 40
3.7.2. Fauna 40
3.8. 3.8. Environmental Baselines 41
3.8.1. Location and Administrative Units 41
3.8.2. Imbo Basin Location and Administrative Units 41
3.8.3. Imbo Basin Topography 44

3.8.2 Topography 45
3.8.4. Geology 46
3.8.5. Soils 47
3.8.6. Hydrology 47
3.8.7. Imbo Basin Hydrology 48
3.8.8. Climate 49
3.9. Hazard Risk Mapping 53
3.8.7 Temperature 57
3.8.8 Rainfall 60
Imbo Basin Rainfall 64
3.10. Implications of Environmental Variables on Resilience and Adaptive Capacity 76
3.11. Stakeholders' Suggestions for Successful Implementation of the project 77
References 83

1. Introduction

1.1. Background

A comprehensive socioeconomic and environmental baseline study was conducted to provide a detailed understanding of the current conditions within the designated project area. The purpose of this study was to gather essential data to inform the development of a full project proposal and serve as a benchmark for monitoring and evaluating project performance over time. Specifically, the findings will support the assessment of progress during mid-term and end-term evaluations and guide adjustments to the project's implementation strategy to ensure that it remains effective and relevant.

The **socioeconomic study** captured critical information on various aspects influencing the livelihoods, resilience, and gender dynamics within the local communities, including:

- **Population Distribution** - Mapping population density, demographic composition, and gender dynamics to understand how resources, responsibilities, and opportunities are distributed across different districts and provinces.
- **Livelihoods and Income-generating Activities** - Identifying primary sources of income for households, for example agriculture, livestock, small-scale businesses, and wage labor, and analyzing how these activities differ by gender and affect economic resilience and diversification.
- **Poverty, Vulnerability, and Food Insecurity Estimates** - Collecting data on poverty levels to pinpoint areas where economic interventions, particularly gender-responsive strategies, are most needed. Using spatial analysis to identify areas with high food insecurity risk, correlating this with poverty levels and climatic challenges.
- **Challenges Posed by Climate-related Events** - Assessing the frequency and impact of droughts, floods, and other climate-related events, with a focus on how gender roles influence the adoption of climate-smart technologies and strategies.
- **Gender-based Socioeconomic and Demographic Factors** - Analyzing how factors such as age, education, economic status, and gender roles affect the ability of communities to adopt parametric insurance solutions and access smart financial tools.
- **Access to Finance and Insurance** - Evaluating existing access to financial services and insurance products, particularly for women and marginalized groups, to identify barriers and opportunities for integrating parametric insurance and smart finance.

The **environmental baseline study** evaluated natural conditions and their interaction with the population's capacity to withstand and adapt to climate change. Key areas of focus included:

1) **Geographical and Administrative Location** - Specifying the project's geographical location and administrative divisions (Bubanza, Bururi, Karusi, Kirundo, Ruyigi, and Rutana) to establish operational boundaries.
2) **Topography** - Documenting landscape characteristics, such as elevation and terrain, and their influence on agricultural practices and climate resilience.
3) **Geology and Soil Characteristics** - Analyzing soil types and formations to understand their suitability for sustainable agricultural practices and their potential to support climate-smart agriculture.

4) **Hydrology and Drainage Patterns** - Mapping water resources, including rivers and drainage systems, to evaluate availability and risks, and identify opportunities for gender-sensitive water management strategies.
5) **Climate Patterns** - Collecting data on rainfall and temperature trends to understand how climate variability impacts agriculture and water availability, with a focus on the differential impacts on women and men.
6) **Biodiversity** - Documenting local biodiversity to assess how changes in land use and climate affect ecosystems and their capacity to support agriculture and resilience.
7) **Land Use Practices** - Evaluating farming, deforestation, and urbanization patterns to determine their impacts on gender equity in resource access and environmental sustainability.
8) **Natural Resource Conditions** - Investigating the state of key resources such as forests and water systems, with a gendered analysis of access and usage.

The baseline study covered six provinces (Bubanza, Bururi, Karusi, Kirundo, Rutana, and Ruyigi) encompassing an area of approximately 10,190 km². This extensive coverage allowed for a comprehensive analysis of socioeconomic, environmental, and gender-responsive factors critical to the project. The study also covered Imbo Basin comprises of four provinces, Cibitoke, Bubanza, Bujumbura Rural, and Bujumbura Mairie encompassing an area of 4,170.68 km². This extensive coverage allowed for a comprehensive analysis of both socioeconomic and environmental factors affecting the region Table 1.

Table 1: Proposed project area

Drainage Level	Province	Characteristics	Water Sub-Basins
Upstream	**Cibitoke Province**	Hilly, forested, high-altitude areas that contribute significantly to water sources.	**Rusizi River Sub-Basin** Small tributaries flow into the Rusizi River.
			Kibira Forest Watershed Key forested area that regulates water flow.
Midstream	**Bubanza Province**	Transitional landscapes with mid-level elevation, supporting agricultural irrigation.	**Rusizi River Sub-Basin** Receives water from upstream, flowing toward Lake Tanganyika.
			Mpanda River Sub-Basin Key tributary flowing toward Lake Tanganyika.
	Bujumbura Rural	Hilly areas, with water flowing from upstream and feeding into Lake Tanganyika.	**Tanganyika Sub-Basin** Streams and rivers flow directly into Lake Tanganyika.
			Mugere River Sub-Basin Major river contributing to Lake Tanganyika.
Downstream			**Rusizi River Sub-Basin**

	Bujumbura Mairie	Urban lowlands, affected by upstream activities, located on the shores of Lake Tanganyika.	Receives final water from the Rusizi River before reaching Lake Tanganyika.
			Tanganyika Sub-Basin Streams and rivers discharge into the lake here.

2. Methods

2.1. Selection of Provinces, Communes, and Participants

The selection of provinces and communes for the baseline study was guided by a collaborative effort between the Ministry of Agriculture and Environment of Burundi (MINEAGRIE), local government officials, and project stakeholders. Several criteria were considered when identifying the target areas:

- **Vulnerability to food insecurity**: Regions identified through food insecurity risk mapping as having high vulnerability were prioritized to target populations most in need of interventions.
- **Agricultural dependence:** Communities reliant on agriculture as their primary livelihood source were selected, given their heightened vulnerability to climate shocks and economic fluctuations.
- **Climate change impacts:** Provinces experiencing significant impacts, such as declining crop yields, soil erosion, and biodiversity loss, were included to address the intersection of environmental and socioeconomic challenges.
- **Poverty levels:** Provinces with high poverty rates were prioritized to ensure that economic vulnerability and inequality, particularly among women, were addressed.
- **Gender disparities**: Areas with documented disparities in access to resources, education, and financial services between men and women were targeted to promote gender equity and inclusion.
- **Access to financial services**: Regions with limited or no access to parametric insurance and smart financial products were chosen to identify barriers and opportunities for financial integration.
- **Early warning systems (EWS):** Provinces with inadequate or non-existent EWS for agricultural risks were included to assess the potential for introducing improved systems.

2.2. Data Collection Methods

A combination of quantitative and qualitative methods was employed to ensure comprehensive and inclusive data collection:

1) **Consultative Planning Meetings** - Initial consultations with the MINEAGRIE team in Bujumbura, along with other stakeholders such as local government representatives and financial institutions, were conducted to outline the scope, objectives, and logistical details

of the study. These meetings also emphasized the importance of integrating gender-responsive strategies.

2) **Key Informant Interviews (KIIs)** - Interviews were conducted with MINEAGRIE technical staff, political leaders, and representatives from provincial and communal administrations. Additional interviews targeted experts in agriculture, gender equality, and financial services to gather insights into local challenges, gender-specific barriers, and potential solutions related to insurance and finance.
3) **Document Review** - Existing reports, policy documents, and previous studies on food insecurity, gender dynamics, and agricultural adaptation in Burundi were reviewed. These documents provided a broader context to supplement primary data collection and ensure alignment with national and regional priorities.
4) **GIS Analysis** - Geographic Information System (GIS) tools were employed to analyze food insecurity risks, population density, climate change impacts and variability. Maps generated through GIS highlighted hotspots of vulnerability and informed the selection of provinces and communes for intervention.
5) **Site Visits** - Field visits were conducted to observe conditions in identified hotspot areas, including agricultural practices, food insecurity challenges, and gender-specific impacts on livelihoods. Photographs and digital records of community initiatives, local markets, and financial service providers were collected to contextualize findings.
6) **Focus Group Discussions (FGDs)** - FGDs were held separately with men, women, and youth to capture diverse perspectives and experiences. Special emphasis was placed on engaging marginalized groups, such as persons with disabilities (PWDs) and the elderly, to understand their unique challenges and needs. Discussions revolved around agricultural practices, access to finance, and coping strategies for food insecurity. A total of **236** participants were involved, including **133** males and **108** females. FGDs were facilitated with the assistance of provincial administrators and mobilized based on communication from communal administrators.

Table 2: Focus Discussion Group Participants by province, commune and gender

Province	Commune	No. of Participants	Gender
Bubanza	Gihanga Bubanza	32	Male: 20 Female: 12
Bururi	Vyanda Bururi	68	Male: 37 Female: 31
Karusi	Bugenyuzi Buhiga	20	Male: 14 Female: 6
Kirundo	Kirundo	20	Male:13 Female: 7
Rutana	Giharo Musongati	21	Male: 11 Female: 10
Ruyigi	Butezi Ruyigi	20	Male: 13 Female: 7
Cibitoke	Rugombo Buganda	34	Male: 22 Female: 12
Bujumbura Rural and Bujumbura Mairie	Isare Kanyosha	21	Male: 8 Female: 13

2.3. Data Analysis

Both qualitative and quantitative data analysis techniques were applied to derive meaningful insights from the collected data:

1) **Quantitative Analysis** - Socioeconomic data, agricultural production statistics, and food insecurity data were analyzed using statistical methods. Averages, proportions, and totals were calculated to summarize key findings, with a focus on disaggregating results by gender and vulnerability levels.
2) **Qualitative Analysis** - Data from FGDs and KIIs were analyzed using thematic, content, and discourse analysis techniques. These methods helped identify recurring themes and patterns related to gender disparities, access to financial services, and community perceptions of agricultural adaptation strategies.
3) **GIS Mapping** – Spatial analysis techniques were applied to generate a variety of maps that provided spatial insights into the project area, including:
    - **Location Map**: Showing the geographical positioning of provinces involved in the study.
    - **Population Density Maps**: Highlighting variations in population density to understand resource distribution and areas of economic vulnerability.
    - **Food Insecurity Risk Maps**: Highlighting areas with high food insecurity, informed by GIS-based risk assessments.
    - **Land Use Land Cover Maps**: Depicting current land use practices, including agricultural areas, urbanization, and deforestation, with an emphasis on areas with high gender disparities in resource access.
    - **Climate Maps**: Displaying rainfall and temperature trends to understand local climate dynamics and their effects on agriculture and livelihoods.

The results were disaggregated by province, gender, and vulnerability level. This approach allowed for a nuanced understanding of how gender, socioeconomic, and environmental challenges intersect across the project area.

3. Results and Discussion

3.1. Socioeconomic Characteristics

3.1.1. Population Distribution and Demographics

Population growth across Bubanza, Bururi, Karusi, Kirundo, Rutana and Ruyigi provinces has been steady over the years, reflecting national trends. The last census conducted in 2008 recorded a national population of approximately 8.05 million, while estimates for 2023 suggest a population of about **13.69 million** (World Bank, 2023; WHO, 2023). The six provinces of interest display varied population densities, which influence land use patterns and pressure on natural resources:

- **Bubanza**: One of the higher-density provinces, influenced by its agricultural potential (World Bank, 2023).

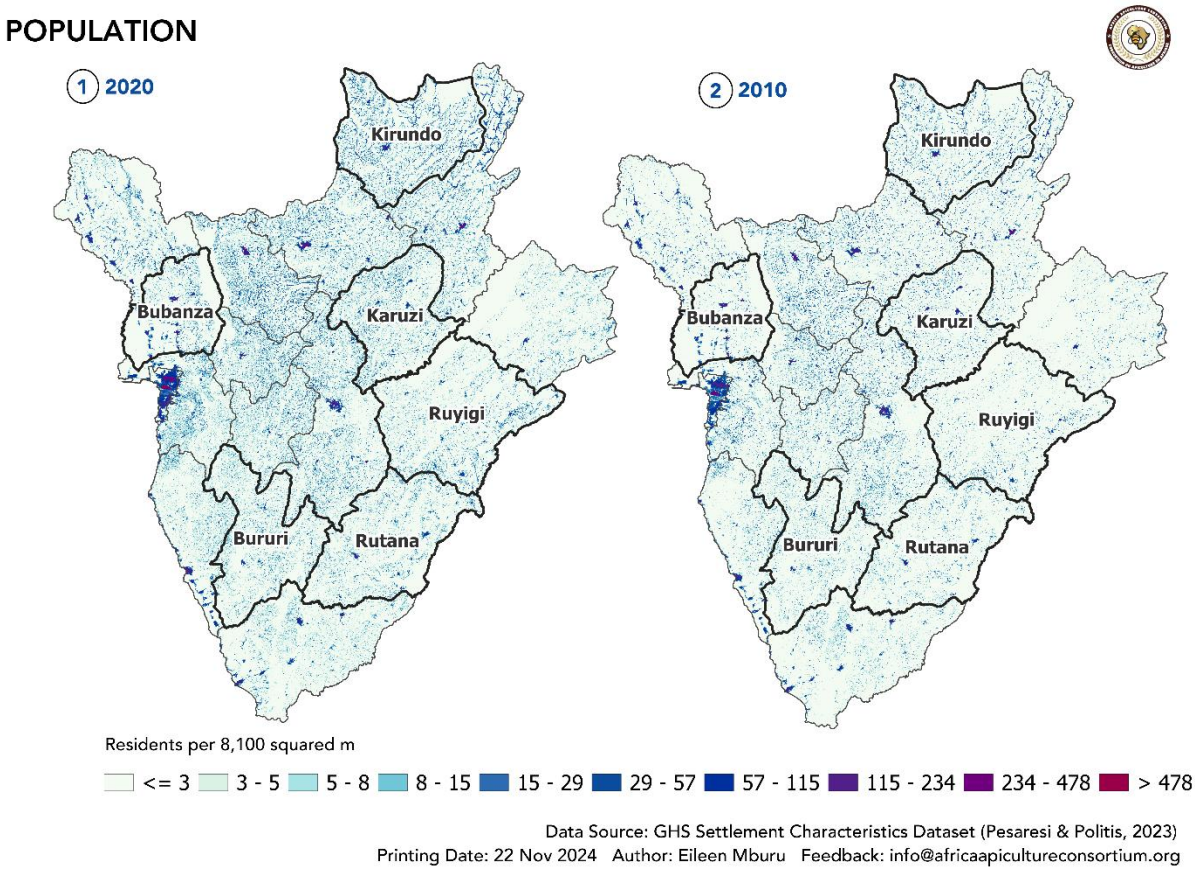
- **Karusi and Kirundo**: These provinces, though agriculturally dependent, face challenges with land degradation and food insecurity due to their high population densities and limited arable land (WHO, 2023).
- **Ruyigi, Rutana, and Bururi**: These provinces, characterized by more dispersed populations, face logistical challenges in implementing large-scale agricultural and financial interventions (WHO, 2023).

1. Demographic Composition

Burundi's population is predominantly rural, with approximately **87% residing in rural areas** as of 2019 (World Bank, 2019). The demographic profile is characterized by a youthful population, with a median age of 17.3 years (World Bank, 2022). The ethnic composition includes 85% Hutu, 14% Tutsi, and 1% Twa, reflecting the country's historical ethnic distribution (World Bank, 2022). This predominantly rural and youthful demographic presents unique challenges and opportunities for sustainable development. The significant proportion of the population engaged in agriculture underscores the importance of targeted interventions in rural areas to improve resilience, gender equity, and access to financial tools.

2. Gender Demographics

As of 2023, Burundi's population is nearly equally split between genders, with males accounting for 49.67% and females 50.33%, equating to a **sex ratio of 98.7 males for every 100 females** (World Bank, 2023; WHO, 2023). This trend is consistent across the six provinces. Women, who are the primary contributors to agricultural labor, play a critical role in ensuring household food security and climate adaptation. However, their access to resources—such as land, financial services, and decision-making opportunities—remains limited (World Bank, 2023). These gender disparities pose challenges to agricultural productivity and the equitable adoption of parametric insurance and smart financial tools.



Bubanza Province

Between 2010 and 2020, Bubanza's population increased by **26.19%,** from 376,005 to 474,469. This growth has placed greater strain on agricultural land, as the province relies heavily on subsistence farming. Focus discussion groups with the community highlighted significant gender disparities, with men primarily managing cash crops like bananas and coffee, while women focus on food crops such as beans, maize, and vegetables. Women's limited land ownership often prevents them from having a decisive role in farming revenues, perpetuating economic inequalities within households (ISTEEBU, 2020).

Bururi Province

Bururi experienced a **41.02%** population increase, growing from 353,753 in 2010 to 498,869 in 2020. Known for its rich forests, Bururi has faced growing **deforestation pressures due to expanding agricultural activities**. During community engagements, participants shared that rural women juggle farming and domestic chores, while men increasingly migrate to urban centers in search of alternative income. This dynamic leaves women managing both households and farms, often without sufficient resources or support systems. While cooperatives provide some women with access to financial services, their impact is limited by a lack of training and financial literacy (World Bank, 2022).

Karusi Province

Karusi saw a population increase of **22.62%,** from 482,501 in 2010 to 591,648 in 2020. The resulting higher population density has placed immense pressure on limited agricultural land, exacerbating food insecurity. Community-led discussions revealed that **the young, predominantly rural population struggles with youth unemployment, which is particularly pronounced among men**. Women in Karusi make significant contributions to farming but face **barriers to accessing resources such as improved seeds and fertilizers**. Moreover, men control cash crops like coffee and bananas, while women manage food crops and kitchen gardens. These inequalities hinder the potential for equitable economic growth in the province.

Kirundo Province

Kirundo, the most populous province of the project locations, saw a **35.37%** increase, from 710,193 in 2010 to 961,361 in 2020. Rapid population growth has led to increased land fragmentation, reducing farm productivity and intensifying food insecurity. Focus Discussion Groups with the community emphasized the **disproportionate burdens women face, as they are often left to manage farms, collect water, and care for children while men migrate to urban areas for work**. Such dynamics amplify vulnerabilities during climate shocks, like droughts, which are frequent in Kirundo. Women's associations in the province have been instrumental in fostering resilience by pooling resources and enhancing access to farming inputs, though systemic gender inequalities remain a barrier to their success (ISTEEBU, 2020).

Rutana Province

Rutana experienced the highest growth rate at **48.69%,** with its population rising from 383,543 to 570,295. This sharp increase has heightened competition for agricultural land and forest resources. Through focus group discussions, women shared their struggles with **limited control over farming revenues, despite being heavily involved in agricultural production**. Men dominate land ownership and decision-making processes, often leaving women without a say in how farming profits are used. Efforts to form cooperatives for financial inclusion have made some progress but remain hindered by systemic barriers, such as financial illiteracy and traditional gender norms.

Ruyigi Province

Ruyigi's population grew by **43.17%,** from 456,692 in 2010 to 653,867 in 2020. This significant growth has increased demand for land and water resources, further stressing the region's natural ecosystems. Discussions with community groups revealed that women bear the brunt of these challenges, as they are primarily responsible for agricultural labor and household management. **Men frequently migrate in search of off-farm work, leaving women with limited support in times of climate-related shocks, such as floods and droughts**. Indigenous groups in Ruyigi, identified during focus group discussions, remain particularly vulnerable due to systemic discrimination and lack of land ownership. These groups often rely on informal labor and pottery, making them less resilient to climate and economic stresses (ISTEEBU, 2020).

3.1.2. Population Distribution in the Imbo basin

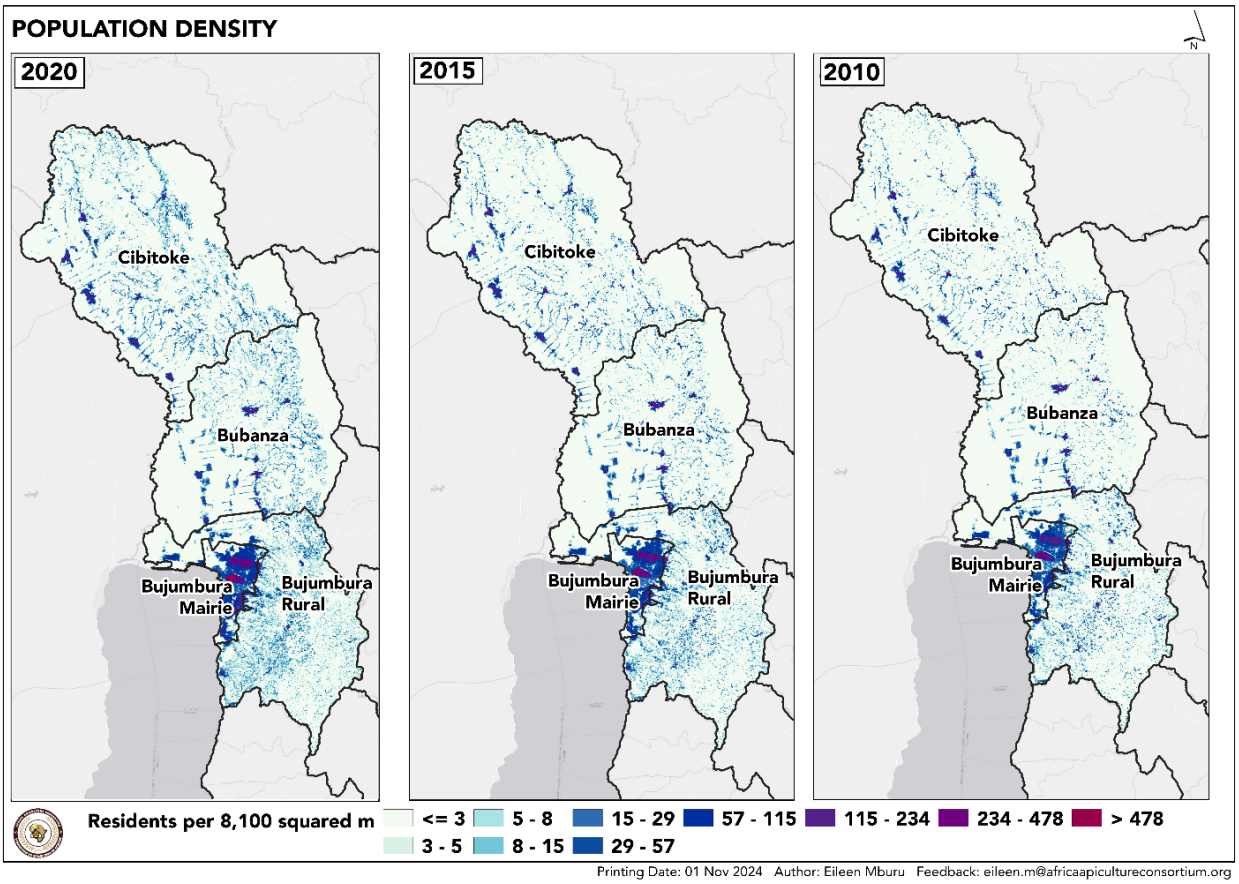
The Imbo basin, located across Burundi's provinces of Cibitoke, Bubanza, Bujumbura Rural, and Bujumbura Mairie, exhibits notable population growth, which has significantly impacted the

region's natural resources and adaptive capacity to climate change. Between 2000 and 2015, the population changes in the provinces were as follows:

- Cibitoke: **+52.3%**
- Bubanza: **+45.6%**
- Bujumbura Rural: **+39.4%**
- Bujumbura Mairie: **+56.2%**

The increasing population density in the basin, dominated by agricultural and rural communities, poses challenges to both sustainable development and resource management.

As of 2024, Burundi's national population comprises 6.75 million males and 6.84 million females, with males making up 49.67% of the population and females 50.33%. This equates to a sex ratio of 98.7 males for every 100 females, resulting in 89,000 more females than males (Burundi Demographics 2024) These gender demographics are consistent across the provinces in the Imbo basin. This gender distribution, though typical of most African rural settings, has significant implications for resource management, especially in regions where women play a pivotal role in agriculture and family-level climate resilience strategies.



The provinces of Cibitoke, Bubanza, Bujumbura Mairie, and Bujumbura Rural in Burundi have undergone significant changes in population density and social demographics in recent years. These changes are attributed to factors like natural population growth, rural-to-urban migration, and socio-economic dynamics (Vinck & Pham, 2015; Barankanira et al., 2022).

Population Density Trends (2010, 2015, 2020)

Between 2010 and 2020, population density in Cibitoke, Bubanza, Bujumbura Mairie, and Bujumbura Rural has shown a steady increase due to high birth rates and rural-to-urban migration (Yiga, 2016). According to Global Human Settlement (GHS) data by the European Commission, urban centers like Bujumbura Mairie are experiencing heightened population density. This capital region attracts people from surrounding rural areas because of comparatively better employment opportunities and access to services (Nibaruta et al., 2021). Rural areas, including Cibitoke and Bubanza, show population density influenced by agricultural activities and limited arable land (Ndayiragije et al., 2017). Rising population density has strained resources, leading to deforestation, soil erosion, and a reduction in available farmland per capita. The region's high fertility rates contribute to a young, fast-growing population, adding to local challenges on natural resources and services (Ekholuenetale et al., 2021).

Age Structure and Youth Dominance

The demographics in these provinces are predominantly young, with over 65% of the population under the age of 25 (Nsabimana et al., 2013). This youth-dominated structure, shaped by high birth rates and relatively low mortality rates, is seen throughout Burundi. While this offers potential for future economic growth, it poses challenges in employment, education, and healthcare provision. A high dependency ratio, especially in rural areas, places significant financial and social pressure on families and communities.

Education and Literacy Disparities

Educational attainment varies widely across urban and rural areas. In Bujumbura Mairie, access to educational facilities leads to higher literacy and school completion rates compared to rural provinces such as Cibitoke and Bubanza. Urban centers benefit from various programs supporting educational development (Nindorera & Bjarnesen, 2018). In contrast, rural areas face challenges like inadequate infrastructure, long distances to schools, and economic constraints that limit literacy rates, particularly among young women.

Employment and Economic Activity

The economy in these regions is mainly agrarian, with agriculture as the primary employment source, particularly in Cibitoke and Bubanza, where over 85% of the population engages in subsistence farming (Pézard and Florquin, 2007). Common crops include maize, beans, and bananas, which are essential for both local consumption and economic sustenance. However, climate-related risks like droughts and floods affect these communities, disrupting food production and income stability. In contrast, Bujumbura Mairie provides diverse employment options in trade, services, and the informal sector, yet urban poverty remains a concern due to high levels of informal employment (Delves et al., 2017).

Health and Access to Services

Healthcare access varies significantly, with Bujumbura Mairie benefiting from better infrastructure compared to rural provinces. Urban areas have improved health outcomes due to access to hospitals and health programs supported by international organizations (Clement et al., 2024). Rural provinces, however, struggle with healthcare access due to a lack of facilities, personnel,

and essential medications, leading to higher rates of maternal and child mortality, malnutrition, and infectious diseases such as malaria.

Migration and Urbanization Pressures

Rural-to-urban migration has intensified population density in Bujumbura Mairie and surrounding areas. Migrants from rural provinces are drawn to the perceived economic opportunities in the capital, resulting in rapid population growth in peri-urban areas. This migration has led to expanding informal settlements, often lacking sanitation and adequate infrastructure. These urban areas face issues of housing shortages and environmental degradation, pressing local governments to adopt sustainable urban planning.

3.1.3. Implications of Population Increase on Resilience and Adaptive Capacity to Climate Change

Population growth in the provinces of Bubanza, Karusi, Kirundo, Ruyigi, Rutana, and Bururi has placed significant pressure on natural resources, weakening resilience to climate change and limiting adaptive capacity. Discussions with local communities revealed that increased population has led to environmental degradation, socio-economic challenges, and heightened vulnerability to climate shocks.

Pressure on Land and Agricultural Systems

Population increase has driven land subdivision into smaller plots, intensifying pressure on agricultural systems. In many cases, these smaller parcels are overused, leading to soil exhaustion and declining productivity. Community members reported that poor farming practices, such as **slash-and-burn agriculture** and the **lack of crop rotation**, are exacerbating soil degradation. Additionally, limited access to sustainable farming technologies and inputs has constrained the ability of farmers—particularly **women, who are primary agricultural laborers**—to maintain productive land (World Bank, 2022).

Deforestation and Resource Depletion

To accommodate the growing population, forests and wetlands have been cleared for agriculture and settlement. This deforestation has not only reduced biodiversity but has also impaired the ecosystem's ability to mitigate climate risks such as flooding and droughts. For example, women in Karusi and Kirundo noted that **the loss of tree cover has increased soil erosion, leading to crop losses during heavy rains**. Participants also reported increased bushfires, often set intentionally for grazing land, which further degrade the environment (WHO, 2023).

Water Scarcity and Climate Impacts

The growing population has strained water resources. Over-extraction of water for irrigation and domestic use has reduced availability, particularly during dry seasons. In areas such as Rutana and Bubanza, communities described how **degraded soils no longer retain water effectively, resulting in reduced agricultural yields and heightened food insecurity**. Seasonal variability, including prolonged droughts and erratic rainfall patterns, has further exacerbated these challenges, making it difficult for farmers to plan and adapt their practices (World Bank, 2023).

Social Vulnerabilities

Population-driven resource strain disproportionately affects vulnerable groups, particularly women, children, and indigenous populations. FGDs highlighted that **women bear the brunt of these challenges due to their central role in food production and family care**. In times of climate stress, such as during droughts, women are often left to find alternative means of sustenance while men migrate to urban areas for work. Indigenous communities, often without secure land tenure, are particularly vulnerable, relying on marginal lands and manual labor for survival.

Implications for Adaptive Capacity

The increase in population, combined with environmental degradation, has significantly reduced adaptive capacity in these provinces. Limited access to climate-smart agriculture, financial tools like parametric insurance, and extension services hinders the ability of communities to respond effectively to climate risks. Moreover, the unequal distribution of decision-making power—particularly among women, who rarely own land or control financial resources—further constrains adaptive capacity (World Bank, 2022).

3.2. Poverty Estimates and Vulnerability

Burundi is ranked among the poorest nations globally, with an estimated 70% of the population living below the international poverty line of $1.90 per day (Lankes et al., 2024; World Bank, 2022). This situation is exacerbated in rural areas where economic opportunities are scarce, and livelihoods are heavily dependent on subsistence agriculture.

Income Inequality and Resource Access

Focus group discussions (FGDs) revealed stark disparities between wealthier households and those in poverty, with the latter often unable to access critical resources such as drought-tolerant seeds, irrigation systems, or fertilizers. Wealthier families have the means to stockpile food, invest in climate-resilient practices, or migrate during periods of stress, whereas poorer households are forced to rely on manual labor, foraging, or aid from associations. Indigenous groups and women-headed households face additional challenges. Indigenous communities often lack secure land tenure, leaving them dependent on marginal lands with low productivity. Similarly, women, who are key contributors to agricultural labor, often lack decision-making power, limiting their ability to implement adaptive strategies (Ngcamu, 2023).

Education and Skills Gap

Low levels of education, particularly among women and marginalized groups, further compound vulnerability. FGDs highlighted that women with limited literacy were less likely to participate in decision-making processes related to farming or financial planning. This lack of knowledge restricts their ability to engage with agricultural innovations, parametric insurance, or other climate adaptation tools.

Food Insecurity and Health Risks

Poverty is closely tied to food insecurity, which was a recurrent theme in the FGDs. Households with limited resources struggle to produce or purchase sufficient food, leading to malnutrition and increased susceptibility to climate shocks. In Rutana and Bubanza, community members cited

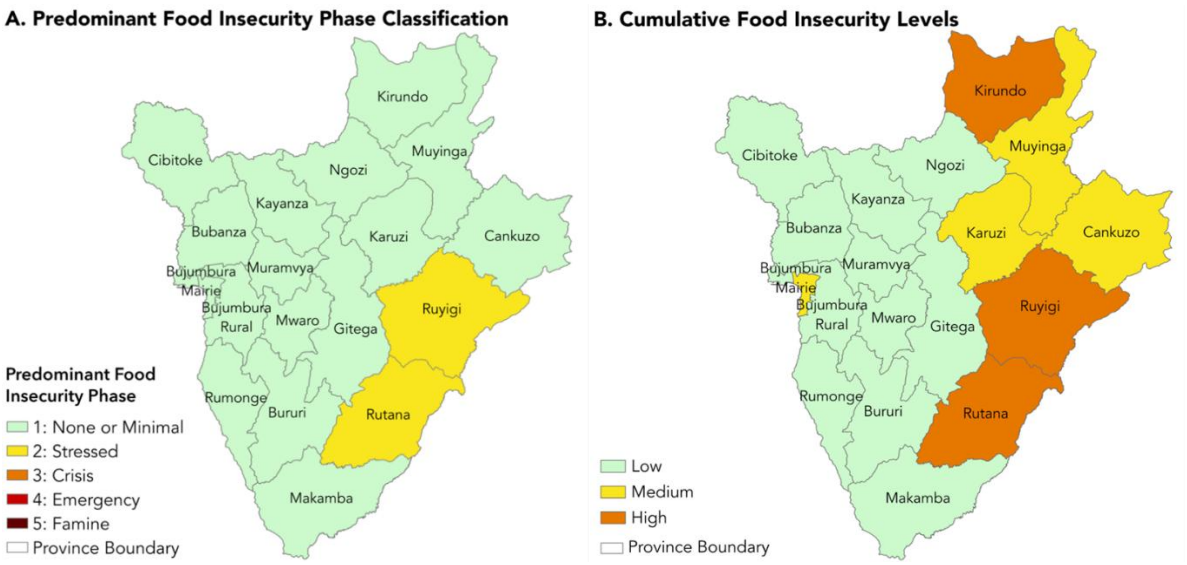
examples of children and vulnerable adults falling ill due to poor diets during prolonged droughts. Health risks, such as malaria and waterborne diseases, further exacerbate vulnerability, particularly for indigenous groups and people with disabilities (WHO, 2023).

Climate-Driven Economic Vulnerabilities

Dependency on agriculture as the primary livelihood exacerbates economic vulnerabilities. Recurrent climate hazards, including droughts, floods, and strong winds, have significantly reduced agricultural productivity. FGDs highlighted that households with limited financial buffers are often unable to recover from these losses, leading to cycles of poverty and food insecurity.

3.2.1. Food Security

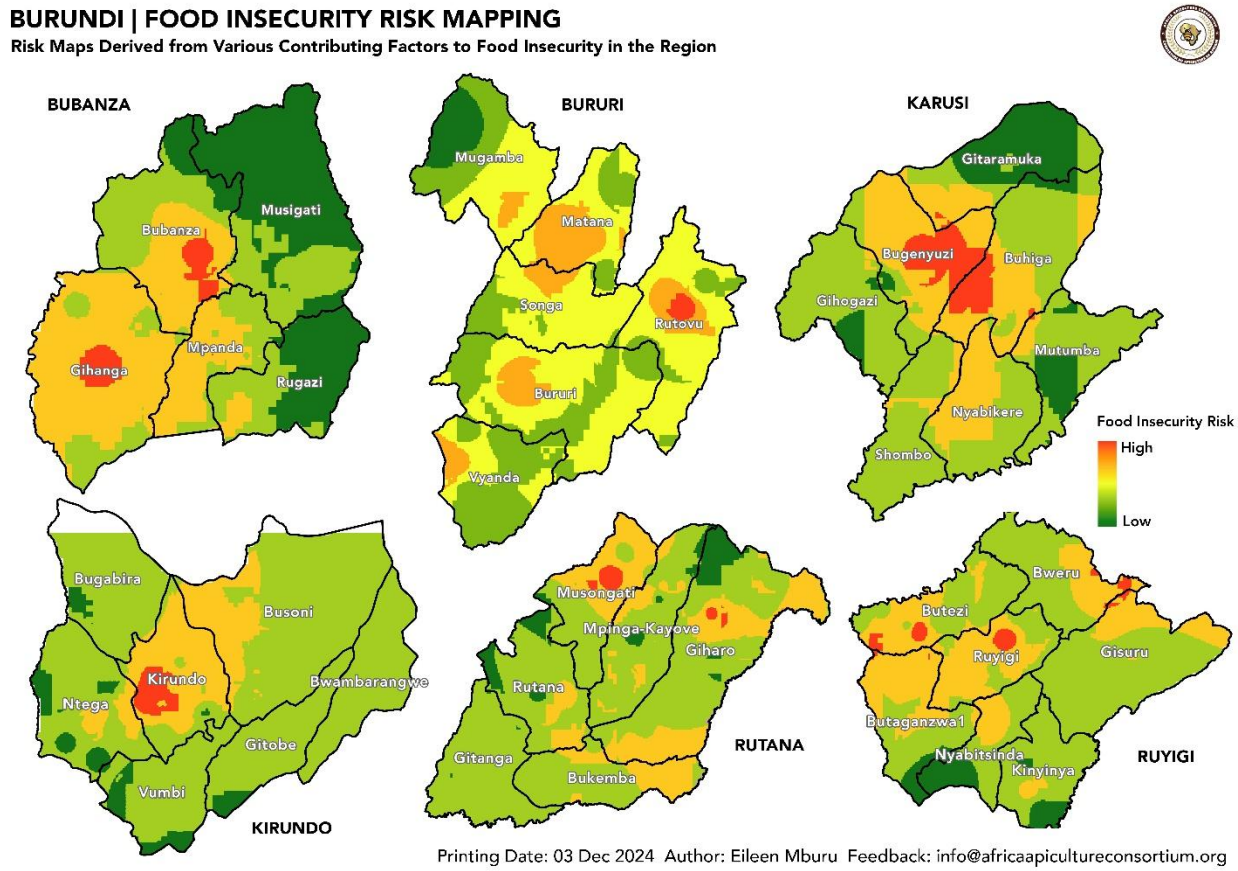
The predominant food insecurity phase classification map below reveals severe and persistent food insecurity across specific regions in Burundi over the period 2010–2023. Seasonal analyses, drawing on Integrated Food Security Phase Classification (IPC) classes 1 to 5 from FEWS NET (Famine Early Warning Systems Network) data, highlight **Rutana** and **Ruyigi** as areas with chronic food security challenges. These provinces are part of the Eastern Lowlands Livelihood Zone, characterized by limited agricultural productivity and recurrent climatic shocks, including droughts and floods. Discussions with the community confirmed that these regions experience erratic rainfall patterns, delayed planting seasons, and crop failures, further exacerbating food insecurity. Women, who are primarily responsible for food production and household nutrition, noted struggles to sustain their families due to dwindling crop yields. Indigenous groups in these areas face added challenges due to systemic discrimination and lack of land ownership, leaving them highly vulnerable to food crises.



Predominant Food Insecurity Phase Classification and Cumulative Food Insecurity Level Maps

Expanding the analysis to include cumulative food insecurity, additional provinces emerge as hotspots, with **Kirundo** being the third-most affected. Kirundo's high population density and fragmented landholdings compound its food security challenges. Discussions with the community

in Kirundo revealed that limited access to improved seeds and fertilizers, coupled with prolonged drought periods, had severely hindered agricultural output.
Other provinces, including Muyinga, **Karusi**, Bujumbura Mairie, and Cankuzo, also demonstrate elevated levels of food insecurity. These regions, although not as critically affected as Rutana, Ruyigi, or Kirundo, face periodic disruptions to food supply due to climatic shocks, pest infestations, and inadequate storage facilities. For instance, women in Karusi highlighted the lack of financial resources to purchase drought-resistant crops or fertilizers, leaving them reliant on traditional farming methods that yield insufficient harvests.



Food Insecurity Risk Maps of the Project Locations

A. Bubanza Province

The province's division into three distinct livelihood zones—Imbo Plain, Congo Ridge Millet, and Northern Highlands—highlights the diverse agricultural landscape and its unique vulnerabilities.

- Imbo Plain: This zone, known for staple crops like sweet potatoes, cassava, and bananas, bears the brunt of torrential rains—accounting for 60% of the province's disaster events. Community discussions emphasized the severe impact of flooding, particularly in Gihanga commune, a designated food insecurity hotspot. Participants noted that recurrent flooding destroys crops, displaces households, and disrupts livelihoods, leaving families reliant on external aid.

- Congo Ridge Millet Zone: Frequent violent winds (38% of disaster occurrences) devastate millet crops, a vital food source for local communities. Community members stressed the economic and nutritional losses caused by disasters often leaving families struggling to recover. This reliance on a single crop exacerbates vulnerabilities, underscoring the need for crop diversification.
- Northern Highlands: Landslides triggered by heavy rains present a persistent threat to Irish potato and vegetable production in this elevated zone. Stakeholder and community insights revealed that landslides force farmers to abandon agricultural land, reducing food availability and intensifying economic strain.

Livestock rearing is a critical livelihood strategy across the province, with goats, bees, and poultry providing essential income and nutrition. However, climatic shocks like floods and winds cause significant livestock losses, which further undermine agricultural productivity by reducing access to fertilizers and animal labor necessary for maintaining soil fertility. The food insecurity risk mapping identified **Gihanga and Bubanza communes** as the highest-risk areas. Gihanga's heightened vulnerability stems from recurrent severe flooding, while Bubanza struggles with a combination of environmental degradation, poor market access, and subsistence agriculture dependency. These factors, compounded by climate shocks, leave communities particularly susceptible to food insecurity.

B. Bururi Province

Bururi Province, with its distinct livelihood zones—the Southern Highlands and the Congo Ridge Millet Zone—faces a range of challenges tied to food insecurity and climate vulnerability.

- Southern Highlands: This zone is a hub for cash crops such as coffee, tea, and pyrethrum, alongside food crops like Irish potatoes and beans. While this dual focus bolsters economic resilience, participants highlighted the risk of over-reliance on cash crops, particularly given global price fluctuations and their sensitivity to climatic changes. The high rainfall, while advantageous for agriculture, increases the risk of torrential rains (58% of disaster events in the province), causing flooding and landslides that destroy crops and infrastructure.
- Congo Ridge Millet Zone: This zone focuses on millet and drought-resistant food crops adapted to drier conditions. However, violent winds (39% of disaster events) and landslides threaten agricultural stability. Participants emphasized that millet's resilience to drought is undermined by intense winds and occasional flooding, which disrupt crop yields and livelihoods.

The food insecurity risk mapping identified Rutovu and Bururi communes as the most affected areas, with **Rutovu commune** showing the highest risk. This vulnerability is linked to recurrent landslides, heavy rainfall, and insufficient disaster preparedness infrastructure.

C. Karusi Province

Karusi Province's agricultural landscape, shaped by the Eastern Arid Plateaus and Humid Plateaus, illustrates a stark contrast in vulnerabilities and opportunities.

- Eastern Arid Plateaus: Dominated by drought-resistant crops like sorghum and millet, this zone struggles with low precipitation and frequent torrential rains (79% of disaster events).

Focus group participants highlighted that flooding and hailstorms disrupt agricultural productivity, leaving many communities vulnerable to food shortages.

- Humid Plateaus: Higher rainfall allows for a diverse range of crops, including maize, beans, and cash crops like coffee and tea. However, soil erosion from heavy rains, combined with hail damage, undermines farming efforts. Livestock rearing, a crucial livelihood strategy, is equally affected by climatic shocks, reducing access to manure and draft power.

The highest food insecurity risks were observed in **Bugenyuzi and Buhiga communes**, where flooding and soil erosion significantly disrupt agricultural cycles and reduce food availability.

D. Kirundo Province

Kirundo Province, characterized by its Northern Highlands and Eastern Lowlands, faces significant challenges in managing food insecurity amid its diverse topography and climatic extremes.

- Northern Highlands: This zone is prone to soil erosion, with community discussions estimating losses of 20-40 tons of soil per hectare annually. Torrential rains, violent winds, and hailstorms (accounting for 83% of disaster events) disrupt potato and bean farming, reducing food availability.
- Eastern Lowlands: Although suited for drought-resistant crops like millet and sorghum, these areas experience waterlogging during heavy rains, which damages crops and exacerbates food insecurity.

The analysis revealed **Kirundo** as a food insecurity hotspot. The convergence of frequent torrential rains, economic vulnerabilities, and limited market access exacerbates risks in these areas.

E. Rutana Province

Rutana Province's agricultural landscape, spanning the Eastern Arid Plateaus, Eastern Lowlands, and Southern Highlands, reflects a range of climatic vulnerabilities impacting food security.

- Eastern Arid Plateaus and Lowlands: These areas face recurrent torrential rains (57% of disaster events) and violent winds (43%), which destroy crops and disrupt livelihoods. Community discussions in Musongati commune underscored the compounded challenges of flooding, soil erosion, and limited access to adaptive agricultural techniques.
- Southern Highlands: High rainfall in this zone supports diverse agricultural production but increases the risks of landslides, which participants identified as a significant challenge for coffee and tea farming.

The highest food insecurity risks were observed in **Musongati and Giharo communes**, where the combined effects of frequent disasters and economic vulnerabilities leave communities particularly exposed.

F. Ruyigi Province

Ruyigi Province, with its Eastern Arid Plateaus and Eastern Lowlands, faces unique challenges stemming from torrential rains and soil erosion.

- Eastern Arid Plateaus and Lowlands: These zones experience erratic rainfall patterns, leading to flooding and delayed planting cycles. Community members in Ruyigi, Bweru,

and Butezi communes highlighted the dual challenges of natural resource degradation and limited access to modern farming techniques, which hinder food security.

The analysis identified **Ruyigi, Bweru, and Butezi** communes as high-risk areas. Frequent floods and limited income diversification leave these areas particularly vulnerable to food insecurity.

Linking Food Security to Poverty and Vulnerability

Food insecurity in Burundi is deeply intertwined with poverty and vulnerability. Provinces experiencing heightened food insecurity, such as Rutana and Ruyigi, are also marked by limited access to infrastructure, education, and health services. These deficits hinder adaptive capacity and exacerbate vulnerabilities to climate shocks. Community discussions revealed that poverty-stricken households, especially those headed by women or indigenous communities, are disproportionately affected. Women in these regions highlighted that while they are primarily responsible for cultivating food crops, men control the limited resources, such as land and income, further complicating resilience-building efforts. Moreover, as the population continues to grow, land fragmentation intensifies, leaving households with smaller plots incapable of sustaining subsistence farming. The integration of food security maps into this analysis provides valuable insights for targeted interventions, emphasizing the need for region-specific strategies to address poverty and build resilience.

3.2.2. Implications of Poverty and Vulnerability on Resilience and Adaptive Capacity to Climate Change

Poverty and vulnerability are deeply intertwined with resilience and adaptive capacity in the project locations. Communities with limited resources often face significant barriers to coping with climate-related challenges, further exacerbating their exposure to risks and reducing their ability to recover from shocks.

Impact on Agricultural Productivity

The dependency on subsistence farming in rural Burundi amplifies the impact of poverty on resilience. Poor households often lack access to drought-resistant seeds, fertilizers, and irrigation systems, leaving their crops vulnerable to erratic rainfall and prolonged droughts. As noted in discussions with farmers in Kirundo and Rutana, crop losses due to climate shocks, such as floods and hailstorms, disproportionately affect poorer households that have minimal financial buffers (Ngcamu, 2023). This results in cycles of food insecurity, malnutrition, and poverty that weaken resilience over time.

Access to Resources and Decision-Making Power

Poverty significantly limits access to critical resources, such as land and water, particularly for marginalized groups. Women, who contribute the most labor in agriculture, often lack land ownership and decision-making authority over farming practices or the sale of produce. This systemic inequality reduces the ability of households to adopt climate-resilient practices and invest in adaptive technologies (Lankes et al., 2024). Indigenous groups, frequently excluded from formal land tenure systems, face similar challenges, relying on marginal lands that are more vulnerable to erosion and reduced productivity (WHO, 2023).

Social and Economic Vulnerabilities

Communities in poverty are more likely to experience disproportionate impacts from climate shocks due to their limited coping mechanisms. Poor households are often forced to resort to negative coping strategies, such as selling assets or reducing food consumption, which further entrenches poverty and reduces their long-term resilience (World Bank, 2022). FGDs highlighted that women and children bear the greatest burden during crises, with women often responsible for securing food and water for their families under increasingly challenging conditions.

Barriers to Adaptive Capacity

Educational disparities and low literacy rates, particularly among women and indigenous populations, limit awareness and uptake of climate-smart technologies and financial tools, such as parametric insurance. Stakeholder and community insights revealed that while communities expressed interest in agricultural insurance, the lack of affordable premiums and delayed payouts in other insurance schemes undermines trust and adoption. This highlights the need for tailored financial solutions that address the specific vulnerabilities of smallholder farmers.

Cumulative Effects on Ecosystem Services

The strain on natural resources due to population growth and poverty has led to deforestation, soil erosion, and reduced water availability, further weakening the resilience of ecosystems that support livelihoods. For example, the loss of wetlands and forests in Bubanza and Kirundo has diminished the natural capacity of these areas to buffer against climate impacts, such as floods and droughts (Ngcamu, 2023; WHO, 2023).

3.3. Sources of Water Pollution in Burundi

Water pollution is a critical environmental challenge in Burundi, with significant impacts observed across the provinces of Bubanza, Bururi, Karusi, Kirundo, Rutana, and Ruyigi. Factors contributing to water pollution in these regions stem from anthropogenic activities, agricultural practices, and natural processes.

1. **Agricultural Runoff**: The provinces of Rutana and Kirundo, known for their extensive agricultural activities, contribute to water pollution through the runoff of fertilizers and pesticides into surface and groundwater systems. These agrochemicals, used to increase crop yields, often result in eutrophication, particularly in areas such as the Eastern Lowlands and Bugesera regions, leading to the degradation of aquatic ecosystems (Barankanira et al., 2023).
2. **Urban Wastewater and Sanitation Challenges**: In urban centers within Bururi and Bubanza, inadequate waste management systems contribute to the discharge of untreated sewage into rivers and lakes. This issue is exacerbated by population growth, as noted in Ruyigi, where urban expansion has strained existing sanitation infrastructure. Open defecation and poorly managed waste disposal sites amplify contamination risks to water bodies.
3. **Mining and Industrial Discharges:** In areas like Bubanza, artisanal mining activities release heavy metals into local streams. Mercury, commonly used in gold mining, is a significant pollutant affecting aquatic biodiversity and human health. Industrial discharges from small-scale factories in Ruyigi and Karusi further exacerbate water quality degradation (Niyonkuru et al., 2015).

4. **Natural Processes and Soil Erosion**: Kirundo and Rutana provinces experience high levels of soil erosion due to deforestation and unsustainable land use practices. Sedimentation from eroded soils carries nutrients into water bodies, reducing water clarity and affecting aquatic habitats. The loss of riparian vegetation in these areas further destabilizes riverbanks, increasing sediment load during heavy rains (Nijimbere & Lizana, 2019).
5. **Policy and Governance Implications:** Focus Group Discussions with communities highlighted gaps in water resource management policies. Stakeholders in Bubanza emphasized the need for stronger regulatory frameworks to manage industrial and agricultural pollutants. Similarly, participants in Ruyigi called for improved public awareness programs on waste disposal practices.

3.4. Energy Sources for Cooking in Burundi

Energy sources for cooking in Burundi overwhelmingly rely on traditional biomass fuels, including firewood and charcoal. Nationally, over 90% of households depend on these sources due to limited access to alternative energy solutions, such as electricity and gas. This reliance is exacerbated by economic constraints and a lack of infrastructure, especially in rural areas. The heavy dependence on biomass has contributed significantly to deforestation, environmental degradation, and health risks stemming from indoor air pollution, which disproportionately affects women and children (Bangirinama et al., 2017; ISTEEBU, 2020).

Bubanza Province: Firewood is the primary cooking fuel, particularly in rural communities. Discussions with community members revealed that deforestation has become a pressing concern as demand for firewood and charcoal grows. Women and children bear the brunt of this reliance, as they are tasked with firewood collection, often spending several hours daily on this activity.

Bururi Province: Bururi, a province with notable forest cover, is facing challenges from charcoal production, which is increasingly depleting forest resources. Community discussions indicated that while firewood remains relatively accessible, localized forest degradation has worsened due to unsustainable harvesting practices. The region's reliance on biomass is further intensified by a lack of affordable energy alternatives.

Karusi Province: Firewood is almost universally used for cooking, with many households employing inefficient three-stone stoves. These stoves contribute to high levels of indoor air pollution, posing significant health risks, particularly to women and young children who spend extended periods near the smoke. Community members reported minimal awareness of or access to cleaner cooking technologies (ISTEEBU, 2020).

Kirundo Province: Kirundo faces acute energy challenges, particularly during the dry season when firewood supplies are scarce. Households often resort to using agricultural residues as a substitute fuel, a practice that depletes soil fertility and is not sustainable in the long term. Community discussions revealed increasing conflicts over access to firewood, highlighting the urgent need for renewable energy options in the region.

Rutana Province: In Rutana, charcoal production is a major contributor to forest degradation. While some initiatives promoting energy-efficient cookstoves have been introduced, adoption remains low due to financial barriers. Community members expressed a strong desire for affordable solutions that would reduce the environmental and economic strain caused by traditional biomass fuels.

Ruyigi Province: In this province, firewood and charcoal dominate as cooking fuels. Focus group discussions revealed that deforestation is a growing issue, with forests being cleared faster than they can regenerate. Community members expressed interest in renewable energy sources such as biogas or solar-powered cooking solutions but cited high costs and limited infrastructure as key barriers to adoption.



Charcoal Production



Charcoal sacks displayed for sale

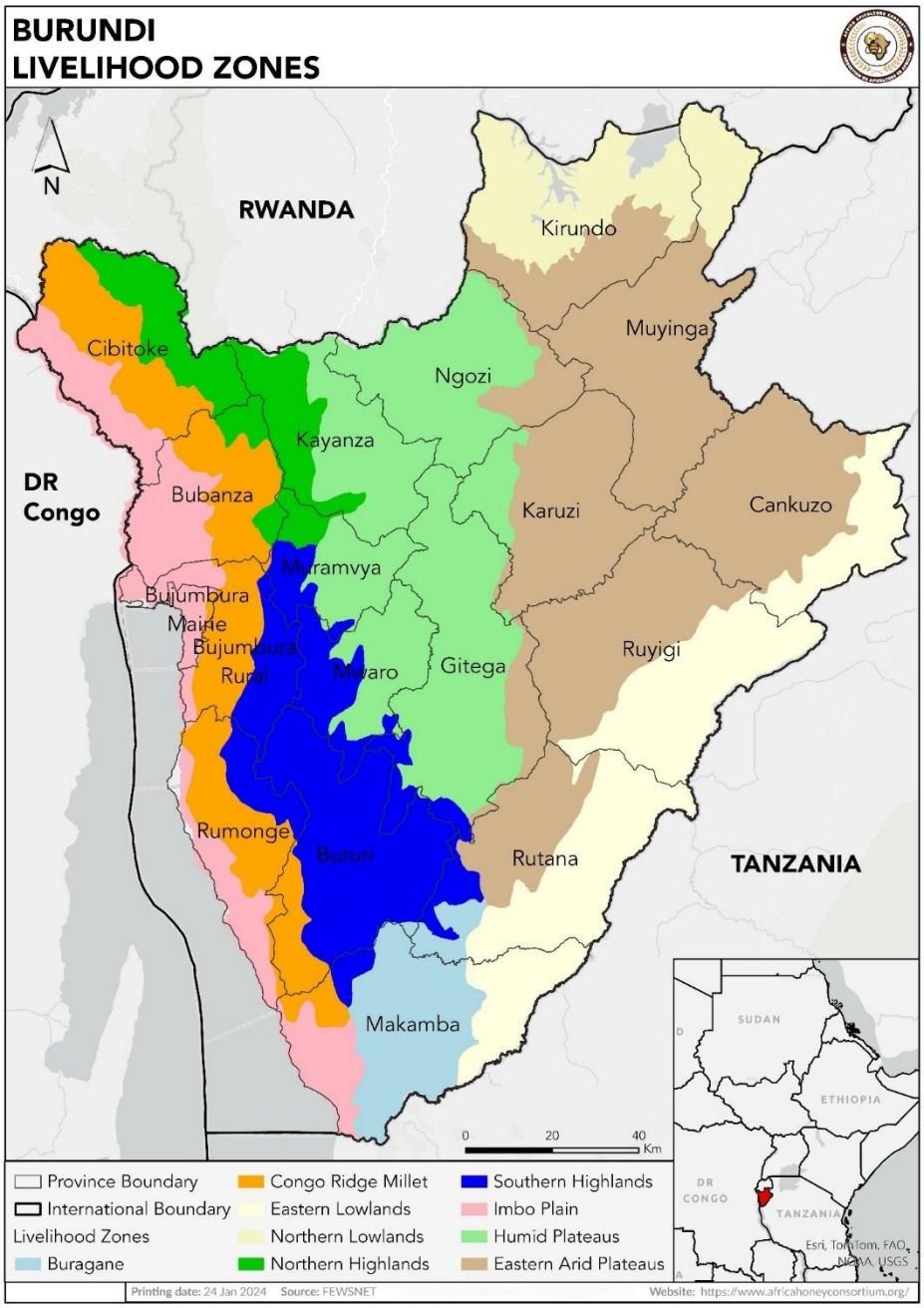
Broader Implications

The widespread reliance on biomass fuels for cooking has serious implications for Burundi's environment and public health. Deforestation caused by the demand for firewood and charcoal is contributing to soil erosion, loss of biodiversity, and increased vulnerability to climate change. Additionally, exposure to indoor air pollution is a leading cause of respiratory illnesses, particularly among women and children. Addressing these challenges requires promoting cleaner, affordable cooking technologies such as improved stoves, biogas systems, and solar-powered solutions. Such interventions could significantly improve household health and reduce the strain on Burundi's natural resources (Bangirinama et al., 2017; World Bank, 2022).

3.5. Livelihoods and Income-Generating Activities (IAs)

The livelihoods of communities in the six provinces under study are primarily dependent on agriculture, supplemented by diverse economic activities tailored to local conditions. These activities are shaped by environmental resources, cultural practices, and economic opportunities within each province. While agriculture dominates, other sectors, including trade, livestock farming, and small-scale enterprises, contribute to household incomes. Focus group discussions (FGDs) highlighted how vulnerabilities, such as climate change, population pressures, and resource scarcity, impact the resilience of these income-generating activities.

3.5.1. Main Economic Activities in the Project Area



Agriculture remains the principal economic activity across the six provinces, engaging over 80% of the population. Households cultivate crops such as beans, maize, cassava, bananas, and sweet potatoes. FGDs revealed that beans and maize are staple crops in all provinces, with regional variations in crop preferences. For example, rice farming is prominent in the lowlands of Kirundo, Rutana, and Ruyigi, while coffee cultivation serves as an important cash crop in Bururi and Bubanza. The reliance on rain-fed agriculture renders livelihoods highly vulnerable to climate variability and environmental degradation. FGDs revealed that income from agricultural activities is highly seasonal. Communities in Ruyigi, Rutana, and Kirundo emphasized how the unpredictability of rainfall patterns impacts planting and harvest cycles, exacerbating food insecurity and income instability.

Livestock farming complements crop production, particularly in provinces like Karusi and Kirundo, where cattle, goats, and poultry are reared. Livestock serves as a buffer against economic shocks, with many households using livestock sales to cover urgent needs. However, discussions with the community underscored challenges, including limited pastureland, drought impacts, and the susceptibility of animals to diseases.

3.5.2. Other Economic Activities in the Project Area

- **Trade and Small-Scale Enterprises**: Trade and small-scale businesses are significant sources of supplementary income. FGDs highlighted that women are particularly active in selling surplus agricultural produce, while men often engage in livestock trading. In urban centers, such as Ruyigi and Rutana towns, small enterprises, including retail shops, tailoring, and carpentry, contribute to household incomes. However, participants noted limited access to credit and market linkages as barriers to expanding these ventures (ISTEEBU, 2020).
- **Pottery and Handicrafts**: In Kirundo and Karusi, indigenous communities, such as the Twa, are involved in pottery and handicrafts. While these activities are culturally significant, they offer limited financial returns. FGDs emphasized the need for skill development and market access to make these crafts more profitable.
- **Migration and Remittances**: In provinces such as Bubanza and Bururi, male household members often migrate to urban areas or neighboring countries for work, sending remittances back to their families. FGDs highlighted that while remittances provide critical financial support, migration places additional burdens on women left to manage agricultural and household responsibilities.
- **Charcoal Production and Firewood Sales**: Charcoal production and firewood sales are prevalent in areas with forest cover, such as Bururi and Bubanza. These activities contribute to household incomes but exacerbate environmental degradation. FGDs revealed that while these practices are critical for income, they are unsustainable in the long term.
- **Informal Employment**: Informal employment opportunities, such as casual labor and small-scale mining, were reported in Ruyigi and Rutana. Participants in FGDs highlighted that these jobs are often unstable and poorly paid, leaving households vulnerable to economic shocks.

3.5.3. Community Insights and Emerging Challenges

- **Gender Roles:** Community discussions highlighted that women play a central role in the economic activities of the six provinces, including farming, firewood collection, and small-scale trade. Despite their significant contributions, women often face systemic challenges such as limited control over land and resources, lack of access to financial services, and minimal participation in decision-making processes regarding household incomes.
- **Environmental Pressures:** Community discussions revealed that heavy reliance on natural resources, such as firewood and charcoal for cooking, coupled with unsustainable practices like slash-and-burn agriculture and unregulated deforestation, has accelerated environmental degradation. Participants stressed the need for sustainable interventions to protect forests and promote alternative energy sources.
- **Youth Employment:** The lack of employment opportunities for youth emerged as a pressing issue. Many young people are forced to engage in informal or unstable economic activities, such as selling firewood or performing casual labor in urban areas. FGDs emphasized the importance of creating programs that provide vocational training and support entrepreneurship to address the growing unemployment rates among the youth.

- **Market Access and Infrastructure:** Limited access to markets was consistently cited as a barrier to improving livelihoods. Poor road networks and inadequate transportation options prevent farmers and artisans from reaching broader markets, reducing their income potential. Community members advocated for infrastructure development to facilitate trade and improve economic resilience.
- **Climate Vulnerabilities:** Communities across the provinces expressed concerns about the increasing frequency and severity of climate-related shocks, such as droughts and floods. These challenges directly impact agricultural productivity, which forms the backbone of the local economy, further exacerbating food insecurity and poverty.
- **Social Inequities:** FGDs noted that marginalized groups, including women, persons with disabilities, and indigenous communities, face heightened economic vulnerabilities. They are often excluded from key livelihood opportunities and lack access to necessary resources, deepening their dependence on low-paying and precarious activities.
- **Access to Credit and Financial Services:** Limited access to credit emerged as a significant challenge for smallholder farmers and entrepreneurs. Community members expressed the need for microfinance programs tailored to their needs, particularly for women and youth, to enable investment in productive activities and diversification of income sources.

3.5.3 Implications of IAs on Resilience and Adaptive Capacity to Climate Change

Income-generating activities (IAs) across the six provinces of Burundi are deeply intertwined with natural resources and the local climate. While they provide essential livelihoods for the population, their sustainability and contribution to resilience against climate change vary significantly.

Heavy Reliance on Climate-Sensitive Activities: The dominance of agriculture as the primary income source in all six provinces underscores the vulnerability of local communities to climate variability. Community discussions revealed that unpredictable rainfall, prolonged droughts, and extreme weather events have significantly disrupted agricultural productivity. These impacts not only reduce household income but also heighten food insecurity, limiting the capacity of communities to adapt to future climate shocks.

Unsustainable Resource Use: Livelihood activities such as firewood collection, charcoal production, and slash-and-burn farming practices are driving deforestation and land degradation. The degradation of ecosystems weakens the natural buffer against climate impacts, such as floods and soil erosion, making communities more susceptible to climate-related risks. Local perspectives highlighted that these activities are critical for household income, their unsustainable nature compromises long-term resilience.

Gendered Impacts on Resilience: Women, who are heavily involved in many income-generating activities such as farming and petty trade, face unique challenges that affect their adaptive capacity. Women's limited access to land ownership, financial resources, and decision-making power restricts their ability to implement adaptive strategies. Addressing these gender disparities is essential to building resilience at the household and community levels.

Economic Diversification as a Resilience Strategy: Diversification of income sources is a key factor in enhancing adaptive capacity. Community discussions revealed that households engaged in multiple economic activities, such as livestock rearing, small-scale trade, and crafts, were better able to cope with climate-induced disruptions compared to those solely dependent on agriculture. However, limited access to credit, markets, and training opportunities constrains efforts to diversify livelihoods.

Barriers to Climate-Resilient Livelihoods: Communities consistently cited barriers such as poor infrastructure, lack of market access, and inadequate financial services as significant obstacles to building climate-resilient livelihoods. For instance, poor road networks in Kirundo and Karusi limit farmers' ability to sell surplus produce during favorable seasons, reducing their capacity to invest in adaptive strategies.

Opportunities for Enhancing Resilience: Despite the challenges, there are opportunities to enhance resilience through targeted interventions. Initiatives promoting climate-smart agriculture, sustainable forestry practices, and renewable energy sources can reduce vulnerability and foster adaptive capacity. Community discussions highlighted the need for capacity-building programs to train communities in sustainable practices and equip them with the tools to manage climate risks effectively.

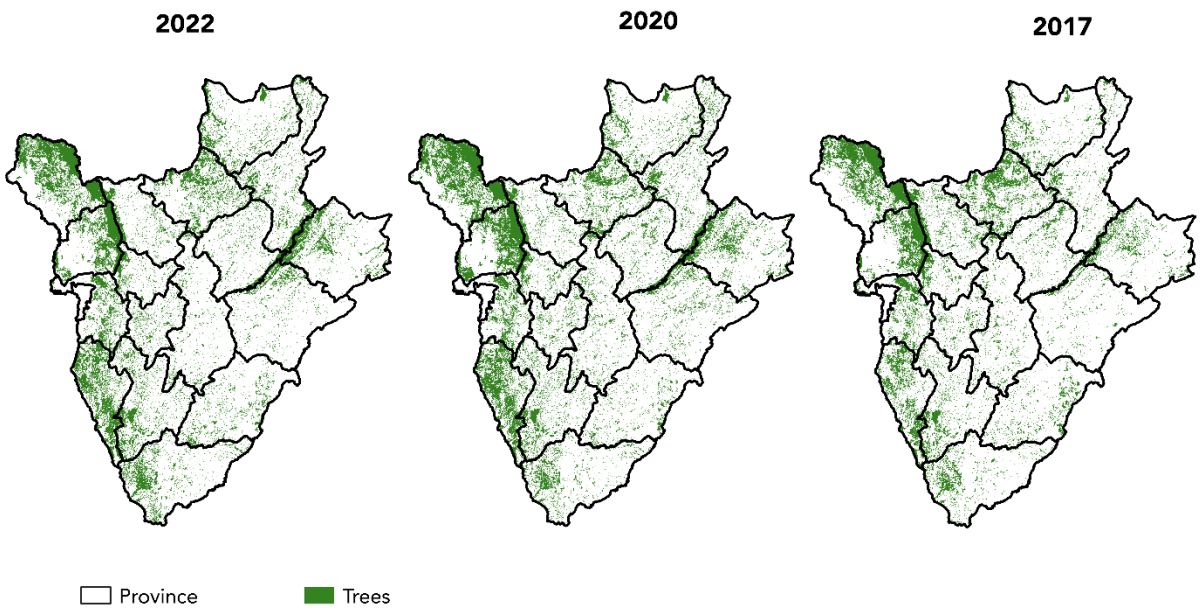
3.6. 3.6 State of Natural Resources

3.6.1. Status of Forests and Land Use

Forests in Burundi are vital for sustaining biodiversity, providing ecosystem services, and supporting rural livelihoods. However, they have undergone significant changes over the years due to deforestation and degradation. These changes are driven by socio-economic pressures, population growth, and environmental challenges.

Burundi had approximately 559,000 hectares of forest in 2000, covering about 21% of the country's land area (Global Forest Watch, 2023). Between 2000 and 2020, the country lost around 8.5% of its forest cover, translating to over 47,000 hectares. This deforestation led to the emission of more than 27.8 million metric tons of CO_2. Provinces such as Bubanza, Bururi, and Kirundo have been particularly affected, with forest loss intensifying between 2015 and 2020, during which an average of 2,000 hectares of forest were cleared annually.

TREE COVER



Dataset Source: ESRI Global Land Use Land Cover from Sentinel-2 (Karra et al., 2021)
Printing Date: 01 Dec 2024 Author: Eileen Mburu Feedback: info@africaapicultureconsortium.org

In Bubanza, tree cover declined significantly from 9.12 km² in 2017 to 12.14 km² in 2022. Rugazi and Gihanga communes also experienced pronounced forest losses, primarily due to agricultural expansion, charcoal production, and overreliance on firewood for cooking. Community discussions underscored that firewood remains the dominant energy source for households, further depleting forest resources.

The primary drivers of deforestation in Burundi include **agricultural expansion**, which converts forests into arable land to support a growing population. **Charcoal production and firewood collection** are also major contributors, as these are critical energy sources for urban and rural households. In provinces such as Bururi and Bubanza, population growth and urbanization have led to increased land demand, accelerating forest degradation. Additionally, climate variability, characterized by prolonged droughts and irregular rainfall, has stressed forest ecosystems, making them more susceptible to human activities and natural hazards.

Forest fires were identified as a significant and growing threat to forest cover, particularly in Kirundo and Bururi provinces. Community members highlighted that prolonged dry conditions and unsupervised burning of land for agricultural clearing often result in uncontrollable fires, which destroy vast forested areas. These fires exacerbate soil erosion and land degradation, further reducing soil fertility and negatively impacting agricultural productivity. Burnt forests are also unable to regenerate quickly, leading to a long-term reduction in tree cover and biodiversity. In

Bururi, forest fires have been reported near Kibira National Park, further threatening this critical biodiversity hotspot.



Burnt forests and fire-damaged landscapes in the project area

In Bururi, deforestation is also driven by the **expansion of tea plantations and illegal logging**, while in Kirundo, forest loss is primarily linked to **land conversion for farming and timber extraction**. Similarly, Bubanza Province has witnessed a sharp reduction in forest cover due to **agricultural activities and the production of charcoal**. The communities in these regions voiced concerns over the environmental consequences of deforestation and forest fires, including the destruction of habitats, reduced biodiversity, and declining water retention capacity of soils.

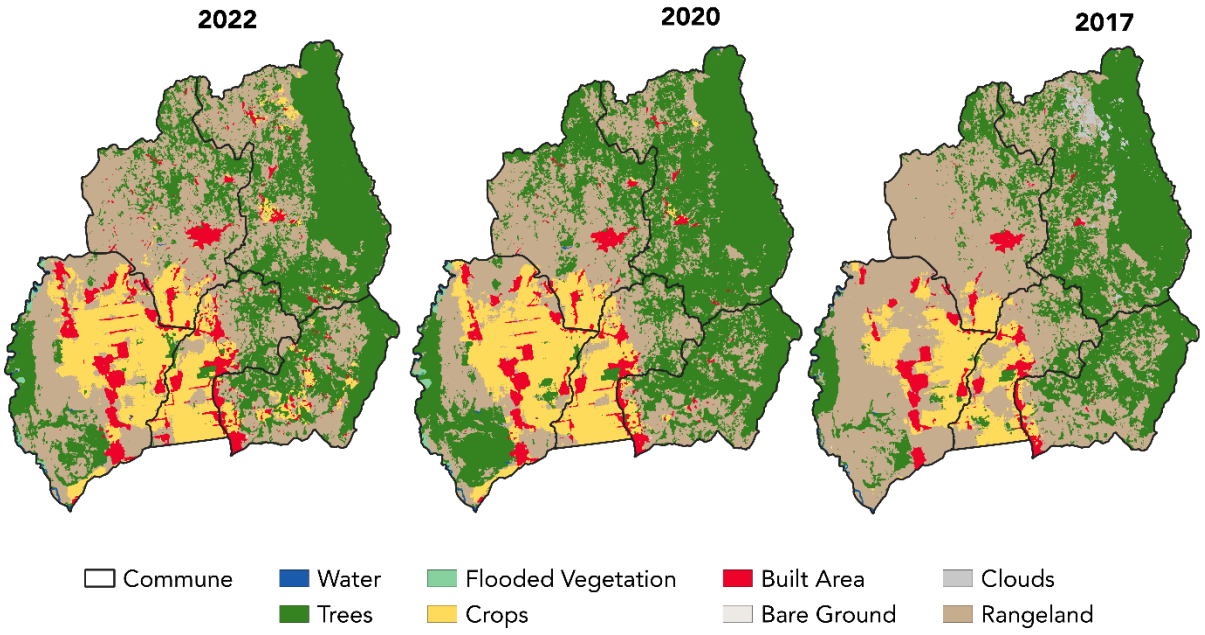
The reduced tree cover has disrupted the water cycle, leading to changes in water availability and an increased risk of floods in low-lying areas. Forest degradation, coupled with forest fires, has broader implications for soil stability, as communities noted an uptick in landslides and desertification-like conditions in affected areas. Local perspectives emphasized the urgency of reforestation efforts, the introduction of fire management strategies, and community awareness campaigns to mitigate the impact of unsupervised land burning and improve forest resilience.

Bubanza province

Known for its forested areas, particularly the extension of Kibira National Park, has experienced significant degradation in forest cover over recent years. The interplay of agricultural expansion, urbanization, and unsustainable resource extraction has contributed to this trend, posing critical challenges for environmental sustainability and climate resilience.

LAND USE LAND COVER

BUBANZA PROVINCE



Dataset Source: ESRI Global Land Use Land Cover from Sentinel-2 (Karra et al., 2021)
Printing Date: 01 Dec 2024 Author: Eileen Mburu Feedback: info@africaapicultureconsortium.org

The analysis of land use and land cover (LULC) data from Bubanza Province, spanning the years 2017, 2020, and 2022, reveals notable trends and changes in forest cover, agricultural land, built-up areas, and rangelands. These changes underscore the influence of socio-economic activities, population dynamics, and environmental pressures on the province's landscape.

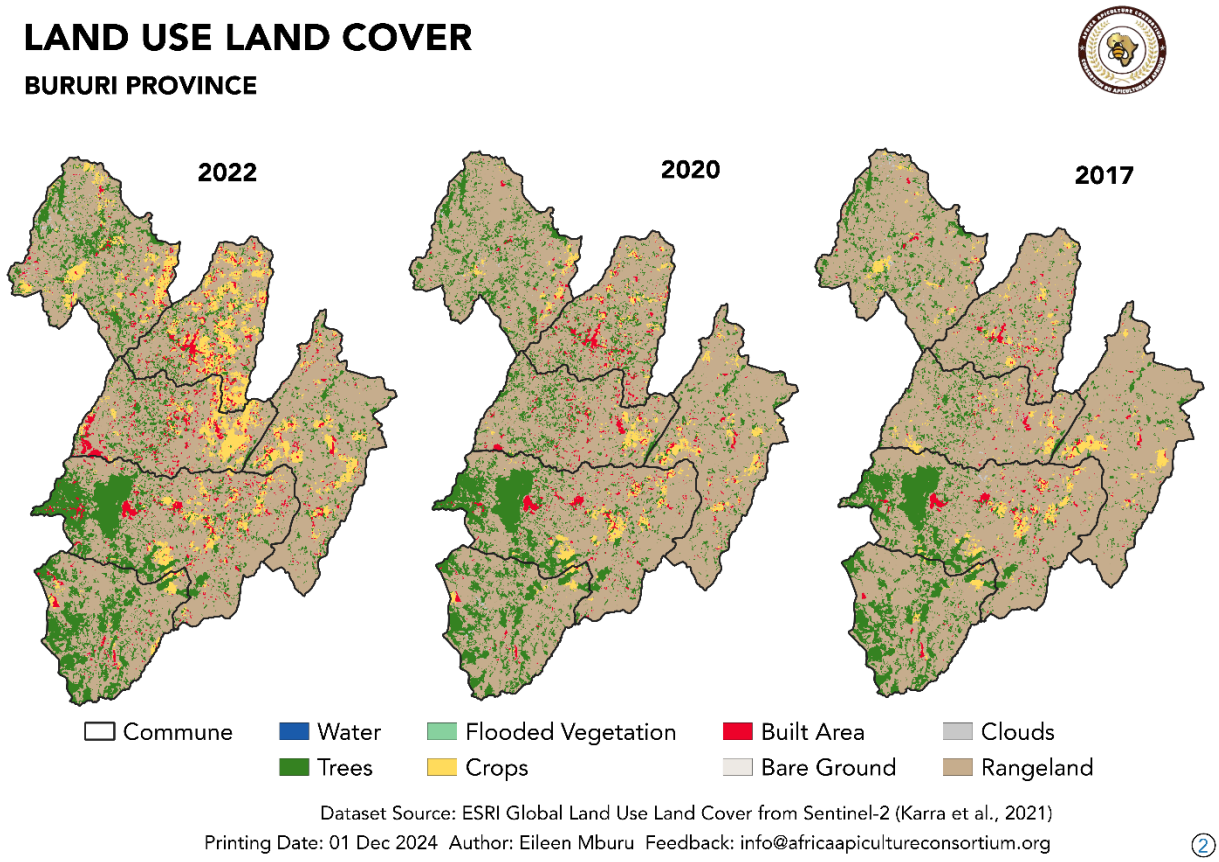
The decline in forest cover is a significant concern, as tree cover has decreased across most communes in Bubanza. For instance, Bubanza Commune saw its forest area shrink from approximately 9.12 km² in 2017 to 12.14 km² in 2022. Similar declines were recorded in Rugazi and Gihanga, where the loss of forest cover was particularly pronounced. Community discussions revealed that this deforestation is primarily driven by agricultural expansion, charcoal production, and the extensive use of firewood for cooking, which remains the primary energy source for many households. The expansion of agricultural land is another critical trend. Agricultural activities have increased substantially, particularly in communes such as Gihanga. Here, crop areas grew from 14.3 km² in 2017 to 22.48 km² in 2022. While this growth supports local livelihoods, it has come at the expense of forests and rangelands, accelerating land degradation and threatening ecosystem balance.

Urbanization has also made its mark on Bubanza Province, as evidenced by a considerable increase in built-up areas. For example, Mpanda's built-up area expanded from 1.76 km² in 2017 to over 3.08 km² in 2022. This urban growth intensifies the strain on natural resources, contributing to habitat loss and deforestation in the process. Rangelands, critical for livestock grazing and

ecosystem health, have experienced a significant reduction. Gihanga, for instance, saw its rangeland areas decrease from 41.48 km² in 2017 to 26.65 km² in 2022. This decline poses challenges for livestock farmers and affects the broader ecological health of the region. Emerging patterns of water and flooded vegetation are notable, particularly in areas like Gihanga. These increases are likely linked to seasonal flooding, which is exacerbated by deforestation and inadequate land management practices. This trend highlights the growing vulnerability of certain areas to climate-related challenges and underscores the need for sustainable land use practices.

Bururi province

The Bururi Forest Reserve, a key biodiversity hotspot, is in Bururi province. This forest is home to various endemic species and supports local water catchments. However, population growth and land conversion for agriculture have led to significant forest encroachment. Community discussions revealed community concerns over declining water availability linked to forest degradation.



The LULC data reveals significant changes in forest cover across the communes of Bururi Province. While some areas, such as Bururi commune, experienced a notable increase in tree cover (from 20.65 km² in 2017 to 25.00 km² in 2022), other communes, like Songa and Matana, reported declining trends. For instance, forest cover in Matana decreased from 3.63 km² in 2017 to 5.42 km² in 2022. Community discussions revealed that in addition to agricultural expansion, charcoal production, and firewood use, forest fires are a recurrent issue in Bururi, particularly in

forested areas near Kibira National Park. These fires not only reduce forest cover but also degrade soil quality, impacting agricultural productivity in adjacent areas. Agricultural land has significantly expanded in communes like Matana, where crop areas grew from 2.03 km² in 2017 to 11.96 km² in 2022. Similarly, Songa recorded an increase in agricultural areas, growing from 2.14 km² in 2017 to 7.38 km² in 2022. While this expansion supports local livelihoods, it has come at the expense of forested and rangeland areas, exacerbating soil erosion and land degradation.

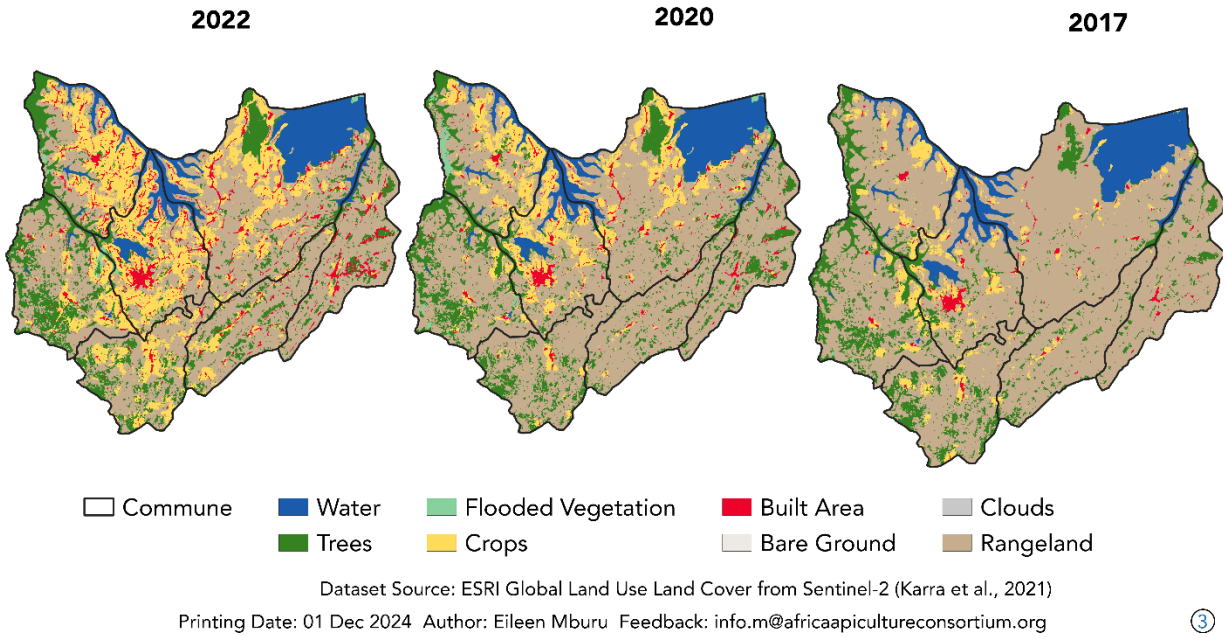
Urban growth is evident in Bururi Province, particularly in communes like Bururi and Songa. Built-up areas in Bururi increased from 2.14 km² in 2017 to 4.20 km² in 2022. This growth aligns with population increases and the demand for housing and infrastructure but intensifies pressure on natural resources and contributes to habitat loss. Rangelands, essential for livestock grazing and ecosystem balance, have declined across many communes. For instance, Matana's rangeland area shrank from 43.80 km² in 2017 to 29.93 km² in 2022. The decline in rangelands is a growing concern for livestock farmers and pastoralists, as highlighted in community discussions. Certain areas, like Bururi commune, experienced an increase in water bodies and flooded vegetation, with water areas expanding from 0.0004 km² in 2017 to 0.0025 km² in 2022. This trend could be linked to seasonal flooding, deforestation, and poor land management practices, particularly in low-lying regions of the province.

Kirundo province

Is characterized by a semi-arid climate with limited natural forest cover. However, the province has significant agroforestry systems where trees are integrated into farming landscapes. Local perspectives revealed that while agroforestry contributes to local livelihoods, it is insufficient to meet the growing demand for wood products, leading to overharvesting.

LAND USE LAND COVER

KIRUNDO PROVINCE



Dataset Source: ESRI Global Land Use Land Cover from Sentinel-2 (Karra et al., 2021)

Printing Date: 01 Dec 2024 Author: Eileen Mburu Feedback: info.m@africaapicultureconsortium.org ③

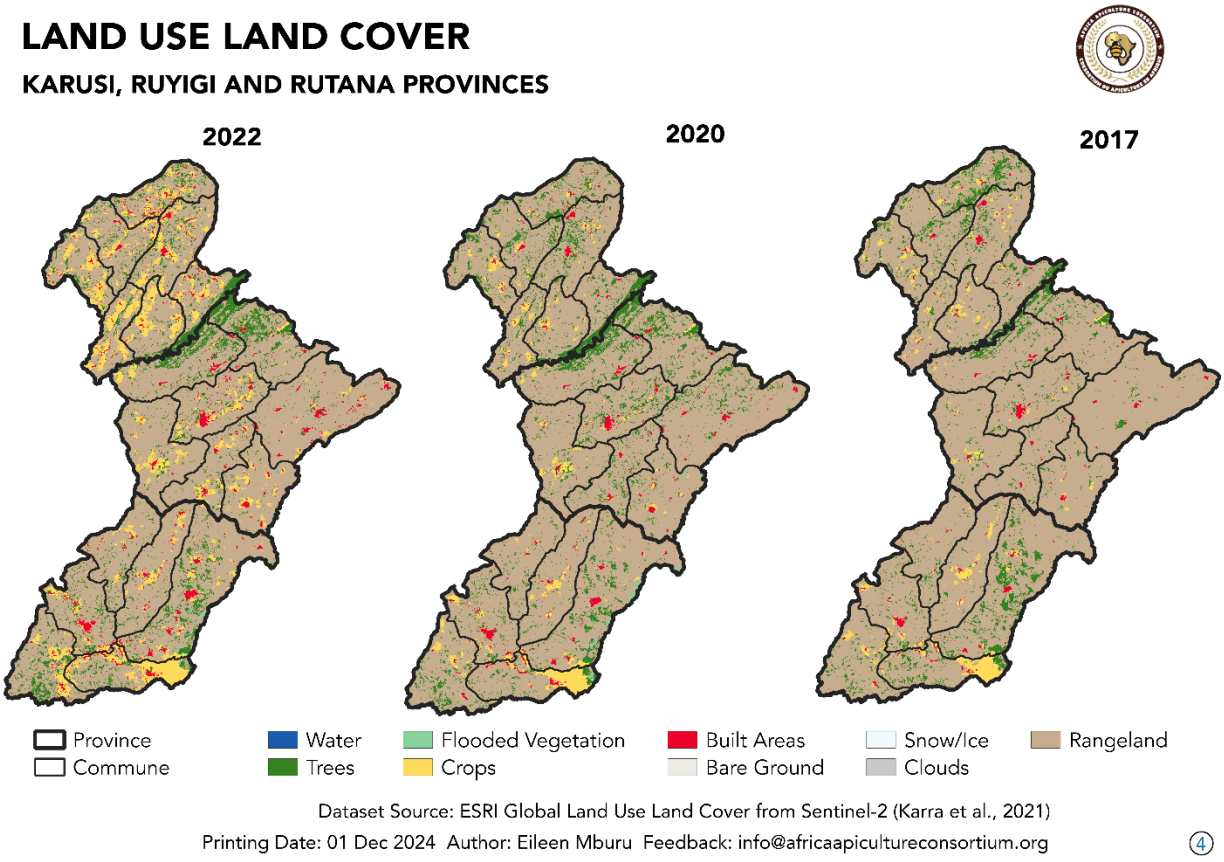
The decline in forested areas is evident across several communes. For instance, Kirundo commune saw a reduction in forested land from approximately 4.79 km² in 2017 to 3.64 km² in 2022. Similar patterns were observed in Bwambarangwe, where forest areas dropped from 4.53 km² in 2017 to 6.36 km² in 2022. Community discussions attributed these changes to deforestation driven by agricultural expansion, charcoal production, and unsustainable use of natural resources. Community insights also revealed that forest fires occasionally affect agroforestry areas, compounding the challenges of overharvesting and deforestation. These fires are often linked to prolonged droughts and mismanaged agricultural burns, further reducing tree cover and impacting soil fertility. Agricultural land has seen a significant increase in communes like Busoni and Ntega. In Busoni, agricultural areas expanded from 2.83 km² in 2017 to 16.92 km² in 2020 and 25.64 km² in 2022. Ntega also experienced growth in agricultural land, increasing from 4.30 km² in 2017 to 9.25 km² in 2022. These expansions, while supporting livelihoods, have contributed to deforestation and habitat loss.

Urbanization is a prominent trend in Kirundo Province. Built-up areas have increased substantially, particularly in Busoni, where urban land grew from 1.03 km² in 2017 to 5.72 km² in 2022. This urban expansion reflects population growth and infrastructural development but intensifies pressure on natural resources. Certain areas, such as Ntega and Vumbi, have shown increases in flooded vegetation and water bodies. Ntega's flooded vegetation increased from 0.14 km² in 2017 to 0.70 km² in 2022. This change is likely linked to seasonal flooding exacerbated by poor land management and deforestation. Rangelands, essential for livestock grazing, have

declined in most communes. For example, Ntega experienced a reduction in rangelands from 40.94 km² in 2017 to 31.81 km² in 2022. Community members highlighted the growing challenges for livestock grazing due to these reductions, which are driven by land conversion for agriculture and urbanization.

Karusi, Rutana and Ruyigi provinces

Has minimal forest cover compared to other provinces. The remaining forests are mostly communal woodlots, which are heavily exploited for firewood and construction materials. Community members emphasized the need for reforestation programs to address the dwindling forest resources and soil erosion challenges. Ruyigi province hosts patches of natural forests, particularly in the eastern parts near the Ruvubu National Park. However, increasing land conversion for agriculture and human settlement has reduced forest areas. Community discussions highlighted the importance of these forests for water regulation and their potential for ecotourism. Ruyigi province has experienced significant deforestation due to agricultural expansion and unsustainable logging practices. Forest resources are critical for providing firewood and construction materials, but their overuse has resulted in habitat loss and reduced soil fertility. Community discussions emphasized the need for alternative energy sources to reduce dependence on firewood.



Forests in all three provinces have faced considerable degradation over the years. For instance, forest cover in Rutana's Gitanga commune decreased from 4.45 km² in 2017 to 10.69 km² in

2022, while Ruyigi's Butaganzwa recorded a decline from 2.27 km² to 2.71 km² in the same period. Similarly, Karusi's Nyabikere saw forest areas reduce from 3.07 km² in 2017 to 4.39 km² in 2022. Community discussions highlighted charcoal production, agricultural encroachment, and firewood use as the primary drivers of deforestation. Additionally, reforestation efforts are limited, leaving these regions vulnerable to soil erosion, biodiversity loss, and reduced ecosystem services. Agriculture remains the backbone of livelihoods in the three provinces, contributing to a marked increase in cropland areas. In Rutana's Bukemba commune, crop areas expanded from 12.35 km² in 2017 to 21.41 km² in 2022. Similarly, in Ruyigi's Bweru commune, agricultural land grew from 0.58 km² in 2020 to 1.56 km² in 2022, while Karusi's Bugenyuzi saw crop areas increase from 0.75 km² in 2017 to 7.37 km² in 2022. While agricultural expansion supports food security and household incomes, it often comes at the expense of forests and rangelands, exacerbating land degradation, habitat destruction, and reduced resilience to climate change.

Urban growth is evident across the three provinces, driven by population increases and infrastructure development. In Karusi's Gihogazi commune, built-up areas grew from 0.34 km² in 2017 to 0.93 km² in 2022. Ruyigi's Gisuru recorded an expansion from 0.88 km² in 2017 to 4.04 km² in 2022, while Rutana's Mpinga-Kayove saw its built-up area grow from 0.36 km² in 2017 to 1.51 km² in 2022. Urbanization intensifies pressure on natural resources, contributing to deforestation and the conversion of rangelands and farmlands. This rapid growth also highlights the need for integrated urban planning to minimize environmental impacts. Rangelands, critical for livestock grazing and ecosystem services, have significantly declined. In Karusi's Mutumba commune, rangelands reduced from 34.33 km² in 2017 to 24.38 km² in 2022. Rutana's Mpinga-Kayove experienced a similar decline from 66.59 km² in 2017 to 63.89 km² in 2022, while Ruyigi's Kinyinya saw its rangelands shrink from 62.32 km² in 2020 to 59.26 km² in 2022. Community discussions revealed that overgrazing and conversion of rangelands into croplands are the primary drivers of this decline. The loss of rangelands affects livestock farming, soil health, and ecosystem stability. Water and flooded vegetation have shown fluctuating trends across the provinces. For instance, Rutana's Bukemba recorded an increase in flooded vegetation from 0.13 km² in 2022. Similarly, Karusi's Gihogazi experienced small gains in water coverage over the years. These changes are likely linked to seasonal flooding and poor land management practices, further exacerbated by deforestation and soil erosion.

3.6.2. Status of Forests at Imbo Basin

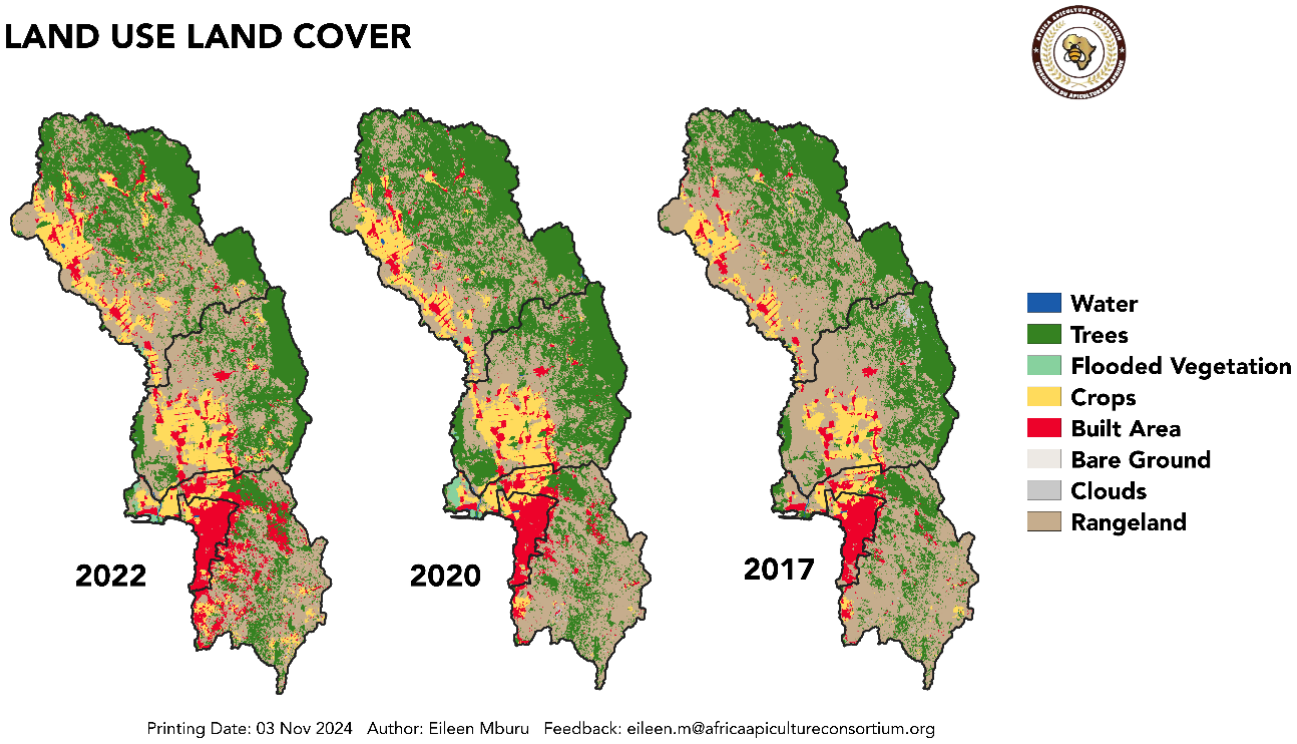
The forest estate in the project areas, particularly Kibira National Park and surrounding forest reserves, has experienced significant degradation over the past decades. The pressures of agricultural expansion, population growth, and the demand for timber and fuelwood have contributed to deforestation and forest degradation. Central and local forest reserves in the region have seen extensive encroachment, with many areas converted to agricultural land or degraded due to illegal logging and charcoal production. In some areas, forest patches have been entirely lost, threatening the ecological functions these forests once provided, such as carbon sequestration, water regulation, and biodiversity conservation.

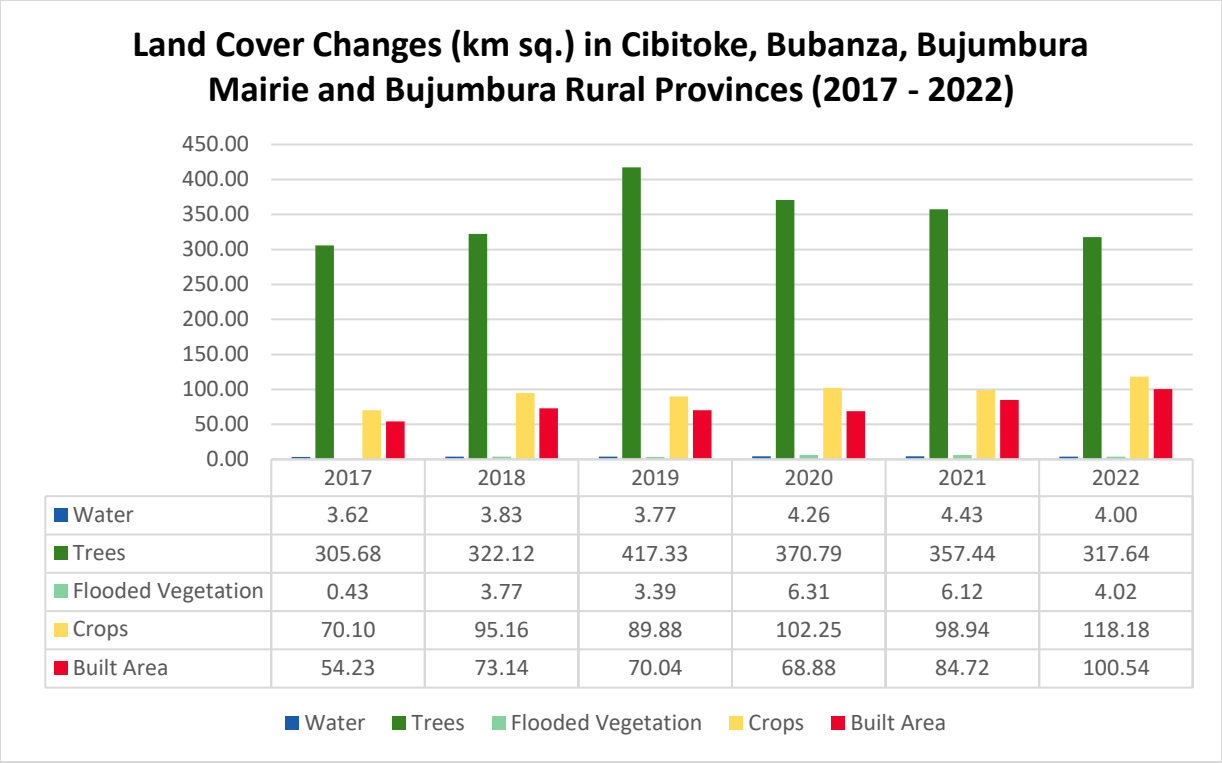




Images illustrating Hills with Scattered Trees in Cibitoke Province

These images depict hills in Cibitoke with sparse tree cover. According to discussions held with the local community, these hills were once densely forested. However, deforestation driven by agricultural expansion, firewood collection, and charcoal production has significantly reduced the number of trees, as evident from the current state of the landscape.





	2017	2018	2019	2020	2021	2022
Water	3.62	3.83	3.77	4.26	4.43	4.00
Trees	305.68	322.12	417.33	370.79	357.44	317.64
Flooded Vegetation	0.43	3.77	3.39	6.31	6.12	4.02
Crops	70.10	95.16	89.88	102.25	98.94	118.18
Built Area	54.23	73.14	70.04	68.88	84.72	100.54

Analysis of land cover (LULC) data from 2017 to 2022 in Cibitoke, Bubanza, Bujumbura Mairie, and Bujumbura Rural provinces reveals significant shifts in resource allocation and land degradation patterns, influenced by demographic and economic pressures in these areas (Ndayiragije et al., 2017). Increasing population density and urbanization have substantially altered land use, mirroring broader socio-economic trends and environmental impacts across Burundi (Niyongabo et al., 2024).

Between 2017 and 2019, there was an initial increase in tree cover, likely due to local reforestation efforts aimed at reducing deforestation and encouraging sustainable land practices. However, this gain was not sustained, with tree cover significantly declining by 2022. The reduction in forested areas corresponds with rising agricultural demands and widespread charcoal production, essential for household energy needs across urban and rural regions, particularly in Bujumbura Mairie (Bitama, 2023). Charcoal production has escalated due to limited alternative fuel options, leading to extensive logging and environmental degradation, particularly in high-population areas (Campalani et al., 2022). Simultaneously, cropland increased notably from 70.10 km² in 2017 to 118.18 km² by 2022, reflecting a shift toward agricultural intensification to meet food security needs in a growing population. This shift includes converting forest and rangeland into cropland, a trend that poses long-term risks for biodiversity, soil health, and carbon sequestration (Beekman et al., 2019).

Urbanization pressures are further evidenced by the expansion of built-up areas, which grew from 54.23 km² in 2017 to 100.54 km² by 2022. Driven by rural-to-urban migration and natural population growth, the urban sprawl around Bujumbura Mairie and nearby areas strains

infrastructure and reduces available open spaces (Niyongabo et al., 2024). This urban expansion often replaces agricultural and natural lands, intensifying competition for land resources (Kinuthia et al., 2016). Additionally, fluctuations in flooded vegetation were observed, with an initial increase by 2020 potentially due to altered water levels influenced by forest loss and rainfall pattern shifts, exacerbated by regional deforestation and climate variations. However, by 2022, flooded vegetation declined slightly, likely due to human intervention in water management and seasonal droughts (Ndayiragije et al., 2017). Rangelands, primarily utilized for grazing, have declined considerably, from 470.97 km² in 2017 to 365.18 km² in 2022. The loss of rangeland reflects the ongoing conversion of natural landscapes to agricultural and urban areas, which affects pastoral livelihoods and reduces ecological resilience, with negative consequences for carbon storage, groundwater recharge, and wildlife habitats (Campalani et al., 2017).

The LULC analysis highlights the environmental trade-offs associated with population growth and socio-economic development in these provinces. The expansion of cropland and urban areas, combined with the decline of forests and rangelands, emphasizes the urgent need for sustainable land management practices. Additionally, the growing reliance on charcoal production as a primary fuel source underscores the importance of sustainable energy alternatives to alleviate deforestation pressures (Bitama, 2023).

3.6.3. 3.6.2 Land Degradation

Land degradation is an escalating challenge in Burundi, severely affecting the six focus provinces: Karusi, Rutana, Ruyigi, Bubanza, Bururi, and Kirundo. The degradation is driven by a mix of deforestation, unsustainable agricultural practices, overgrazing, and climate-related pressures. Insights from community discussions, stakeholder consultations, and research data provide a comprehensive picture of the problem and its implications.

Key Drivers of Land Degradation

Deforestation: Community discussions highlighted extensive deforestation driven by agricultural expansion, charcoal production, and construction activities. For instance, forest cover in Rutana and Bubanza has significantly declined over the past decade, a trend corroborated by satellite imagery from Global Forest Watch (Global Forest Watch, 2023). Local residents emphasized that the heavy reliance on firewood as a primary energy source for cooking exacerbates the problem, leaving forests severely depleted.

Unsustainable Farming Practices: In provinces like Ruyigi and Karusi, population pressures have intensified over-cultivation without sufficient soil restoration practices. Slash-and-burn agriculture, commonly employed in Rutana, accelerates soil erosion and nutrient depletion. Community discussions revealed that in steeply sloped regions, such as Bururi and Bubanza, the absence of terracing exacerbates topsoil loss during heavy rains, compounding land degradation.

Overgrazing: Communal rangelands in Kirundo and Karusi are heavily overburdened by livestock, leading to soil compaction, reduced vegetation cover, and heightened vulnerability to erosion. Stakeholders noted that the lack of controlled grazing practices is a persistent issue, making rangelands unsustainable for long-term livestock production.

Climate Change: Climate variability has exacerbated land degradation across all provinces. Prolonged dry spells and intense rainfall have significantly contributed to soil erosion and reduced agricultural productivity. Frequent flooding in low-lying areas such as Bubanza and Rutana has led to extensive soil loss and sedimentation in water bodies (World Bank, 2022).

Infrastructure Development: Urban expansion in Bururi and Kirundo has resulted in increased quarrying and sand mining activities, destabilizing soil structures and reducing vegetative cover. Community stakeholders highlighted that unregulated construction activities often fail to incorporate necessary environmental safeguards, further aggravating land degradation.



Evidence of landslides in the region

Impacts of Land Degradation

1. **Reduced Agricultural Productivity**: In Karusi and Ruyigi, farmers reported declining crop yields due to degraded soils. Soil fertility loss has pushed many to rely on chemical fertilizers, increasing production costs and environmental risks.
2. **Increased Soil Erosion**: Steep slopes in Bururi and Kirundo experience severe erosion, as reported in stakeholder consultations. This has resulted in the loss of arable land, forcing communities to cultivate marginal lands.
3. **Sedimentation of Water Bodies**: Rivers and wetlands in Rutana and Bubanza have suffered from heavy sedimentation caused by upstream deforestation and soil erosion. This affects water quality and reduces the capacity of reservoirs critical for irrigation and drinking water.

4. **Biodiversity Loss**: Habitat destruction, particularly in forested and rangeland areas of Karusi and Rutana, has threatened plant and animal species dependent on these ecosystems. The loss of wetlands in Rutana was identified as a critical concern for local biodiversity.

Community Perspectives

Discussions in Kirundo revealed a strong demand for terracing and reforestation programs to address soil erosion and restore degraded lands. Farmers in Rutana emphasized the importance of sustainable farming practices, such as agroforestry, to enhance soil fertility and promote environmental sustainability. Stakeholders in Ruyigi highlighted the critical need to involve youth in sustainable land management initiatives, not only to address environmental challenges but also to create employment opportunities for young people. In Bubanza, women reported that deforestation has increased the distances they must travel to collect firewood, significantly adding to their workload and limiting their ability to participate in income-generating activities.

3.7. Biodiversity in Burundi

3.7.1. Flora

Burundi's flora is highly diverse, with notable vegetation types including montane forests, savannas, and wetlands. The Kibira National Park, which extends into Bururi Province, is home to dense montane forests that support a variety of endemic and economically important plant species. Among these are medicinal plants and timber species, such as African mahogany (*Khaya anthotheca*) and East African camphor (*Ocotea usambarensis*).

The wetlands in Ruyigi and Rutana support species such as papyrus (*Cyperus papyrus*) and reeds, which are essential for water filtration and local crafts. Agricultural expansion and charcoal production in provinces like Karusi and Bubanza have significantly degraded forested areas, reducing native plant cover. Community discussions revealed that invasive plant species are increasingly dominating degraded lands, further threatening native flora. Stakeholders in Bururi emphasized the need for reforestation programs to restore degraded landscapes.

3.7.2. Fauna

Burundi's fauna is equally diverse, encompassing species found in forests, wetlands, and grasslands. Key species include primates such as chimpanzees (*Pan troglodytes*), which inhabit the Kibira National Park, and a variety of antelope species in savanna regions of Rutana and Ruyigi. Birdlife is abundant, with Lake Tanganyika and associated wetlands supporting species like the African fish eagle (*Haliaeetus vocifer*) and the shoebill (*Balaeniceps rex*).

However, wildlife populations are under threat due to habitat loss and hunting. Community discussions in Kirundo highlighted the depletion of small mammals and bird species, attributed to overhunting for bushmeat and agricultural encroachment. Wetlands in Ruyigi and Rutana have experienced significant declines in amphibian populations, primarily due to pesticide use and water pollution. Stakeholders stressed the importance of biodiversity-friendly agricultural practices and habitat conservation to protect these species.

3.8. 3.8. Environmental Baselines

3.8.1. Location and Administrative Units

Burundi is a landlocked country located in the Great Lakes region of East Africa. It is bordered by Rwanda to the north, Tanzania to the east and south, and the Democratic Republic of the Congo to the west. The country has a total land area of approximately 27,834 square kilometers, with diverse topography characterized by high plateaus, mountains, and lowlands along Lake Tanganyika. Administratively, Burundi is divided into 18 provinces, each further subdivided into communes, zones, collines (hills), and households. This section focuses on the six provinces relevant to the project: Bubanza, Bururi, Kirundo, Karusi, Rutana, and Ruyigi, along with their respective communes of interest.

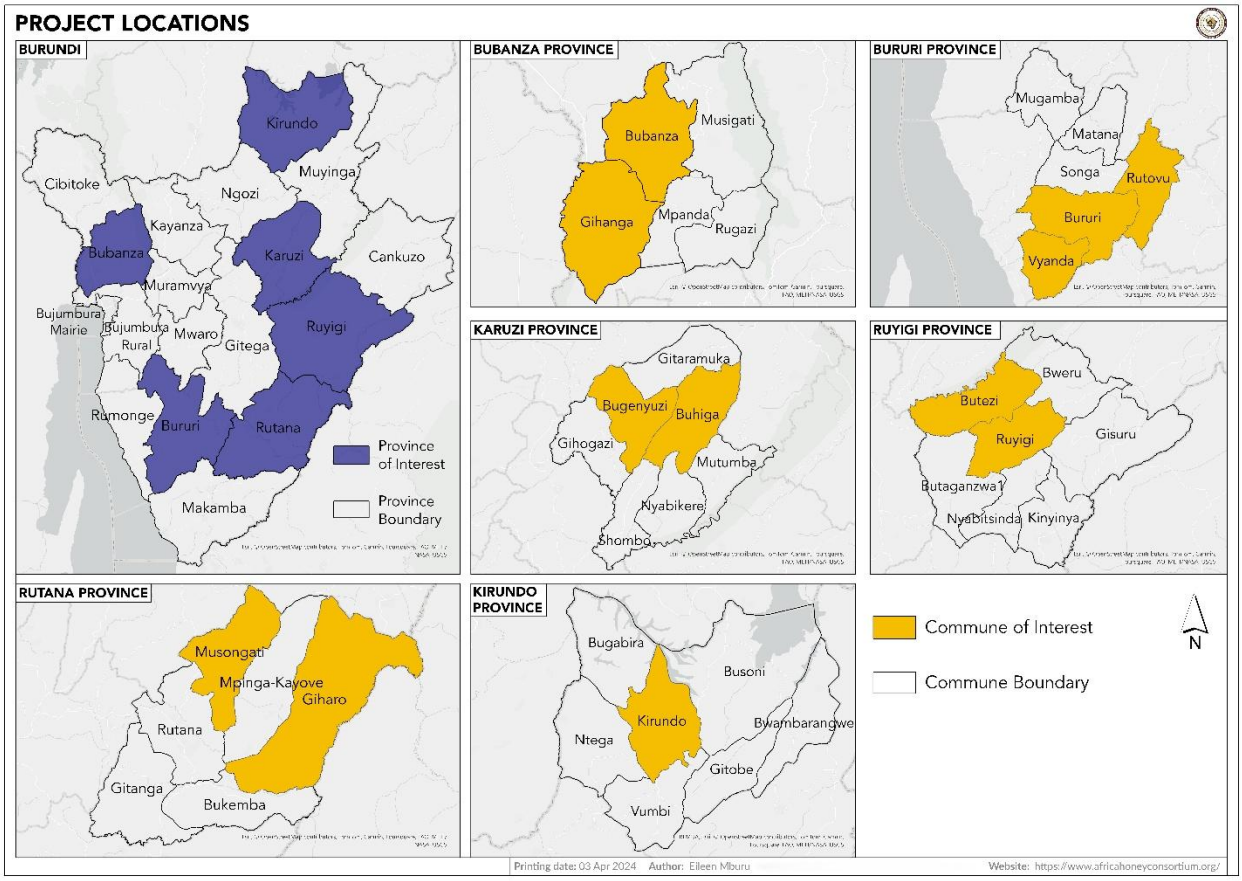
3.8.2. Imbo Basin Location and Administrative Units



The project is situated in Burundi, focusing on the regions of Cibitoke, Bubanza, Bujumbura Rural, and Bujumbura Mairie. These regions are key for both agricultural activities and environmental conservation due to their diverse topography and ecosystems. The total project area covers 4,170.68 km^2, representing a significant portion of Burundi's rural and urban landscape. The regions are integral to the country's efforts in improving food security and building climate resilience, as they encompass both densely populated urban areas and agriculturally rich rural lands.

- **Cibitoke and Bubanza**- Primarily rural, these regions are known for their agricultural productivity, contributing significantly to Burundi's staple food crops and coffee production.
- **Bujumbura Rural**- This region features a mix of agricultural lands and forested areas, playing a critical role in biodiversity conservation and supporting subsistence farming.
- **Bujumbura Mairie**- As the urban heart of the country and home to the capital city, this region serves as a hub for trade, services, and governance, with some surrounding areas still used for urban agriculture.

This mix of regions provides a unique opportunity for the project to influence both rural and urban adaptation strategies, ensuring that efforts to build resilience are inclusive and context specific.



Bubanza Province

Located in the western lowlands, Bubanza is characterized by fertile plains and its proximity to Kibira National Park. The province is heavily reliant on agriculture and artisanal activities.

- **Bubanza Commune:** Known for its subsistence farming and small-scale livestock keeping, Bubanza struggles with deforestation and soil erosion, driven by agricultural expansion and charcoal production.
- **Gihanga Commune:** This commune serves as an agricultural hub with significant rice farming in its wetlands. However, it is vulnerable to flooding and overextraction of water resources, as highlighted during community discussions.

Bururi Province

In the southwest, Bururi features montane forests, wetlands, and agricultural land. The province hosts parts of Kibira National Park, which serves as a critical biodiversity hotspot.

- **Rutovu Commune**: Known for its cool climate and high-altitude terrain, Rutovu is predominantly agricultural, with crops like potatoes and beans being cultivated. Terracing is a common practice to manage its steep slopes.
- **Bururi Commune**: The administrative center of the province, Bururi has a mix of small-scale farming and forestry activities. The commune also faces issues of land degradation and soil fertility loss due to overuse.

- **Vyanda Commune**: Vyanda is marked by its wetlands and forests, which have seen significant degradation due to farming and charcoal production. Stakeholders noted a pressing need for sustainable land management practices.




Bururi's Hilly Landscape

Kirundo Province

Positioned in the north, Kirundo features wetlands and grasslands, with Lake Rweru serving as a key natural resource for fishing and irrigation.

- **Kirundo Commune:** This commune is a fishing and agricultural hub, with a reliance on cassava and maize farming. However, land degradation and overgrazing are major concerns, as discussed during community consultations.

Karusi Province

Located in central Burundi, Karusi is predominantly rural, with agriculture as the primary livelihood.

- **Bugenyuzi Commune:** Bugenyuzi is characterized by its high population density and intensive small-scale farming. Issues of soil erosion and limited access to water resources were raised during community discussions.
- **Buhiga Commune:** Known for its maize and bean cultivation, Buhiga also faces significant challenges from soil degradation and declining crop yields due to overcultivation.

Rutana Province

Situated in southeastern Burundi, Rutana has a mix of savannas and wetlands, making it suitable for both crop farming and livestock rearing.

- **Musongati Commune:** This commune is notable for its mining activities, particularly nickel deposits, which offer economic opportunities but also contribute to land degradation.
- **Giharo Commune:** Giharo is largely agricultural, with extensive maize and cassava farming. However, deforestation and overgrazing are critical issues impacting its natural resources.

Ruyigi Province

In the east, Ruyigi's administrative zones include a mix of highland and lowland areas, predominantly used for farming.

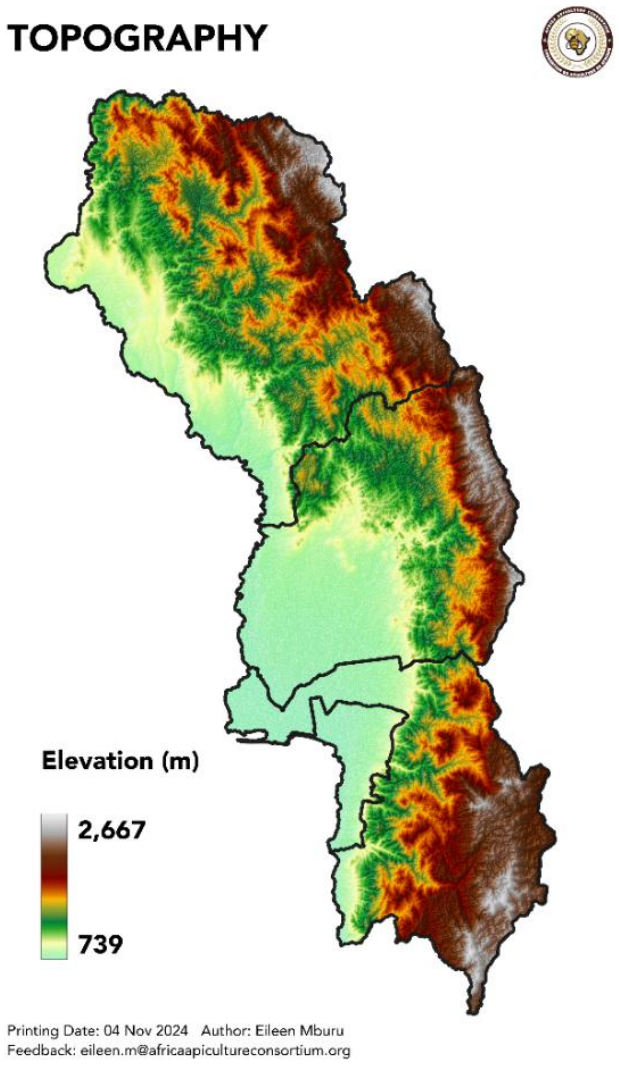
- **Butezi Commune:** This commune is known for its rice cultivation in lowland areas and coffee farming in uplands. However, flooding and soil erosion are recurrent issues, as emphasized by community members.
- **Ruyigi Commune:** The provincial center, Ruyigi is an important trade and agricultural hub. Challenges include limited access to clean water and environmental degradation from unsustainable farming practices.

3.8.3. Imbo Basin Topography

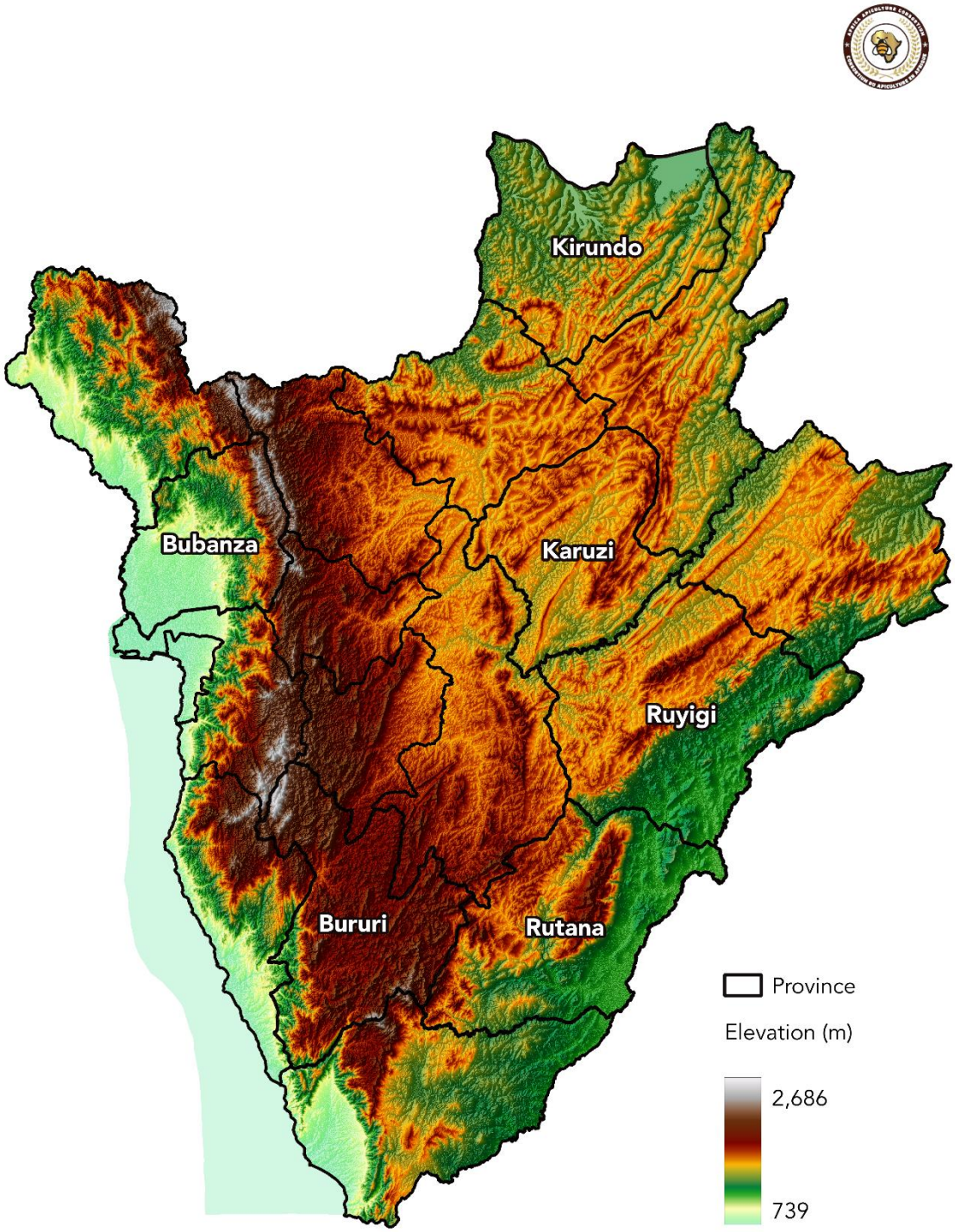
Burundi's landscape is highly varied, with the project regions displaying distinct topographical features:

- **Cibitoke-** Characterized by hilly terrain, with elevations ranging from 900 to 2,000 meters above sea level. The region is part of the western plateau and receives significant rainfall due to its elevation, supporting coffee and banana plantations.
- **Bubanza-** Featuring more gentle rolling hills and flat plains, this region is ideal for agriculture, particularly the cultivation of rice, maize, and cassava. It is one of the lower-lying areas, with an average altitude of 1,100 meters.
- **Bujumbura Rural-** Dominated by steep hills and the towering Mount Heha, the region is part of the Congo-Nile divide and has highly fertile volcanic soils. Its rugged terrain creates microclimates that favor diverse agricultural activities.
- **Bujumbura Mairie-** Situated on the shores of Lake Tanganyika, the capital city lies in a relatively flat plain with surrounding hills. The region is urbanized, but its outskirts still engage in agriculture, particularly vegetable farming and livestock rearing.

Mount Heha, located in Bujumbura Rural, is Burundi's highest peak at 2,670 meters. The varying elevations across the project areas influence local climates, water resources, and agricultural potential, making tailored interventions necessary for each area.



3.8.2 Topography



Dataset Source: United States Geological Survey (USGS)

Printing Date: 02 Dec 2024 Author: Eileen Mburu Feedback: info@africaapicultureconsortium.org

Bubanza Province: Bubanza lies in Burundi's western lowlands, characterized by flat to gently undulating terrain. The low elevation and fertile soils make the province a hub for rice farming and other agricultural activities. However, the flat topography in areas like Gihanga Commune increases vulnerability to flooding, particularly during heavy rainfall. Community discussions emphasized the challenges of waterlogging and sediment deposition in wetlands, which affect agricultural productivity.

Bururi Province: Bururi is situated in the southwestern highlands, with steep hills and rugged terrain. The province features some of the highest altitudes in Burundi, particularly in Rutovu Commune, where terraced farming is a common practice to prevent soil erosion. The topography also supports montane forests, such as those in the Kibira National Park. However, the steep slopes are prone to landslides, especially during intense rains, as highlighted during stakeholder consultations.

Kirundo Province: Kirundo's landscape is marked by rolling hills interspersed with expansive wetlands and valleys, particularly near Lake Rweru. The topography in Kirundo Commune supports both fishing and small-scale farming. However, the undulating terrain exacerbates water runoff, leading to soil erosion and sediment accumulation in wetlands. Community stakeholders noted that unregulated farming on hill slopes further depletes soil fertility.

Karusi Province: Located in central Burundi, Karusi features a mix of gently rolling hills and highland plateaus. In Bugenyuzi and Buhiga Communes, the topography supports subsistence farming of crops like maize and beans. However, the hilly terrain is prone to erosion due to inadequate soil conservation measures. Community discussions revealed that farmers struggle with declining crop yields because of nutrient loss from topsoil erosion.

Rutana Province: Rutana's southeastern landscape transitions from rolling hills to flat savannas. Musongati Commune is notable for its undulating terrain, which supports both agriculture and livestock rearing. In contrast, Giharo Commune has flatlands interspersed with gentle slopes, which are prone to overgrazing and deforestation. Stakeholders highlighted the vulnerability of these areas to seasonal flooding and soil compaction.

Ruyigi Province: Ruyigi's eastern location features a combination of highland plateaus and low-lying valleys. Butezi Commune has steep slopes used for coffee farming, while Ruyigi Commune is marked by flat areas suitable for rice cultivation. The varying elevation creates microclimates that influence agricultural practices but also heighten vulnerability to soil erosion and water runoff. Community members highlighted the need for terracing and reforestation to stabilize slopes and reduce erosion.

3.8.4. Geology

Burundi's geology is dominated by Precambrian rocks, particularly the Kibaran Belt, which extends across the central and eastern parts of the country. This ancient formation is rich in minerals such as gold, nickel, and rare earth elements. The western part, including provinces like Bubanza and Bururi, features younger sediments, such as sandstone and shale, while volcanic rocks are scattered in some northern areas, especially near Kirundo.

The provinces of interest have diverse geological characteristics:

- **Bubanza (Bubanza and Gihanga):** Predominantly underlain by metamorphic rocks like schists and gneisses, which are significant for water retention and agriculture.
- **Bururi (Rutovu, Bururi, Vyanda):** Known for its granitic formations and lateritic soils, which influence the hilly landscape and water drainage patterns.
- **Kirundo:** Features volcanic deposits and sedimentary layers, often contributing to fertile soils but susceptible to erosion.
- **Karusi (Bugenyuzi, Buhiga):** Hosts metamorphic rocks with occasional quartzite outcrops, influencing groundwater aquifers.
- **Rutana (Musongati, Giharo):** Rich in nickel and other metals, with ultramafic and mafic rock formations.
- **Ruyigi (Butezi, Ruyigi):** Includes crystalline basement rocks, particularly granite and gneiss, with scattered mineralization zones.
- **Cibitoke:** These areas are influenced by the volcanic activity of the Mitumba Mountains, with soils derived from basaltic rock and volcanic ash. The volcanic soils are highly fertile, supporting the cultivation of cash crops like coffee.
- **Bujumbura Rural:** The region is part of the Congo-Nile divide, where volcanic and metamorphic rocks dominate. The soil in this area is fertile, particularly in the highlands, where deep red and black loamy soils support coffee and banana farming.
- **Bujumbura Mairie:** The geology here is more sedimentary, with deposits from the surrounding hills and Lake Tanganyika forming a mix of sandy and clay soils. While these soils are less fertile compared to the volcanic areas, they still support horticultural activities in the peri-urban zones.

3.8.5. Soils

Burundi's soils are generally fertile but increasingly degraded due to overuse and erosion. The dominant soil types in the six provinces include:

- Ferralsols: Found in Bubanza, Rutana, and Bururi, these reddish soils are acidic and nutrient-poor but suitable for certain crops like coffee.
- Acrisols: Common in Kirundo and Karusi, these are leached soils with low fertility, necessitating improved farming practices.
- Vertisols: Found in lowland areas of Ruyigi, these clay-rich soils swell and shrink with moisture changes, challenging agriculture.
- Andosols: Present in volcanic areas like Kirundo, these soils are highly fertile and ideal for diverse cropping systems.
- Cambisols: Cover the hilly regions of Bururi, often shallow and prone to erosion on slopes.

Soil erosion is a critical issue, particularly in provinces like Karusi and Ruyigi, where unsustainable farming practices and overgrazing exacerbate degradation. Community discussions revealed that terracing and agroforestry practices are increasingly being adopted to mitigate these challenges.

3.8.6. Hydrology

Burundi's hydrology is shaped by its location within the Nile and Congo River basins, with numerous rivers and lakes supporting agriculture, energy, and domestic water use. Key hydrological features in the six provinces include:

- **Bubanza:** Rivers like the Mpanda and Rusizi provide vital water sources but are prone to seasonal flooding, affecting agricultural activities.
- **Bururi:** The province is part of the Nile River Basin, with numerous streams originating from its hills, including the Bururi Natural Reserve.
- **Kirundo**: Known for its lakes, such as Cohoha and Rweru, which are crucial for irrigation and fishing but face siltation due to land degradation.
- **Karusi:** Hosts smaller rivers feeding into larger systems like the Ruvubu, which forms part of the Nile's upper catchment.
- **Rutana:** The Kagunuzi River and its tributaries are vital for farming and hydropower but are heavily impacted by sedimentation.
- **Ruyigi:** The eastern region features rivers like the Ruvubu, which support irrigation and livestock but experience reduced flows during dry spells.

Efforts to improve hydrology management in these provinces include community-led water harvesting projects and reforestation programs aimed at stabilizing watersheds.

3.8.7. Imbo Basin Hydrology

The hydrological network in the project regions of Cibitoke, Bubanza, Bujumbura Rural, and Bujumbura Mairie plays a critical role in shaping the availability of water resources and supporting agricultural, domestic, and economic activities. This network includes prominent rivers, wetlands, and Lake Tanganyika, each contributing uniquely to the resilience and livelihoods of local communities.

Key hydrological features include:

- **The Rusizi River** - serves as a major water source in Cibitoke, flowing from Lake Kivu and forming part of the natural boundary between Burundi and the Democratic Republic of Congo. This river is vital for irrigation in the low-lying plains of the region, supporting the cultivation of crops such as rice and maize. However, the river is increasingly threatened by sedimentation and pollution from agricultural runoff, which undermine its capacity to sustain the agricultural livelihoods it supports.
- **The Ntahangwa River** - flowing through Bujumbura Mairie, is a key source of water for both domestic and agricultural uses. The floodplains along the river support small-scale urban agriculture, including the cultivation of vegetables for local markets. However, the river also presents a significant flooding risk during heavy rains, as noted in FGDs with urban communities. This has led to the destruction of homes and urban farms, highlighting the need for integrated flood management strategies.
- **Lake Tanganyika** - One of the world's largest and deepest freshwater lakes, Lake Tanganyika, is central to the livelihoods of communities in Bujumbura Mairie. The lake supports a range of activities, including fishing, which provides both food and income for local communities, irrigation, particularly for agriculture in nearby lowland areas and tourism, which contributes to the local economy.

Wetlands around these rivers and the lake act as natural buffers, regulating water flow and mitigating the impacts of extreme weather events such as floods and droughts. These wetlands also:

- Support biodiversity, hosting a range of flora and fauna.
- Provide opportunities for rice farming, which is a key livelihood activity for many households.

However, wetland encroachment for agriculture and settlement has reduced their capacity to perform these ecological functions. FGDs revealed that communities rely heavily on these wetlands, particularly during dry spells, underscoring the importance of protecting these hydrological systems.

3.8.8. Climate

Burundi's climate is primarily equatorial, with regional variations influenced by topography. The country's weather patterns feature two wet seasons (February–May and September–December) and two dry seasons (June–August and January), driven by the intertropical convergence zone (ITCZ). Annual rainfall ranges from 800 mm in the lowlands to over 2,000 mm in the highlands, which supports agriculture, biodiversity, and water resources but also exacerbates vulnerabilities to climate variability (Niyongendako et al., 2020; Ndayiragije et al., 2022).

Regional Climate Characteristics

The six focus provinces exhibit distinct climatic conditions:

Bubanza

Experiences warmer temperatures and lower rainfall, with annual precipitation ranging between 1,000 mm and 1,500 mm. These climatic conditions increase the province's susceptibility to droughts and water shortages, particularly during the dry season. Rain-fed agriculture dominates the economy, with key crops including maize, cassava, beans, and sweet potatoes. Community discussions revealed gendered agricultural roles, with men primarily cultivating maize and tomatoes, while women focus on cassava and beans for household consumption. Livestock, particularly goats and chickens, plays a supplementary role in the local economy. However, stakeholders emphasized the need for enhanced water management systems to mitigate the effects of seasonal variability on agricultural productivity.

Bururi

Bururi benefits from higher altitudes, cooler temperatures (15°C to 20°C), and substantial rainfall exceeding 1,800 mm annually. These favorable conditions support a diverse range of crops such as tea, coffee, maize, and bananas. Tea and coffee are significant cash crops in Rutovu and Bururi communes, cultivated predominantly by men, while women play a crucial role in growing beans, sweet potatoes, and vegetables. Despite its favorable climate, Bururi's hilly terrain makes it prone to landslides during heavy rains, as noted in stakeholder consultations. Addressing soil erosion through terracing and reforestation was identified as a critical need for sustaining agricultural productivity.

Kirundo

In the drier northern lowlands, Kirundo faces frequent dry spells and irregular rainfall, with annual precipitation ranging from 800 mm to 1,200 mm. These challenging conditions necessitate the

cultivation of drought-tolerant crops like millet, sorghum, and cassava. Community discussions in Kirundo Commune revealed that men prioritize sorghum and bananas for market-oriented production, while women focus on cassava and groundnuts for household food security. Livestock rearing, particularly cattle and goats, is integral to the local economy. However, overgrazing and limited access to water resources were highlighted as significant challenges affecting both agricultural and livestock productivity.

Karusi

Located centrally, Karusi experiences moderate rainfall (1,000 mm to 1,400 mm) and temperatures ranging from 18°C to 25°C. Shifts in seasonal rainfall patterns have disrupted traditional farming systems, requiring farmers to adopt more resilient practices. Beans, maize, and bananas are the primary crops, with Bugenyuzi and Buhiga communes emerging as key agricultural hubs. Community discussions revealed that women are actively involved in cultivating beans and vegetables for household consumption and income. Men, on the other hand, dominate banana and maize farming due to their higher market value. Stakeholders emphasized the importance of improving access to irrigation and storage facilities to enhance agricultural resilience.

Rutana

Rutana's mix of highland and lowland characteristics results in diverse climatic conditions. Highland areas receive significant rainfall (1,200 mm to 1,600 mm annually), while lowland areas are comparatively drier. In Musongati and Giharo communes, rice, maize, and cassava are the main crops. Community members noted that men dominate rice farming due to its profitability, while women focus on cassava and vegetables for household use. Reforestation and soil fertility restoration initiatives were highlighted as crucial interventions for addressing land degradation and sustaining agricultural productivity in Rutana.

Ruyigi

Ruyigi shares similar climatic diversity with Rutana, characterized by a mix of highland and lowland areas. Rainfall ranges from 1,200 mm to 1,500 mm annually. Butezi and Ruyigi communes are known for cultivating maize, beans, and cassava. Men typically grow maize and bananas for commercial purposes, while women concentrate on beans and cassava, which are essential for household food security. Livestock rearing, particularly of chickens and goats, complements farming activities. However, community discussions emphasized the need for improved veterinary services and market access to maximize livestock-related income.

Cibitoke: Known for its rain-fed agriculture, Cibitoke experiences two main rainy seasons, from October to February and February to July. These seasons enable farmers to cultivate a variety of crops central to household food security and income. Key crops include soy, maize, beans, rice, cassava, sweet potatoes, tomatoes, eggplant, and amaranth. Field observations and stakeholder consultations revealed that certain crops are preferred by men or women due to economic returns and cultural norms. For instance, tomatoes, watermelon, cabbages, rice, and cucumber are primarily cultivated by men because these crops are perceived as short-term investments with high market value. Women tend to focus on crops such as cassava, soy, peanuts, sweet potatoes,

and pumpkin, which are critical for household food security and often require less immediate financial outlay (International Fertilizer Development Center [IFDC], 2022).

Livestock plays an essential role in Cibitoke's economy, with men raising cows and women focusing on pigs and chickens. However, cultural norms often require women to seek permission from their husbands before selling livestock, which can limit their financial autonomy. Besides farming, community members engage in various activities such as small-scale vegetable trading, livestock rearing, and house construction, adding resilience to households reliant on agriculture amid changing climate conditions (One Acre Fund, 2023).

Bujumbura Rural and Bujumbura Mairie: In the lowland areas of Bujumbura Rural and Bujumbura Mairie, temperatures average between 22°C and 28°C, with a warmer and more humid climate near Lake Tanganyika. These conditions favor crops such as cassava, amaranth, carrots, onions, beans, soybean, and maize. Field observations and discussions with stakeholders revealed that men often cultivate bananas, cabbage, eggplant, onions, cucumbers, tomatoes, and maize. These crops are generally more profitable and have shorter growth cycles, allowing for quicker returns on investment. Women, in contrast, focus on beans, soybeans, cassava, vegetables, and carrots, which contribute significantly to household food security (United Nations Environment Programme [UNEP], 2023).

Socio-cultural dynamics allow women in these regions to sell smaller livestock (like chickens and goats) independently, as these animals are generally considered less valuable and are thus under their control. This autonomy offers women an additional income source to support household needs. Beyond agriculture, women are often involved in trading and food sales, while men engage in construction and larger-scale livestock trading, contributing to household economic diversification.

Recent trends of unpredictable rainfall and prolonged dry seasons have led some farmers to adopt water pumps for irrigation, although these can be costly. Further support for climate-smart practices and diversified income strategies is essential to sustain agricultural productivity and improve food security across these vulnerable regions (IFDC, 2022; UNEP, 2023).



Image illustrating Flooded Area Adjacent to a Road in Bujumbura Rural Province

Impacts of Climate Variability

Recent decades have seen increased droughts, floods, and unseasonal rainfall patterns across Burundi, significantly affecting food security and water availability. Reduced rainfall during critical agricultural months has heightened reliance on irrigation systems and climate-resilient crops. Community discussions emphasized the urgent need for adaptive strategies, such as reforestation and conservation agriculture, to address these climate challenges (Schneiderbauer et al., 2020). Provinces like Kirundo and Bubanza face challenges related to irregular rainfall and prolonged dry spells, which disrupt agricultural cycles and water access. Conversely, Bururi and Rutana, with their high rainfall levels, frequently experience heavy rains that increase the risk of landslides and soil erosion. These climatic extremes underline the necessity for tailored interventions to enhance resilience.

Across the six provinces, gender dynamics in farming are consistently observed. Men primarily focus on cash crops like maize, bananas, and rice, which are grown for commercial purposes, while women prioritize food security crops, including cassava, beans, and vegetables, vital for household sustenance. These roles shape resource allocation and decision-making in agricultural activities. Improved access to irrigation, widespread reforestation efforts, and the adoption of sustainable farming practices are critical to enhancing resilience to climatic variability. Livelihood diversification strategies, such as integrating climate-smart agriculture and promoting alternative income-generating activities, were identified as essential for supporting communities in adapting to the impacts of changing climate conditions.

3.9. Hazard Risk Mapping

An analysis of disasters across the six provinces in the region between 2018 and 2023 reveals significant variations in frequency, impact, and displacement. Bubanza emerged as the most disaster-prone province with 216 incidents, while Karusi reported the least, with only 13 recorded events. Kirundo and Rutana also experienced high disaster frequencies, with 83 and 72 incidents respectively, indicating a notable regional susceptibility to hazards.

The majority of incidents in the six provinces were triggered by torrential rains, which led to widespread flooding, displacement, and property damage. Torrential rains were consistently reported as the primary hazard type across all provinces, underscoring the region's vulnerability to hydrometeorological disasters. Secondary impacts often included landslides and erosion, particularly in areas with steep terrain or deforested land. The predominance of such disasters suggests a need for improved infrastructure, sustainable land management, and early warning systems to mitigate future impacts.

Analysis at the commune level reveals significant disparities in disaster impact:

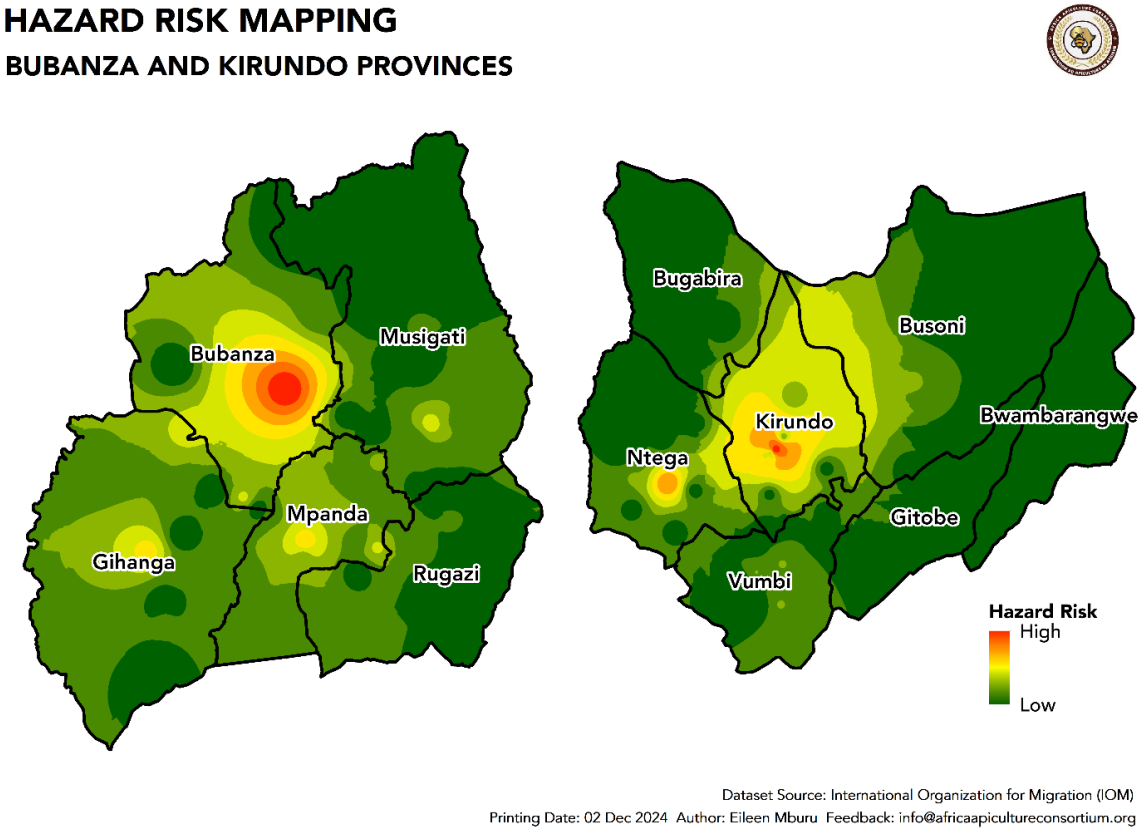
- Kirundo Province: Within Kirundo, the commune of Busoni was most affected, reporting a large number of incidents and a high impact on population displacement and damage to infrastructure.
- Bubanza Province: Musigati stands out as the most disaster-prone commune, experiencing frequent incidents with notable displacement figures, likely exacerbated by its exposure to heavy rainfall and flooding.
- Rutana Province: In Rutana, Musongati recorded the highest number of incidents, driven primarily by heavy rains that disrupted communities and agriculture.
- Bururi Province: In Bururi, Rutovu was disproportionately affected, with high numbers of incidents affecting local populations.
- Karusi Province: Bugenyuzi was identified as the most affected commune in Karusi, reflecting concentrated impacts in a smaller number of disaster events.
- Ruyigi Province: In Ruyigi, Butezi faced the highest exposure, with frequent torrential rains and their cascading effects on housing and livelihoods.

Population Impact: The disasters affected thousands of individuals across age and gender categories, with Kirundo bearing the brunt. It recorded the highest numbers of affected boys (26,407), girls (33,308), and female adults (20,292). This indicates a critical need for targeted interventions in Kirundo to address the vulnerabilities of children and women. Bubanza followed closely, with substantial numbers of boys (5,043) and girls (5,799) affected, underscoring the widespread human impact of disasters in this province.

Displacement and Housing Instability: Bubanza also faced the most severe displacement, with 1,747 households and 8,081 individuals displaced during the analyzed period. Rutana experienced similar challenges, with 1,008 displaced households and 4,508 displaced individuals. In contrast, despite Kirundo's high number of affected individuals, displacement was relatively limited, with only 186 households and 842 individuals displaced. This disparity could reflect variations in disaster type, housing resilience, or local response effectiveness.

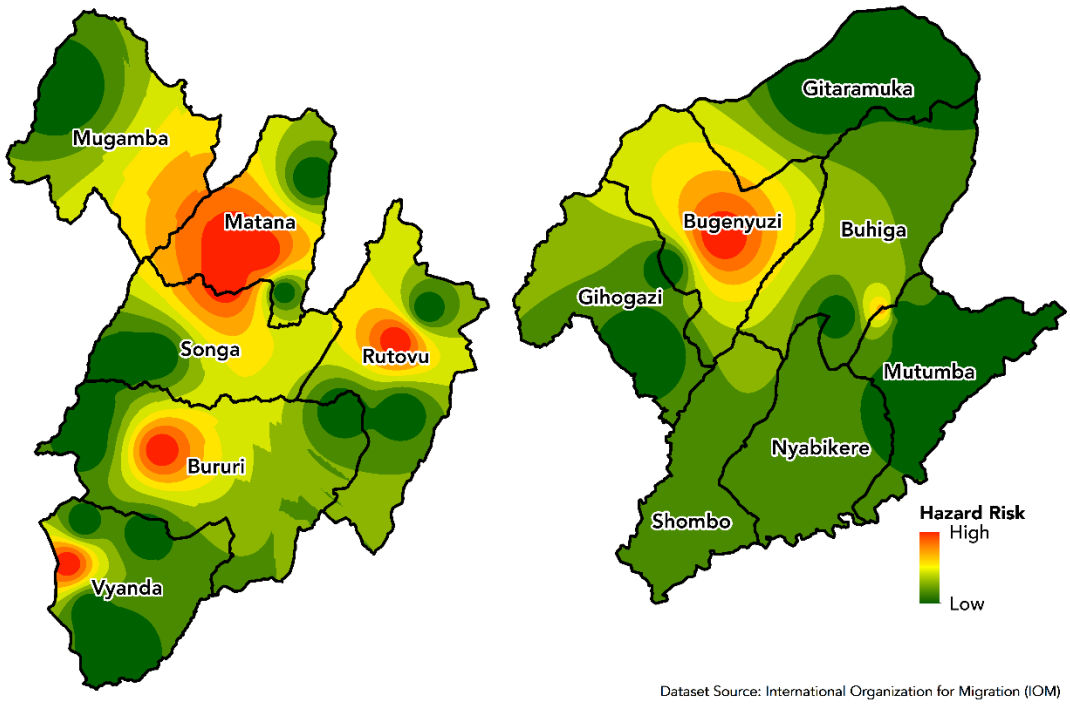
Vulnerability Dynamics: Across all provinces, the number of girls affected consistently exceeded that of boys, indicating a potential gendered dimension to disaster vulnerability. For instance, Kirundo saw 33,308 girls affected compared to 26,407 boys, a trend mirrored in other provinces. This highlights the need for gender-sensitive disaster risk reduction strategies, particularly in child protection and education continuity during crises.

Implications for Disaster Risk Management: These findings highlight the urgent need for tailored disaster management strategies across the six provinces. Bubanza and Kirundo, in particular, require prioritized intervention given their high disaster frequencies and significant human impacts. Meanwhile, Rutana and Ruyigi also show considerable vulnerability, particularly regarding displacement. Coordinated efforts in risk reduction, community preparedness, and post-disaster recovery are critical to mitigating the socio-economic effects of these hazards.



HAZARD RISK MAPPING

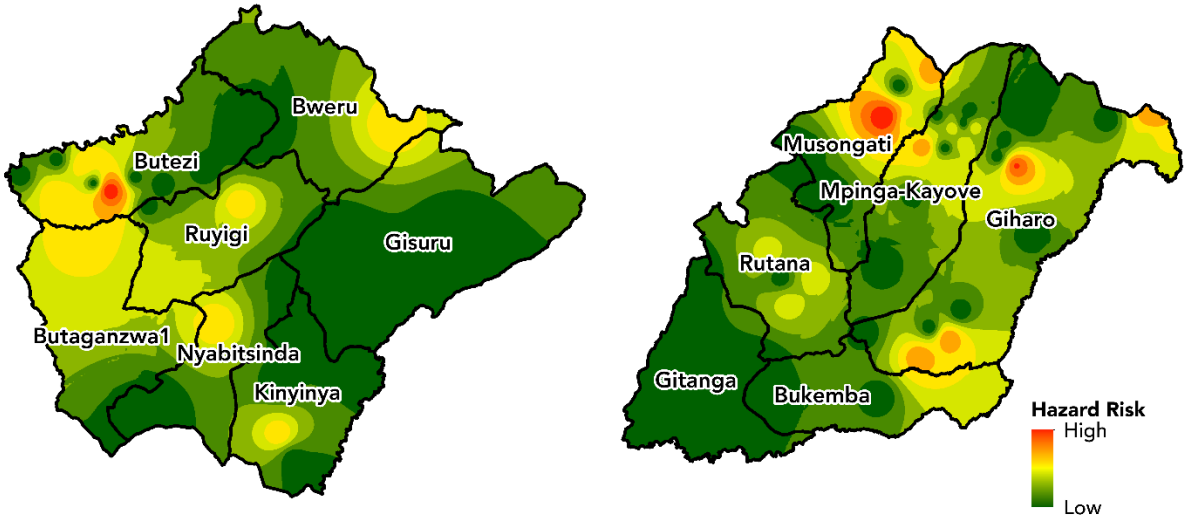
BURURI AND KARUSI PROVINCES



Dataset Source: International Organization for Migration (IOM)

Printing Date: 02 Dec 2024 Author: Eileen Mburu Feedback: info@africaapicultureconsortium.org

HAZARD RISK MAPPING
RUYIGI AND RUTANA PROVINCES



Dataset Source: International Organization for Migration (IOM)
Printing Date: 02 Dec 2024 Author: Eileen Mburu Feedback: info@africaapicultureconsortium.org

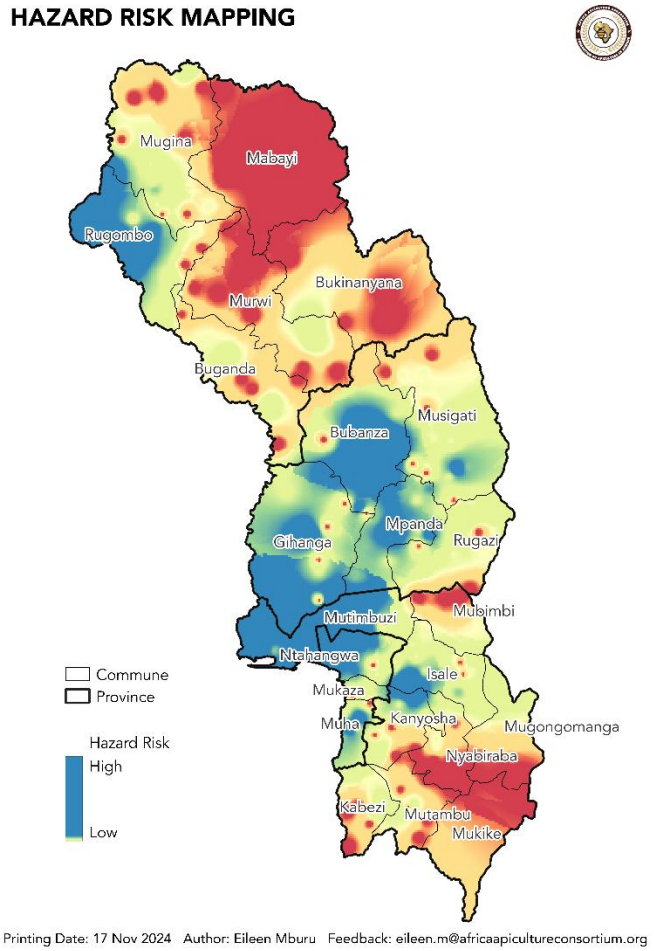
Cibitoke and Bujumbura Rural

The hazard analysis focused on disaster occurrences recorded over the period 2018 to 2023 in the provinces of Cibitoke, and Bujumbura Rural. This timeframe provided critical insights into the types and frequencies of hazards impacting these regions during the five-year period.

In Cibitoke, the most frequent hazard type was **Violent Wind**, with **72** recorded events. Bubanza experienced the highest number of occurrences of **Torrential Rain**, accounting for **128** events, making it particularly susceptible to heavy rainfall events. Similarly, Bujumbura Rural was significantly affected by **Violent Wind**, with **67** recorded occurrences. These patterns indicate region-specific vulnerabilities to distinct hazard types. Across these provinces, a total of **unique hazard types** were identified during the analysis period. The most common hazards overall include **Torrential Rain, Violent Wind and Floods**, which together represent a significant proportion of all recorded disasters. This diversity highlights the importance of tailoring disaster risk management strategies to address the specific needs and hazards of each province.

Cibitoke and Bujumbura Rural emerged as major hotspots for recurring disasters, facing repeated hazards that demand urgent mitigation measures. These include infrastructure upgrades and community-level interventions to enhance resilience. Although Bubanza experienced fewer

overall events, its vulnerability to certain high-impact hazards like torrential rains underscores the need for localized disaster preparedness and risk reduction measures.



Certain locations within these provinces were identified as particularly vulnerable. For instance, R**ugombo in Cibitoke** and **Mutimbuzi in Bujumbura Rural** have experienced multiple hazard events over the years. Targeted measures in these hotspots, such as the implementation of early warning systems, enhanced flood management infrastructure and public awareness campaigns, are essential to mitigate future risks.

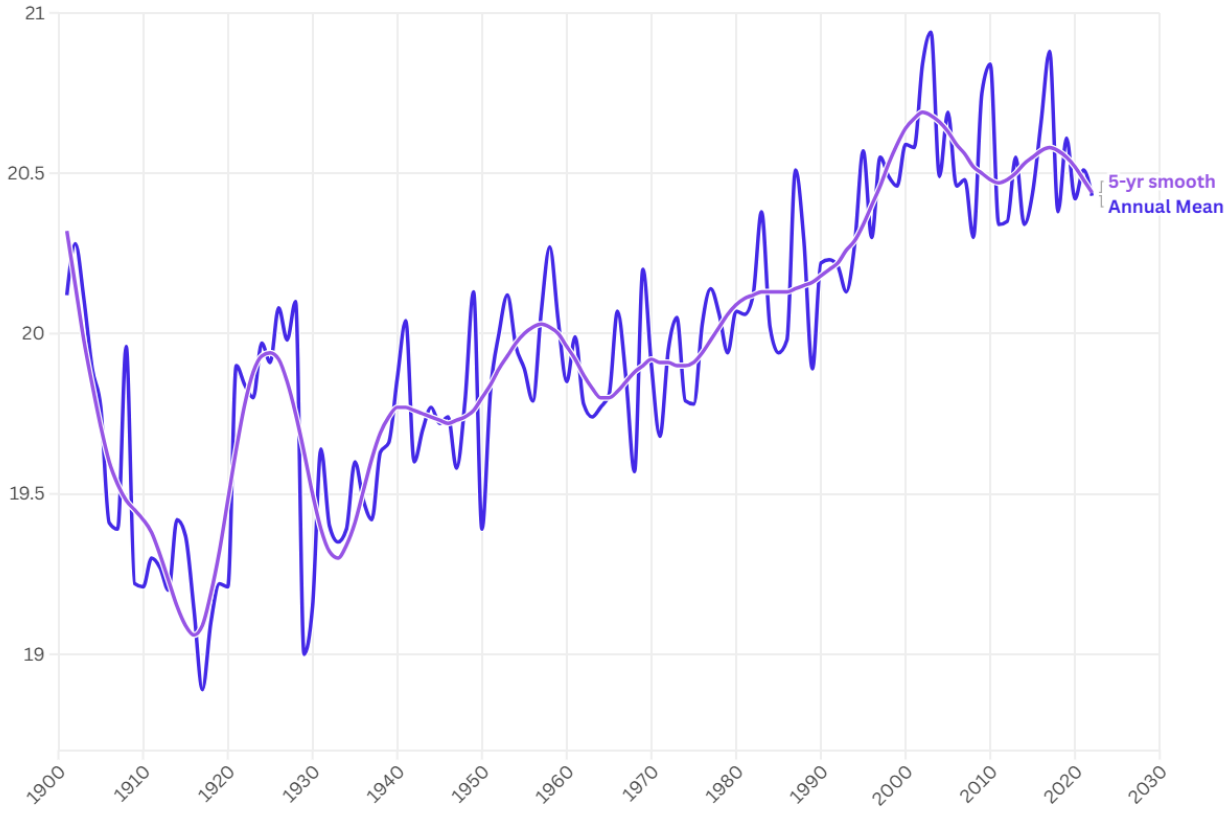
3.8.7 Temperature

Burundi experiences a diverse range of temperatures influenced by its topography and geographic location. Average annual temperatures in the lowland regions, such as Bubanza and Kirundo, range from 20°C to 28°C, while higher altitudes, such as those in Bururi and Karusi, have

cooler averages between 16°C and 22°C. This variation significantly affects agricultural productivity, crop choice, and livelihood resilience across the six focus provinces.

In recent decades, climate variability has led to increased temperature extremes, with hotter days and prolonged warm periods. Communities in Bubanza and Kirundo have reported higher temperatures affecting maize and bean yields, which are staple crops in these regions. Similarly, discussions in Bururi emphasized how cooler conditions in higher altitudes, though beneficial for tea and coffee cultivation, have seen shifts in frost patterns, occasionally damaging crops (Dampha & Jones, 2023).

Temperature increases have also contributed to rising evaporation rates, exacerbating water scarcity issues in provinces like Rutana and Ruyigi. This has impacted both rain-fed agriculture and irrigation practices, as noted in community focus group discussions. Stakeholders in Karusi highlighted that shifting temperature patterns have led to unpredictable agricultural cycles, affecting traditional farming calendars. The need for climate-smart agricultural practices and resilient crop varieties is paramount. Adaptive strategies, such as shade tree planting and mulching, have been discussed as viable interventions to mitigate temperature-related agricultural losses.



Observed annual average mean surface air temperature of Burundi for 1901- 2022

The observed annual average mean surface air temperature for Burundi over the past century shows a gradual increase, particularly evident from the mid-20th century onwards. This trend aligns with global patterns of warming observed due to anthropogenic climate change (IPCC,

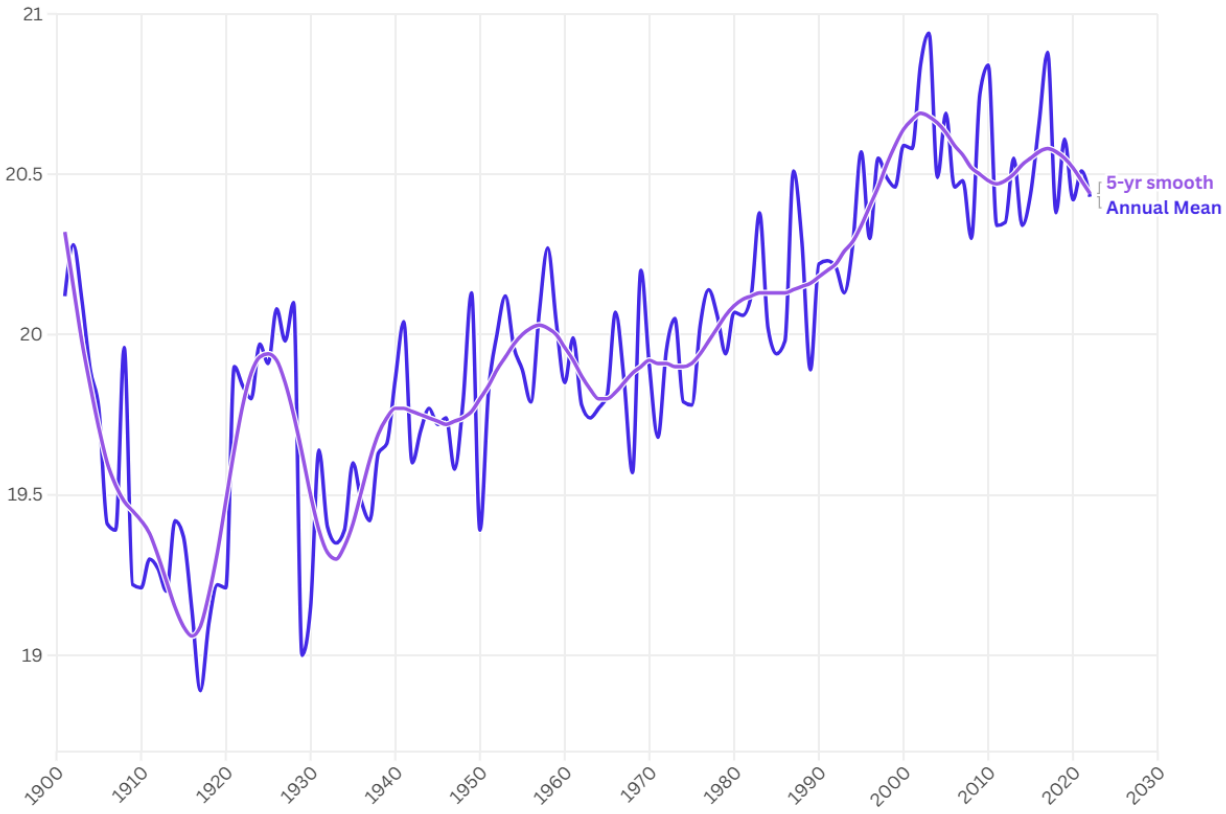
2021). The 5-year smoothed line highlights this upward trend while also capturing periods of climate variability, indicating relatively stable conditions in the early 20th century, followed by noticeable warming from the 1950s onwards. Such variability, interspersed with a general warming trend, suggests fluctuations in regional climate patterns, potentially influenced by both natural cycles and external factors like greenhouse gas emissions.

In recent decades, average temperatures in Burundi have exceeded 20°C consistently, with peaks observed in 2016 (20.66°C) and 2017 (20.88°C). This sustained increase, alongside instances of variability, has significant implications for agriculture, water resources, and biodiversity within the country. Elevated temperatures and fluctuations can affect crop yields, water availability, and ecosystem health, making it essential to develop adaptive strategies to manage both gradual warming and short-term climate variations.

Imbo Basin Temperature

Temperature across the Imbo Basin is largely influenced by altitude:

- **Highland areas (Bujumbura Rural and Cibitoke)-** Temperatures range from 15°C to 25°C, with cooler conditions in the higher elevations. This cool climate is ideal for coffee cultivation.
- **Lowland areas (Bubanza and Bujumbura Mairie)-** Average temperatures range from 22°C to 28°C, with warmer and more humid conditions near Lake Tanganyika. These regions support rice and other crops that thrive in tropical climates.



Observed annual average mean surface air temperature of Burundi for 1901 2022

The observed annual average mean surface air temperature for Burundi over the past century shows a gradual increase, particularly evident from the mid-20th century onwards. This trend aligns with global patterns of warming observed due to anthropogenic climate change (IPCC, 2021). The 5-year smoothed line highlights this upward trend while also capturing periods of climate variability, indicating relatively stable conditions in the early 20th century, followed by noticeable warming from the 1950s onwards. Such variability, interspersed with a general warming trend, suggests fluctuations in regional climate patterns, potentially influenced by both natural cycles and external factors like greenhouse gas emissions.

In recent decades, average temperatures in Burundi have exceeded 20°C consistently, with peaks observed in 2016 (20.66°C) and 2017 (20.88°C). This sustained increase, alongside instances of variability, has significant implications for agriculture, water resources, and biodiversity within the country. Elevated temperatures and fluctuations can affect crop yields, water availability, and ecosystem health, making it essential to develop adaptive strategies to manage both gradual warming and short-term climate variations.

Temperature variations within the project regions of Bubanza, Cibitoke, Bujumbura Rural, and Bujumbura Mairie provinces reflect the impact of topography. Highland areas, such as Bujumbura Rural and parts of Cibitoke, typically experience cooler temperatures, ranging from 15°C to 25°C. This cooler climate is favorable for coffee cultivation, as coffee plants thrive at moderate temperatures. In contrast, lowland areas like Bubanza and Bujumbura Mairie experience warmer, more humid conditions, with temperatures averaging between 22°C and 28°C. These regions are well-suited for crops that require warmer climates, such as rice and other tropical species. Additionally, the proximity of Bujumbura Mairie to Lake Tanganyika further moderates the climate, maintaining relatively stable but warmer conditions that support diverse agricultural activities.

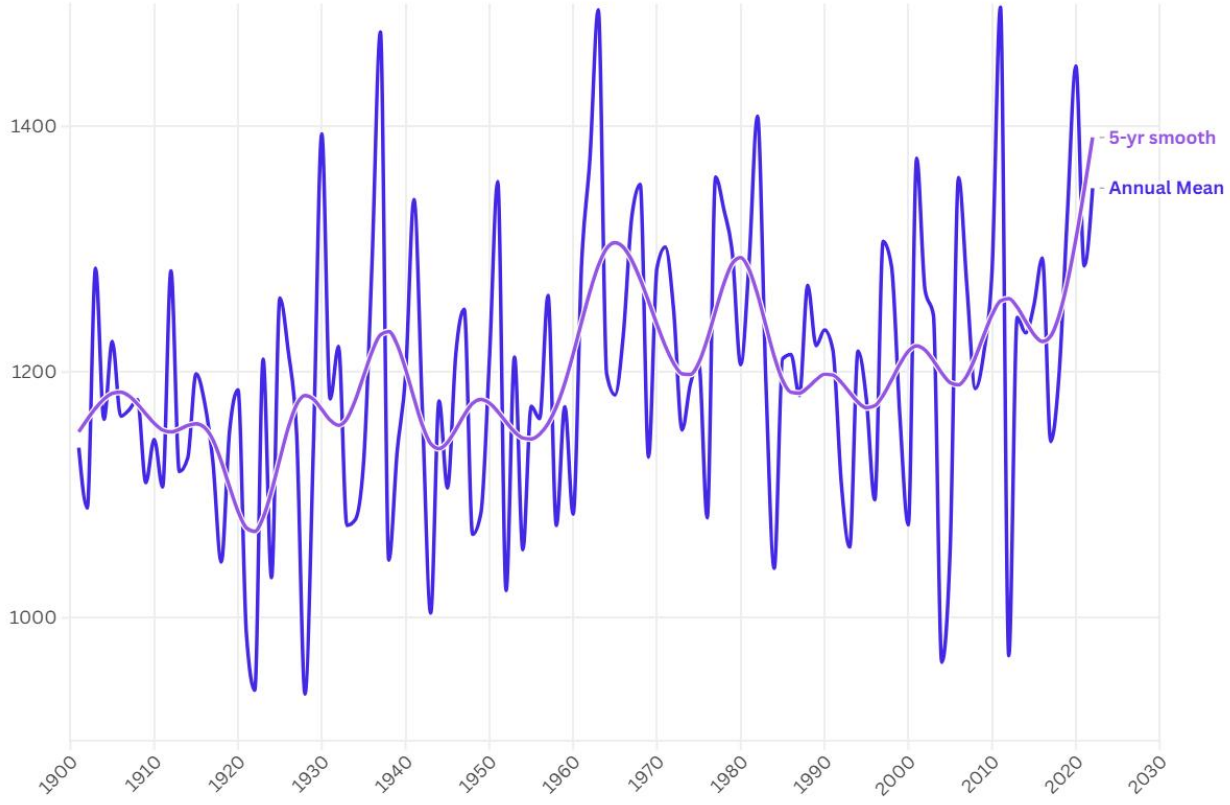
3.8.8 Rainfall

Rainfall patterns across Burundi exhibit significant spatial and temporal variability, deeply influencing agricultural productivity, water availability, and community livelihoods. Over the years, changes in precipitation patterns have posed challenges for traditional farming systems and water resource management.

- **Bubanza:** This province experiences relatively lower rainfall, making it more susceptible to prolonged dry spells and water scarcity, a challenge frequently discussed during community engagements (Ochieng et al., 2016).
- **Bururi:** With its high-altitude regions, Bururi benefits from substantial rainfall. However, intense precipitation often triggers landslides, exacerbating soil erosion (Palmer et al., 2023).
- **Kirundo**: Located in the northern lowlands, Kirundo faces erratic rainfall patterns, frequently experiencing prolonged dry periods that hinder crop yields (Ochieng et al., 2016).

- **Karusi**: Positioned centrally, Karusi receives moderate rainfall. However, community discussions highlighted increasing unpredictability in the timing and distribution of rainfall (Palmer et al., 2023).
- **Rutana and Ruyigi:** These southeastern provinces demonstrate a mix of highland and lowland rainfall characteristics. The elevated areas receive significant rainfall, supporting dense vegetation, while lowland regions are comparatively drier, facing challenges like water deficits during planting seasons (Ochieng et al., 2016).

In recent years, studies have reported increased variability in East African rainfall, characterized by more frequent extremes, such as droughts and intense storms. These changes have heightened vulnerability in agrarian economies like Burundi's, where over 90% of the population depends on rain-fed agriculture. Long-term rainfall variability also impacts water resource availability, affecting both domestic consumption and irrigation systems (Palmer et al., 2023). Field discussions emphasized the urgent need for climate-resilient agricultural practices. These include the adoption of drought-resistant crop varieties and improved irrigation techniques. Moreover, conservation measures such as reforestation and soil preservation strategies were suggested to mitigate the impacts of extreme rainfall events (Ochieng et al., 2016).



Observed annual precipitation (mm) of Burundi for 1901- 2022

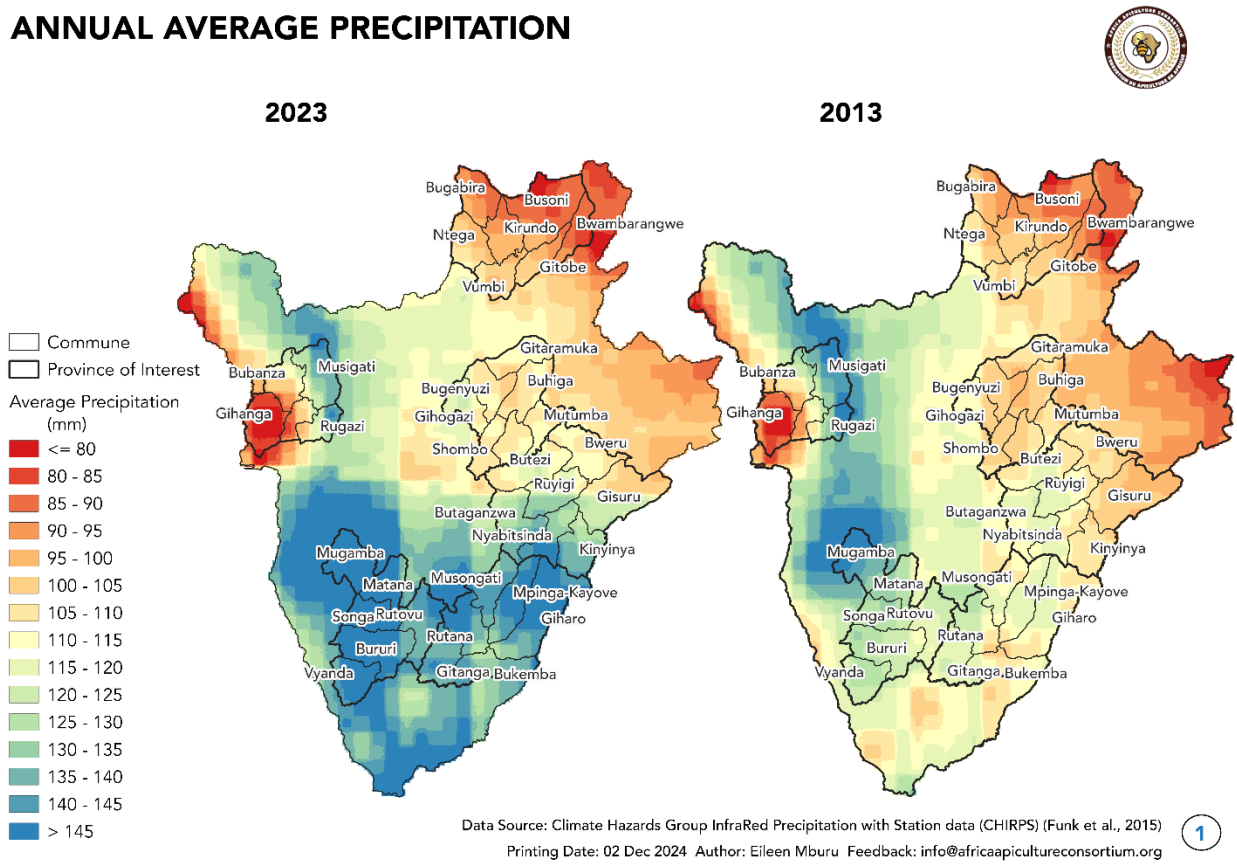
A fluctuating pattern in annual precipitation over the past century is observed with several peaks and troughs indicating significant climate variability. For instance:

- Early 20th Century: The years from 1901 to the 1940s show a mixed pattern with periods of high precipitation interspersed with low values. Notable peaks occurred in 1903 (1284.5

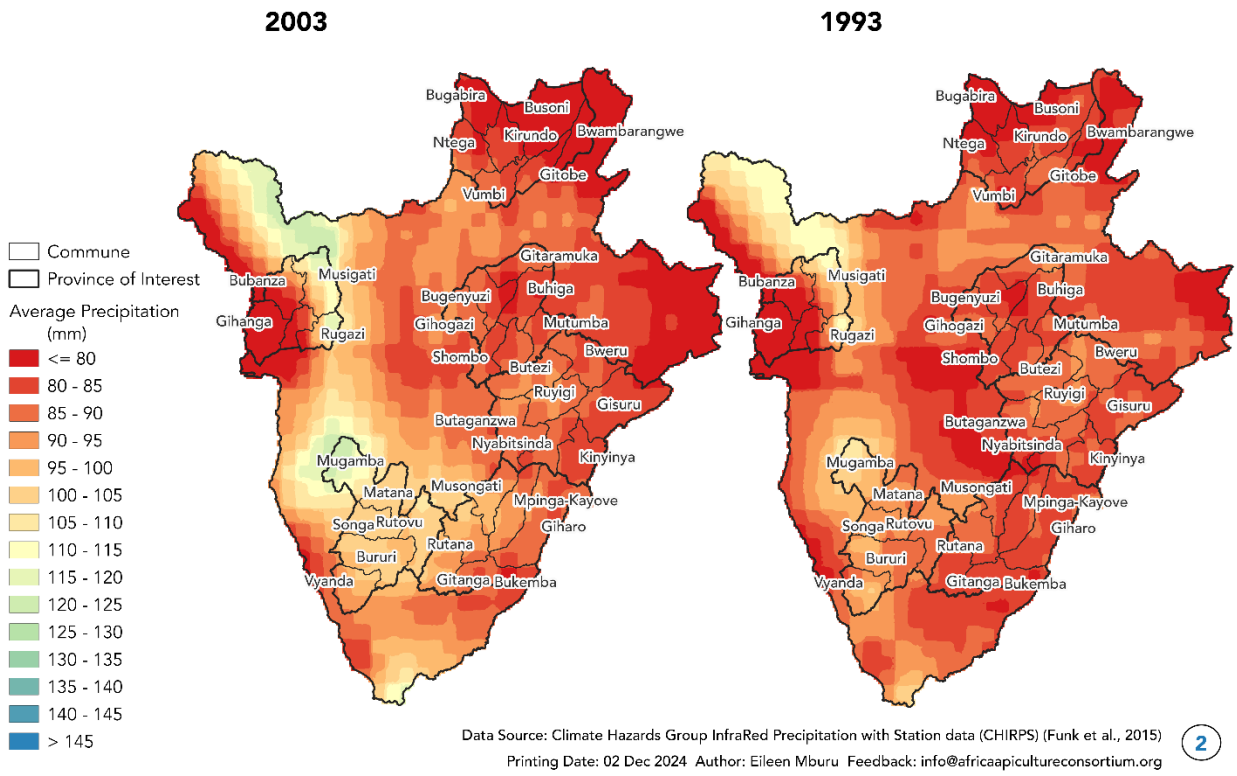
mm) and 1923 (1210.59 mm), while years like 1921 saw lower precipitation levels (987.19 mm).

- Mid-20th Century: A more stable trend emerged, with peaks around 1937 (1476.84 mm) and 1963 (1495.04 mm). This period likely supported substantial agricultural productivity but also may have been marked by occasional flood risks during peak rainfall years.
- Recent Decades: From the 1980s onwards, the data shows an increase in both the frequency and intensity of high precipitation years. Notable peaks occurred in 2011 (1497.03 mm) and 2020 (1449.11 mm), reflecting potential impacts from climate variability, including El Niño events or other regional climatic influences.

The 5-year smoothed trend analysis helps to capture broader precipitation trends by averaging out short-term fluctuations. It indicates a gradual increase in precipitation, particularly in the late 20th century and early 21st century. The smoothed line shows periods of relatively high precipitation around the 1960s and again in the recent two decades, suggesting that Burundi has been experiencing increased wet years. This increase aligns with global precipitation patterns associated with climate variability and changes in regional atmospheric circulation (IPCC, 2021).



ANNUAL AVERAGE PRECIPITATION



The annual average precipiattion maps illustrate the spatial distribution and temporal trends in annual average precipitation across the six provinces (Bubanza, Bururi, Kirundo, Karusi, Ruyigi, Rutana) over 3 decades.

1993: Uniform Precipitation Patterns

The year 1993 depicts a relatively uniform distribution of precipitation, with average values ranging from 73 mm in Kirundo to 90 mm in Rutana and Bururi. This stability likely reflects a lack of extreme climatic events during this period. Higher precipitation in Rutana and Bururi may be attributed to their high-altitude terrain, which enhances orographic rainfall. In contrast, the lowlands of Kirundo experience less precipitation, consistent with its historical climate.

2003: Emerging Variability and Climatic Disruptions

By 2003, variability begins to emerge, with notable increases in Bururi and Rutana and slower growth in Kirundo. Bubanza also shows gradual gains, with precipitation increasing across its communes. The variability could be linked to the intensification of the East African Monsoon system, which can result in heavier rainfall in high-altitude regions. Additionally, land use changes, including deforestation and agricultural expansion, may have started influencing localized rainfall patterns, particularly in drier regions like Kirundo. Communes such as Bururi's Mugamba (116 mm) and Rutana's Musongati (94 mm) recorded the most significant gains. Conversely, Kirundo's Bwambarangwe (73 mm) showed stagnation, indicating persistent climatic challenges.

2013: Intensified Disparities

By 2013, disparities across provinces became more pronounced. Rutana and Bururi experienced sharp increases, with provincial averages exceeding 125 mm, while Kirundo lagged behind at 85–100 mm. The observed trends align with global climate change patterns, particularly the increased intensity of the Indian Ocean Dipole (IOD) events. Positive IOD phases during the 2000s likely contributed to wetter conditions in parts of East Africa, benefiting provinces like Rutana and Bururi. However, drought-like conditions during negative IOD phases disproportionately impacted Kirundo and parts of Karusi. In Bubanza, steady growth was observed across all communes, with Musigati (142 mm) and Rugazi (134 mm) showing uniform increases. Rutana's communes such as Mpinga-Kayove (116 mm) and Giharo (112 mm) emerged as significant gainers.

2023: Intensified Regional Variability

By 2023, the maps reveal intensified variability, with Rutana and Bururi consistently leading in precipitation, averaging 140–150 mm, while Kirundo remains the driest province with averages below 100 mm. The sustained high precipitation in Bururi and Rutana is likely due to topographic effects and the continuing influence of the monsoon system. Kirundo's drier trends may stem from deforestation, soil degradation, and shifting rainfall patterns, compounded by its proximity to regions with declining vegetation cover. Climate models predict that climate variability in East Africa is leading to more erratic rainfall patterns, with wet areas becoming wetter and dry areas experiencing reduced rainfall. Communes like Bururi's Mugamba (166 mm) and Rutana's Musongati (140 mm) showed consistent gains, while Kirundo's Bwambarangwe (88 mm) and Busoni (87 mm) lagged significantly.

Key Trends in Mean Precipitation Values

- **Provinces Leading Growth**: Bururi and Rutana consistently recorded the highest mean precipitation values over the decades, with steady growth in most of their communes. Bururi's Mugamba recorded the largest absolute increase, from 101 mm in 1993 to 166 mm in 2023.
- **Drier Conditions Persist in Kirundo:** Kirundo continues to show the slowest growth in mean precipitation, with communes like Bwambarangwe improving by only 15 mm over 30 years. This reflects persistent climatic challenges in the province.
- **Bubanza's Stability:** Bubanza demonstrated uniform growth across its communes, with average precipitation values increasing by 20–30 mm per decade, culminating in averages of 110–134 mm in 2023.
- **Rutana's Rapid Growth:** Rutana showed significant increases, with communes like Musongati growing from 84 mm in 1993 to 140 mm in 2023, highlighting its consistent exposure to favorable climatic conditions.

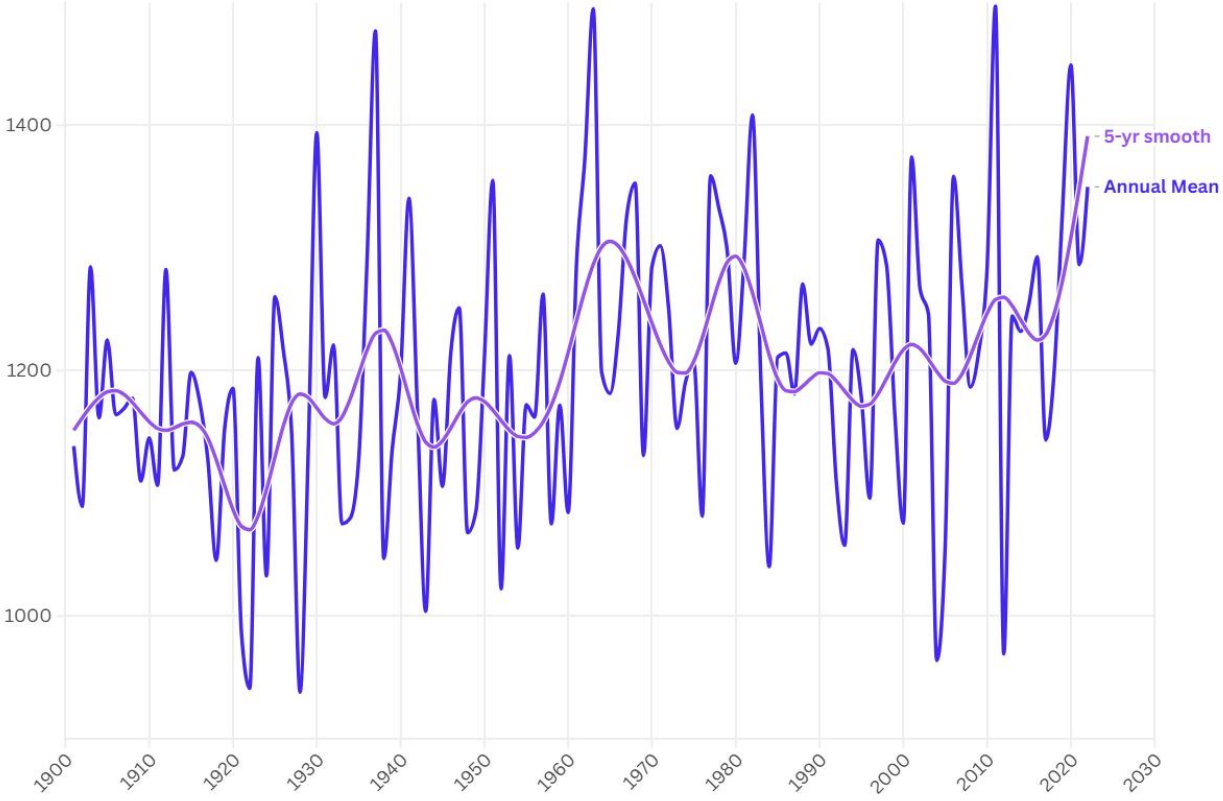
Imbo Basin Rainfall

Rainfall distribution is uneven across the project areas:

- **Cibitoke and Bujumbura Rural-** These highland regions receive the most rainfall, with annual precipitation exceeding 1,400mm. The higher rainfall supports lush vegetation and agriculture, though it also increases the risk of soil erosion on steep slopes.

- **Bubanza and Bujumbura Mairie-** These regions receive less rainfall, averaging between 1,000mm and 1,200mm annually. This lower rainfall can lead to water stress during dry seasons, particularly in agricultural zones reliant on rain-fed systems.

Given the variability in rainfall and temperature, the project will integrate climate-smart agricultural practices and water management strategies to build resilience against climate change impacts and improve food security in these vulnerable regions.

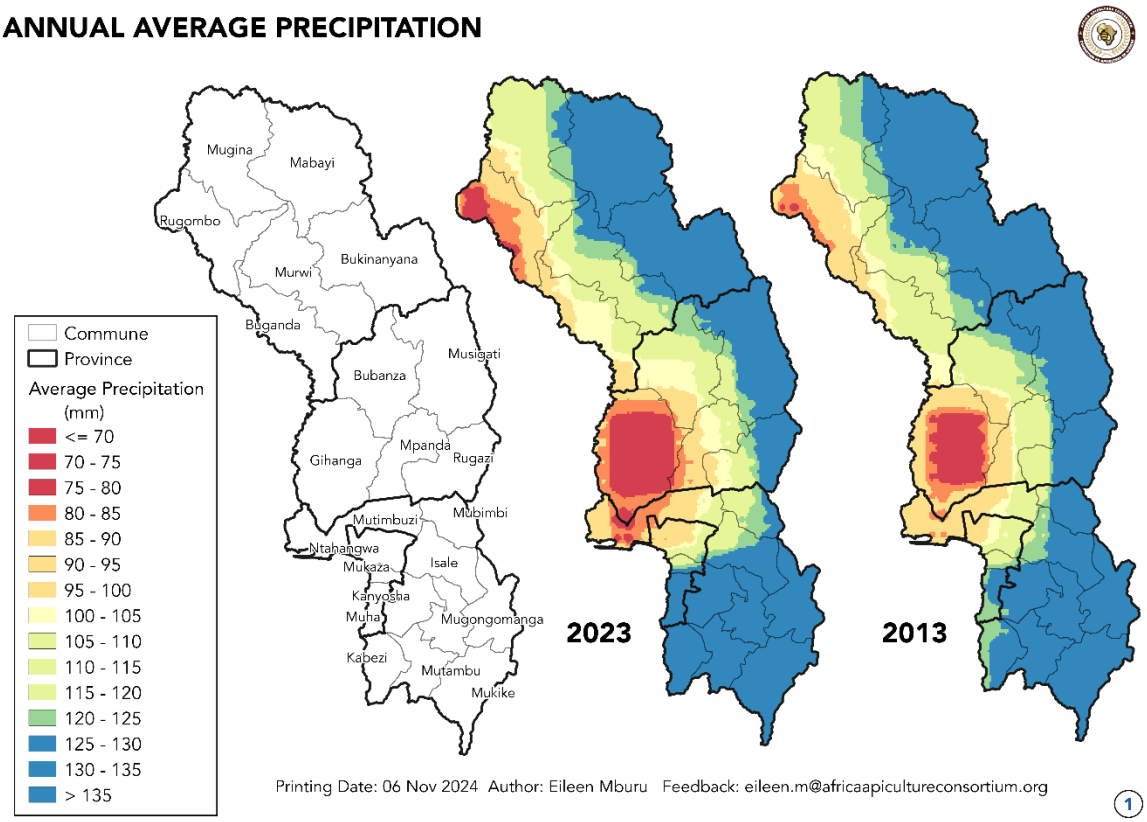


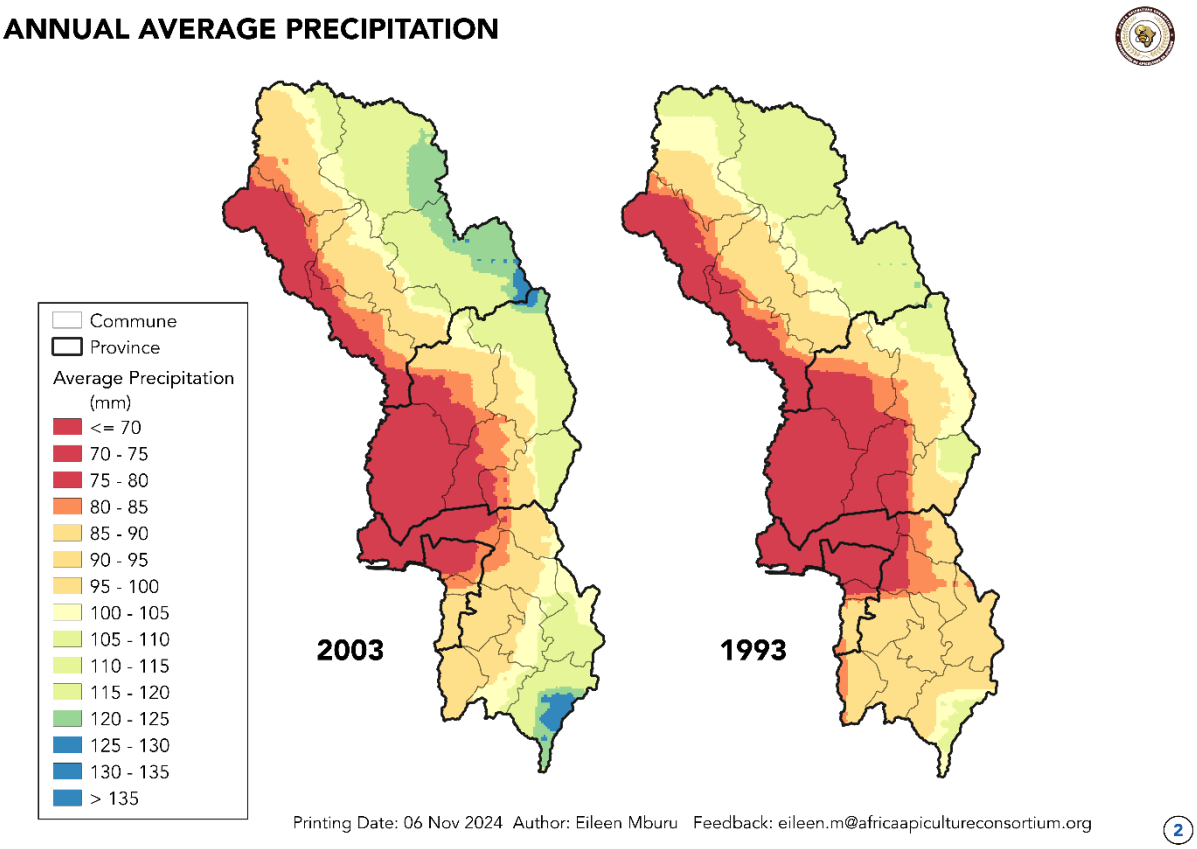
Observed annual precipitation (mm) of Burundi for 1901- 2022

A fluctuating pattern in annual precipitation over the past century is observed with several peaks and troughs indicating significant climate variability. For instance:

- Early 20th Century: The years from 1901 to the 1940s show a mixed pattern with periods of high precipitation interspersed with low values. Notable peaks occurred in 1903 (1284.5 mm) and 1923 (1210.59 mm), while years like 1921 saw lower precipitation levels (987.19 mm).
- Mid-20th Century: A more stable trend emerged, with peaks around 1937 (1476.84 mm) and 1963 (1495.04 mm). This period likely supported substantial agricultural productivity but also may have been marked by occasional flood risks during peak rainfall years.
- Recent Decades: From the 1980s onwards, the data shows an increase in both the frequency and intensity of high precipitation years. Notable peaks occurred in 2011 (1497.03 mm) and 2020 (1449.11 mm), reflecting potential impacts from climate variability, including El Niño events or other regional climatic influences.

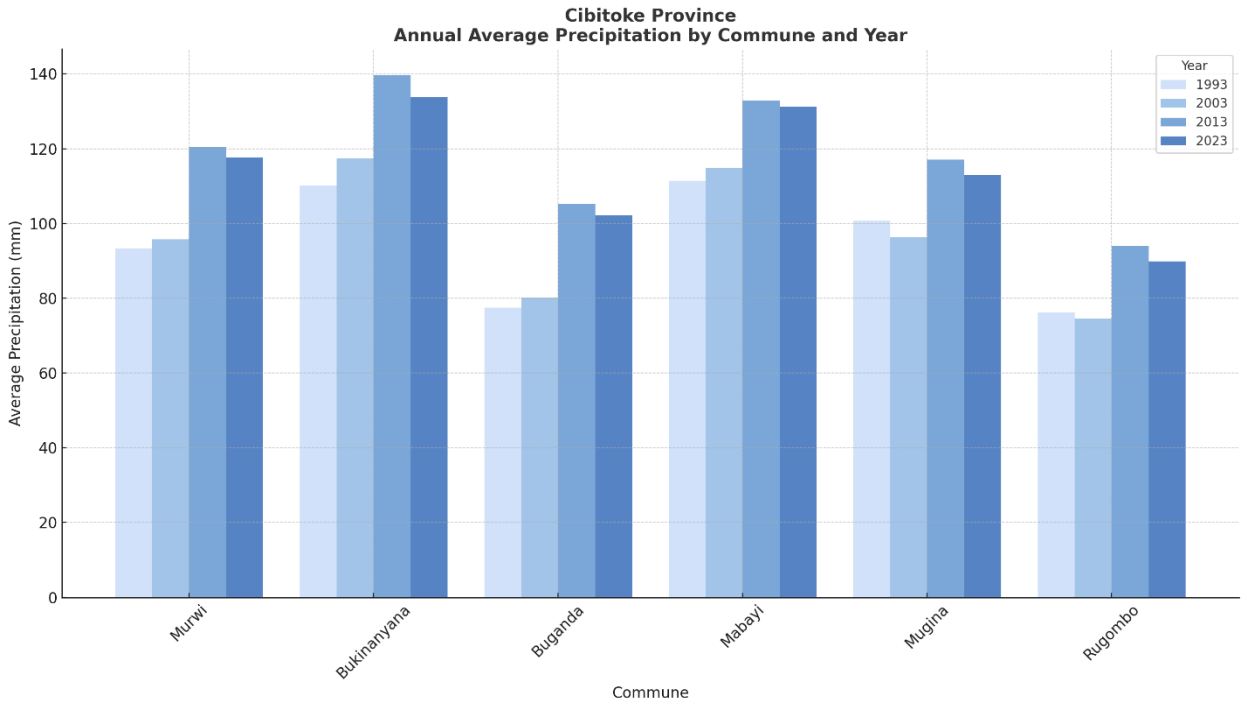
The 5-year smoothed trend analysis helps to capture broader precipitation trends by averaging out short-term fluctuations. It indicates a gradual increase in precipitation, particularly in the late 20th century and early 21st century. The smoothed line shows periods of relatively high precipitation around the 1960s and again in the recent two decades, suggesting that Burundi has been experiencing increased wet years. This increase aligns with global precipitation patterns associated with climate variability and changes in regional atmospheric circulation (IPCC, 2021).





Burundi's precipitation is heavily influenced by its mountainous geography, particularly in provinces like Cibitoke and Bujumbura Rural, which experience higher rainfall due to orographic effects. The precipitation trends in Burundi are also impacted by regional climatic events like the El Niño Southern Oscillation (ENSO), which can cause variability in annual and seasonal rainfall. Burundi's precipitation data shows changing rainfall patterns over the past 30 years, with notable differences in annual mean precipitation values across communes within the four focus provinces. This analysis highlights trends and variability that are significant for planning flood and drought resilience strategies.

Cibitoke Province



1993: In 1993, Cibitoke's communes such as Mabayi and Mugina exhibited high average precipitation values. Mabayi, for instance, recorded an average precipitation of approximately 111.46 mm, while Mugina reached around 100.63 mm. This substantial rainfall likely supported agriculture, particularly in higher-altitude areas that benefit from reliable water availability. Studies have shown that adequate precipitation during this period was essential for staple crops like bananas and beans, which are common in highland regions of Cibitoke. However, such high rainfall also carries potential risks, as excessive water can lead to soil erosion on sloped terrains, affecting long-term soil health.

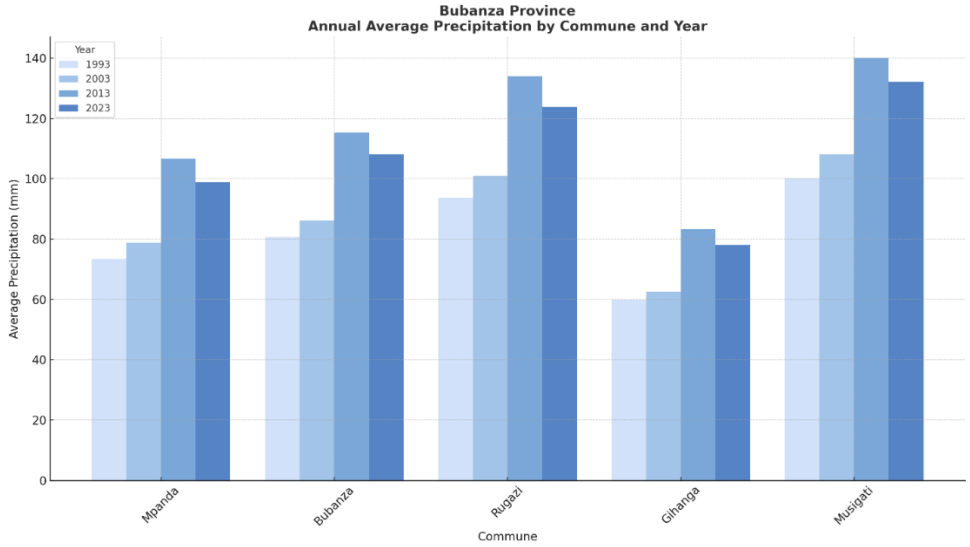
2003: By 2003, precipitation levels in Mabayi and Bukinanyana increased further, with averages reaching 114.90 mm and 117.38 mm, respectively. This rise in rainfall could have amplified the risk of environmental challenges, such as soil erosion and landslides, especially in Cibitoke's hilly areas. Research on East African highlands (e.g., Niang et al., 2014) highlights that heavy rains often lead to topsoil degradation in such regions, affecting agricultural productivity and necessitating soil conservation efforts. For instance, the highlands in Bukinanyana and Mabayi may have faced increased water runoff, which demands effective water management strategies to safeguard both soil and crops.

2013: Cibitoke's communes continued to experience high precipitation, with Bukinanyana reaching an impressive average of 139.72 mm. This consistent trend of high rainfall over the decades suggests a phase of sustained precipitation, which could elevate flood risks, particularly in lowland areas. According to studies on East African precipitation patterns, prolonged wet phases increase the likelihood of both seasonal flooding and potential waterlogging in crop fields (Anyah & Semazzi, 2007). For Cibitoke, this could mean periodic challenges in agricultural planning and the need for resilient crop varieties that can tolerate wetter soils. Additionally, managing water drainage becomes essential to protect settlements and farmland in these wetter communes.

2023: Cibitoke witnessed slight variations, with some communes showing minor decreases. For instance, Mabayi recorded an average precipitation of 131.22 mm, while Bukinanyana maintained relatively high levels at 133.82 mm. The persistently high rainfall levels underscore the importance of ongoing water management efforts. Frequent and intense rains can impact soil stability, making slopes more susceptible to erosion. Adaptation measures, such as terrace farming and afforestation in steep areas, are crucial to mitigate soil loss and enhance agricultural resilience. Studies from neighboring regions indicate that communities adopting such practices can reduce runoff and retain fertile soil layers, crucial for Cibitoke's sustainability.

The rainfall trends in Cibitoke are consistent with broader patterns of climate variability observed across East Africa. According to the Intergovernmental Panel on Climate Change (IPCC), there is evidence of increased variability in rainfall, with more frequent extreme wet and dry periods. In the context of Cibitoke, this variability necessitates proactive adaptation, such as soil conservation techniques, resilient crop varieties, and improved water management systems.

Bubanza Province



1993: Bubanza Province exhibited moderate precipitation levels. The average precipitation in Bubanza commune was approximately 80.69 mm, with other communes like Mpanda and Gihanga showing lower averages (e.g., 73.36 mm and 59.85 mm, respectively). These precipitation levels were generally favorable for agriculture, supporting staple crops such as maize and beans, which thrive in moderate moisture (Anyah & Semazzi, 2007). The rainfall was likely adequate to sustain crop growth without significant risks of waterlogging or flooding. Moderate rainfall during this period aligns with historical weather patterns in East Africa, where variability is influenced by the El Niño Southern Oscillation (ENSO), often resulting in fluctuating rainfall distribution (IPCC, 2021).
2003: By 2003, there was a notable increase in precipitation in Bubanza Province. Musigati recorded an average precipitation of 108.16 mm, while Rugazi reached 100.96 mm. This increase

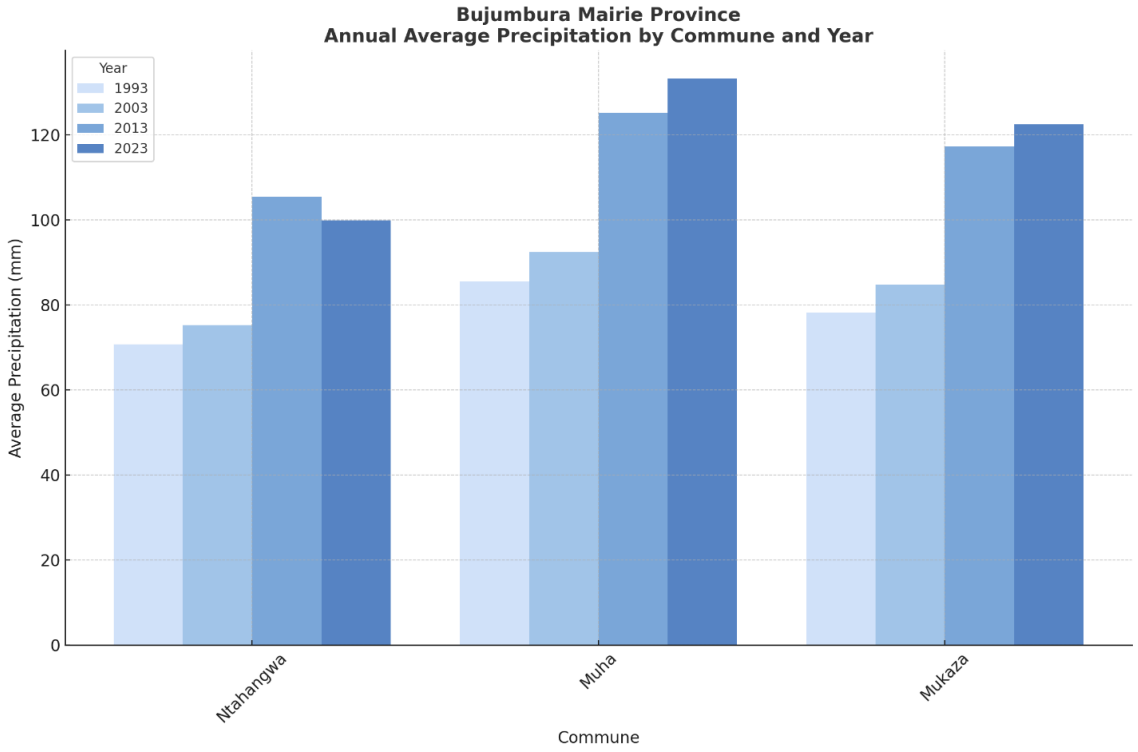
in rainfall, particularly in these hilly regions, could have led to challenges in water management, including heightened erosion risks and strain on local infrastructure. The elevated rainfall levels are consistent with regional climate variability trends that influence seasonal rainfall intensities, often attributed to warming Indian Ocean temperatures, which can enhance moisture-laden winds over East Africa (Niang et al., 2014). Consequently, these conditions may have amplified the potential for seasonal flooding in low-lying areas of Bubanza Province.

2013: The year 2013 marked a peak in precipitation levels, especially in Musigati, where the average rainfall reached 140.11 mm, one of the highest recorded across all communes in Bubanza. Rugazi and Mpanda also experienced high averages of 133.95 mm and 106.61 mm, respectively. These elevated precipitation levels suggest that Musigati faced a significant increase in flood risk, with potential implications for agricultural productivity and soil stability (Anyah & Semazzi, 2007). High precipitation levels may contribute to soil saturation, which, combined with the region's topography, increases the likelihood of landslides and runoff, affecting both farmlands and infrastructure. This trend aligns with the broader context of climate change impacts observed across East Africa, where increased rainfall intensity and variability have challenged traditional agricultural practices (IPCC, 2021).

2023: The average precipitation levels slightly decreased from the peak observed in 2013, but they remained relatively high. Musigati still showed a substantial average of 132.08 mm, while Bubanza and Rugazi recorded averages of 108.10 mm and 123.84 mm, respectively. This sustained rainfall highlights an ongoing trend of high precipitation in Bubanza Province, which may continue to impact flood-prone areas, especially in lowlands and valleys (Niang et al., 2014). However, with appropriate adaptation measures, such as improved drainage systems and soil conservation practices, the province may manage seasonal water surpluses more effectively, potentially reducing the negative impacts on agricultural activities and local livelihoods.

The precipitation trends in Bubanza Province from 1993 to 2023 demonstrate an overall increase in average rainfall levels, with peaks in 2013 and sustained high levels in 2023. These patterns reflect broader climate variability, likely influenced by global warming and regional climate oscillations (Anyah & Semazzi, 2007). As these precipitation levels could exacerbate flood risks and soil erosion, especially in hilly and lowland areas, the implementation of climate adaptation strategies remains critical.

Bujumbura Mairie



1993: Precipitation levels in Bujumbura Mairie were moderate, with Muha recording the highest average precipitation at 85.58 mm, followed by Mukaza at 78.17 mm, and Ntahangwa at 70.74 mm. These levels indicate relatively stable rainfall, likely adequate to meet the area's basic water needs without causing significant waterlogging or flood risks. This period aligns with the stable climatic conditions noted in East Africa during the early 1990s, supporting moderate vegetation growth and manageable water resources (Ackerl et al., 2023).

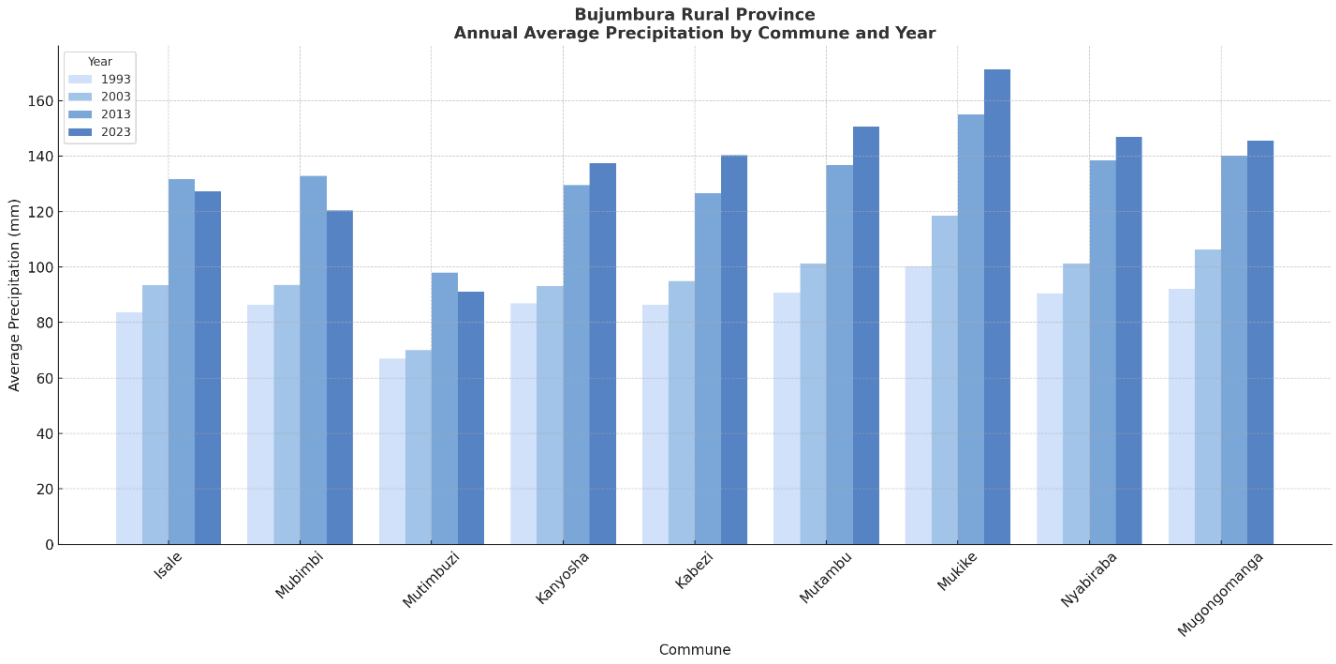
2003: A slight increase in precipitation was observed across the communes. Muha's average precipitation rose to 92.46 mm, Ntahangwa increased to 75.28 mm, and Mukaza to 84.73 mm. Although still within moderate levels, the increased rainfall may have started to strain local water infrastructure, particularly in low-lying areas close to Lake Tanganyika. These areas could have experienced minor waterlogging and runoff challenges due to the slight uptick in precipitation, hinting at the early effects of climate variability influencing urban water dynamics (Haile et al., 2020).

2013: Bujumbura Mairie experienced a significant rise in precipitation levels, with Muha recording an average of 125.25 mm, Mukaza at 117.29 mm, and Ntahangwa rising sharply to 105.42 mm. This aligns with an increase in rainfall intensity observed across the Great Lakes region, often attributed to climate variability and warming trends (Adhikari & Nejadhashemi, 2015). The higher precipitation rates during this period likely exerted pressure on the city's urban drainage systems, causing frequent urban flooding, especially in densely populated areas. This increase highlights the importance of climate-resilient infrastructure to address heightened flood risks and mitigate potential damage from increased precipitation.

2023: The precipitation levels remained high, with Muha at 133.33 mm, Mukaza at 122.55 mm, and Ntahangwa at 99.94 mm. These sustained levels of high rainfall emphasize the ongoing trend of increased precipitation in the region, especially affecting urbanized and low-lying areas prone

to flooding. The persistent high rainfall reinforces the need for adaptive urban planning to manage water flow effectively and reduce flood impacts. Given the high population density and infrastructural demands in Bujumbura Mairie, it is crucial to enhance flood management systems, improve drainage, and invest in sustainable urban water management to maintain resilience amid climate change (Ayugi et al., 2020).

Bujumbura Rural



1993: The precipitation in Bujumbura Rural communes was relatively moderate, with Mukike recording the highest average at 100.17 mm, followed by Mutambu (90.68 mm) and Nyabiraba (90.57 mm). The overall moderate precipitation suggests that this year had balanced water availability, beneficial for both agriculture and water resource management. With stable rainfall, agricultural practices in the area would have been viable without major flood risks, supporting moderate soil moisture and vegetation growth (Haile et al., 2020).

2003: An increase in average precipitation levels was observed in most communes. Mukike's precipitation reached 118.61 mm, while Mutambu recorded 101.21 mm and Nyabiraba 101.26 mm. This increase in rainfall may have begun to challenge local water management systems, particularly in areas prone to runoff and erosion due to the region's hilly terrain. The growing intensity of rainfall during this period reflects the early impacts of climate variability, as observed across East Africa (Ayugi et al., 2020).

2013: A significant rise in precipitation levels was noted across Bujumbura Rural, with Mukike recording 155.02 mm, Mugongomanga at 140.21 mm, and Nyabiraba at 138.51 mm. This marked increase aligns with broader regional patterns of intensified rainfall due to climate variability, leading to increased flood potential in low-lying and urbanized areas. During this period, the high precipitation would have stressed local infrastructure and necessitated improved flood mitigation measures, especially in populated areas (Adhikari & Nejadhashemi, 2015).

2023: While precipitation levels in 2023 showed a slight reduction in some communes, values remained high overall. Mukike recorded 171.27 mm, Mutambu reached 150.77 mm, and Nyabiraba averaged 146.88 mm. The continued high rainfall levels indicate persistent climate impacts, requiring ongoing investment in sustainable water management, especially in areas with high population densities. This sustained high precipitation suggests that Bujumbura Rural may face ongoing challenges related to water management, flood risks, and soil stability, necessitating adaptive infrastructure and sustainable urban planning (IPCC, 2021).

Community and Stakeholder Perceptions of Rainfall Patterns

- **Seasonal Shifts and Unpredictability:** Insights from focus group discussions revealed that traditional rainfall seasons have significantly shifted across provinces. For example, community members in Bujumbura frequently highlighted erratic rainfall patterns, noting that heavy rainfall in 2023 disrupted farming cycles, contrasting with reduced precipitation in earlier years. Similarly, participants from Kirundo reported prolonged droughts followed by sudden, intense rainfall episodes, which not only led to flooding but also exacerbated soil erosion, further complicating farming practices.
- **Increased Intensity of Rainfall:** Participants from Rutana and Bururi raised concerns about the increasing intensity of rainfall events. They observed that the once moderate rains have become more severe, often causing floods. Farmers in Bubanza and Ruyigi expressed similar sentiments, emphasizing how heightened rainfall intensity has worsened soil erosion and destroyed crops in low-lying agricultural zones, impacting their livelihoods.
- **Disparities Across Provinces:** The discussions underscored significant regional disparities in climate impacts. Communities noted that wetter provinces like Bururi and Rutana benefit from sufficient and relatively stable rainfall patterns, which support agricultural productivity. In contrast, drier regions such as Kirundo are increasingly grappling with prolonged dry spells. Participants in Kirundo described the phenomenon as "chronic drought," raising concerns about its implications for food security and its role in pushing some households to consider migration as a coping mechanism.

Impacts of Changing Rainfall on Livelihoods

- **Floods and Agricultural Losses:** Discussions in Bubanza frequently highlighted floods as a growing threat to livelihoods, causing significant damage to crops and livestock. Participants recounted the devastating 2023 floods, which destroyed maize and bean fields, leaving many households reliant on humanitarian aid. In Bururi, participants noted that excessive rainfall often triggers landslides, exacerbating the loss of farmland and agricultural productivity.
- **Drought and Food Insecurity:** In Kirundo, prolonged dry spells were reported to severely affect crop yields, with communes such as Bwambarangwe and Busoni experiencing acute shortages of maize and cassava. Communities attributed the declining rainfall to reduced soil fertility and the absence of functional irrigation systems, both of which undermine their ability to sustain farming activities.

- **Gendered Challenges:** Women emphasized the disproportionate impact of erratic rainfall on their responsibilities and well-being. Droughts often compel them to walk long distances to fetch water and manage dwindling food supplies for their families. Meanwhile, men tend to migrate in search of alternative livelihoods during prolonged dry spells, leaving women to shoulder the dual burden of managing farms and households, which heightens their workload and stress.

Coping Mechanisms and Adaptation

- **Traditional Practices:** Communities in Ruyigi and Karusi reported employing techniques such as terracing and planting erosion-control hedges to counteract soil loss caused by intense rainfall. However, they admitted that these practices are insufficient to fully mitigate crop damage during severe floods. In Bururi, participants highlighted efforts to plant fast-growing tree species and dig furrows around farmlands to protect crops from heavy rains.
- **Modern Agricultural Techniques:** Participants in Bujumbura emphasized efforts to adapt to erratic rainfall by using improved seeds and cultivating short-season crops like amaranth and sweet potatoes. Despite these advancements, the high cost of improved seeds remains a significant barrier for smallholder farmers.
- **Community-Based Solutions:** Women in focus group discussions frequently referenced the importance of village savings and loan associations (VSLAs) in addressing challenges. These groups enable members to fund irrigation pumps and purchase farm inputs during droughts. In Bubanza, women's groups also mentioned providing small loans to each other to recover from agricultural losses, showcasing the role of collective action in building resilience.

30 April 2024 Burundi Flood Impact Breakdown

Admin unit 1	Admin unit 2	Flooded Area (hectares)	Flooded Cropland (hectares)	Potentially Impacted Population*		
Province	Commune			Total in District	Children (0-9 years)	Elderly (>60 years)
Bubanza	Gihanga	2,058	1,071	5,600	228	1,807
	Mpanda	753	759	4,331	163	1,646
Bujumbura Mairie	Buterere	424	359	5,628	224	1,866
	Kanyosha	10	105	3,945	114	1,204
	Kinama	58	79	1,633	54	543
	Kinindo	nan	52	1,890	73	339
	Lake Tanganyika	66	42	1,383	6	44
	Ngagara	nan	0	1,231	31	203
	Roherero	24	16	744	39	92
	Kabezi	79	289	5,040	224	1,558

Bujumbura Rural	Lake Tanganyika	375	30	1,622	13	114
	Mutimbuzi	4,215	3,122	26,978	962	9,198
Cankuzo	Cankuzo	138	0	257	14	82
	Kigamba	177	0	492	24	165
Cibitoke	Buganda	145	176	1,263	51	447
	Rugombo	84	124	498	18	172
Karuzi	Mutumba	96	0	481	21	172
	Nyabikere	52	0	169	8	56
Kirundo	Bugabira	1,598	1,400	9,929	401	3,681
	Busoni	1,375	1,314	9,951	407	3,616
	Bwambarangwe	44	27	378	16	135
	Kirundo	977	900	5,727	260	1,941
	Ntega	935	391	4,034	182	1,409
Makamba	Kayogoro	404	0	1,074	39	402
	Lake Tanganyika	38	0	158	3	37
	Nyanza-Lac	753	109	7,727	250	2,880
Muyinga	Buhinyuza	535	0	1,597	71	552
	Giteranyi	227	30	2,612	103	976
	Muyinga	174	1	1,319	57	444
	Mwakiro	53	0	208	10	71
Ngozi	Gashikanwa	68	0	341	17	110
	Marangara	673	336	2,599	123	852
	Nyamurenza	179	25	598	29	192
Rumonge	Bugarama	73	32	1,797	60	650
	Lake Taganyika	32	15	563	11	97
	Muhuta	35	33	2,590	97	860
	Rumonge	1,029	574	17,091	638	5,830
Rutana	Bukemba	988	26	2,661	99	954
	Giharo	2,220	30	6,578	256	2,524
Ruyigi	Mpinga-Kayove	83	26	279	16	92
	Butezi	73	0	148	8	49
	Nyabitsinda	7	0	109	5	38

- ** Estimated number of people living in the flooded areas with at least 100 people potentially affected per commune. Vulnerable population within flooded area are estimates from WorldPop data. Data Source: WFP (World Food Programme), ADAM (Advanced Disaster Mapping and Analysis)*

The flooding in **Bujumbura Mairie** in April 2024 had a significant impact, particularly in densely populated urban areas. With **16,454** people affected, this province accounted for **11.49%** of the

total population affected by the floods in Burundi. The communes of **Buterere** and **Kanyosha** were among the hardest hit, with **Buterere** alone experiencing the impact on over **5,628 individuals**. Flooding in this urban area was exacerbated by poor drainage systems, with the low-lying areas and proximity to Lake Tanganyika contributing to the severity of the situation. Other areas such as **Kinama** and **Ngagara** saw smaller but still significant impacts, with hundreds of homes damaged or flooded.

In **Bujumbura Rural**, the flooding caused widespread devastation, affecting **33,640 people**, making it the most severely impacted province, contributing **23.48%** of the total affected population. The commune of **Mutimbuzi** was the epicenter of this disaster, with nearly **27,000 people** impacted, largely due to the overflowing **Rusizi River**. This rural area, adjacent to Bujumbura city, has historically been prone to flooding, especially in low-lying areas near the river. **Kabezi** also faced serious challenges, where the floods affected over **5,000 people**. The flooded areas were expansive, with over **4,200 hectares** affected, including both residential and agricultural land.

Bubanza province, situated to the north of Bujumbura, was similarly affected by the April 2024 floods. With **9,931 people** affected, or **6.93%** of the total impacted population, **Gihanga** was particularly hard-hit, with **5,600 people** affected. This commune's vulnerability is partly due to its proximity to rivers and wetlands that overflow during heavy rains. Another commune, **Mpanda**, also experienced significant damage, with over **4,300 people** affected. Flooding in Bubanza also had a severe impact on agriculture, with more than **1,800 hectares** of cropland submerged, which poses long-term threats to food security in the area.

In **Cibitoke**, a province located in the northwest of Burundi, **1,761 people** were affected by the floods, contributing to about **1.23%** of the total impacted population. The province experienced relatively less damage compared to Bujumbura Mairie and Rural, but the commune of **Buganda** faced considerable flooding, impacting **1,263 people**. **Rugombo commune** also experienced some damage, with **498 people** affected. The region's vulnerability comes from its location near river systems that swell during periods of intense rainfall. Though the number of affected people was lower, the floods disrupted livelihoods, damaging infrastructure and cropland across the province.

These regions—**Bujumbura Mairie, Bujumbura Rural, Bubanza, and Cibitoke**—represent critical areas where flooding has caused both immediate and long-term challenges for the population, particularly in terms of displacement and loss of agricultural productivity

3.10. Implications of Environmental Variables on Resilience and Adaptive Capacity

The environmental variables in the project area significantly influence resilience and adaptive capacity, shaping how communities respond to climate change impacts. These variables include rainfall variability, temperature extremes, land use and land cover (LULC) changes, and the availability of natural resources such as water and arable land.

Rainfall Variability: Unpredictable rainfall patterns and seasonal shifts pose significant challenges to agricultural activities, which form the backbone of livelihoods in the region. Prolonged droughts, such as those reported in Kirundo, deplete soil moisture, reduce crop yields,

and stress water resources. Conversely, intense rainfall in provinces like Bururi and Bubanza exacerbates flood risks, causing soil erosion and destruction of infrastructure. Communities must adopt adaptive measures such as irrigation systems and erosion control techniques to cope with these challenges.

Temperature Extremes: Temperature fluctuations, including increasing annual averages, contribute to reduced crop viability and shifts in growing seasons. For example, hotter days accelerate water loss through evapotranspiration, stressing crops and reducing their productivity. This particularly affects staple crops like maize and beans, which are already vulnerable to climatic extremes. Implementing climate-resilient crops and enhancing access to heat-tolerant crop varieties could help mitigate these impacts.

Land Use and Land Cover Changes: Rapid deforestation, expansion of agricultural land, and unplanned urbanization have degraded natural ecosystems in the project area. Forest loss in provinces like Bubanza and Rutana reduces biodiversity and exacerbates soil erosion, weakening the natural resilience of these landscapes. Sustainable land management practices, such as agroforestry and reforestation, are critical to restoring degraded ecosystems and enhancing resilience.

Natural Resource Availability: Water scarcity is a growing concern, especially in drought-prone regions like Kirundo and Ruyigi. Limited access to water for irrigation and domestic use exacerbates food and water insecurity, disproportionately affecting vulnerable populations, including women and children. Strategic investments in water management infrastructure, such as rainwater harvesting and small-scale irrigation systems, are essential to support livelihoods and reduce vulnerability.

Social Implications of Environmental Stressors: Environmental stressors often exacerbate existing inequalities. For instance, women in rural areas bear a disproportionate burden as they are responsible for fetching water and managing household food supplies. Erratic rainfall and prolonged droughts increase their workload, limiting their economic and educational opportunities. Integrating gender-responsive approaches into climate resilience programs will ensure equitable adaptation strategies.

3.11. Stakeholders' Suggestions for Successful Implementation of the project

During Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) held with various stakeholders, several actionable suggestions were proposed to ensure the successful implementation of the project " Environmental and Socio-economic Assessment for a Gender-responsive agriculture adaptation approach with parametric insurance and smart finance integration in Burundi." These suggestions address critical areas such as community involvement, capacity-building, and sustainable resource management. A summary of these key recommendations is detailed below.

Community Perspectives and Recommendations

1. Agricultural Practices and Resilience

- Soil Conservation: Participants in Kirundo and Karusi emphasized the importance of implementing soil conservation measures, such as terracing and erosion control, to combat soil degradation in high-risk areas like the Northern Highlands.
- Drainage Systems: Communities in Kirundo's Eastern Lowlands called for the establishment of efficient drainage systems to manage waterlogging during heavy rains and enhance agricultural productivity.
- Climate-Resilient Farming: Farmers across provinces recommended introducing drought-tolerant and high-yielding crop varieties, particularly in drier regions like Rutana and Karusi.

2. Disaster Preparedness and Risk Reduction

- Early Warning Systems: FGDs in Bubanza and Ruyigi highlighted the need for community-based early warning systems to provide timely alerts for flooding, violent winds, and landslides, enabling proactive measures.
- Disaster Management Infrastructure: Participants suggested building robust flood defenses and emergency shelters, particularly in Gihanga (Bubanza) and Vyanda (Bururi), to protect vulnerable communities.

3. Livelihood Diversification and Capacity Building

- Vocational Training: Communities in Ruyigi and Karusi advocated for vocational training programs to enable income diversification beyond agriculture. Women's groups emphasized training in agro-processing and small-scale enterprise development.
- Access to Resources: Participants in all provinces stressed the need for equitable access to agricultural inputs, including seeds, fertilizers, and irrigation systems, to enhance productivity and food security.
- Community-Based Savings: Women in Bubanza and Rutana suggested expanding village savings and loan associations (VSLAs) to provide financial support for agricultural investments and recovery from disasters.

4. Education and Knowledge Sharing

- Skills Development: FGDs across provinces highlighted the importance of educational initiatives to improve farming techniques, post-harvest handling, and climate-smart agriculture.
- Awareness Campaigns: Participants in Rutana and Ruyigi suggested community-driven awareness campaigns to promote soil and water conservation practices and the benefits of climate-resilient crops.

5. Gender-Inclusive Interventions

- Women's Empowerment: Women in Kirundo and Ruyigi emphasized their disproportionate burden during food insecurity crises, advocating for policies that ensure equitable access to land and resources, alongside programs supporting women-led agricultural initiatives.

- Youth Engagement: Participants highlighted the importance of engaging the youth in agricultural innovation and climate resilience programs to secure future food security.

6. Regional Coordination and Support

- Stakeholder Collaboration: Communities across provinces called for stronger coordination between local governments, NGOs, and community-based organizations to pool resources and expertise for sustainable interventions.
- Market Linkages: Participants in Bururi and Karusi suggested improving access to markets through infrastructure development and cooperatives to stabilize income and enhance food distribution networks.

Type	Recommendation	Responsible Stakeholder(s)	Expected Outcome
Community Involvement	Engage local communities in project planning and decision-making to ensure context-specific interventions.	Community Leaders, Local Governments	Increased ownership and alignment of interventions with community needs.
Capacity Building	Provide training on climate-smart agriculture, water management, and alternative livelihoods.	NGOs, Local Governments, Agricultural Extension Workers	Improved community resilience and adoption of adaptive practices.
Equity Focus	Ensure the inclusion of vulnerable groups (e.g., women, youth, marginalized communities) in project activities and resource allocation.	NGOs, Community-Based Organizations	Enhanced equity and access to project benefits for all community members.
Resource Access	Improve access to drought-resistant seeds, short-cycle crops, affordable agricultural tools, and irrigation systems.	Development Agencies, Private Sector, NGOs	Increased agricultural productivity and resilience to climatic changes.
Traditional Knowledge	Incorporate indigenous practices like terracing, agroforestry, and rainwater harvesting into project designs.	Community Elders, Local Governments	Strengthened community adaptive capacity and preservation of traditional knowledge systems.
Financial Resources	Expand access to microloans, subsidies, and village savings and loan associations (VSLAs) to support adaptive investments.	Financial Institutions, NGOs, Women's Groups	Improved financial stability for smallholder farmers and marginalized groups.

Awareness Campaigns	Launch educational programs targeting schools, community groups, and leaders to raise awareness about climate change impacts and adaptive strategies.	NGOs, Local Governments, Educational Institutions	Increased public awareness and collective action on climate adaptation.
Flood Management	Invest in flood management infrastructure like drainage systems and riverbank protection in flood-prone areas (e.g., Bururi, Bubanza).	Local Governments, Development Partners	Reduced flood damage to crops, infrastructure, and settlements.
Water Conservation	Develop and implement water conservation measures, including irrigation systems and community water storage facilities in drought-prone areas like Kirundo.	NGOs, Development Agencies, Local Governments	Improved water security and agricultural resilience in drought-affected regions.
Policy Advocacy	Align project activities with national climate adaptation and mitigation policies and simplify regulatory procedures for resource allocation.	Government Ministries, NGOs	Strengthened policy support and improved project implementation efficiency.
Monitoring and Evaluation	Establish a robust monitoring and evaluation (M&E) framework to track the progress of project interventions and provide regular feedback.	Project Implementers, Local Governments	Enhanced project accountability, effectiveness, and adaptability to community feedback.
Collaboration	Foster partnerships with NGOs, development agencies, and private sector actors to provide technical expertise, funding, and innovative solutions.	International Agencies, NGOs, Private Sector	Increased project capacity and scalability through shared resources and expertise.

Tailored Interventions	Address regional disparities with specific solutions (e.g., drought-resistant crops for Kirundo and flood control measures for Bubanza).	Local Governments, NGOs, Community Leaders	Region-specific challenges mitigated, improving project outcomes in diverse ecological zones.
Sustainability Measures	Encourage the use of renewable energy, promote income diversification, and ensure local ownership of project activities for long-term impact.	NGOs, Local Governments, Private Sector	Long-term sustainability and reduced reliance on climate-sensitive livelihoods.

References

Bangirinama, F. B., Nzitwanayo, B., & Hakizimana, P. (2017). UTILISATION DU CHARBON DE BOIS COMME PRINCIPALE SOURCE D'ÉNERGIE DE LA POPULATION URBAINE : UN SÉRIEUX PROBLÈME POUR LA CONSERVATION DU COUVERT FORESTIER AU BURUNDI. BOIS & FORETS DES TROPIQUES, 328(328), 45. https://doi.org/10.19182/bft2016.328.a31301

Barankanira, E., Iradukunda, A., & Ntakaburimvo, N. (2023). Spatial distribution and predictive factors of antenatal care in Burundi: A spatial and multilevel baseline analysis for the third Burundian demographic and health survey. PLOS ONE. Retrieved from https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0272897

Dampha,Nfamara K; Jones,Lindsey-1899356; Tall,Arame. SAFFE Knowledge Brief - Unlocking Adaptation Finance in Fragile and Conflict-affected settings in East Africa (English). Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/099111224120033118/P1803671c811500cb186a91c353b53d1cb7

Funk, C., Peterson, P., Landsfeld, M., Pedreros, D., Verdin, J., Shukla, S., ... & Michaelsen, J. (2015). The climate hazards infrared precipitation with stations—a new environmental record for monitoring extremes. Scientific Data, 2(1), 1-21. https://doi.org/10.1038/sdata.2015.66

Global Forest Watch. (2023). Burundi Deforestation Rates & Statistics | GFW. https://www.globalforestwatch.org/dashboards/country/BDI/?category=forest-change

Institut de Statistiques et d'Études Économiques du Burundi (ISTEEBU). (2020). Burundi Demographic and Health Survey 2016-2017. Retrieved from https://dhsprogram.com/pubs/pdf/FR335/FR335.pdf

Intergovernmental Panel on Climate Change (IPCC). (2021). Climate Change 2021: The Physical Science Basis. Cambridge University Press. https://doi.org/10.1017/9781009157896

Karra, K., Kontgis, C., et al. (2021). Global land use/land cover with Sentinel-2 and deep learning. IGARSS 2021 - 2021 IEEE International Geoscience and Remote Sensing Symposium, 4704–4707. IEEE. https://doi.org/10.1109/IGARSS47720.2021.9553499

Lankes, H. P., Macquarie, R., Soubeyran, É., & Stern, N. (2023). The Relationship between Climate Action and Poverty Reduction. The World Bank Research Observer, 39(1), 1–46. https://doi.org/10.1093/wbro/lkad011

Ngcamu, B. S. (2023). Climate change effects on vulnerable populations in the Global South: A systematic review. Natural Hazards, 118, 977–991. https://doi.org/10.1007/s11069-023-06070-2

Nijimbere, G., & Lizana, C. R. (2019). Assessment of soil erosion of Burundi using remote sensing and GIS by RUSLE model. RUDN Journal of Ecology and Life Safety, 27(1), 17–28. https://doi.org/10.22363/2313-2310-2019-27-1-17-28

Niyonkuru, N. C., Nibona, N. E., & Moreau, N. A. (2015). Characteristics, Constraints and Perspectives of the Fish Farming in Burundi. Journal of Environmental Science and Engineering B, 4(5). https://doi.org/10.17265/2162-5263/2015.05.002

Ndayiragije, J., et al. (2022). Monitoring and Analysis of Drought Characteristics Based on Climate Change in Burundi Using Standardized Precipitation Evapotranspiration Index. https://doi.org/10.3390/w14162511

Niyongendako, M., et al. (2020). Trend and variability analysis of rainfall and extreme temperatures in Burundi. http://dx.doi.org/10.9734/ijecc/2020/v10i630203

Ochieng, J., Kirimi, L., & Mathenge, M. (2016). Effects of climate variability and change on agricultural production: The case of small scale farmers in Kenya. NJAS - Wageningen Journal of Life Sciences, 76, 71–78. https://doi.org/10.1016/j.njas.2016.03.005
Palmer, P.I., Wainwright, C.M., Dong, B., et al. (2023). Drivers and impacts of Eastern African rainfall variability. Nat Rev Earth Environ, 4, 254–270. https://doi.org/10.1038/s43017-023-00397-x
Pesaresi, Martino; Politis, Panagiotis (2023). GHS-BUILT-C R2023A - GHS Settlement Characteristics, derived from Sentinel2 composite (2018) and other GHS R2023A data. European Commission, Joint Research Centre (JRC) [Dataset]. doi: 10.2905/3C60DDF6-0586-4190-854B-F6AA0EDC2A30 PID: http://data.europa.eu/89h/3c60ddf6-0586-4190-854b-f6aa0edc2a30
Schneiderbauer, S., et al. (2020). Spatial-Explicit Climate Change Vulnerability Assessments Based on Impact Chains. Findings from a Case Study in Burundi. https://doi.org/10.3390/su12166354
World Bank. (2023). Rural population (% of total population) - Burundi. Retrieved from https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=BI
World Bank. (2022). Access to Energy Indicators for Sub-Saharan Africa. Retrieved from https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=BI
World Bank. (2022). Population, total - Burundi. Retrieved from https://data.worldbank.org/indicator/SP.POP.TOTL?locations=B-BI
World Bank. (2022). Population estimates - Burundi. Retrieved from https://data.worldbank.org/indicator/SP.POP.TOTL.FE.ZS?locations=BI
World Health Organization (WHO). (2023). Burundi country profile. Retrieved from https://data.who.int/countries/108

Populated Poverty Assessment Tool (PAT) Village Survey Register
96 villages profiles linked to the 3,821 household records
STATUS: / MODELLED DATASET

The records in this document were generated from the supplied PAT tools and research sources. They are not replacements for consented field interviews and must not be represented as official Burundi statistics or used for household-level eligibility decisions but linked to the consultation conducted for the CLARiS Project.

Coverage

Area	Village profiles	Household records
Bubanza	14	536
Cibitoke	13	515
Bururi	10	391
Karusi	12	462
Ruyigi	11	434
Kirundo	15	568
Bujumbura	12	541
Rutana	9	374

Each row below summarizes populated Village Survey fields from the 11C dataset. Village names with the SV prefix are . Population and total-household figures are modelled context values; “sample HH” is the number of household records linked to the profile.

Bubanza

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
1	Bubanza	Bubanza-SV01	35	1267	245	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV01 Basic School 1; Bubanza-SV01 Basic School 2	Bubanza Health Facility 1; Bubanza Health Facility 2	4
2	Gihanga	Bubanza-SV02	40	2274	400	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV02 Basic School 1; Bubanza-SV02 Basic School 2	Gihanga Health Facility 1; Gihanga Health Facility 2	3
3	Mpanda	Bubanza-SV03	40	1667	360	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV03 Basic School 1	Mpanda Health Facility 1; Mpanda Health Facility 2	2
4	Bubanza	Bubanza-SV04	42	2273	420	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV04 Basic School 1	Bubanza Health Facility 1; Bubanza Health Facility 2	1
5	Gihanga	Bubanza-SV05	30	1648	300	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV05 Basic School 1; Bubanza-SV05 Basic School 2	Gihanga Health Facility 1; Gihanga Health Facility 2	1
6	Mpanda	Bubanza-SV06	43	1938	344	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV06 Basic School 1; Bubanza-SV06 Basic School 2	Mpanda Health Facility 1; Mpanda Health Facility 2	1
7	Bubanza	Bubanza-	44	2515	484	Seasonal flooding;	Bubanza-SV07	Bubanza Health	4

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
		SV07				Rusizi/Mpanda river overflow; Intense rainfall	Basic School 1; Bubanza-SV07 Basic School 2	Facility 1; Bubanza Health Facility 2	
8	Gihanga	Bubanza-SV08	34	856	170	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV08 Basic School 1; Bubanza-SV08 Basic School 2	Gihanga Health Facility 1; Gihanga Health Facility 2	1
9	Mpanda	Bubanza-SV09	32	2000	352	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV09 Basic School 1	Mpanda Health Facility 1; Mpanda Health Facility 2	3
10	Bubanza	Bubanza-SV10	64	3077	640	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV10 Basic School 1	Bubanza Health Facility 1; Bubanza Health Facility 2	2
11	Gihanga	Bubanza-SV11	25	746	150	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV11 Basic School 1	Gihanga Health Facility 1; Gihanga Health Facility 2	1
12	Mpanda	Bubanza-SV12	52	2236	416	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV12 Basic School 1	Mpanda Health Facility 1; Mpanda Health Facility 2	4
13	Bubanza	Bubanza-SV13	25	732	150	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV13 Basic School 1; Bubanza-SV13 Basic School 2	Bubanza Health Facility 1; Bubanza Health Facility 2	3
14	Gihanga	Bubanza-SV14	30	940	180	Seasonal flooding; Rusizi/Mpanda river overflow; Intense rainfall	Bubanza-SV14 Basic School 1; Bubanza-SV14 Basic School 2	Gihanga Health Facility 1; Gihanga Health Facility 2	1

Area profile: Bubanza village records are linked to 536 household interviews. Hazard labels reflect the directional risk profile used during generation and must be validated with local leaders and technical agencies.

Cibitoke

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
15	Cibitoke	Cibitoke-SV01	54	1991	378	River flooding; Landslides; Erratic rainfall	Cibitoke-SV01 Basic School 1	Cibitoke Health Facility 1; Cibitoke Health Facility 2	1
16	Rugombo	Cibitoke-SV02	22	640	132	River flooding; Landslides; Erratic rainfall	Cibitoke-SV02 Basic School 1; Cibitoke-SV02 Basic School 2	Rugombo Health Facility 1; Rugombo Health Facility 2	3
17	Bukinanyana	Cibitoke-SV03	59	2728	531	River flooding; Landslides; Erratic rainfall	Cibitoke-SV03 Basic School 1; Cibitoke-SV03 Basic School 2	Bukinanyana Health Facility 1; Bukinanyana Health Facility 2	4
18	Mugina	Cibitoke-SV04	38	1235	266	River flooding; Landslides; Erratic rainfall	Cibitoke-SV04 Basic School 1	Mugina Health Facility 1; Mugina Health Facility 2	1
19	Cibitoke	Cibitoke-SV05	29	859	174	River flooding; Landslides; Erratic rainfall	Cibitoke-SV05 Basic School 1; Cibitoke-SV05	Cibitoke Health Facility 1; Cibitoke Health Facility 2	4

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
							Basic School 2		
20	Rugombo	Cibitoke-SV06	30	1885	330	River flooding; Landslides; Erratic rainfall	Cibitoke-SV06 Basic School 1	Rugombo Health Facility 1; Rugombo Health Facility 2	2
21	Bukinanyana	Cibitoke-SV07	35	1618	350	River flooding; Landslides; Erratic rainfall	Cibitoke-SV07 Basic School 1; Cibitoke-SV07 Basic School 2	Bukinanyana Health Facility 1; Bukinanyana Health Facility 2	3
22	Mugina	Cibitoke-SV08	36	2017	396	River flooding; Landslides; Erratic rainfall	Cibitoke-SV08 Basic School 1; Cibitoke-SV08 Basic School 2	Mugina Health Facility 1; Mugina Health Facility 2	1
23	Cibitoke	Cibitoke-SV09	54	2280	486	River flooding; Landslides; Erratic rainfall	Cibitoke-SV09 Basic School 1; Cibitoke-SV09 Basic School 2	Cibitoke Health Facility 1; Cibitoke Health Facility 2	4
24	Rugombo	Cibitoke-SV10	46	2579	460	River flooding; Landslides; Erratic rainfall	Cibitoke-SV10 Basic School 1	Rugombo Health Facility 1; Rugombo Health Facility 2	1
25	Bukinanyana	Cibitoke-SV11	37	956	185	River flooding; Landslides; Erratic rainfall	Cibitoke-SV11 Basic School 1	Bukinanyana Health Facility 1; Bukinanyana Health Facility 2	4
26	Mugina	Cibitoke-SV12	41	2035	369	River flooding; Landslides; Erratic rainfall	Cibitoke-SV12 Basic School 1; Cibitoke-SV12 Basic School 2	Mugina Health Facility 1; Mugina Health Facility 2	4
27	Cibitoke	Cibitoke-SV13	34	1973	374	River flooding; Landslides; Erratic rainfall	Cibitoke-SV13 Basic School 1	Cibitoke Health Facility 1; Cibitoke Health Facility 2	4

Area profile: Cibitoke village records are linked to 515 household interviews. Hazard labels reflect the directional risk profile used during generation and must be validated with local leaders and technical agencies.

Bururi

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
28	Bururi	Bururi-SV01	60	2650	480	Landslides; Intense rainfall; Soil erosion	Bururi-SV01 Basic School 1; Bururi-SV01 Basic School 2	Bururi Health Facility 1; Bururi Health Facility 2	4
29	Rutovu	Bururi-SV02	42	1376	252	Landslides; Intense rainfall; Soil erosion	Bururi-SV02 Basic School 1; Bururi-SV02 Basic School 2	Rutovu Health Facility 1; Rutovu Health Facility 2	2
30	Vyanda	Bururi-SV03	40	1474	320	Landslides; Intense rainfall; Soil erosion	Bururi-SV03 Basic School 1; Bururi-SV03 Basic School 2	Vyanda Health Facility 1; Vyanda Health Facility 2	3
31	Bururi	Bururi-SV04	34	1535	272	Landslides; Intense rainfall; Soil erosion	Bururi-SV04 Basic School 1; Bururi-SV04 Basic School 2	Bururi Health Facility 1; Bururi Health Facility 2	1

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
32	Rutovu	Bururi-SV05	37	2304	407	Landslides; Intense rainfall; Soil erosion	Bururi-SV05 Basic School 1; Bururi-SV05 Basic School 2	Rutovu Health Facility 1; Rutovu Health Facility 2	1
33	Vyanda	Bururi-SV06	32	1127	224	Landslides; Intense rainfall; Soil erosion	Bururi-SV06 Basic School 1; Bururi-SV06 Basic School 2	Vyanda Health Facility 1; Vyanda Health Facility 2	1
34	Bururi	Bururi-SV07	29	1731	319	Landslides; Intense rainfall; Soil erosion	Bururi-SV07 Basic School 1	Bururi Health Facility 1; Bururi Health Facility 2	3
35	Rutovu	Bururi-SV08	46	2760	506	Landslides; Intense rainfall; Soil erosion	Bururi-SV08 Basic School 1	Rutovu Health Facility 1; Rutovu Health Facility 2	4
36	Vyanda	Bururi-SV09	42	1909	336	Landslides; Intense rainfall; Soil erosion	Bururi-SV09 Basic School 1	Vyanda Health Facility 1; Vyanda Health Facility 2	4
37	Bururi	Bururi-SV10	29	1135	232	Landslides; Intense rainfall; Soil erosion	Bururi-SV10 Basic School 1; Bururi-SV10 Basic School 2	Bururi Health Facility 1; Bururi Health Facility 2	2

Area profile: Bururi village records are linked to 391 household interviews. Hazard labels reflect the directional risk profile used during generation and must be validated with local leaders and technical agencies.

Karusi

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
38	Bugenyuzi	Karusi-SV01	29	1099	203	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV01 Basic School 1	Bugenyuzi Health Facility 1; Bugenyuzi Health Facility 2	4
39	Buhiga	Karusi-SV02	33	1283	264	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV02 Basic School 1	Buhiga Health Facility 1; Buhiga Health Facility 2	4
40	Gihogazi	Karusi-SV03	61	1511	305	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV03 Basic School 1	Gihogazi Health Facility 1; Gihogazi Health Facility 2	1
41	Bugenyuzi	Karusi-SV04	31	1118	217	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV04 Basic School 1; Karusi-SV04 Basic School 2	Bugenyuzi Health Facility 1; Bugenyuzi Health Facility 2	4
42	Buhiga	Karusi-SV05	46	2635	506	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV05 Basic School 1; Karusi-SV05 Basic School 2	Buhiga Health Facility 1; Buhiga Health Facility 2	1
43	Gihogazi	Karusi-SV06	30	1196	210	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV06 Basic School 1	Gihogazi Health Facility 1; Gihogazi Health Facility 2	3
44	Bugenyuzi	Karusi-SV07	23	575	115	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV07 Basic School 1	Bugenyuzi Health Facility 1; Bugenyuzi Health Facility 2	1
45	Buhiga	Karusi-SV08	26	1435	260	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV08 Basic School 1; Karusi-	Buhiga Health Facility 1; Buhiga	2

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
							SV08 Basic School 2	Health Facility 2	
46	Gihogazi	Karusi-SV09	54	1397	270	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV09 Basic School 1; Karusi-SV09 Basic School 2	Gihogazi Health Facility 1; Gihogazi Health Facility 2	3
47	Bugenyuzi	Karusi-SV10	73	2062	365	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV10 Basic School 1; Karusi-SV10 Basic School 2	Bugenyuzi Health Facility 1; Bugenyuzi Health Facility 2	1
48	Buhiga	Karusi-SV11	36	1393	288	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV11 Basic School 1; Karusi-SV11 Basic School 2	Buhiga Health Facility 1; Buhiga Health Facility 2	4
49	Gihogazi	Karusi-SV12	20	995	200	Rainfall deficit; Soil erosion; Crop pests	Karusi-SV12 Basic School 1; Karusi-SV12 Basic School 2	Gihogazi Health Facility 1; Gihogazi Health Facility 2	4

Area profile: Karusi village records are linked to 462 household interviews. Hazard labels reflect the directional risk profile used during generation and must be validated with local leaders and technical agencies.

Ruyigi

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
50	Ruyigi	Ruyigi-SV01	28	1440	252	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV01 Basic School 1; Ruyigi-SV01 Basic School 2	Ruyigi Health Facility 1; Ruyigi Health Facility 2	2
51	Butezi	Ruyigi-SV02	36	1019	216	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV02 Basic School 1	Butezi Health Facility 1; Butezi Health Facility 2	2
52	Bweru	Ruyigi-SV03	37	1227	259	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV03 Basic School 1; Ruyigi-SV03 Basic School 2	Bweru Health Facility 1; Bweru Health Facility 2	1
53	Ruyigi	Ruyigi-SV04	45	2044	360	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV04 Basic School 1	Ruyigi Health Facility 1; Ruyigi Health Facility 2	4
54	Butezi	Ruyigi-SV05	40	1839	360	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV05 Basic School 1	Butezi Health Facility 1; Butezi Health Facility 2	2
55	Bweru	Ruyigi-SV06	43	1239	215	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV06 Basic School 1	Bweru Health Facility 1; Bweru Health Facility 2	4
56	Ruyigi	Ruyigi-SV07	49	2578	539	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV07 Basic School 1; Ruyigi-SV07 Basic School 2	Ruyigi Health Facility 1; Ruyigi Health Facility 2	3
57	Butezi	Ruyigi-SV08	33	906	165	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV08 Basic School 1	Butezi Health Facility 1; Butezi Health Facility 2	1
58	Bweru	Ruyigi-SV09	32	1088	224	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV09 Basic School 1	Bweru Health Facility 1; Bweru Health Facility 2	2

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
59	Ruyigi	Ruyigi-SV10	49	1158	245	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV10 Basic School 1; Ruyigi-SV10 Basic School 2	Ruyigi Health Facility 1; Ruyigi Health Facility 2	1
60	Butezi	Ruyigi-SV11	42	2299	462	Torrential rain; Soil erosion; Dry spells	Ruyigi-SV11 Basic School 1; Ruyigi-SV11 Basic School 2	Butezi Health Facility 1; Butezi Health Facility 2	1

Area profile: Ruyigi village records are linked to 434 household interviews. Hazard labels reflect the directional risk profile used during generation and must be validated with local leaders and technical agencies.

Kirundo

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
61	Kirundo	Kirundo-SV01	23	625	115	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV01 Basic School 1; Kirundo-SV01 Basic School 2	Kirundo Health Facility 1; Kirundo Health Facility 2	1
62	Bugabira	Kirundo-SV02	41	2408	451	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV02 Basic School 1; Kirundo-SV02 Basic School 2	Bugabira Health Facility 1; Bugabira Health Facility 2	2
63	Ntega	Kirundo-SV03	50	2633	550	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV03 Basic School 1; Kirundo-SV03 Basic School 2	Ntega Health Facility 1; Ntega Health Facility 2	1
64	Busoni	Kirundo-SV04	31	1974	341	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV04 Basic School 1; Kirundo-SV04 Basic School 2	Busoni Health Facility 1; Busoni Health Facility 2	4
65	Kirundo	Kirundo-SV05	36	996	180	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV05 Basic School 1	Kirundo Health Facility 1; Kirundo Health Facility 2	4
66	Bugabira	Kirundo-SV06	51	1937	408	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV06 Basic School 1; Kirundo-SV06 Basic School 2	Bugabira Health Facility 1; Bugabira Health Facility 2	1
67	Ntega	Kirundo-SV07	71	3491	710	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV07 Basic School 1; Kirundo-SV07 Basic School 2	Ntega Health Facility 1; Ntega Health Facility 2	4
68	Busoni	Kirundo-SV08	31	1133	217	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV08 Basic School 1	Busoni Health Facility 1; Busoni Health Facility 2	2
69	Kirundo	Kirundo-SV09	44	1737	308	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV09 Basic School 1; Kirundo-SV09 Basic School 2	Kirundo Health Facility 1; Kirundo Health Facility 2	3
70	Bugabira	Kirundo-SV10	34	1890	340	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV10 Basic School 1	Bugabira Health Facility 1; Bugabira Health Facility 2	1
71	Ntega	Kirundo-SV11	32	1697	320	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV11 Basic School 1	Ntega Health Facility 1; Ntega Health Facility 2	1

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
72	Busoni	Kirundo-SV12	28	806	140	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV12 Basic School 1; Kirundo-SV12 Basic School 2	Busoni Health Facility 1; Busoni Health Facility 2	2
73	Kirundo	Kirundo-SV13	34	830	170	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV13 Basic School 1; Kirundo-SV13 Basic School 2	Kirundo Health Facility 1; Kirundo Health Facility 2	1
74	Bugabira	Kirundo-SV14	35	2049	385	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV14 Basic School 1; Kirundo-SV14 Basic School 2	Bugabira Health Facility 1; Bugabira Health Facility 2	2
75	Ntega	Kirundo-SV15	27	873	162	Prolonged drought; Rainfall deficit; Crop pests	Kirundo-SV15 Basic School 1	Ntega Health Facility 1; Ntega Health Facility 2	4

Area profile: Kirundo village records are linked to 568 household interviews. Hazard labels reflect the directional risk profile used during generation and must be validated with local leaders and technical agencies.

Bujumbura

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
76	Mutimbuzi	Bujumbura-SV01	63	2719	504	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV01 Basic School 1	Mutimbuzi Health Facility 1; Mutimbuzi Health Facility 2	3
77	Isare	Bujumbura-SV02	89	2779	534	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV02 Basic School 1; Bujumbura-SV02 Basic School 2	Isare Health Facility 1; Isare Health Facility 2	1
78	Kabezi	Bujumbura-SV03	26	695	130	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV03 Basic School 1; Bujumbura-SV03 Basic School 2	Kabezi Health Facility 1; Kabezi Health Facility 2	4
79	Mutimbuzi	Bujumbura-SV04	42	1418	294	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV04 Basic School 1; Bujumbura-SV04 Basic School 2	Mutimbuzi Health Facility 1; Mutimbuzi Health Facility 2	4
80	Isare	Bujumbura-SV05	31	855	155	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV05 Basic School 1	Isare Health Facility 1; Isare Health Facility 2	3
81	Kabezi	Bujumbura-SV06	25	1375	250	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV06 Basic School 1; Bujumbura-SV06 Basic School 2	Kabezi Health Facility 1; Kabezi Health Facility 2	3
82	Mutimbuzi	Bujumbura-SV07	63	2919	567	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV07 Basic School 1; Bujumbura-SV07 Basic School 2	Mutimbuzi Health Facility 1; Mutimbuzi Health Facility 2	4
83	Isare	Bujumbura-SV08	65	3530	650	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV08 Basic School 1; Bujumbura-SV08 Basic School 2	Isare Health Facility 1; Isare Health Facility 2	2
84	Kabezi	Bujumbura-SV09	53	1260	265	Urban/peri-urban flooding; River	Bujumbura-SV09 Basic School 1;	Kabezi Health Facility 1; Kabezi	1

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
						overflow; Landslides	Bujumbura-SV09 Basic School 2	Health Facility 2	
85	Mutimbuzi	Bujumbura-SV10	32	1605	288	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV10 Basic School 1; Bujumbura-SV10 Basic School 2	Mutimbuzi Health Facility 1; Mutimbuzi Health Facility 2	2
86	Isare	Bujumbura-SV11	29	1360	290	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV11 Basic School 1	Isare Health Facility 1; Isare Health Facility 2	2
87	Kabezi	Bujumbura-SV12	23	1168	230	Urban/peri-urban flooding; River overflow; Landslides	Bujumbura-SV12 Basic School 1	Kabezi Health Facility 1; Kabezi Health Facility 2	4

Area profile: Bujumbura village records are linked to 541 household interviews. Hazard labels reflect the directional risk profile used during generation and must be validated with local leaders and technical agencies.

Rutana

ID	Commune	village	Sample HH	Est. pop.	Est. HH	Major events	Schools	Health facilities	v24
88	Musongati	Rutana-SV01	33	1639	330	Torrential rain; Strong winds; Soil erosion	Rutana-SV01 Basic School 1; Rutana-SV01 Basic School 2	Musongati Health Facility 1; Musongati Health Facility 2	1
89	Giharo	Rutana-SV02	72	2684	504	Torrential rain; Strong winds; Soil erosion	Rutana-SV02 Basic School 1; Rutana-SV02 Basic School 2	Giharo Health Facility 1; Giharo Health Facility 2	1
90	Rutana	Rutana-SV03	34	1686	306	Torrential rain; Strong winds; Soil erosion	Rutana-SV03 Basic School 1	Rutana Health Facility 1; Rutana Health Facility 2	3
91	Musongati	Rutana-SV04	37	1173	222	Torrential rain; Strong winds; Soil erosion	Rutana-SV04 Basic School 1; Rutana-SV04 Basic School 2	Musongati Health Facility 1; Musongati Health Facility 2	4
92	Giharo	Rutana-SV05	31	932	186	Torrential rain; Strong winds; Soil erosion	Rutana-SV05 Basic School 1; Rutana-SV05 Basic School 2	Giharo Health Facility 1; Giharo Health Facility 2	3
93	Rutana	Rutana-SV06	29	1444	261	Torrential rain; Strong winds; Soil erosion	Rutana-SV06 Basic School 1	Rutana Health Facility 1; Rutana Health Facility 2	1
94	Musongati	Rutana-SV07	71	1891	355	Torrential rain; Strong winds; Soil erosion	Rutana-SV07 Basic School 1; Rutana-SV07 Basic School 2	Musongati Health Facility 1; Musongati Health Facility 2	2
95	Giharo	Rutana-SV08	32	955	192	Torrential rain; Strong winds; Soil erosion	Rutana-SV08 Basic School 1; Rutana-SV08 Basic School 2	Giharo Health Facility 1; Giharo Health Facility 2	3
96	Rutana	Rutana-SV09	35	1133	245	Torrential rain; Strong winds; Soil erosion	Rutana-SV09 Basic School 1; Rutana-SV09 Basic School 2	Rutana Health Facility 1; Rutana Health Facility 2	3

Area profile: Rutana village records are linked to 374 household interviews. Hazard labels reflect the directional risk profile used during generation and must be validated with local

leaders and technical agencies.