Simplified Approval Process
Funding Proposal

Project/Programme title:	Climate Adaptation and Technology Leveraging for Enhanced Climate Resilience in Eastern Uganda (CATLER – Uganda)
Country(ies):	Republic of Uganda
National Designated Authority(ies):	Ministry of Finance, Planning, and Economic Development (MFPED)
Accredited Entity:	Ministry of Water and Environment (MWE)
Date of first submission:	*[YYYY/MM/DD]*
Date of current submission/ version number	*[YYYY/MM/DD] [V.000]*

GREEN CLIMATE FUND

Contents

Notes to accredited entities on the use of the SAP funding proposal template

- The Simplified Approval Process Pilot Scheme (SAP) supports projects and programmes with a GCF contribution of up to USD 25 million with minimal to no environmental and social risks. Projects and programmes are eligible for SAP if they are ready for scaling up and have the potential for transformation, promoting a paradigm shift to low-emission and climate-resilient development.
- This template is for the SAP funding proposals and is different from the funding proposal template under the standard project and programme cycle. Distinctive features of the SAP funding proposal template are:
  - *Simpler documents*: key documents have been simplified, and presented in a single, up-front list;
  - *Fewer pages*: A shorter form with significantly fewer pages. The total length of funding proposals should **not exceed 20 pages,** annexes can be used to provide details as necessary;
  - *Easier form-filling*: fewer questions and clearer guidance allows more concise and succinct responses for each sub-section, avoiding duplication of information.
- Accredited entities can either directly incorporate information into this proposal, or provide summary information in the proposal with cross-reference to other funding proposal documents such as project appraisal document, pre-feasibility studies, term sheet, legal due diligence report, etc.
- Submitted SAP Pilot Scheme funding proposals will be disclosed simultaneously with submission to the Board, subject to the redaction of any information which may not be disclosed pursuant to the GCF Information Disclosure Policy.
- For more information on how to develop Funding Proposals under the SAP please refer to the Simplified Approval Process (SAP) Funding proposal guidelines.

Please submit the completed form through the GCF Digital Proposal Submission Platform (DPS)[1]

[1] See the DPS user guide for further information on how to access and submit proposals.

A. PROJECT/PROGRAMME SUMMARY

A.1. Has this FP been submitted as a SAP CN before?			Yes ☒ No ☐		
A.2. Is the Environmental and Social Safeguards Category C or I-3?			Yes ☒ No ☐		
A.3. Project or programme	*Indicate whether this FP refers to a combination of several projects (programme) or one project.* ☒ Project ☐ Programme	**A.4. Public or private sector**	☒ Public sector ☐ Private sector	**A.5. RfP**	Not applicable

A.6. Result area(s)			
	Check the applicable GCF result area(s) that the overall proposed project/programme targets. For each checked result area(s), indicate the estimated percentage of GCF and Co-financers' budget devoted to it. The total of the percentages when summed should be 100% for GCF and Co-financers' contribution respectively.		
		GCF Contribution	**Co-financers' contribution[2]**
	Mitigation total	Enter number %	Enter number %
	☐ Energy generation and access	Enter number %	Enter number %
	☐ Low emission transport	Enter number %	Enter number %
	☐ Buildings, cities and industries and appliances	Enter number %	Enter number %
	☒ Forestry and land use	Enter number %	Enter number %
	Adaptation total	Enter number %	Enter number %
	☐ Most vulnerable people and communities	Enter number %	Enter number %
	☒ Health and well-being, and food and water security	Enter number %	Enter number %
	☐ Infrastructure and built environment	Enter number %	Enter number %
	☐ Ecosystem and ecosystem services	Enter number %	Enter number %

A.7.1. Expected mitigation outcome *(Core indicator 1: GHG emissions reduced, avoided or removed / sequestered)*	28,575,404 tCO_2-e	**A.7.2 Expected adaptation outcome** *(Core indicator 2: direct and indirect beneficiaries reached)*	*Indicate total number of direct and indirect beneficiaries*	
			871,600 direct beneficiaries	4,487,000 indirect beneficiaries
			1.77% of total population	9.16% of total population
A.8.1. Total investment (GCF + co-finance[3])	Amount: 25,000,000 USD	**A.8.2 Total GCF funding requested** (max USD 25M)	Amount: 25,000,000 USD	
A.9. Type of financial instrument requested for the GCF funding	*Mark all that apply.* ☒ Grant ☐ Loan[4] ☐ Equity ☐ Guarantees ☐ Others:			

[2] Co-financer's contribution means the financial resources required, whether Public Finance or Private Finance, in addition to the GCF contribution (i.e. GCF financial resources requested by the Accredited Entity) to implement the project or programme described in the funding proposal.
3 Refer to the Policy on Co-financing of the GCF.
4 Senior loans and subordinated loans.

A.10. Implementation period (months)	60 months (2026-2030)	**A.11. Total project/ programme lifespan (years)**	20 Years
A.12. Expected date of internal approval	*The date that the Accredited Entity obtained/will obtain its own approval to implement the project/ programme, if available* *Click or tap to enter a date.*	**A.13. Has Readiness or PPF support been used to prepare this FP?**	Yes ☒ No ☐
A.14. Is this FP included in the entity work programme?	Yes ☐ No ☐	**A.15. Is this FP included in the country programme?**	Yes ☐ No ☐
A.16. Executing Entity information	Ministry of Water and Environment (MWE)		
A.17. Scalability and potential for transformation (max. 100 words)			

Provide a brief description of how the proposed project/programme will scale-up the previous initiatives/activities financed by the Global Environmental Facility, Adaptation Fund, Climate Investment Funds or others and how it will promote paradigm shift to low-emission and climate-resilient development.

Between 2018 and 2021, Uganda conducted a comprehensive Technology Needs Assessment (TNA) with GEF & UNEP support to identify and prioritize climate adaptation and mitigation technologies across four critical sectors: agriculture, water, forestry, and energy. The TNA's outcome was a set of twelve Technology Action Plans (TAPs) pinpointing high-impact measures ranging from drought-resilient crop breeding and farmer-managed natural regeneration (FMNR) to rooftop solar photovoltaic (PV) systems and bio-latrines. These TAPs not only catalogued the country's most urgent climate technology needs but also dissected underlying adoption barriers—high upfront costs, inadequate local capacity, fragmented coordination, and inadequate financial instruments. They further provided a blueprint for overcoming these obstacles through targeted interventions, including community-driven financing mechanisms, decentralized technology distribution networks, research and development (R&D) to localize solutions, and robust institutional frameworks.

CATLER–Uganda delivers on these TAP recommendations through an integrated and territorially embedded model that links technology supply, financing, institutional reform, and end-user empowerment. It does not treat each technology as a stand-alone intervention, but rather as part of a bundled solution responding to the interconnected vulnerabilities of Eastern Uganda's agrarian and forest-edge communities. The project operationalizes TAP priorities by establishing sub-regional technology access points that provide bundled inputs—e.g., drought-resilient seeds, solar water pumps, bio-fertilizers—and linking them with localized financial mechanisms, such as community-managed revolving funds and SACCO-driven credit schemes tailored for smallholder contexts. By working through established district structures and extension systems, the project ensures that TAP technologies are not externally introduced, but embedded within existing local service delivery. To enable sustained access, CATLER also invests in domestic innovation systems to produce region-specific planting material and FMNR protocols. Simultaneously, it supports regulatory reform and harmonized by-laws at district level to institutionalize the use and protection of these technologies. This multi-level approach ensures scalability not through replication alone, but through systems change—addressing the structural conditions that have kept TAPs from moving beyond planning into durable, large-scale implementation.

The project promotes a paradigm shift by transforming climate technology deployment from fragmented, project-based delivery into an institutionalized, locally owned, and nationally scalable system. It restructures rural production systems around low-emission, water-secure, and restoration-focused livelihoods. Uganda's biomass reliance (88% of household energy) is replaced with decentralized solar. Rainfed agriculture is upgraded to resilient, solar-irrigated cropping. Landscape degradation is reversed through formalized FMNR, with reforestation of 50,000 ha. By embedding finance, technology, and governance within Uganda's decentralization architecture, CATLER transforms the TNA from a strategic document into a national mechanism for climate-resilient, low-carbon rural development.

A.18. Project/Programme rationale, objectives and approach (max. 300 words)

Provide a brief description of project/programme including: Climate rationale of the project/programme, Purpose and activities of the project/programme, Climate results of the project/programme, Rationale for the use of GCF funding, Short justification for the chosen instrument to be financed by the GCF

Uganda, a landlocked country in East Africa, is divided into four administrative regions, including the Eastern Region, which comprises 37 districts as of 2020. The region has experienced rapid population growth, increasing from 6.2 million in 2002 to 9 million in 2014. Alongside this demographic shift, Eastern Uganda is facing growing climate challenges. Rising temperatures, erratic rainfall, and more frequent extreme weather events—such as prolonged droughts and severe floods—are disrupting ecosystems and livelihoods. Projections indicate temperatures could rise by 1.1 to 2.5°C by the 2050s, intensifying evapotranspiration, reducing soil moisture, and accelerating land degradation, particularly in semi-arid areas like Teso and Bukedi. Rainfall patterns have also become increasingly unpredictable. While some models project an annual increase of up to 21.8% under RCP8.5, this rainfall is concentrated in extreme downpours, leading to destructive floods rather than consistent water availability. These changes pose serious threats to key sectors, including agriculture, water resources, forestry, and energy, undermining both economic stability and food security.

Agriculture, which employs over 68% of Eastern Uganda's population, is particularly vulnerable. The increasing frequency of dry spells, erratic rains, and extreme weather events has led to declining crop yields and worsening food insecurity. Droughts in Teso and Bukedi have depleted soil moisture, severely impacting staple crops such as maize, millet, sorghum, and cassava. Some areas have seen maize yields decline by up to 42% due to heat stress and soil degradation. Conversely, extreme rainfall in Bugisu, particularly in Bududa and Sironko, has triggered landslides that

bury farmland and displace entire communities. In 2022 alone, floods destroyed over 3,000 hectares of crops, exacerbating food shortages and economic instability. Additionally, rising temperatures have fueled pest and disease outbreaks, including fall armyworm infestations that have devastated maize crops. Climate-induced humidity shifts have also expanded the spread of banana bacterial wilt and cassava mosaic disease, further threatening agricultural productivity. Without urgent interventions, these climatic trends will continue to destabilize the region's food systems, intensifying poverty and malnutrition.

Water resources in Eastern Uganda are under increasing pressure due to rising temperatures, erratic precipitation, and worsening land degradation. Higher temperatures accelerate evapotranspiration, depleting surface water levels, while irregular rainfall patterns lower groundwater recharge rates. These changes have led to declining river flows in the Mpologoma, Manafwa, and Lokok catchments, particularly during prolonged dry spells, reducing water availability for both domestic use and agriculture. In flood-prone areas, increased surface runoff—projected to rise by 37.6% to 51.8%—has caused excessive sedimentation in water bodies, reducing reservoir capacity and degrading water quality. The degradation of wetlands has further exacerbated these challenges. The loss of these ecosystems has made surrounding communities more vulnerable to both water shortages during dry seasons and extreme flooding during heavy rains. Beyond agriculture, the impact of climate variability on water security poses serious public health risks. Flood-induced contamination of drinking water sources has led to recurrent outbreaks of waterborne diseases such as cholera and typhoid, particularly in Mbale, Pallisa, and Butaleja districts. Climate projections indicate that while rainfall variability will increase, it will not improve water security unless adaptive water management systems are implemented.

Forestry ecosystems in Eastern Uganda, particularly in Mount Elgon and the Kyoga Basin, are under severe threat from deforestation, land degradation, and shifting climate conditions. Forest cover has declined drastically, from 24% in 1990 to just 9% in 2017, with ongoing deforestation—driven primarily by agricultural expansion and charcoal production—continuing to diminish the region's carbon sequestration capacity. Rising temperatures and frequent droughts are intensifying moisture stress in forested areas, slowing tree growth and increasing tree mortality rates. In Bugisu and Teso, forest degradation has accelerated soil erosion, reducing land productivity and heightening the risk of floods and landslides, particularly in mountainous districts like Bududa and Sironko. Meanwhile, in lowland areas, the conversion of wetlands and forest margins into farmland has disrupted hydrological cycles, making communities more vulnerable to flash floods, prolonged dry spells, and biodiversity loss. These environmental changes are also threatening forest-based livelihoods. Communities that depend on fuelwood collection, beekeeping, and non-timber forest products are facing declining incomes as forest resources dwindle. Without targeted reforestation efforts and sustainable land management practices, these negative trends will continue, leading to irreversible ecosystem degradation and heightened climate vulnerability.

Compounding these challenges, Eastern Uganda's energy sector is highly vulnerable to climate variability due to its heavy reliance on biomass. Biomass fuels account for 88% of the region's energy consumption, making deforestation both a consequence and a driver of worsening environmental conditions. The rising demand for firewood and charcoal has accelerated forest loss in Teso, Bugisu, and Bukedi, further reducing carbon sequestration capacity and exacerbating soil erosion. Additionally, rising temperatures and prolonged dry spells are increasing energy demands for cooling, irrigation, and food preservation, particularly in urban centers like Mbale and Soroti, straining already limited energy infrastructure. Meanwhile, rural electrification rates remain critically low, with only 28% of households having access to electricity, forcing most communities to rely on unsustainable biomass sources. Without climate-resilient energy solutions and a transition to cleaner, decentralized alternatives, increasing climate extremes will further destabilize energy access, raise costs, and intensify environmental degradation across the region.

In response to these challenges, the Climate Adaptation and Technology Leveraging for Enhanced Resilience in Eastern Uganda (CATLER-Uganda) is designed to operationalize Uganda's Technology Action Plans (TAPs) by scaling up climate adaptation and mitigation technologies across the agriculture, water, forestry, and energy sectors. Uganda's TAPs, developed under the UNFCCC Technology Needs Assessment (TNA) between 2018 and 2021, identify critical climate technologies that can enhance resilience, reduce vulnerability, and drive sustainable development. However, their widespread adoption has been hindered by financial constraints, weak institutional coordination, and limited technical capacity. CATLER-Uganda addresses these barriers by embedding climate technologies into community-driven adaptation strategies, strengthening institutional frameworks for technology uptake, and mobilizing financial resources to improve accessibility and affordability. Through a combination of technical assistance, financial innovation, and knowledge-sharing, the project is structured into three key components that align with Uganda's Technology Action Plans (TAPs) and facilitate the widespread adoption of climate technologies:

- Component 1: Strengthening rural agricultural community resilience to climate risks
- Component 2: Empowering communities through sustainable enterprise development and environmental restoration
- Component 3: Enhancing financial and regulatory frameworks for sustained climate-smart technology adoption.

The project aims to enhance climate resilience, food and water security, landscape restoration, and low-carbon development by promoting the adoption of climate-smart technologies in agriculture, water resources, forestry and energy:

- Agriculture & Water Security: Scaling up climate-smart agriculture and water management will boost productivity and stability, reducing crop losses from droughts, floods, and erratic rainfall. Farmers will gain access to drought-tolerant crops, improved irrigation systems, and sustainable soil management, ensuring higher yields and greater food security.
- Forestry & Ecosystem Restoration: The restoration of degraded landscapes through Farmer-Managed Natural Regeneration (FMNR) and sustainable agroforestry will enhance carbon sequestration, improve ecosystem services, and mitigate soil erosion and flood risks in vulnerable areas like Mount Elgon and wetland catchments. These nature-based solutions will also create alternative livelihoods through forest-based enterprises, promoting economic resilience while conserving biodiversity.
- Energy & Emission Reductions: Expanding access to decentralized solar technologies, such as solar-powered water pumps and off-grid renewable energy, will reduce dependence on biomass, curbing deforestation and improving energy security.

The project is expected to achieve significant GHG emission reductions of 28,575,404 tCO_2-e through avoided deforestation, improved soil carbon retention, and reduced reliance on unsustainable energy sources.

CATLER-Uganda is leveraging GCF financing to overcome systemic barriers to the adoption of climate technologies that are essential for enhancing agricultural resilience, water security, forest restoration, and sustainable energy access. Despite Uganda's strong policy commitments, including its Technology Action Plans (TAPs) and Nationally Determined Contributions (NDCs), the widespread deployment of climate-smart solutions remains severely constrained by high upfront costs, limited access to finance, weak institutional capacity, and market failures that restrict affordability and scalability. GCF grant funding is critical to de-risk investments in climate technologies, unlock private sector participation, and establish scalable financial mechanisms such as community-managed revolving funds that ensure long-term access to climate-smart solutions for smallholder farmers, forest-dependent communities, and off-grid households. The project aligns directly with GCF's mandate to support transformative climate action by catalysing systemic shifts toward low-carbon, climate-resilient development, while delivering measurable climate impact through enhanced food and water security, ecosystem restoration, and reduced dependence on unsustainable biomass energy. Without GCF support, the financial and institutional bottlenecks limiting access to climate technologies will persist, leaving vulnerable communities in Eastern Uganda increasingly exposed to worsening climate shocks, economic losses, and environmental degradation.

B. PROJECT/PROGRAMME DETAILS

B.1. Context and baseline (max. 500 words)

Describe the climate vulnerabilities and impacts, GHG emissions profile, and mitigation and adaptation needs that the prospective intervention is envisaged to address.

B.1.1. Geographic, Climatic, and Environmental Profile of Uganda

The Republic of Uganda is a landlocked nation located in East-Central Africa, between latitudes 1° S and 4° N and longitudes 29.5° E and 35° E, bordered by Kenya to the east, South Sudan to the north, the Democratic Republic of the Congo (DRC) to the west, and Rwanda and Tanzania to the southwest and south, respectively. Positioned within the greater East African region and influenced by the tectonic activities of the East African Rift System and the Intertropical Convergence Zone (ITCZ), Uganda's varied elevations—shaped by rift-related mountain chains—and extensive freshwater systems, notably Lake Victoria, create a unique and complex climatic regime. This equatorial proximity and environmental diversity form the backdrop to Uganda's socioeconomic realities: with an estimated population of approximately 46 million as of the 2024 National Population and Household Census (NPHC) and a population growth rate of 2.9%, the country contends with immense pressure on infrastructure, social services, livelihoods, and natural resources.[5]

Agriculture remains central to its economy, contributing 24.1% to national GDP in 2021/22, 35% to national export earnings, and employing over 68% of the working population.[6,7] In Eastern Uganda, subsistence farming of crops like plantains, cassava, rice, maize, and sorghum dominates livelihoods but is highly sensitive to shifting climatic conditions, as outlined in the country's First Biennial Update Report to the UNFCCC (2019).[8] Uganda's vulnerability is reflected in its ranking of 155 out of 181 countries in the 2018 Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index, underscoring its high climate change susceptibility and low adaptive capacity.[9] Recurring extreme events—prolonged droughts, severe floods, and landslides on weak slopes—have increasingly undermined agricultural productivity and food security, while intense rainfall has accelerated soil erosion on the slopes of Mt. Elgon, diminishing land productivity and exacerbating rural poverty. Furthermore, rapid urbanization at a rate of 5.2% has intensified challenges in urban infrastructure and housing, particularly in unplanned settlements such as those in Mbale, where inadequate access to essential services strains both human well-being and sustainable development (UNDP, 2022).[10]

B.1.1.1. Physical Environment

Uganda's diverse topography intricately shape its climatic patterns and ecological systems. The country's landscape is predominantly a plateau, averaging about 1,100 meters above sea level, gently descending from approximately 1,500 meters in the south to 900 meters in the north. This elevation gradient influences temperature and precipitation, with higher altitudes experiencing cooler temperatures and increased rainfall, thereby fostering varied microclimates and rich biodiversity. Prominent mountain ranges further define Uganda's terrain. The Rwenzori Mountains, also known as "Mountains of the Moon" and located along the western border, feature Margherita Peak, which rises to 5,109 meters, making it Uganda's highest point. These mountains, often shrouded in clouds and capped with glaciers, create unique microclimates that support diverse flora and fauna. In the east, Mount Elgon, an extinct volcano straddling the Uganda-Kenya border, reaches an elevation of 4,321 meters. Its expansive caldera and fertile slopes are vital for agriculture and harbour diverse ecosystems, influencing local climate patterns by attracting higher rainfall.

Uganda's soils arise from a dynamic interplay of geological parent material, topography, climate, and land use practices, producing a complex mosaic of fertility levels and agricultural potential. Highland areas, especially on the slopes of Mount Elgon, are dominated by rich volcanic Andosols, which benefit from high organic matter content, enhanced moisture retention, and moderate temperatures conducive to profitable perennial crops such as coffee and bananas according to Uganda's TNC of 2020.[11] In these elevated zones, soils are generally less acidic and more nutrient-rich compared to the highly weathered and often nutrient-depleted Ferralsols and Acrisols that prevail in lower elevations. However, steep gradients around Elgon increase the risk of accelerated erosion, particularly when vegetation cover is reduced, undermining soil structure and long-term productivity. Unplanned agricultural expansion, limited use of soil

[5] https://www.ubos.org/nphc-2024-census-page/
[6] Press Release: Revised Annual GDP, UBOS, 2022
[7] Uganda Country Commercial Guide, International Trade Administration (ITA), Agricultural Sector, 2023
[8] First Biennial Update Report to the UNFCCC, Ministry of Water and Environment (MWE), 2019
[9] Ogenrwoth et al., The impact of climate change on food security in Uganda: A panel regression analysis, Research Gate, 2023
[10] https://www.undp.org/sites/g/files/zskgke326/files/2023-01/Socio%20Economic%20Update%20of%20Uganda-First%20Edision%20Oct%202022.pdf
[11] https://unfccc.int/sites/default/files/resource/Final%20TNC%20Uganda.pdf

amendments, and inadequate soil management strategies have led to declining organic matter levels, reduced cation exchange capacity, and a persistent nutrient deficit, thereby intensifying vulnerability to climatic shocks.[12]

Uganda's hydrological features are equally significant. The country is endowed with substantial water resources, including major lakes such as Lake Victoria, Lake Kyoga, and Lake Albert, as well as extensive river systems like the Victoria Nile. Lake Victoria, the world's second-largest freshwater lake by surface area, dominates the southern region. Its vast expanse influences local weather patterns by moderating temperatures and enhancing humidity, which in turn affects precipitation in surrounding areas. The Victoria Nile originates from Lake Victoria, traversing northward through Lake Kyoga and Lake Albert before continuing as the Albert Nile into South Sudan. This river system not only facilitates water flow across various regions but also contributes to the formation of wetlands and supports agriculture through irrigation.[13]

The Directorate of Water Resources Management within the Ministry of Water and Environment (MWE) of Uganda has categorized the surface water resources into eight main drainage sub-basins: Lake Victoria, Lake Kyoga, River Kafu, Lake Edward, Lake Albert, River Aswa, Albert Nile, and Kidepo Valley. Consequently, there are four Water Management Zones (WMZs), the Upper Nile manages the Albert Nile, Achwa, and Kidepo Basins. The Kyoga (KWMZ) manages the Victoria Nile and Lake Kyoga Basins. The Lake Albert (AWMZ) manages the Lake Edward and Lake Albert Basins. To enhance sustainable water management at the sub-national level, Catchment Management Organizations (CMOs) were established to oversee water resources at the sub-basin level. CMOs operate through a stakeholder forum, management committee, secretariat, technical committee, and sub-catchment/micro-catchment committees, ensuring local stakeholder engagement and effective implementation of catchment management plans.[14]

B.1.1.2. Forests, Ecosystems, Biodiversity, and Land Use

The country's diverse landscapes encompass tropical rainforests, savannas, wetlands, and montane ecosystems, each shaped by the East African Rift System, equatorial proximity, and extensive freshwater bodies such as Lake Victoria (Figure 1). These ecological zones support significant biodiversity, including approximately 18,783 recorded species of fauna and flora, and host globally important populations like over half of the world's remaining mountain gorillas in Bwindi Impenetrable National Park, as well as about 1,061 bird species—representing 53.9% of all African bird species.[15] Ranking 12th worldwide in mammalian diversity, Uganda harbours at least 345 mammal species, underlining its global conservation importance. The integrity of these ecosystems is closely linked to climate regimes and land use patterns, with forests, wetlands, and protected areas ensuring carbon sequestration, water regulation, and genetic resources crucial for climate resilience.

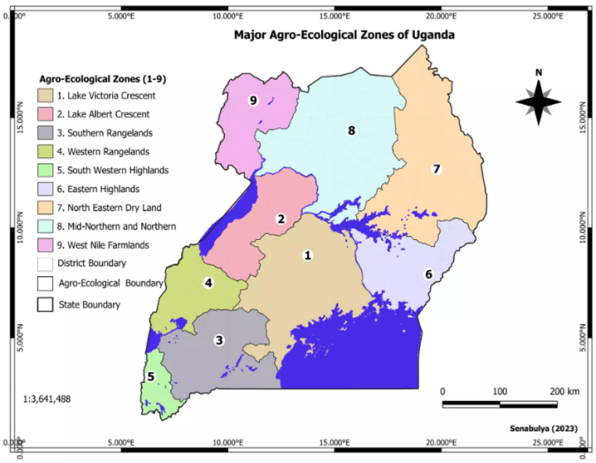

Figure 1: Agro-ecological zones (AEZ) of Uganda (Senabulya Steven, 2023)

Despite this wealth of natural capital, Uganda's land cover has experienced substantial losses in recent decades. Forest cover declined from 24% of total land area in 1990 to about 9% (1.83 million hectares) by 2017, largely due to agricultural expansion, wood fuel extraction, and population pressures.[16] Wetland coverage fell from 15.6% in 1994 to 8.9% by 2017, resulting in diminished carbon storage, disrupted hydrological cycles, and lower soil fertility.[17] Agriculture while essential for livelihoods and economic growth, occupies over 70% of the country's area and often expands at the expense of natural habitats and ecosystem integrity according to the country's TNC. This land-use change fragments critical habitats, intensifies soil erosion, and undermines the resilience needed to cope with the climate variability described in the TNC, including rainfall shifts and temperature increases.

Within this context of shrinking forest cover and disappearing wetlands, efforts to safeguard biodiversity increasingly depend on integrated land-use planning and sustainable management practices, as emphasized in the National Land Use Policy and ongoing conservation initiatives. Strengthened protection and restoration of degraded habitats,

[12] https://www.fao.org/fileadmin/user_upload/GSP/SSM/SSCAF/4-Status-of-soils-in-Uganda.pdf
[13] https://www.scirp.org/journal/paperinformation?paperid=50896&utm
[14] https://winrock.org/wp-content/uploads/2021/08/Uganda_Country_Profile_Final.pdf
[15] https://www.cbd.int/doc/c/380d/3794/b2be7b1fb51bf8682379eefd/fbws-2017-01-presentation-day2-uganda-en.pdf
[16] https://nfa.go.ug/images/NFA_STRATEGIC_PLAN_2020_25.pdf
[17] https://www.ubos.org/wp-content/uploads/publications/12_2020Ecosystem_Accounts_for_Uganda_Report_NEW_new.pdf

improved governance in protected areas, and the adoption of resilient agro-ecological systems can enhance water resource reliability and bolster genetic diversity, ensuring that both rural and urban communities can better adapt to climate extremes. Balancing economic development with ecosystem stewardship is thus central to maintaining the country's extraordinary biodiversity and securing its future adaptive capacity.

B.1.2. Climate Conditions and Seasonal Trends

Uganda's climate is predominantly tropical, but its equatorial position, diverse topography, and large water bodies create significant regional and seasonal variations. According to the updated Köppen-Geiger classifications, the south and central regions feature tropical rainforest (Af) and monsoon (Am) climates, while the north and northeast exhibit tropical savannah (Aw) conditions. Elevation significantly influences climate—highland areas like Mount Elgon in the east and the Rwenzori Mountains in the west are cooler and receive more rainfall than the warmer low-lying basins and plateaus. Seasonal patterns are driven by the ITCZ's latitudinal movement and regional monsoonal circulation, which transport moisture into East Africa. These large-scale atmospheric dynamics, combined with Lake Victoria, wetlands, and mountain ranges, shape localized climate variations, making Uganda's climate highly sensitive to global and regional climatic shifts.

B.1.2.1. Current Temperature Distribution and Trends

Nationwide temperature conditions are shaped by its equatorial position, the influence of elevation, and the presence of large water bodies. Over much of the country, mean annual temperatures traditionally fell between approximately 20°C and 25°C, with slightly cooler conditions in higher-altitude regions, such as those surrounding Mount Elgon, and warmer conditions in the lower-lying plains.[18] These geographic and topographic contrasts have historically supported a range of agricultural activities and ecological niches, as cooler highland zones enabled the cultivation of temperature-sensitive crops, while warmer lowlands facilitated a broader variety of subsistence and commercial farming. However, since the mid-20th century, Uganda has experienced a clear and consistent warming trend. Between 1960 and 2010, mean annual temperature rose by around 1.3°C, a significant increase that has been recorded across multiple regions and seasons.[19] This rise has manifested in more frequent hot days and fewer cool intervals, contributing to shifts in local climate patterns and making certain agricultural tasks more challenging (Figure 2).

The Mount Elgon area, once valued for its comparatively moderated climate, now reports higher temperatures that have begun to disrupt traditional growing seasons for key crops. These observed changes are supported both by meteorological data and local perceptions. Farmers, extension officials, and community leaders have consistently noted that warmer conditions are making it more difficult to predict planting and harvesting periods, in turn influencing the availability and stability of food sources.[20] The alignment of measured temperature increases, and firsthand accounts underscores the real and tangible impact of these trends. Although the full implications of this warming for Uganda's long-term development remain under study, rising temperatures have already begun to challenge historical adaptation practices and highlight the need for informed climate resilience strategies.

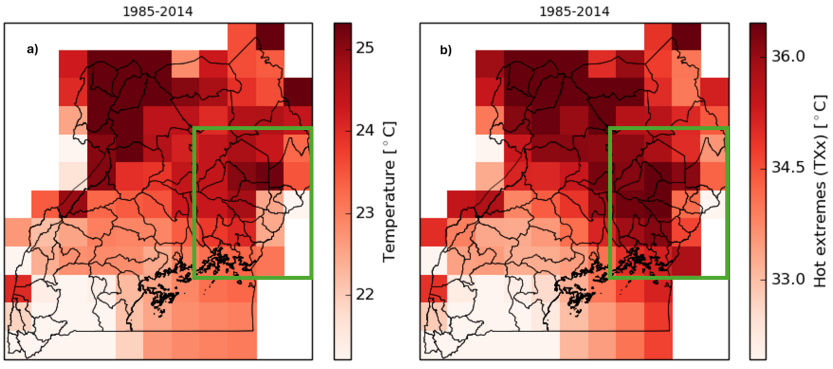

Figure 2: Annual Average Temperature and Hot Extremes (1985-2014) Based on the EWEMBI Dataset

Figure 2 presents the **annual average temperature (a)** and **hot extremes (TXx) (b)** for Uganda over the baseline period **1985-2014**, based on the **EWEMBI dataset**. Figure 2.a shows that **higher annual temperatures** are concentrated in **northern and northeastern Uganda**, where values exceed **25°C**, while **cooler areas** (below 23°C) are observed in the **southwest and central highlands**. Figure **2.b)** highlights **hot temperature extremes (TXx)**, with

[18] Uganda Climate Risk Profile, World Bank Climate Knowledge Portal, 2021
[19] Climate Risk Profile: Uganda, GIZ Climate and Development, 2023
[20] https://www.iied.org/sites/default/files/pdfs/2023-11/22091g.pdf

the highest daily maximum temperatures exceeding **36°C** in the **northern and northeastern regions**. The **green box** focuses on **Eastern Uganda**, where temperatures are relatively high, particularly in lowland areas. This region is likely to experience **increased heat stress**, affecting **agriculture and water availability**. The data suggests that except **northern Uganda, the Eastern Uganda** is also exposed to extreme heat events, which could exacerbate **drought conditions and climate vulnerabilities** in this regions.

B.1.2.2. Current Precipitation Variability and Trends

Uganda's rainfall regime is shaped by the seasonal migration of the Intertropical Convergence Zone, variations in elevation, and the moisture-bearing influences of large inland water bodies. Across most of the country, rainfall commonly exhibits a bimodal pattern, with primary peaks typically occurring from March to May (MAM) and secondary peaks from September to November (SON), especially in the central, western, and southern regions.[21] Annual precipitation generally ranges between approximately 700 mm in the northeastern semi-arid landscapes and over 2,000 mm in the highland and southwestern areas, reflecting the pronounced spatial variability that arises from Uganda's complex topography and heterogeneous microclimates. In parts of the north and northeast, the rainfall pattern is more unimodal, with a single main wet season often commencing around April and concluding by October, creating a distinct seasonal cycle that differs markedly from the bimodal regimes elsewhere. These established rainfall distributions have long supported a wide range of rainfed agricultural practices, horticultural systems, and pastoralist livelihoods, yet they are now increasingly subject to evolving climatic pressures.

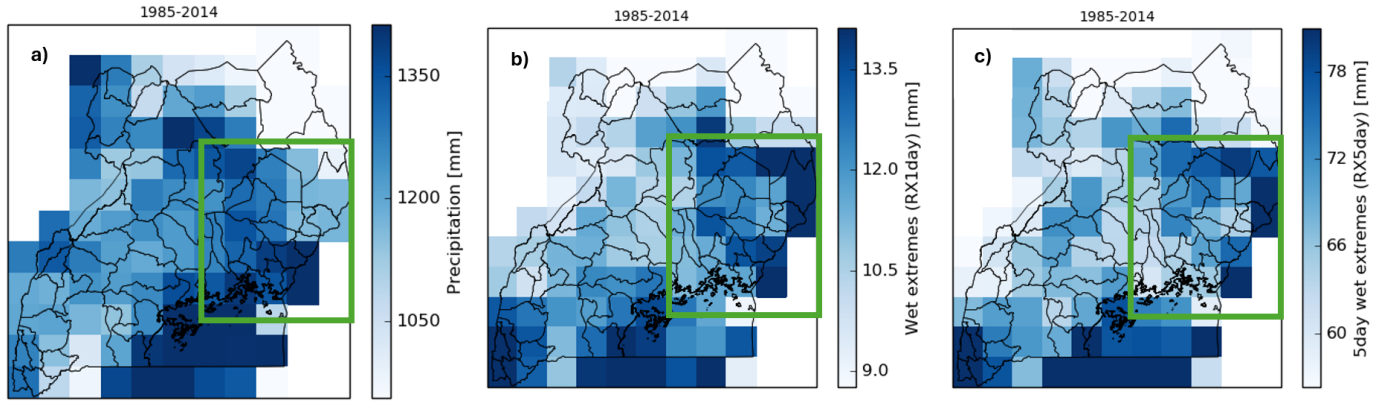

Figure 3: Mean annual precipitation (1985-2014) (a), 1-day wet extreme (RX1day) average (1985-2014) and 5-day wet extreme (RX5day) average (1985-2014) (c). This map is based on the EWEMBI dataset.

Figure 3 presents an analysis of precipitation and wet extremes in Uganda for the reference period 1985-2014. It shows the mean annual precipitation, with higher rainfall observed in the southwestern, central, and eastern regions, particularly around Mount Elgon and Lake Victoria (Figure 3 a). Figure 3.b illustrates the 1-day wet extreme (RX1day) average, highlighting areas with the highest single-day rainfall events. Eastern Uganda, especially the Mount Elgon region, experiences notable extreme rainfall. Figure 3.c displays the 5-day wet extreme (RX5day) average, indicating the cumulative effect of heavy rainfall over five consecutive days. Again, eastern and southwestern Uganda show high values, suggesting susceptibility to prolonged heavy rainfall. The green box emphasizes a specific region, likely Eastern Uganda, which appears to experience both high precipitation and extreme wet events, increasing the risk of flooding, landslides, and soil erosion.

B.1.1.4 Climate Projections

Projected future temperature conditions vary notably depending on different emission pathways and their associated radiative forcing levels. Under RCP8.5, mean annual temperature is projected to increase by 2.0–2.3 °C by the 2050s relative to the baseline period of 1971–2000. In scenarios evaluated under both RCP4.5 and RCP8.5, mean annual temperatures are anticipated to rise by approximately 1.1 to 2.5 °C by the same mid-century timeframe. Such consistent increases in temperature across all modelled futures reinforce the understanding that higher emissions lead to greater

[21] https://www.mdpi.com/2071-1050/16/14/6081#:~:text=Uganda%20experiences%20two%20distinct%20rainfall,September%20to%20November%20(SON).

warming. Under higher emission scenarios, these increments may be substantial enough to increase the frequency of hot days, with conditions potentially exceeding critical physiological and agronomic thresholds more regularly.[22]

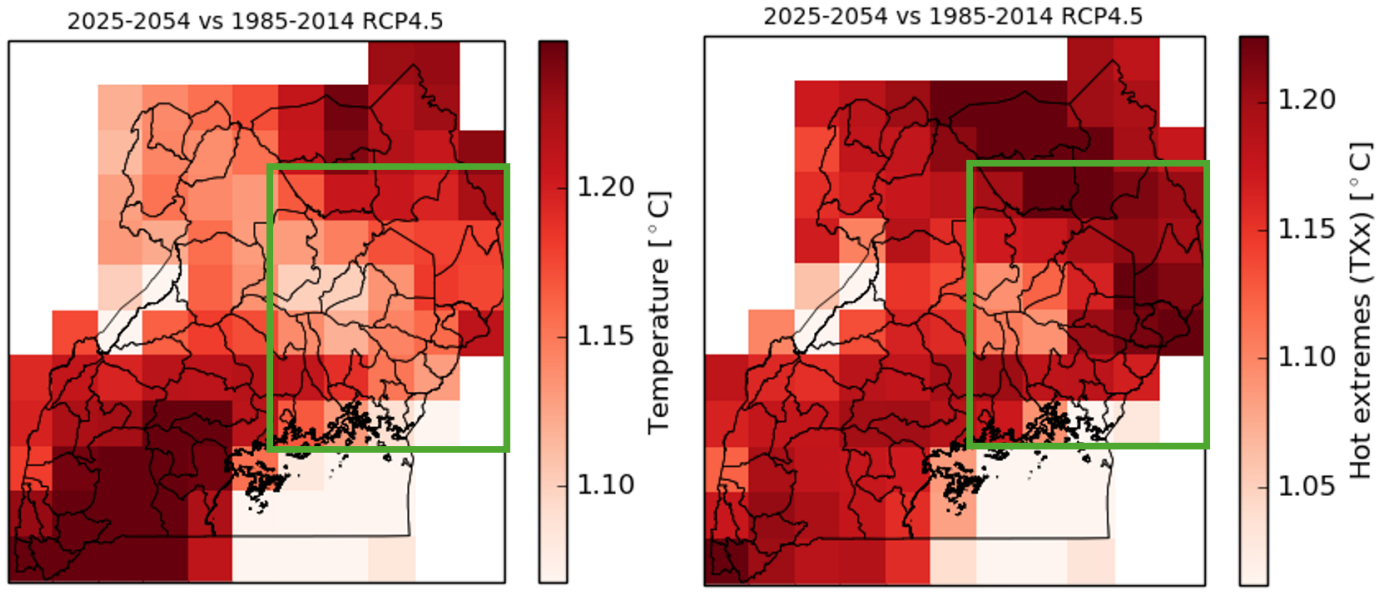

Figure 4:Projected Temperature and Hot Extreme Changes (2025-2054 vs. 1985-2014) under RCP4.5. Data represents the ensemble mean of regional climate model projections, with gray areas indicating model disagreement.

Figure 4 illustrates the projected temperature increases for 2025-2054 compared to the 1985-2014 baseline under the RCP4.5 emissions scenario. The left map shows changes in mean annual temperature, indicating a general warming of 1.1 to 1.2°C across Uganda, with the highest increases observed in northern and eastern regions. The Mount Elgon area and northeastern districts are expected to experience significant warming, potentially exacerbating heat stress and drought conditions. The right panel presents changes in hot temperature extremes (TXx), showing that extreme heat events will become more intense and frequent, particularly in northern and eastern Uganda, where TXx may increase by more than 1.2°C. These trends could lead to prolonged heat waves, negatively impacting agriculture, water availability, and human health. The projections emphasize the urgent need for heat adaptation strategies, particularly in Eastern Uganda, where warming trends are most severe.

These scenario-based projections indicate that while all futures point toward a warmer Uganda, the magnitude and pace of this change depend on the extent to which global mitigation efforts succeed. In lower-emission pathways, incremental warming may remain within a manageable range, still challenging but not wholly overwhelming existing coping strategies. In higher-emission futures, however, substantially increased temperatures would intensify heat stress on crops, livestock, and natural systems, ultimately complicating the livelihoods and food security of rural and urban communities alike. The range of projected outcomes thus underscores the pivotal role that current and future decisions on emissions and adaptation measures will play in shaping Uganda's long-term climate resilience.

National and Sub-regional future rainfall dynamics are projected to reflect not only shifts in total amounts but also marked changes in seasonality, intensity, and distribution. Under high-emission scenarios such as RCP8.5, scenario analyses indicate a "potential increase in mean annual rainfall of 4.3% by the 2050s relative to the baseline (1971–2000)" (GIZ, 2021). These increments are neither uniform nor evenly spread throughout the year. For instance, it is noted that "increases in rainfall are likely to be concentrated during the wettest months", complicating efforts to manage water resources effectively. Concurrently, "the frequency of extreme rainfall events, defined as precipitation exceeding 50 mm per day, is projected to increase under high-emission scenarios" according to the IIED Climate Risk Assessment Report for Uganda, a development that may heighten flood risk, soil erosion, and infrastructure vulnerability. Such trends align with findings that describe intensified rainfall variability and heavier precipitation episodes in key rainy

[22] https://climateknowledgeportal.worldbank.org/sites/default/files/2021-05/15464-WB_Uganda%20Country%20Profile-WEB%20%281%29.pdf

seasons (Okirya & Plessis, 2024), further challenging the reliability of long-established agricultural cycles and land-use practices.[23]

Figure 5 presents projected changes in annual precipitation (left) and 5-day wet extremes (RX5day) (right) for 2025-2054 relative to 1985-2014 under the RCP4.5 scenario. The left panel shows an overall increase in annual precipitation, particularly in eastern and northern Uganda, with some areas exceeding 100 mm of additional rainfall. The right panel highlights a rise in extreme 5-day rainfall events, especially in eastern Uganda, suggesting a higher risk of flooding and waterlogging. Gray areas indicate model disagreement, highlighting uncertainties in specific regions. These trends underscore the need for enhanced flood management and climate adaptation strategies in vulnerable areas.

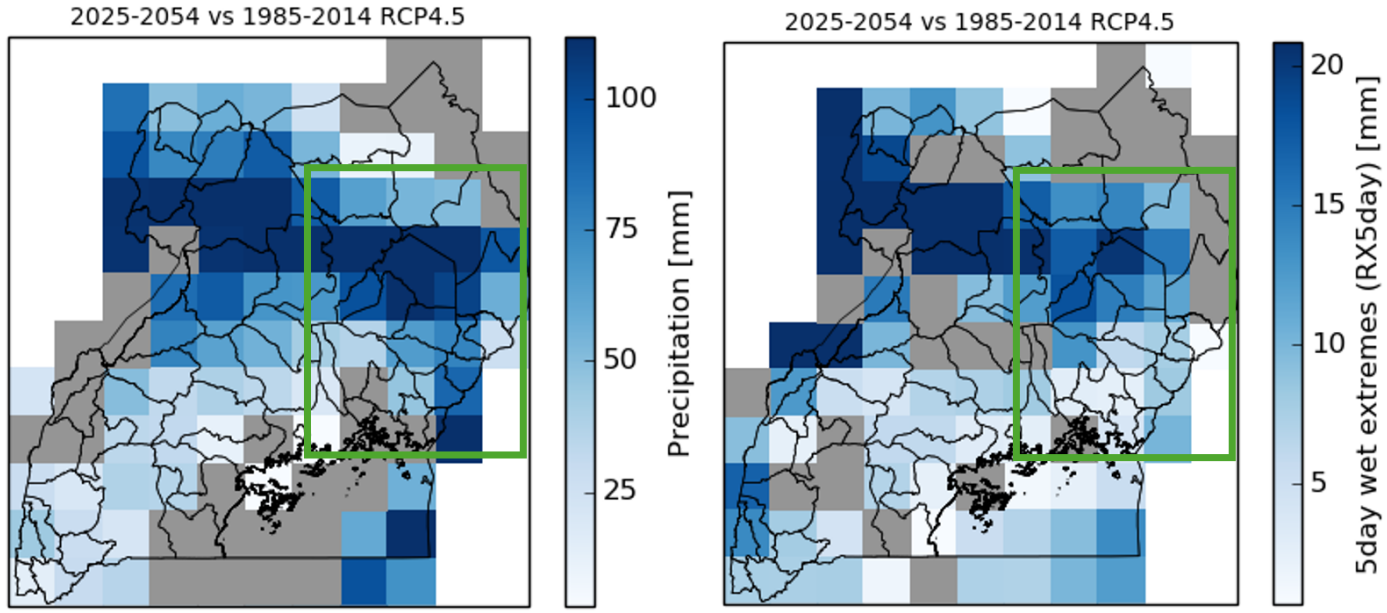

Figure 5: Projected Annual precipitation and 5day wet extremes (RX5day) changes (2025-2054 vs. 1985-2014) under RCP4.5. Data represents the ensemble mean of regional climate model projections, with gray areas indicating model disagreement.

This evolving rainfall regime may result in uneven spatial and temporal patterns of precipitation, with delays in the onset of principal rainy seasons and a heightened likelihood of extreme weather events disrupting critical planting and harvesting periods. The documented shifts suggest a complex interplay between periodic dry spells and sudden, heavy downpours, potentially undermining water availability, soil moisture retention, and overall agricultural productivity. As Uganda's agricultural base is predominantly rain-fed, the combined effect of more intense rainfall bursts, higher seasonal variability, and increased instances of extreme precipitation underscores the urgency of adaptive measures.

[23] https://www.mdpi.com/2071-1050/16/14/6081#:~:text=Uganda%20experiences%20two%20distinct%20rainfall,September%20to%20November%20(SON).

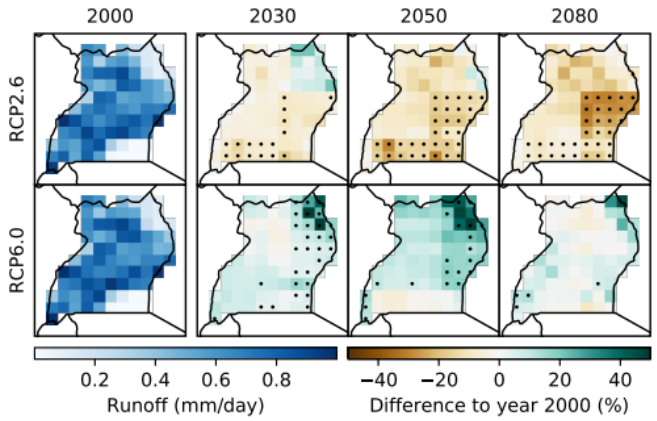

Figure 6a: Water Availability from Precipitation (runoff) projections for Uganda under different emission scenarios. Source: GIZ Uganda Climate Risk Profile 2021

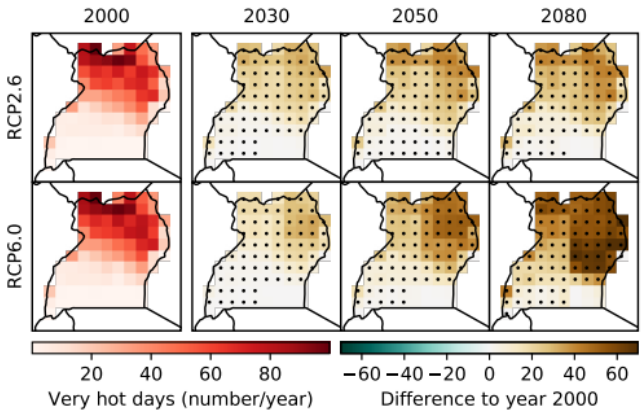

Figure 6b: Projections of annual number of very hot days (above 35°C) for Uganda under different emission scenarios. source: GIZ Uganda Climate Risk Profile 2021

B.1.3. Sectoral Impacts of Climate Change in Eastern Uganda

B.1.3.1. Agri-Food Systems and Food Security

Climate change has significantly disrupted Uganda's agrifood systems, with rising temperatures, erratic rainfall, prolonged droughts, and extreme weather events compounding existing agricultural vulnerabilities. These climatic changes have had direct and cascading effects on agricultural productivity, food supply chains, and food security, particularly in Teso and Bugisu sub-regions, where smallholder farmers rely heavily on rain-fed agriculture for both subsistence and income generation. The increase in average temperatures has intensified evaporation rates, reducing soil moisture availability and limiting the water retention capacity of farmlands, particularly for maize, millet, sorghum, and coffee, which require stable soil conditions for optimal growth (Mulinde et al., 2016).[24] As temperatures rise, crops are forced into shorter growing seasons, which affects their development and leads to lower yields. For example, maize production in semi-arid regions has declined by up to 42% due to heat stress and moisture loss, leaving farmers unable to meet household food demands or generate sufficient marketable surplus (Ogenworth, 2023).[25] Additionally, heat stress has negatively impacted livestock productivity, reducing milk yields in cattle and increasing mortality rates due to water scarcity and pasture degradation, further limiting food availability and economic stability in pastoralist communities.

Erratic rainfall patterns have further destabilized agricultural systems, creating unpredictable planting and harvesting seasons that have left many farmers unable to plan effectively for production. In some areas, rainfall deficits during the planting season have delayed or stunted crop growth, while excessive rainfall during harvest periods has increased post-harvest losses due to waterlogging and fungal infections in stored produce. In Teso, farmers have struggled with extended dry spells that severely affect staple crops, forcing many to abandon traditional farming methods and adopt drought-tolerant varieties, often without adequate training or institutional support (Mulinde et al., 2016). Conversely, Bugisu's farmers have suffered intensified rainfall and increased frequency of landslides, particularly in districts such as Bududa and Sironko, where fragile soils have become highly susceptible to erosion and destruction. The 2022 floods alone destroyed over 3,000 hectares of farmland, displacing thousands of farming households and cutting off market access for many smallholder producers, leading to severe disruptions in the availability of staple crops and cash crops such as coffee and bananas. The destruction of rural roads, bridges, and food storage facilities in these events has further destabilized food supply chains, making it difficult for farmers to transport their produce, resulting in significant economic losses and increased food prices (Ogenworth, 2023).

The increasing frequency of droughts and floods has not only reduced agricultural yields but has also encouraged the spread of pests and diseases, further jeopardizing food security. The fall armyworm outbreak, which has thrived under

[24] https://repository.ruforum.org/sites/default/files/Mulinde%20et%20al%202016_METEOROLOGICAL-DROUGHT-OCCURRENCE-AND-SEVERITY-IN-UGANDA.pdf
[25] https://rochade-project.org/en/news-and-events/de/Assets/documents/2023-06_impact-of-climate-change-on-food-security-in-uganda.pdf

rising temperatures and shifting rainfall patterns, has devastated maize fields across Teso, Bukedi, and Busoga, worsening food shortages and forcing farmers to spend more on pesticides and other costly inputs. Similar trends have been observed with banana bacterial wilt and cassava mosaic disease, both of which have expanded into new regions due to climate-induced changes in humidity and temperature, increasing losses among smallholder farmers who depend on these crops for both subsistence and income (Mulinde et al., 2016). With agricultural losses mounting, many households are being pushed deeper into poverty and food insecurity, as reduced farm incomes and higher production costs prevent them from affording adequate food supplies. The inability to access climate-resilient seed varieties, sustainable water management technologies, and reliable market systems has worsened these vulnerabilities, leaving smallholder farmers at the mercy of climate variability and market shocks.

The widespread impact of climate change on Uganda's agrifood sector extends beyond production losses to national food security, value chains, and economic resilience. As climate-induced disruptions increase post-harvest losses and reduce domestic food production, Uganda has become increasingly reliant on food imports, further exposing the country to global market fluctuations and external price shocks. Limited access to efficient storage facilities and transport infrastructure has constrained the ability of farmers to engage in commercial agriculture, reducing their participation in both local and international markets. Additionally, the loss of productive farmland due to soil degradation, flooding, and shifting agro-ecological zones has forced some communities to migrate in search of more stable agricultural conditions, creating rural displacement and increasing pressure on already strained food systems. The combination of lower agricultural yields, weakened value chains, and rising food prices has exacerbated food insecurity at both household and national levels, making it increasingly difficult for vulnerable populations to access adequate nutrition and economic stability.

B.1.3.2. Water Resources and Wetlands

Climate change has had profound and far-reaching effects on water resources, water systems, and overall water security in Eastern Uganda, with critical impacts observed in key catchment areas such as the Mpologoma Catchment, the Manafwa Catchment, as well as the Lokok and Lokere Catchments. These impacts arise from increasing temperatures, erratic rainfall patterns, and extensive land use changes, all of which disrupt hydrological cycles, reduce water availability, degrade water quality, and intensify extreme weather events. Rising temperatures have accelerated evapotranspiration rates, leading to increased surface water loss and soil moisture depletion, while changes in rainfall patterns have resulted in unpredictable wet and dry spells that reduce the reliability of water sources for agriculture, domestic use, and industrial activities. Climate models suggest that precipitation in the region will increase by 7.4% under RCP4.5 and by 21.8% under RCP8.5 scenarios, leading to more severe flood risks in the wet season while exacerbating water shortages during prolonged dry periods (Gabiri et al., 2020).[26] Furthermore, surface runoff is projected to increase between 37.6% and 51.8%, which will likely trigger higher sedimentation, erosion, and nutrient loading in water bodies, diminishing both water quality and retention capacity while elevating flood risks for low-lying areas such as Mpologoma and Lwakhakha sub-catchments.

One of the most significant factors amplifying climate change impacts on water security is land use change, particularly wetland encroachment, deforestation, and agricultural expansion, which have severely altered natural hydrological processes in Eastern Uganda (Omuna et al., 2024).[27] The Mpologoma Catchment, a critical component of the Kyoga Basin, has seen extensive wetland degradation due to drainage for rice farming, urban expansion, and uncontrolled land conversion. This degradation reduces the natural water retention capacity of the wetlands, leading to increased flood intensity, loss of groundwater recharge zones, and heightened exposure to seasonal water stress. Wetlands serve as natural filtration and flood mitigation systems, but their destruction has resulted in higher surface runoff, increased sedimentation in rivers, and diminished water quality for both households and agricultural users. The rapid deforestation of watershed areas surrounding major river systems, including the Namatala and Lwakhakha Rivers, has exacerbated soil erosion, increased siltation, and reduced the capacity of rivers to retain consistent water levels, particularly during the dry season. Omuna's study on the impacts of climate change on water security in Uganda has found that increased deforestation in upstream areas leads to faster water flow into river systems, creating flash floods that erode riverbanks, destroy infrastructure, and cause long-term damage to agricultural fields (Omuna et al., 2024).

The implications of water resource degradation and variability extend directly to agriculture, livestock, and food security. Prolonged dry spells in Teso and other semi-arid zones have made it increasingly difficult for farmers to rely on

[26] https://www.mdpi.com/2225-1154/8/7/83
[27] https://ijarm.com/pdfcopy/2024/sep2024/ijarm5.pdf

traditional rain-fed agriculture, leading to reduced maize, millet, and rice yields while also diminishing grazing land for livestock. Water shortages have forced many smallholder farmers to abandon their usual planting cycles, delaying crop production and increasing dependence on emergency food assistance. Furthermore, the increasing unpredictability of seasonal rainfall and prolonged dry periods has led to high crop failure rates, particularly among farmers lacking access to irrigation infrastructure (Turyasingura et al., 2022).[28] Meanwhile, in areas such as Bugisu, Mbale, and Bududa, where extreme rainfall events have become more common, heavy storms have caused frequent flooding and landslides, wiping out entire fields of high-value cash crops like coffee and bananas, damaging road networks that link farmers to markets, and submerging storage facilities, resulting in large-scale post-harvest losses. This cyclic pattern of drought-induced crop failures in Teso and flood-induced agricultural losses in Bugisu reflects the dual nature of climate change impacts on water security, where too little water limits production, while too much leads to destruction (Turyasingura et al., 2022).

Beyond its impact on agricultural systems, climate-induced changes in water availability and quality are also compromising public health and exacerbating socio-economic inequalities. Flood-related contamination has become a major concern in peri-urban and rural settlements, where households rely heavily on surface water sources that are increasingly polluted with runoff from agricultural chemicals, human waste, and industrial effluents (Omuna et al., 2024). The increased frequency and severity of floods have contributed to the spread of waterborne diseases such as cholera, dysentery, and typhoid, particularly in low-lying flood-prone areas such as Mbale and the Doho rice scheme. Similarly, prolonged dry spells have intensified water scarcity, forcing pastoralist communities and small-scale farmers to travel longer distances to access drinking water, often increasing the burden on women and children, who are traditionally responsible for water collection. Moreover, increased competition for dwindling water resources has heightened conflicts between farmers, pastoralists, and local industries, particularly in areas experiencing intense seasonal water shortages, such as the Mpologoma Basin and the Teso Cattle Corridor (Turyasingura et al., 2022).

The projected continuation of climate-induced changes in Eastern Uganda's hydrological systems underscores the urgent need for adaptive water management strategies that integrate sustainable wetland conservation, climate-resilient agricultural practices, and enhanced community-based governance of water resources. Investments in rainwater harvesting technologies, small-scale irrigation systems, and ecosystem-based water retention solutions are critical to reducing dependency on erratic rainfall and ensuring year-round water availability for domestic, agricultural, and industrial use. Additionally, the adoption of integrated catchment management approaches, focusing on reforestation, sustainable land use planning, and wetland restoration, will be crucial in stabilizing hydrological systems and reducing the risks of both extreme droughts and devastating floods. Without such targeted interventions, water security in Eastern Uganda will continue to deteriorate, deepening food insecurity, increasing economic losses, and exacerbating vulnerabilities in already at-risk communities.

B.1.3.3. Forest Landscapes, Resources, Forest-Dependent Communities

Agricultural expansion, driven by climate-induced declines in crop productivity and shifting agro-ecological zones, has emerged as one of the most significant drivers of deforestation in Uganda, particularly in Eastern Uganda's forested landscapes such as Mount Elgon and the Kyoga basin. As prolonged droughts, erratic rainfall, and declining soil fertility render traditional farmlands less productive, smallholder farmers and commercial agricultural ventures are increasingly clearing forests and wetlands in search of more fertile land for cultivation (Okurut, 2020).[29] This pattern of land-use change is exacerbated by population growth, weak land governance, and rising food demand, all of which contribute to the rapid conversion of forested land into agricultural plots. The expansion of maize, millet, sorghum, and rice cultivation in response to changing climatic conditions has led to the encroachment of farmland into protected areas, particularly in fragile upland regions of Mount Elgon and low-lying wetlands of the Mpologoma Catchment (Tukwatanise, 2023).[30] The consequences of this agriculture-driven deforestation are profound, as they threaten not only the integrity of Uganda's forests and biodiversity but also water security, soil stability, and climate resilience across the region.

The transformation of forested areas into farmland has significantly altered Uganda's landscapes, leading to widespread land degradation, loss of ecosystem services, and increased vulnerability to extreme weather events. Forests play a critical role in stabilizing slopes, retaining soil moisture, and regulating water flow, yet deforestation in Mount Elgon's steep terrains has dramatically increased soil erosion, sedimentation, and landslide risks (Okurut, 2020).

[28] https://www.nilebasin-journal.com/pdf_ReadDownload.php?type=read&file=Paper-1-Effect-of-Climate-Change-in-Uganda-20240312.pdf
[29] https://rsisinternational.org/journals/ijrias/DigitalLibrary/Vol.5&Issue12/130-135.pdf
[30] https://illuminem.com/illuminemvoices/deforestation-in-uganda-causes-and-recommendations

The devastating Bududa landslide of 2018, which resulted in multiple fatalities and large-scale destruction, is a clear example of how forest loss weakens slope stability, making hillsides more susceptible to collapse during intense rainfall (Tukwatanise, 2023). This pattern is not isolated—other districts in the Bugisu sub-region, including Sironko and Bulambuli, have also experienced increasing landslides, exacerbated by the clearing of protective forest cover for agriculture. In lowland areas such as the Kyoga basin and the Mpologoma Catchment, wetland conversion for rice farming has further disrupted hydrological cycles, reducing the landscape's ability to absorb floodwaters, maintain groundwater recharge, and regulate seasonal water flows. As a result, flooding events have become more frequent and severe, overwhelming farmlands, displacing communities, and destroying rural infrastructure critical for agricultural supply chains.

Beyond its impact on landscapes, deforestation driven by agricultural expansion has significantly reduced Uganda's forest cover, weakening the carbon sequestration potential of these ecosystems and accelerating regional climate changes. Forests act as carbon sinks, absorbing atmospheric CO_2 emissions, yet rapid deforestation in Eastern Uganda has reversed this role, making these regions net carbon emitters instead of carbon absorbers (Okurut, 2020). The loss of tree cover has also increased surface temperatures and altered local rainfall patterns, further reinforcing climatic extremes that already threaten agricultural productivity. The conversion of forests into cropland has been particularly damaging in areas with highly erodible soils, such as Mount Elgon's slopes, where rapid runoff and soil loss reduce the land's agricultural potential over time, leading to a cycle of declining productivity, further land clearing, and deeper environmental degradation. In many cases, cleared land is quickly exhausted due to poor soil management, prompting farmers to abandon degraded fields and encroach further into remaining forest areas, perpetuating the expansion-deforestation cycle.

Another major consequence of agriculture-driven deforestation is its impact on forest-dependent communities, particularly those in the Mount Elgon region, where local populations rely on forests for fuelwood, medicinal plants, and food supplements. The depletion of these resources has worsened rural poverty, food insecurity, and resource conflicts, as communities are forced to compete for diminishing natural assets (Okurut, 2020). The widespread reliance on firewood and charcoal as primary energy sources has further intensified deforestation, with over 90% of Ugandan households dependent on biomass for cooking and heating, placing unsustainable pressure on remaining forest reserves (Uganda Forest Landscape Restoration Opportunity Assessment Report, 2016).[31] In Eastern Uganda, the increasing demand for fuelwood has driven illegal logging and forest clearing, compounding the environmental crisis by reducing tree cover faster than natural regeneration can replenish it. The loss of forests has also led to declining water availability, as deforested areas experience higher surface runoff, decreased groundwater recharge, and reduced capacity to retain moisture, worsening seasonal water shortages in regions already affected by climate-induced droughts (Tukwatanise, 2023). Additionally, the displacement of forest communities, coupled with the destruction of key cultural and ecological sites, has led to the erosion of indigenous knowledge systems that previously played a role in sustainable forest management and conservation.

B.1.3.4. Energy Availability, Infrastructure, and Access

Climate change is increasingly impacting Uganda's energy availability, infrastructure, and access, posing significant challenges to national development and economic resilience. The country's energy mix is heavily reliant on biomass, with approximately 88% of total energy consumption coming from firewood and charcoal, while only 28% of the population has access to electricity (Twinomuhangi et al., 2021).[32] This reliance on biomass exacerbates deforestation and land degradation, reducing ecosystem resilience to climate change and further intensifying energy insecurity. Climate variability has also disrupted Uganda's hydropower generation, which constitutes over 80% of the national electricity supply (IRENA, 2023).[33] The increasing frequency of droughts and erratic rainfall patterns has led to fluctuations in river flows, significantly affecting hydroelectric dams such as Nalubaale and Karuma. Lower water levels in the Nile and its tributaries have resulted in reduced electricity generation capacity, leading to periodic power shortages and load shedding, which hinder industrial productivity and economic activities (Uganda National Climate Change Policy, 2015).[34]

[31] Forest Landscape Restoration Opportunity Assessment for Uganda, Ministry of Water and Environment (MWE), 2016
[32] https://www.intechopen.com/chapters/78417#
[33] https://100re-map.net/wp-content/uploads/2020/10/100REMAP_Scenario-Report_Uganda.pdf
[34] https://www.mwe.go.ug/sites/default/files/library/National%20Climate%20Change%20Policy%20April%202015%20final.pdf

The vulnerability of Uganda's energy infrastructure to climate-induced disasters, including extreme rainfall events, floods, and landslides, is a growing concern. Heavy rains have led to infrastructural damage, particularly in regions such as Eastern Uganda, where flooding frequently disrupts energy transmission and distribution networks. In hilly regions like the Mount Elgon area, landslides triggered by intensified rainfall have damaged energy transmission lines and hydropower infrastructure, exacerbating access challenges. Additionally, high temperatures and prolonged dry spells in the cattle corridor and northeastern regions increase the demand for electricity for irrigation and cooling systems, further straining the already limited energy supply (Uganda National Climate Change Policy, 2015). Rising temperatures also increase evaporation rates in water reservoirs used for hydropower, further reducing their efficiency. These disruptions highlight the urgent need for climate-resilient energy planning, including diversification of renewable energy sources and reinforcement of infrastructure to withstand extreme weather events.

Energy access remains highly unequal, with rural communities particularly disadvantaged due to limited electrification and grid infrastructure. While urban electrification rates are relatively higher, rural areas face significant disparities, with only a small fraction of households connected to the grid (IRENA, 2023).[35] The increasing demand for energy, driven by rapid population growth and urbanization, further complicates access issues, as grid expansion struggles to keep pace with demand. Additionally, the ongoing development of Uganda's oil and gas sector poses a risk of increasing greenhouse gas emissions and environmental degradation, conflicting with the country's commitments to climate resilience and sustainable energy transitions (Twinomuhangi et al., 2021). Despite the potential of solar and other renewable energy sources, investment in decentralized renewable energy solutions remains insufficient to bridge the access gap, particularly for off-grid communities.

B.1.3.5. Human Settlements and Livelihoods

Climate variability has had profound impacts on human settlements and livelihoods in Eastern Uganda. Flooding, landslides, and prolonged droughts have displaced thousands of people, destroyed homes, and disrupted communities. According to the International Organization for Migration (IOM, 2022), the interplay between climate change and socio-economic pressures has led to significant migration, particularly among vulnerable groups in Eastern Uganda.[36] The destruction of infrastructure, such as roads and bridges, has isolated communities, limiting access to essential services, including healthcare and education. The impact on agriculture, which is the main source of income for most of the population, has led to reduced household incomes, increased poverty, reduced nutrition, and heightened food insecurity. In the Mount Elgon region, displaced populations have increased reliance on temporary shelters with inadequate facilities, which exacerbates vulnerabilities to health risks and reduces overall quality of life. The combination of reduced agricultural productivity, loss of livestock, and increased food prices has negatively affected nutrition and food intake, particularly among vulnerable groups such as children and the elderly. The cascading effects of climate-related disasters on income and economic stability highlight the interconnected nature of climate impacts in the region.

B.1.4. National GHG Emissions Profile

Uganda's greenhouse gas (GHG) emissions inventory highlights a rapidly escalating trajectory driven by unsustainable practices in key sectors. Between 1995 and 2017, emissions from the energy sector increased from 968 Gg to 5,010 Gg CO_2 equivalent, primarily due to a heavy reliance on biomass, which accounts for 94% of total energy consumption, and transport-related emissions, which alone contributed 3,168.4 Gg CO_2 equivalent in 2017. Biomass combustion, widely used in households and industries, has seen carbon monoxide emissions rise sharply from 770 Gg in 1995 to 1,438 Gg in 2017, while the commercial and residential sectors emitted 2,297 Gg and 425 Gg CO_2 equivalent of methane (CH_4) and nitrous oxide (N_2O), respectively, in 2017.

The agriculture, forestry, and other land use (AFOLU) sector is the largest contributor to Uganda's GHG emissions, driven by deforestation, land degradation, and livestock emissions. Deforestation, which reduced forest cover from 24% in 1990 to 9% in 2017, has released substantial carbon stocks, while livestock activities generated 264 Gg of CH_4 through enteric fermentation in 2017 and additional emissions from manure management and nitrogen application to soils. The waste sector also plays a significant role, with urban waste generation doubling between 1995 and 2017, dominated by methane emissions from solid waste disposal, which accounts for over 70% of waste-related emissions.

[35] https://100re-map.net/wp-content/uploads/2020/10/100REMAP_Scenario-Report_Uganda.pdf
[36] Assessing the Evidence: Migration, Environment and Climate Change Nexus in Uganda, IOM, 2022

Inefficient industrial wastewater treatment further adds to methane emissions, particularly from sugar refining and fish processing.[37]

B.1.5. Adaptation and Mitigation Needs in Eastern Uganda

Uganda's updated NDC demonstrates a clear recognition of the potential for climate technologies to significantly contribute to adaptation and resilience across multiple sectors. The document outlines ambitious targets for integrating technologies such as renewable energy systems, efficient irrigation, and sustainable land management practices to enhance climate resilience and steer the country towards sustainable development.[38] With the support of the Global Environment Facility (GEF), Uganda conducted its Technology Needs Assessment (TNA) in 2021 under the UNFCCC Article 4 that aims to enable developing nations to respond to climate change through commitments made by developed nations to transfer environmentally sound and appropriate technologies.

The TNA project intended to; (i) identify priority climate adaptation and mitigation technologies, (ii) identify, analyse, and address barriers hindering the deployment and uptake of prioritized technologies, and (iii) prepare Technology Action Plans (TAPs) with specific actions to support the implementation of twelve (12) prioritized climate adaptation and mitigation technologies in strategic high impact regions in Uganda. The TNA prioritized key sectors such as agriculture, water, forestry, and energy based on their significance to Uganda's socioeconomic development.[39] The results of the technology prioritization and scoring process were the following.

Sector	TNA Priority Technologies
Agriculture	Crop breeding for climate change adaptation, community-based irrigation (CBI) systems and responsive agricultural extension (RAE)
Water	Rainwater harvesting (RWH), deep-well water extraction (DWWE) and surface runoff water harvesting (SRWH)
Forestry	Farmer Managed Natural Regeneration (FMNR) for forest landscape restoration (FLR), Integrated pest management (IPM) in natural forests and forest plantations, and promoting Forest based enterprises (FBEs).
Energy	Rooftop solar PV systems, institutional energy saving cook stoves and bio-latrines for institutions.

Table 1: Priority climate technologies from Uganda's Technology Needs Assessment (TNA)

The Technology Action Plans (TAPs) are strategic outcomes of Uganda's country-driven TNA, designed to prioritize and facilitate the transfer and adoption of climate technologies across key sectors—agriculture, water, forestry, and energy. These plans serve as blueprints for addressing sector-specific and cross-cutting challenges in Eastern Uganda, providing targeted actions and interventions to enhance resilience against climate change impacts and drive sustainable development.

a. Accessible Financial Mechanisms for Climate-Smart Technologies

Financial barriers remain a substantial hurdle to the uptake of climate-smart technologies in Eastern Uganda, particularly in vulnerable rural communities where poverty and access to as well as affordability of favourable financial services remain a significant challenge especially post-COVID-19. Targeted financial mechanisms such as concessional micro-loans, grants, and subsidies are critical to bridge this gap, particularly for smallholder farmers and marginalized communities who depend on subsistence farming. The TAPs recommend establishing and strengthening community-managed revolving funds in rural communities to provide continuous and affordable financing options for solar-powered irrigation systems and drought-tolerant seed varieties. Strengthening partnerships with Savings and Credit Cooperative Organizations (SACCOs) and local microfinance institutions (MFI) is also crucial for developing financial services tailored to the unique needs of rural farmers, ensuring the resilience of their livelihoods to climate change impacts. Subsidizing critical technologies like solar irrigation pumps, particularly in areas like Bukedi, and implementing input credit schemes can promote sustainable practices while enhancing farmers' resilience against extreme climate events.

b. Strengthened Research and Development (R&D) for Locally Adapted Solutions

[37] Uganda's Third National Communication to the UNFCCC, MWE, 2022
[38] Uganda's Updated NDC, UNFCCC, 2022
[39] Uganda's Technology Needs Assessment Reports on Adaptation and Mitigation, UNEP Copenhagen Climate Centre, 2021

Localized R&D investments are imperative to create climate-adapted crops and forestry solutions tailored to Eastern Uganda's distinct agro-ecological zone.[40] Enhanced support for the National Agricultural Research Organization (NARO), and decentralized research institutes such as the Buginyanya Zonal Agricultural Research and Development Institute (BugiZARDI), Nabuin ZARDI, National Forest Resources Research Institute (NaFORRI), and the National Coffee Research Institute (NaCORI) is necessary to strengthen breeding programs for drought-resistant staples like millet, sorghum, coffee, maize, rice, and tree seed species such as pine and eucalyptus.[41,42] These institutions need to be supported to focus on developing, storing, and distributing climate-resilient varieties suitable for Sub-counties and communities in need, which have been significantly affected by shifting climatic conditions. The need to support the subsidization of their production and training costs cannot be overstated. Moreover, expanding R&D efforts to include agroforestry innovations in the Mount Elgon region is crucial for addressing soil erosion, promoting soil health, and restoring degraded forest lands. Collaborative efforts involving national research institutions and private sector stakeholders will not only bring advanced technologies to the region but also ensure knowledge dissemination through localized farmer field schools, making cutting-edge agricultural practices accessible and implementable by rural communities.

c. Improved Access to Climate Technology Inputs and Services

Access to climate technology inputs and services is crucial to transforming smallholder agricultural systems in Eastern Uganda into more resilient ones. The TAPs highlight the need for establishing regional climate-smart technology distribution centres in urban centres like Mbale to act as focal points for accessing drought-resistant seeds, bio-fertilizers, and renewable energy systems and associated services. Partnerships with private sector companies can also enhance market access and incentivize technology adoption for smallholder farmers. These distribution hubs should prioritize the dissemination of solar-powered water systems to address water scarcity, especially in drought-prone sub-regions like Teso. Expanding off-grid solar energy solutions in Bududa will reduce deforestation by offering clean alternatives to biomass, thus contributing to improved energy security for households and agricultural activities as well as improved health and education outcomes for women and youth.

d. Capacity Building and Training for Inclusive Climate Resilience

Building the technical capacity of local stakeholders, including farmers, extension workers, women, and youth, is vital for achieving long-term sustainability of adaptation measures. The TAPs recommend comprehensive training programs in target communities to empower community members with the knowledge to effectively install, operate, and maintain climate technology interventions. Specific emphasis should be placed on training women in adaptive farming methods, as they are disproportionately vulnerable due to their crucial role in agricultural production but limited access to resources. This requires developing gender-sensitive training programs and expanding support for women-led agricultural initiatives. Training extension officers to be adept in transferring climate-smart technologies is another critical need to enhance the technical support available to farmers on the ground.

e. Enhanced Institutional Coordination and Effective Regulatory Implementation

Weak institutional coordination and fragmented regulatory enforcement continue to be significant barriers to effective climate adaptation in Eastern Uganda and the country. The TAPs emphasize the need to strengthen coordination mechanisms among government agencies, local administrations, NGOs, and community groups, particularly in districts like Bududa. A cohesive strategy is required to promote integrated approaches in reforestation, agroforestry, and disaster risk management. For instance, implementing Farmer-Managed Natural Regeneration (FMNR) and enforcing forest conservation regulations on Mount Elgon's slopes could mitigate the risk of landslides while enhancing ecosystem services. Local governments must receive financial and technical support to effectively lead the enforcement those regulations and provide on-ground leadership for implementing these integrated landscape management practices.

f. Sustainable Land and Resource Management Practices

The ongoing land degradation in Bugisu and Teso necessitates urgent interventions to restore soil health and agricultural productivity. The TAPs recommend expanding sustainable land management practices, such as agroforestry, conservation tillage, and rotational grazing, particularly in highly degraded areas. Farmer-Managed Natural Regeneration (FMNR) should be prioritized in sub-regions like Bukedi to restore tree cover, improve water retention, and reduce the impacts of soil erosion. Additionally, addressing land tenure issues in Teso through

[40] Eastern Uganda Agro-ecological Zone, Sustainable Land Management in Uganda (SLM), National Agricultural Research Laboratories (NARL)
[41] About BugiZARDI
[42] About NaCORI

participatory land mapping and securing land rights can incentivize smallholder farmers to adopt sustainable land management techniques, ensuring the long-term viability of interventions and reducing vulnerability to climate-induced disasters.

g. Community Awareness and Engagement for Behavioural Change

Community engagement is essential to ensure the uptake and sustainability of climate-smart technologies. Raising awareness through local media campaigns, community meetings, and hands-on demonstrations will foster a greater understanding of the benefits of climate-resilient practices, specifically climate technologies. The TAPs recommend targeting schools and health centres to showcase technologies such as solar rooftop systems and bio-latrines, which can serve as practical examples for community members. This community-based approach, coupled with the distribution of easy-to-understand technical guides, is key to bridging knowledge gaps and encouraging behavioural change towards adopting sustainable agricultural and energy practices.

B.1.6. Complementarity With Past and Ongoing Donor-Funded Projects

Recent/On-going Project	Complementarity
Uganda Irrigation for Climate Resilience (ICRP) Project – World Bank[43] ICRP is a transformative initiative aimed at addressing climate variability and water scarcity by promoting sustainable irrigation practices and improving water resource management. Targeting climate-vulnerable regions including Eastern Uganda, the project seeks to enhance agricultural productivity and food security, particularly for smallholder farmers. A cornerstone of the project is the development of large-scale irrigation schemes and community-based systems that ensure reliable water access for agriculture, even during prolonged dry spells. These systems reduce reliance on unpredictable rainfall, mitigating the risks of crop failures and fostering resilience in districts like Pallisa, Ngora, and Butaleja. Integrated water resource management (IWRM) is a key focus, with activities such as wetland restoration, afforestation, and sustainable land management to conserve water sources and protect catchment areas, ensuring a sustainable supply of water for irrigation and other uses. Beyond infrastructure, the project emphasizes capacity building and institutional strengthening to ensure the sustainable operation and maintenance of irrigation systems. It trains water user associations, local governments, and communities to manage water equitably and efficiently. Complementing these efforts, the project promotes climate-resilient agricultural practices, including the use of drought-tolerant crops, efficient water-use technologies, and soil conservation techniques. These practices enhance productivity and resilience to climate shocks. Additionally, the ICRP integrates gender-sensitive approaches to ensure women and other vulnerable groups have equitable access to irrigation services, training, and resources, fostering inclusive growth. By improving agricultural incomes and creating job opportunities, the project supports livelihoods, reduces poverty, and enhances long-term economic stability in Eastern Uganda, aligning	The CATLER-Uganda project complements the ICRP by expanding the scope of climate resilience interventions to address localized challenges and systemic barriers in Eastern Uganda. While the ICRP focuses on large-scale irrigation infrastructure, CATLER-Uganda integrates renewable energy-powered solutions, such as small-scale solar-powered irrigation units and community-based rainwater harvesting systems, to ensure reliable water access for smaller farming communities in districts like Bududa, Butaleja, and Soroti. These interventions fill critical gaps by providing water for agriculture and domestic use in areas not directly served by large-scale irrigation schemes, enhancing overall water security. Additionally, CATLER-Uganda incorporates wetland projection activities like rainwater harvesting that complement ICRP's integrated water resource management efforts by improving ecosystem services, such as water retention and flood mitigation, which are vital for sustaining irrigation infrastructure. Beyond water access, CATLER-Uganda scales agricultural resilience through tailored climate-smart practices and diversified livelihoods, enhancing the impact of ICRP's irrigation systems. Interventions like drought-tolerant seed adoption, advanced soil management techniques, and Farmer-Managed Natural Regeneration (FMNR) are implemented in regions such as Teso and Bugisu, addressing agricultural vulnerabilities while restoring degraded landscapes. By integrating forestry-based livelihoods, such as agroforestry and tree nursery management, CATLER-Uganda provides additional income streams and promotes biodiversity, complementing the ICRP's focus on stabilizing crop production. Institutionally, CATLER-Uganda builds on ICRP's governance efforts by introducing revolving funds and financial partnerships to address affordability barriers, enabling smallholder farmers to adopt climate-smart technologies. These coordinated efforts create a synergistic framework where the large-scale infrastructure of ICRP is amplified by CATLER-Uganda's localized, community-driven

[43] https://documents1.worldbank.org/curated/en/860371591125380263/pdf/Uganda-Irrigation-for-Climate-Resilience-Project.pdf

with broader climate adaptation and development objectives.	solutions, ensuring sustainable and scalable resilience across Eastern Uganda.
Building Resilient Communities, Wetlands Ecosystems and Associated Catchments in Uganda – GCF FP034[44] This project, implemented by the Government of Uganda through the Ministry of Water and Environment (MWE) with support from UNDP and the Green Climate Fund (GCF), focuses on restoring Uganda's degraded wetlands while building the climate resilience of communities that depend on them. Targeting districts across Eastern and Southwestern Uganda—including areas within the Mpologoma, Lokok, Awoja, and Maziba catchments—the project aims to restore 760 km² of wetland ecosystems through community-based rehabilitation, afforestation, and improved water retention and flow management. These ecological interventions are coupled with livelihood diversification efforts, such as introducing climate-smart agriculture, expanding small-scale irrigation, and promoting sustainable enterprises like beekeeping, aquaculture, and eco-tourism. Special attention is given to empowering women, youth, and landless households through vocational training, access to inputs, and financial services. The project also strengthens climate information services and early warning systems, equipping communities with timely forecasts and risk alerts to enhance preparedness and adaptive capacity.	The CATLER-Uganda project complements the FP034 wetlands restoration project by extending climate resilience interventions beyond wetland ecosystems into the surrounding forest, upland, and agricultural landscapes of Eastern Uganda. While FP034 focused on wetland rehabilitation, early warning systems, and climate-resilient livelihoods in districts like Butaleja and Budaka, CATLER-Uganda addresses upstream drivers of wetland degradation through interventions such as Farmer-Managed Natural Regeneration (FMNR), agroforestry to restore of 50,000 hectares of degraded forest and agricultural land. These measures help stabilize soils, improve water retention, and protect hydrological flows that are critical to sustaining wetland health. The project also aims to install small and large rainwater harvesting reservoirs, small-scale solar-powered irrigation systems, providing alternative water sources that reduce pressure on wetlands previously restored under FP034. By supporting the development and uptake of drought-tolerant seed varieties, expanding access to renewable energy for productive use, and creating financial mechanisms to reach last-mile users, CATLER-Uganda strengthens the resilience of farming communities and addresses structural barriers to technology adoption that were beyond the scope of FP034. Together, these efforts form a complementary resilience-building framework that safeguards ecological gains while enabling sustainable, community-driven adaptation across interconnected landscapes.
The Running Out Of Trees (ROOTS) Campaign[45] The ROOT Campaign, spearheaded by TotalEnergies Uganda in collaboration with the National Forestry Authority (NFA), the Ministry of Water and Environment, and other partners, aims to combat Uganda's alarming deforestation rates by planting 200 million trees by 2025, with an annual target of 40 million trees. The initiative focuses on restoring forest cover in critical areas, including degraded forest reserves, community-managed woodlots, and private lands, particularly in regions such as Northern and Eastern Uganda and water catchment zones like the Albertine Graben and Mount Elgon. By involving local communities, the campaign emphasizes sensitization, training, and the provision of seedlings to ensure tree survival and long-term environmental benefits. Through integrating agroforestry practices, the initiative supports livelihoods by providing resources such as fruits and timber while enhancing soil fertility and reducing erosion. ROOTS also aligns with Uganda's Nationally Determined Contributions (NDCs), promoting biodiversity, improving ecosystem health, and contributing to climate change mitigation by sequestering carbon and fostering sustainable land management. This	The CATLER-Uganda project complements the ROOTS Campaign by integrating large-scale reforestation efforts into a broader framework of climate resilience, sustainable livelihoods, and ecosystem restoration in critical areas of Eastern Uganda, including the Mount Elgon region, Teso, and Bugisu sub-regions. While ROOTS focuses on planting 200 million trees by 2025, CATLER-Uganda enhances this initiative through the reforestation of 50,000 hectares of degraded land using Farmer-Managed Natural Regeneration (FMNR) and agroforestry practices, targeting regions like Bududa and Butaleja, where reforestation reduces landslide risks and improves soil stability. The project further complements ROOTS by integrating sustainable livelihoods through forest-based enterprises, such as tree nurseries and beekeeping, in districts like Soroti, linking reforestation efforts with income generation and ensuring community ownership. CATLER-Uganda also addresses systemic drivers of deforestation by promoting renewable energy solutions, such as solar-powered irrigation and bio-latrines, reducing reliance on wood fuel and preserving restored landscapes. Moreover, the project strengthens institutional frameworks by establishing standardized

[44] https://www.greenclimate.fund/sites/default/files/document/funding-proposal-fp034-undp-uganda.pdf
[45] https://totalenergies.ug/uganda-running-out-trees-partners-target-grow-40-million-trees-year

large-scale, community-driven effort reflects a commitment to reversing Uganda's 2.6% annual deforestation rate and achieving sustainable environmental stewardship.	regulations and multi-level coordination mechanisms, ensuring that reforestation aligns with broader land management strategies and national climate goals. Together, these initiatives create a synergistic impact, combining ROOTS' ambitious tree-planting targets with CATLER-Uganda's integrated, community-driven approach to restoring ecosystems, enhancing resilience, and fostering sustainable development.
Promoting solar-powered irrigation and pumping in Uganda – GGGI Uganda[46] The focuses on advancing the adoption of solar-powered irrigation and water pumping systems to enhance agricultural productivity and resilience in Uganda. It aims to address challenges faced by smallholder farmers, such as unreliable rainfall and high costs of traditional irrigation, by promoting affordable and sustainable solar technologies. The project integrates capacity-building initiatives, policy development support, and stakeholder engagement to create an enabling environment for scaling up solar irrigation solutions. By improving access to renewable energy technologies, the project seeks to increase agricultural yields, reduce greenhouse gas emissions, and support Uganda's climate adaptation and mitigation goals.	This proposal complements the GGGI project by embedding solar-powered irrigation systems within a broader climate-resilient framework that addresses systemic barriers to water security, agricultural sustainability, and ecosystem health. By integrating solar-powered irrigation with rainwater harvesting and landscape restoration, the proposal ensures that water management solutions are not only scalable but also resilient to climate variability, addressing critical vulnerabilities in Eastern Uganda. Furthermore, the project strengthens financial and institutional mechanisms—such as revolving funds and standardized regulations—that enhance the affordability, accessibility, and long-term sustainability of solar technologies. These advancements amplify the impact of the GGGI project by creating an enabling environment for widespread adoption while linking irrigation systems to climate-smart agriculture and ecosystem restoration. This integrated approach ensures that solar-powered technologies contribute to sustainable development by improving agricultural productivity, fostering biodiversity, and building systemic resilience, extending the utility and impact of the GGGI project.

B.1.7. Barriers to Climate Technology Development and Transfer

a. Financial Barriers

Financial barriers are pervasive and form a significant obstacle to the adoption of climate technologies in Eastern Uganda, particularly in underdeveloped districts where economic deprivation is a major constraint.

- High Initial Costs of Climate Technologies: The initial investment required for technologies like solar-powered irrigation systems, renewable energy installations, and bio-latrines is prohibitively high. This situation is particularly acute in rural areas where the majority of farmers live below the poverty line. The TAP for solar rooftop systems alone estimates the requirement for an investment of USD 4,080,000, which is beyond the financial capacity of smallholder farmers and rural communities, limiting their ability to transition to these systems without substantial financial assistance.
- Limited Access to Affordable Credit: Access to credit remains a formidable challenge due to high-interest rates and the limited willingness of financial institutions to provide loans for climate-related technologies. Financial institutions in Eastern Uganda are generally risk-averse and tend to avoid extending loans to agricultural ventures, which are perceived as high-risk due to climate variability.[47] The TAPs indicate that the absence of soft loans and affordable credit mechanisms hampers farmers in districts like Soroti and Mbale from investing in technologies such as solar water pumps and climate-resilient seeds. The unavailability of microfinance services in some rural areas further exacerbates the issue, reducing the overall adoption of climate-smart innovations.

[46] https://gggi.org/project/ug23-promoting-solar-powered-irrigation-and-pumping-in-uganda/
[47] Agricultural MSME Financing in Uganda: A Response to COVID-19, Alliance for Financial Inclusion, 2021

- Absence of Subsidies and Incentives: A lack of well-structured subsidies and incentives significantly restricts technology uptake. Unlike other regions that may have benefited from renewable energy subsidies, Eastern Uganda lacks substantive government-led financial incentives to support the adoption of technologies such as solar rooftop systems. Subsidies are critical for reducing the cost of renewable energy and irrigation technologies by enabling access to quality-certified products at affordable prices, but these mechanisms are not adequately available to most rural communities in this region. Without such incentives, the diffusion of climate-smart technologies remains limited to those who can afford the high costs, typically excluding most small-scale farmers and lower-income households.

b. Institutional Barriers

Institutional barriers are significant obstacles to the effective transfer and diffusion of climate technologies in Eastern Uganda. These include challenges related to institutional coordination, capacity, and governance frameworks.

- Fragmented Institutional Coordination: Institutional fragmentation is a primary barrier that hinders the implementation of climate technologies. In Eastern Uganda, the lack of coordinated efforts between local government bodies, NGOs, and key ministries undermines the efficacy of interventions and results in the duplication of interventions as well as inconsistent and inadequate monitoring of their uptake. The TAPs stress the importance of an integrated institutional framework, but existing silos between various agencies prevent the effective scaling of technologies like agroforestry and conservation agriculture.
- Inadequate Institutional Capacity: The TAPs reveal significant gaps in human resources within institutions responsible for promoting and managing climate technologies. For example, the availability of extension workers in sub-regions such as Teso is insufficient, with one extension worker often tasked with serving several thousand farmers. This disparity hinders effective outreach and training for new technologies, meaning that farmers do not receive adequate guidance to adopt and sustain climate-resilient practices. The lack of adequate personnel with specialized knowledge also affects the capacity of local governments and institutions to implement technologies such as water conservation systems effectively.

c. Technical Barriers

Technical barriers relate to the limitations in the physical implementation, operation, and maintenance of climate technologies at different levels. These barriers are compounded by insufficient infrastructure, inadequate technical skills, and supply chain challenges.

- Shortage of Skilled Technicians: The adoption of technologies like solar rooftop systems, bio-latrines, and improved irrigation systems is severely limited by a lack of skilled technicians capable of installing, operating, and maintaining these technologies. In districts like Mbale, there is a shortage of trained individuals who can effectively manage the technical requirements of these systems. The TAPs highlight that vocational training is either non-existent or insufficient to meet the growing demand for technical expertise in these areas. This skills gap means that even when technologies are available, communities often face challenges in keeping them operational, reducing their long-term effectiveness.
- Inadequate Local Infrastructure: Eastern Uganda lacks the necessary infrastructure to support the widespread adoption of climate technologies. For example, the TAP for solar water pumping mentions that local facilities are inadequate for fabricating or repairing essential components of solar systems, which must often be sourced from distant urban centres like Mbale, Jinja, Kampala or even abroad. Unlike urban households, rural households typically do not have necessary roofing facilities to enable rooftop water harvesting. This limitation results in significant delays in maintenance and increased costs, discouraging users from adopting or sustaining these technologies. The absence of local demonstration centres further limits awareness and the willingness of community members to adopt new technologies.
- Supply Chain Issues: The supply chain for climate technology components is often weak, particularly in remote parts of Eastern Uganda. The unavailability of critical inputs, such as solar panels, bio-fertilizers, and efficient irrigation equipment, hinders technology diffusion. In Bududa and Amuria, the TAPs identify the challenge of delayed procurement processes and poor distribution networks that make it difficult for rural users to acquire necessary technology components in a timely and cost-effective manner. The lack of a reliable supply chain not only inflates costs but also leads to frequent disruptions, further discouraging potential users.

d. Regulatory Barriers

Regulatory-related barriers are often linked to weak regulatory frameworks, lack of enforcement, and outdated policies that do not align with current climate adaptation needs.

- Weak Enforcement of Existing Regulations: The enforcement of policies related to climate technologies, such as renewable energy, sustainable agriculture, and water management, is often inconsistent. For instance, regulations on land use and environmental protection are poorly enforced in regions like Kapchorwa and the Mount Elgon area, where land degradation and deforestation remain prevalent. The TAPs emphasize that despite having regulations and standards in place to regulate the cutting of trees and manage land sustainably, enforcement mechanisms are weak, resulting in continued environmental degradation. The lack of regulatory enforcement undermines efforts to introduce sustainable land management practices, such as agroforestry, in these vulnerable areas.
- Outdated Regulatory Frameworks: Many of the regulations guiding renewable energy adoption and water management are outdated and do not reflect the changing climate and socio-economic realities of Eastern Uganda. For example, the TAPs mention that the regulatory frameworks for water conservation technologies like surface runoff harvesting are not adapted to modern needs, limiting the capacity of communities to implement these solutions effectively. This misalignment between regulations and current technological needs results in regulatory bottlenecks that stifle innovation and hinder the adoption of critical climate technologies.

e. Knowledge and Awareness Barriers

Knowledge and awareness gaps are significant impediments to the adoption of climate technologies, particularly in rural areas of Eastern Uganda. These gaps result in a lack of understanding and appreciation for the benefits of these technologies.

- Limited Awareness of Technology Benefits: A considerable portion of the population in Eastern Uganda lacks awareness of the potential benefits of climate technologies such as bio-latrines, solar water pumps, and efficient irrigation systems. In many districts in the region, the TNA outcomes reveal that farmers are often unaware of how technologies like bio-latrines could improve sanitation and provide clean energy, or how solar-powered pumps could increase their resilience to drought. This lack of information inhibits the adoption of technologies that could significantly improve community resilience to climate change impacts.
- Cultural Resistance to Technology Adoption: Cultural beliefs and traditional practices can also act as barriers. In some communities, there is resistance to adopting new farming technologies due to ingrained traditional agricultural practices that are perceived as more reliable but are in fact degrading nearby land and natural resources. The TAPs mention the importance of involving local cultural leaders in awareness campaigns, yet resistance persists due to scepticism about the effectiveness of newer technologies compared to conventional methods. Without targeted education and community engagement, these social barriers continue to impede progress towards broader technology uptake outcomes.

B.2.1. Project/Programme description (max. 1,000 words)

Describe the proposed set of components, outputs and activities that will address the identified barriers and lead to the intended project/programme outcomes. The description should be provided for each component, output, and activity and should include a clear rationale for the cause-effect relationship of the interventions in each outcome. Include a description of the target beneficiaries. The project/programme breakdown (e.g. component/output/activities) should be consistent with the financing by component in section C.2, the Logical Framework (Annex 2a) and Timetable (Annex 2b) of the project/programme.

The narrative in this section should summarize the Logical Framework (annex 2a) of the funding proposal.

B.2.1.1. About the CATLER-Uganda Project

The **"Climate Adaptation and Technology Leveraging for Enhanced Resilience in Eastern Uganda (CATLER – Uganda)"** project addresses barriers to climate technology adoption in agriculture, water, forestry, and energy sectors to promote adaptive capacity and resilience of rural communities and landscapes in Eastern Uganda to climate related risks, hazards, and impacts. Targeting 30 sub-counties across 10 districts in Eastern Uganda, the project aims to enhance the adaptive capacity of vulnerable communities, improve food and water security, and reduce anthropogenic GHG emissions, contributing to Uganda's NDC goals and sustainable development pathways. It employs an integrated, multi-component approach to tackle financial, institutional, awareness, and technical challenges.

CATLER-Uganda Objectives

1. **Enhance Agri-Food System Resilience to Climate Change Impacts:**

This objective focuses on enhancing resilience in Uganda's agriculture and water sectors by promoting climate-smart and sustainable practices, directly addressing the financial and technical barriers that hinder the adoption of adaptive farming methods. By mitigating the effects of climate variability and reducing vulnerability to extreme weather, the project aims to ensure smallholder farmers have the tools and support necessary to adapt their agricultural practices, thus enhancing food security and reducing climate-related risks and shocks.

2. **Reduce Anthropogenic GHG Emissions and Catalyse Local Nature-Based Enterprise Development:** This objective targets the promotion of sustainable energy solutions and economic development by supporting and stimulating investment in the energy sector and cross-cutting sectoral benefits as well as the growth of local nature-based enterprises. It addresses barriers such as limited access to financial resources, inadequate market linkages, and the absence of technical support systems. By providing targeted financial resources and capacity building to support renewable energy technology uptake and enhanced market access for FBE products, the project aims to create viable economic opportunities for vulnerable communities, allowing them to diversify their livelihoods and reduce dependency on unsustainable energy sources, thus improving resilience to climate impacts.

3. **Strengthen Institutional Capacity and Regulatory Frameworks for Long-Term Technology Uptake:** This objective aims to ensure the long-term sustainability of climate technology interventions and solutions as well as uptake by enhancing institutional capacity and strengthening regulatory frameworks at the national, district, and community levels. It addresses barriers such as fragmented governance, inadequate institutional capacity, and inconsistent regulatory enforcement, which limit effective development and transfer of environmentally sound technology to enhance adaptive capacity to climate change. Through capacity building, advocacy, and support for standardization as well as monitoring/backstopping and evaluation mechanisms, the project will enhance institutional readiness and coordination, ensuring that climate adaptation efforts are coherent, sustainable, and impactful for communities in Eastern Uganda.

Goal statement:

IF climate-smart technologies prioritized in Uganda's Technology Action Plans (TAPs) are effectively applied across agricultural systems, water management, energy use, and forest landscapes in Eastern Uganda, **THEN** the adaptive capacity and climate resilience of local communities will be significantly strengthened, reducing their vulnerability to climate-induced shocks such as droughts, floods, and erratic weather patterns, while supporting long-term sustainable livelihoods and food security; **BECAUSE** the adoption of climate-smart technologies will enhance agri-food system resilience, improve water resource management, promote ecosystem restoration, and diversify sustainable livelihoods, fostering institutional capacity and climate-informed decision-making to ensure long-term adaptation and sustainable development in Uganda's most climate-vulnerable regions.

Target Communities & Beneficiaries

The target communities for this project proposal are rural and peri-urban populations in Eastern Uganda, particularly those within the Teso, Bugisu, Bukedi, and Busoga sub-regions as detailed in table 2 below. These communities are highly vulnerable to climate change due to their heavy dependence on rain-fed agriculture, natural resources, and biomass energy, as well as their limited adaptive capacity to environmental, climatic, and economic shocks. The project will primarily focus on smallholder farmers, forest-dependent communities, fisherfolk, pastoralists, and marginalized groups such as women, youth, and indigenous populations, ensuring that interventions enhance climate resilience, improve livelihoods, and promote sustainable resource management. The agricultural communities in these regions face recurrent climate-induced stressors, including prolonged droughts, erratic rainfall, and flash floods, which have led to declining crop yields, soil degradation, and food insecurity. Farmers in Teso and Bukedi sub-regions cultivate staple crops such as maize, millet, sorghum, rice, and cassava, but climate variability has reduced productivity, forcing many to expand agricultural land into fragile ecosystems like wetlands and forest margins, exacerbating deforestation and biodiversity loss. In Bugisu, where high-altitude farming is common, increased rainfall intensity has triggered landslides and soil erosion, displacing communities and reducing available arable land. Many farming households lack access to climate-resilient seeds, irrigation infrastructure, and post-harvest storage technologies, making them particularly vulnerable to climate shocks and market volatility.

Forest-dependent communities in and around Mount Elgon and Kyoga forested landscapes rely on forests for fuelwood, medicinal plants, and non-timber forest products, but rapid deforestation—driven by agricultural expansion, charcoal production, and illegal logging—has threatened both livelihoods and ecosystem services. The Mount Elgon region, in particular, has experienced severe forest degradation, increasing the frequency and intensity of floods and landslides, which have disproportionately affected women and children in these communities. Without urgent interventions, forest

degradation will continue to erode natural resources, pushing more households into poverty and food insecurity. The fishing communities along Lake Kyoga, Lake Victoria Crescent, and the Mpologoma Catchment are also vulnerable due to climate-induced changes in water levels, declining fish stocks, and increased pollution from agricultural runoff and deforestation-driven sedimentation. Water scarcity and wetland degradation have negatively impacted fish breeding grounds, reducing fish productivity and threatening the livelihoods of thousands of small-scale fisherfolk. Additionally, increased competition over diminishing fish resources has led to conflicts among community members, exacerbating socio-economic instability.

Pastoralist communities in Teso and the Kyoga Basin cattle corridor have faced severe water shortages, pasture degradation, and increased conflicts over grazing land, particularly during prolonged drought periods. Climate variability has disrupted seasonal livestock migration patterns, leading to livestock deaths, reduced milk production, and weakened economic stability. These communities, already marginalized due to their mobile lifestyles, face limited access to formal land tenure systems and climate-adaptive livestock management practices, further increasing their vulnerability. Additionally, peri-urban and off-grid rural households in energy-insecure districts suffer from low access to electricity, relying primarily on firewood and charcoal for cooking and heating. The high dependence on biomass energy has fuelled deforestation and environmental degradation, while the lack of affordable, reliable renewable energy solutions continues to limit economic opportunities, educational access, and overall community resilience.

By targeting these highly vulnerable communities, the project aims to enhance adaptive capacity through climate-smart technologies, resilient agricultural systems, improved water resource management, and decentralized renewable energy solutions. The interventions will focus on scaling up access to climate-resilient infrastructure, strengthening local governance frameworks, and fostering inclusive economic opportunities, ensuring that the most affected populations benefit from sustainable, long-term climate adaptation strategies in Eastern Uganda.

Sub-region	Districts
Teso Sub-region	Soroti and Katakwi
Bugisu Sub-region	Bududa and Mbale
Bukedi Sub-region	Tororo, Busia, and Butalejja
Busoga Sub-region	Bugiri, Mayuge, and Kamuli

Table 2: Target districts in Eastern Uganda

B.2.1.2. CATLER-Uganda Project Components/Outcomes

Component 1 will strengthen rural resilience through climate-adapted seeds, sustainable water management practices, and solar irrigation technologies and associate support and capacity building. **Component 2** focuses on degraded landscape restoration and conservation practices as well as sustainable nature-based enterprise development like Farmer-Managed Natural Regeneration (FMNR) and Forest-Based Enterprises (FBE), while **Component 3** builds an enabling environment for technology development and transfer through financial mechanisms and regulatory support. Outcomes include enhanced climate resilience, reduced deforestation, improved clean energy access, and stronger institutional capacity, contributing to enhanced regional resilience to climate change in Eastern Uganda.

Component 1: Strengthening of Rural Agricultural Community Resilience to Climate Risks in Eastern Uganda

This component directly addresses the vulnerabilities of Eastern Uganda's agricultural systems, which are highly dependent on rain-fed farming, making them susceptible to erratic rainfall patterns, prolonged droughts, and destructive floods. Regions like Bududa in the Elgon sub-region are particularly prone to landslides, water contamination, and soil erosion, while districts such as Teso face extended dry spells that exacerbate food insecurity and livelihood disruptions. [48] Current crop yields for staples such as maize, millet, rice, and beans are severely constrained by declining rainfall reliability and the loss of genetic diversity in seeds, limiting farmers' adaptive capacity to climatic shocks.

To address these challenges, this component operationalizes climate-resilient technologies aimed at improving seed systems and water resource management. National research institutions such as NARO, Makerere University, and decentralized ZARDIs will be supported to develop improved high-quality crop and tree seed varieties tailored to regional agro-ecological zones at lower production costs. These varieties will combine traits like drought tolerance, pest

[48] McKinney L, Wright DC. Climate Change and Water Dynamics in Rural Uganda. *Sustainability*. 2021; 13(15):8322. https://doi.org/10.3390/su13158322

resistance, and higher nutritional value with farmer-preferred attributes, ensuring adoption while boosting food security. A decentralized seed production and distribution system, supported by Sub-county-based storage hubs and subsidy mechanisms, will ensure that farmers in remote areas access high-quality authentic seeds in a timely and affordable manner. The intervention also tackles Uganda's persistent issue with counterfeit seeds, which undermine farming efforts by compromising yields.

To complement these seed-based interventions, water resource management interventions under this component will integrate rainwater harvesting systems, both at the household and community levels, with solar-powered irrigation units designed to irrigate over 12,000 hectares of farmland in arid and semi-arid zones within the project area. These systems will reduce dependence on erratic rainfall and collection tanks will protect low-land landscapes and wetlands while promoting efficient water use in agriculture. In flood-prone areas, excess rainwater will be redirected and stored, mitigating risks to crops and infrastructure. Community-based governance structures and training programs will further ensure equitable management and long-term sustainability of water systems.

Output 1.1: Widespread access to affordable climate-adapted seed varieties to support agricultural productivity during unfavourable climate conditions

Eastern Uganda's seed systems are characterized by limited access to high-quality, climate-adapted seed varieties, which significantly hinders agricultural resilience and productivity, particularly in the face of increasing climate variability. Smallholder farmers, who account for the bulk of food production in the region, predominantly rely on informal seed systems, with over 85% of farmers using farm-saved seeds (Mulesa et al., 2024).[49] However, the quality and availability of these seeds are inconsistent, and formal seed markets are plagued by issues such as high production costs, limited access to improved varieties, and counterfeit seed infiltration. In some cases, 30-50% of seeds in the market have been found to be substandard or fake, undermining productivity and farmer confidence (Edema et al., 2021).[50] Moreover, research institutions such as NARO and Zonal Agricultural Research and Development Institutes (ZARDIs) lack the necessary breeding infrastructure to accelerate the production of improved, climate-resilient seed varieties, leading to delays of up to two years in the release of new varieties (Mulesa et al., 2024).

To address these systemic barriers, the project will strengthen decentralized seed systems by equipping research institutes with high-precision breeding tools and facilities, reducing production costs and improving the efficiency of seed multiplication. This includes enhancing breeding programs at BugiZARDI which serves the eastern agro-ecoloical zone, Nabuin ZARDI which serves the northeast agro-ecological zone, NaFORRI and NaCORI, where drought- and flood-tolerant crop varieties, such as maize, millet, rice, and coffee, will be developed and scaled up. Given that poor storage conditions often reduce seed viability and contribute to post-harvest losses, the project will establish temperature-controlled decentralized seed banks in key districts such as Mbale and Soroti to ensure high-quality seed availability throughout planting seasons. These storage units will help mitigate seed deterioration, addressing a critical bottleneck in the seed supply chain (Mulesa et al., 2024). Recognizing the role of market linkages and financial accessibility, the project will facilitate subsidized seed distribution schemes integrated with village savings and loan associations (VSLAs), targeting vulnerable groups, particularly women and youth. Through this approach, smallholder farmers will be able to access improved seeds at reduced costs while promoting financial sustainability in seed access mechanisms (Edema et al., 2021). Additionally, partnerships with private seed producers and local agro-input dealers will be established to enhance last-mile delivery networks, ensuring that certified seeds reach even the most remote farming communities (Mulesa et al., 2024).

Complementary to seed distribution, the project will enhance farmer and extension worker capacity through structured training programs focused on seed authenticity verification, sustainable agronomic practices, and climate-smart agricultural techniques. These sessions will be delivered through farmer field schools and decentralized training hubs, ensuring hands-on engagement with smallholders. Training content will be tailored to the specific needs of farmers in Teso and Bugisu, where vulnerability to climate impacts is highest (Edema et al., 2021). Furthermore, information dissemination will be supported through digital extension services and radio broadcasts, reinforcing best practices in climate-resilient agriculture. By integrating seed system reforms with financial incentives, storage infrastructure, capacity-building, and private sector engagement, the project will enable at least 100,000 smallholder farmers to access affordable, high-quality, climate-adapted seed varieties. This will directly enhance agricultural resilience, food security, and climate adaptation in Eastern Uganda, supporting national efforts to strengthen seed system governance and ensure sustainable agricultural productivity.

[49] https://www.researchgate.net/publication/382931146_Seeding_Diversity_Enhancing_farmers'_access_to_crop_varieties_and_quality_planting_materials_in_Uganda's_seed_systems

[50] https://www.researchgate.net/publication/377983893_Seed_systems_in_Uganda_Review_of_Present_Status_and_Future_Needs

Activity 1.1.1: Increase investment in and increase capacity of local research institutions to lower production costs for climate-adapted crop and tree seed species.

This activity aims to enhance the capacity and efficiency of national and sub-national agricultural research institutions in Uganda by strengthening seed research, production systems, and delivery mechanisms to ensure smallholder farmers in Eastern Uganda's highlands and dryland regions have affordable, climate-adapted crop and tree seed species. Through the Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF), the project will conduct a comprehensive assessment of the technical and infrastructural gaps within Uganda's research and development (R&D) institutions, particularly at the national level (NARO) and decentralized research centres like BugiZARDI, Nabuin ZARDI, NaFORRI, and NaCORI, which are responsible for developing climate-resilient crop and tree seed varieties. Findings from this assessment will form the basis for targeted investments in high-precision breeding technologies, modernized seed processing equipment, and state-of-the-art laboratory infrastructure to reduce production costs, shorten the breeding cycle, and improve the scalability of climate-adapted seed varieties. Current inefficiencies in research institutions—such as delayed varietal release cycles, limited access to genetic materials, and outdated breeding methodologies—contribute to higher seed costs and limited farmer access to improved varieties. By equipping these institutions with advanced seed phenotyping tools, molecular breeding kits, and tissue culture facilities, the project will facilitate the development of fast-maturing, drought-tolerant, and flood-resilient crops such as maize, millet, sorghum, rice, and coffee, tailored to specific soil and climate conditions in the Eastern Highlands and Northeastern Drylands.

This activity will target climate-adapted seed varieties for food crops including;

- Maize: Longe 5, MM3, Longe 11H, Longe 5D, UH 5051
- Beans: Nabe 15, Nabe 17, NARO Bean 1
- Millet: Seremi 1, Seremi 2
- Sorghum: SESO 3, SESO 2

Additionally, recognizing that technical capacity gaps among research personnel limit the effectiveness of these institutions, the project will implement comprehensive training programs for plant breeders, laboratory technicians, and seed technologists to ensure the effective operation, maintenance, and long-term sustainability of newly installed breeding infrastructure. The project will also develop and disseminate operational and maintenance (O&M) manuals to support continuous knowledge transfer and technical troubleshooting, ensuring that institutions can retain expertise and maximize the lifespan of newly acquired equipment. By addressing financial, technical, and knowledge constraints in climate-adapted seed research, this intervention will enable localized, cost-effective production of high-quality seeds, reducing dependence on expensive, externally sourced varieties and ensuring that vulnerable subsistence farmers have access to affordable, high-yielding, and climate-resilient crop varieties. Through these targeted interventions, the project will establish a robust foundation for long-term seed system sustainability, food security, and climate adaptation in Eastern Uganda.

Deliverable 1.1.1.1: High-precision equipment made available to NARO and ZARDIs to reduce production costs of flood and drought-tolerant crop and tree seed species.

Deliverable 1.1.1.2: Training manuals produced for technical personnel on the operation and maintenance of new research equipment.

Deliverable 1.1.1.3: Flood and drought-resistant crop and tree seed species developed for popular key crops, including coffee and rice, tailored to various agro-ecological zones.

Activity 1.1.2: Strengthening Decentralized Climate-Resilient Seed Systems and Technical Capacity for Smallholder Farmers

Building on the improvements in seed research and development under Activity 1.1.1, this activity strengthens decentralized seed production, storage, distribution, and technical capacity to ensure that smallholder farmers and extension workers have access to high-quality, climate-adapted crop and tree seed species. The project will partner with ZARDIs and private seed producers to scale up the production, multiplication, and last-mile distribution of drought- and flood-tolerant seed varieties, such as maize, millet, rice, and coffee, which are critical to agricultural resilience in Eastern Uganda. Many ZARDIs, particularly BugiZARDI, Nabuin ZARDI, and NaCORI, lack adequate infrastructure and operational support to effectively multiply and distribute improved seed varieties, leading to logistical bottlenecks and unreliable seed access for farmers. To overcome these limitations, the project will equip ZARDIs with modernized seed storage and processing infrastructure, ensuring that high-quality seed varieties are produced efficiently, stored optimally, and delivered to smallholder farmers through decentralized distribution networks.

A key component of this activity is the installation of temperature-controlled storage facilities at ZARDIs, minimizing post-harvest losses and maintaining seed viability for extended periods. These upgrades will help ensure that seeds remain available throughout planting seasons, mitigating supply shortages that often arise due to poor storage conditions or untimely seed distribution. The project will also establish robust seed marketing and distribution networks, linking ZARDIs with private seed companies, local agro-input dealers, and farmer cooperatives to enhance the efficiency of seed delivery systems and ensure that quality-certified seeds reach last-mile farmers in remote areas. Recognizing that many farmers struggle to differentiate between certified and counterfeit seeds, the project will implement a traceability system and certification protocols to enhance seed authenticity verification and strengthen farmer trust in improved seed varieties. Beyond ensuring seed availability, this activity addresses critical knowledge and technical capacity gaps among farmers and extension workers, which have historically hindered the adoption and effective utilization of climate-resilient seed varieties. Many smallholders, particularly in Bugisu and Teso, lack the skills to verify seed authenticity and apply best agronomic practices for climate-resilient farming. To address these gaps, the project will implement structured training programs for farmers, extension workers, and agro-dealers, focusing on seed verification techniques, certification standards, and agronomic practices tailored to drought- and flood-prone crops. These training sessions will be delivered through farmer field schools, decentralized demonstration farms, and community-based extension hubs, ensuring hands-on engagement and practical learning opportunities. Additional training materials, including audiovisual resources and mobile learning platforms, will be deployed to reinforce knowledge retention and ensure widespread technical support for farmers adopting improved seed varieties.

Recognizing the institutional and operational challenges faced by ZARDIs, the project will also invest in capacity-building programs for seed research personnel, storage facility managers, and extension officers. This will include training on inventory management, demand forecasting, and climate-informed seed production strategies, ensuring that ZARDIs can maintain a consistent supply of climate-adapted seeds even in periods of increased demand. The introduction of climate-resilient seed production frameworks will allow these institutions to adapt seed multiplication efforts to shifting climatic conditions, ensuring that farmers receive varieties best suited to evolving climate risks. By integrating research, storage, marketing, and technical capacity-building into a single intervention, this activity will strengthen Uganda's decentralized seed system, ensure reliable farmer access to climate-resilient seed varieties, and enhance smallholder agricultural resilience.

Deliverable 1.1.2.1: Formal partnerships with NARO, ZARDIs, and private seed enterprises will enhance seed production, processing, and storage through upgraded temperature-controlled facilities, ensuring seed viability and timely distribution to smallholder farmers.

Deliverable 1.1.2.2: Promotion of the implementation of traceability mechanisms and certification protocols under MAAIF to improve seed authenticity, while linking ZARDIs, agro-input dealers, and farmer cooperatives to establish efficient last-mile distribution networks for climate-adapted seeds.

Deliverable 1.1.2.3: Comprehensive training programs and extension services will equip farmers, extension workers, and agro-dealers with skills in seed verification, certification standards, and climate-smart agronomic practices, supported by ten district-level information hubs and digital advisory tools for continuous knowledge dissemination.

Activity 1.1.3: Support seed affordability through subsidies and local financing schemes.

This activity directly addresses the financial barriers that limit smallholder farmers' ability to access climate-resilient seed varieties, building on the seed production, distribution, and capacity-building interventions established in preceding activities. In Eastern Uganda, high seed costs and limited access to affordable financing options prevent many vulnerable farmers, especially women and youth, from adopting improved seed varieties essential for climate adaptation. To mitigate these challenges, the project will integrate targeted subsidy programs with localized financing mechanisms such as village savings and loan associations (VSLAs). Subsidy models will be tailored to reduce the upfront cost of purchasing climate-adapted seeds for critical crops like maize, millet, and rice, enabling broader adoption among resource-constrained households. These subsidies will be complemented by local financing schemes, through the government-led development programs i.e., the Parish Development Model (PDM) and VSLAs designed to prfor agricultural inputs such as climate-adapted seed varieties, ensuring affordability while fostering a culture of investment in quality seeds. Partnerships with existing community-based organizations and local government structures will ensure that these financial interventions are accessible and aligned with the socio-economic realities of farming communities. Furthermore, the project will incorporate monitoring mechanisms to ensure equitable distribution of subsidies, prioritizing the most vulnerable groups, including women-headed households and youth-led farming cooperatives. To ensure sustainability, the project will develop financial literacy programs for farmers, equipping them with the skills to manage loans and plan investments in climate-resilient technologies. By reducing the cost burden and providing viable financial pathways, Activity 1.1.3 will ensure that high-quality climate-adapted seeds are not only accessible but also

financially sustainable for farming communities, strengthening the foundation for long-term resilience and agricultural productivity in Eastern Uganda.

Deliverable 1.1.3.1: Subsidies and tailored loan schemes for climate-adapted seed affordability integrated into the Parish Development Model and facilitated through local VSLAs ensuring accessible financing options for smallholder farmers.

Output 1.2: Enhanced water access management practices for sustained agricultural production.

Water availability is a fundamental determinant of agricultural productivity, human well-being, and ecosystem stability in Eastern Uganda, particularly within the Kyoga Water Management Zone (WMZ). However, increasing climate variability, including erratic rainfall, prolonged dry spells, and extreme events such as floods and landslides, has significantly strained water resources, undermining food security, water security, and livelihoods. The Manafwa, Mpologoma, Lokere and Lokok catchments, which are critical for domestic and agricultural water supply in the project areas, are experiencing increased surface runoff, sedimentation, and reduced groundwater recharge due to widespread land-use change and deforestation. The degradation of wetlands—exacerbated by agricultural expansion, over-extraction, and inefficient water management—has further weakened the region's capacity to regulate water availability, heightening vulnerability to climate risks. These challenges are most evident in semi-arid areas such as the Lokok and Lokere catchments, where over 97% of precipitation is lost through evapotranspiration, significantly reducing surface water retention and groundwater recharge, making communities highly dependent on rain-fed agriculture and seasonal water bodies. Without urgent interventions, the intensification of droughts and floods will continue to compromise agricultural production, disrupt local economies, and push more households into food and water insecurity.

To address these pressing challenges, Output 1.2 introduces a multi-faceted water management approach that integrates rainwater harvesting (RWH) systems, solar-powered community-based irrigation (CBI) units, and strengthened institutional coordination to enhance water availability, storage, and equitable distribution across Eastern Uganda. The project will install 700 household-scale RWH tanks (10m³ each) and 20 large-scale community RWH valley tanks (100,000m³ each) to capture and store excess rainfall during peak seasons, ensuring year-round access to water for both agricultural and domestic use. This intervention is particularly crucial in flood-prone areas such as Butaleja and Bududa, where excess water from heavy rainfall frequently destroys farmland and infrastructure. By diverting excess water into controlled storage, the project will help reduce the frequency and intensity of flood-related damage while ensuring that water is available for agricultural production during extended dry spells. To complement the rainwater harvesting systems, the project will establish 120 solar-powered CBI units capable of irrigating 12,000 hectares of farmland, reducing reliance on rain-fed agriculture and improving crop survival rates during prolonged dry periods. The use of solar energy aligns with Uganda's Updated NDC commitments to low-emission, climate-resilient energy solutions, ensuring that expanded irrigation capacity does not contribute to greenhouse gas emissions. Additionally, this intervention addresses a critical gap in water accessibility for smallholder farmers, who often struggle to access irrigation infrastructure due to financial and logistical constraints.

Recognizing that sustainable water management is not just about infrastructure but also effective governance and capacity-building, the project will work within existing water user committees at the catchment and sub-catchment levels to support equitable water allocation, reduce conflicts, and ensure the maintenance of installed infrastructure. These committees, which already play a role in coordinating water access and usage, will be strengthened through additional capacity-building initiatives, equipping members with the technical knowledge to oversee community-based water distribution, optimize storage management, and enhance coordination with local government structures. To ensure long-term knowledge retention and local ownership, the project will establish ten district-level demonstration centres, where farmers, extension workers, and local leaders will receive hands-on training on sustainable water harvesting and irrigation techniques. These centres will feature fully operational RWH systems and solar irrigation units, serving as permanent learning hubs for the promotion of climate-resilient water management practices. Additionally, the project will develop training manuals and educational materials in local languages, ensuring that knowledge about efficient water use and conservation reaches a broad spectrum of community members. By integrating scientific innovations, localized governance models, and climate-adaptive infrastructure, the project will stabilize water availability across seasons, protecting farmers from crop failures, reducing disaster risks, and strengthening climate resilience in Eastern Uganda, ultimately securing livelihoods while safeguarding critical water resources for future generations.

Activity 1.2.1: Procure and Install Water Harvesting Equipment and Storage Tanks in semi-arid & flood prone areas

Activity 1.2.1 focuses on the installation of 700 household rainwater harvesting (RWH) tanks with a capacity of 10 m³ each and 20 large-scale community tanks of 100,000 m³ each across target districts in Eastern Uganda's Kyoga WMZ. These systems are designed to capture and store rainfall during peak precipitation periods, providing a reliable water source for agriculture and domestic use during prolonged dry spells and erratic rainfall seasons. This intervention

directly complements the deployment of climate-adapted seeds under Output 1.1 by ensuring a stable water supply essential for their success, particularly in drought-prone and flood-affected areas like the Teso and Bugisu sub-regions. The tanks will be constructed using durable, climate-resilient materials to withstand extreme weather events and prevent water loss, while strategically sited to minimize runoff and soil erosion. To facilitate widespread understanding and adoption, the RWH Handbook developed under the Ministry of Water and Environment will be disseminated and popularized through local languages, featuring tailored guidance on system installation, maintenance, and sustainable water use practices. This resource will be accessible via district-level information hubs and farmer field schools, reinforcing training efforts and enhancing community engagement. By integrating the RWH systems with improved land management practices, the project also aims to stabilize agricultural land productivity and reduce reliance on wetlands, which have faced significant degradation from overuse. Community-level governance structures will manage the shared tanks, ensuring equitable access and sustainability while promoting local ownership and maintenance. Together, these actions will address critical water scarcity challenges, directly supporting agricultural resilience and reducing the vulnerability of households to climate-induced water stress, thereby amplifying the impacts of other project activities and creating a foundation for long-term sustainability in the region.

Deliverable 1.2.1.1: Installation of 700 rainwater harvesting (RWH) tanks (10 m³ each) in households, schools, and hospitals across targeted districts in Eastern Uganda.

Deliverable 1.2.1.2: Promote the MWE RWH Handbook distributed in local languages via publications, radio/TV shows, and community meetings to enhance awareness of the environmental, social, and economic advantages of RWH. It will also be made available at district-level information hubs and to local farmer field schools.

Deliverable 1.2.1.3: Installation of 20 large-scale (100,000 m³) community-level SRWH valley storage tanks in designated catchment areas to reduce flood damage to agricultural landscapes and wetlands.

Activity 1.2.2: Establish Small-Scale Solar-Powered Community-Based Irrigation (CBI) Units in rural farming communities

This activity integrates the installation of 120 solar-powered Community-Based Irrigation (CBI) units with structured capacity-building efforts to enhance water availability, agricultural resilience, and climate adaptation in Eastern Uganda. The intervention builds upon the rainwater harvesting infrastructure established under Activity 1.2.1, ensuring that stored water is efficiently utilized for year-round irrigation of 12,000 hectares of farmland, particularly in drought-prone and water-stressed communities. With erratic rainfall patterns and prolonged dry spells becoming more frequent, reliance on rainfed agriculture is increasingly unsustainable, making access to reliable irrigation solutions critical for smallholder farmers. The solar-powered irrigation units will provide an energy-efficient, low-emission solution to climate-induced water shortages, reducing agricultural dependence on inconsistent rainfall while ensuring a stable water supply for key crops cultivated using climate-adapted seeds introduced under Output 1.1. The irrigation units will be strategically located based on agro-ecological suitability and community consultations, ensuring maximum coverage and impact on agricultural productivity.

To ensure the long-term functionality and efficiency of the installed irrigation and water harvesting systems, the project will establish four (4) sub-regional demonstration centres, which will serve as technical training hubs for farmers, extension workers, and local stakeholders. These centres will be equipped with fully operational RWH systems, solar-powered irrigation units, and real-time monitoring tools, enabling practical, hands-on learning in sustainable water use, system maintenance, and irrigation best practices. Beyond demonstrating proper use and maintenance of irrigation infrastructure, these centres will also serve as training sites for previously introduced climate adaptation technologies, including climate-resilient seed varieties and improved rainwater harvesting techniques. Through structured workshops, field demonstrations, and guided technical sessions, farmers will gain critical skills in optimizing irrigation schedules, preventing water loss, and maximizing crop yields through water-efficient farming methods. The Ministry of Water and Environment's RWH Handbook will be widely disseminated and integrated into training modules, ensuring that farmers and extension workers have access to reliable, locally adapted technical guidance on water conservation and sustainable irrigation practices.

Recognizing the importance of local technical expertise in sustaining installed systems, the project will implement comprehensive capacity-building programs tailored for 500 farmers, extension workers, and maintenance personnel, equipping them with the skills required to operate, maintain, and troubleshoot solar-powered irrigation systems and RWH units. These programs will be delivered through on-site mentorship, mobile advisory services, and farmer-to-farmer learning networks, ensuring that technical knowledge is accessible, practical, and retained at the community level. By integrating infrastructure deployment with sustained technical training, this activity will create a self-sufficient,

climate-resilient irrigation system that enhances agricultural productivity, improves food security, and ensures sustainable water access for smallholder farmers in Eastern Uganda.

Deliverable 1.2.2.1: Capacity needs assessment reports and tailored comprehensive training programs for 500 extension workers, farmers, and technical personnel to ensure effective installation, operation, and maintenance of CBI units and will focus on building technical knowledge in irrigation system management.

Deliverable 1.2.2.2: Establishment of 120 small-scale solar-powered community-based irrigation units, irrigating a total of 12,000 hectares of farmland across Eastern Uganda. Each unit will be accompanied by a sustainability plan, including local leadership involvement and provisions for spare parts, to ensure long-term operational capacity.

Deliverable 1.2.2.3: Establishment of four (4) demonstration centres, equipped with rainwater harvesting systems, solar irrigation units, and agricultural technology demonstration sites, serving as permanent hubs for farmer training and sustainable water resource management.

Activity 1.2.3: Develop Equitable Rules for Water Infrastructure Management and Benefit Sharing

Activity 1.2.3 focuses on establishing a framework of equitable rules for managing water infrastructure and sharing its benefits, ensuring the long-term sustainability and fair distribution of resources generated through the rainwater harvesting systems and solar-powered CBI units. These rules will be developed in close collaboration with local stakeholders, integrating traditional water management practices with modern governance approaches to reflect the unique socio-economic and cultural dynamics of the Kyoga WMZ. Drawing insights from the participatory training conducted under Activity 1.2.2 and building on the infrastructure deployed in previous activities, the framework will include clearly defined roles and responsibilities for maintenance, allocation schedules for agricultural and domestic water use, and mechanisms for conflict resolution. The rules will emphasize inclusivity, ensuring that women (at least 35%), youth, and marginalized groups have equitable access to water resources and decision-making processes. To institutionalize these practices, user committees will be established and trained to oversee adherence to the rules and facilitate ongoing dialogue among stakeholders. This activity directly addresses governance barriers, reducing competition and disputes over limited water resources while enhancing community ownership and the efficiency of infrastructure utilization. By embedding equitable and transparent management practices, it reinforces the sustainability of water interventions and ultimately strengthens the resilience of agricultural systems to climate variability.

Deliverable 1.2.4.1: Development and dissemination of a "Rules of Engagement" manual for equitable water infrastructure management and benefit sharing. This manual will include locally relevant guidelines to ensure fair access to water resources and prevent conflicts. It will be distributed through community meetings, workshops, and local institutions to ensure widespread adoption and understanding.

Component 2: Empowering Communities through Sustainable Enterprise Development and Environmental Restoration

Component 2 addresses the critical need to combat deforestation, promote sustainable livelihoods, and transition away from unsustainable energy practices in Eastern Uganda. The region faces an escalating crisis of forest degradation, with forest cover plummeting from 24% in 1990 to just 9% by 2017 due to agricultural expansion, reliance on biomass for energy, and demographic pressures. On the slopes of Mount Elgon, cash crop farming, particularly coffee, has intensified deforestation, soil erosion, and biodiversity loss. These dynamics not only reduce the carbon sequestration potential of the region but also destabilize water cycles, exacerbate landslide risks, and threaten food security.[51] Furthermore, over 90% of the population in Uganda depends on biomass for cooking and heating, a practice that continues to strain forest resources while contributing to greenhouse gas emissions and health risks from indoor air pollution.[52,53] The energy sector, despite its significant potential for renewables such as solar and geothermal, remains underdeveloped, leaving rural communities without viable alternatives to biomass energy.

CATLER-Uganda recognizes that tackling these complex challenges requires integrated solutions that link environmental conservation with sustainable economic opportunities. Component 2, therefore, employs Farmer-Managed Natural Regeneration (FMNR) to restore degraded forest landscapes, a proven approach that leverages existing root systems to regrow native trees, enhancing soil health, increasing biodiversity, and creating resilient ecosystems. Simultaneously, the project will support Forest-Based Enterprises (FBEs) that harness non-timber forest products such as honey, mushrooms, and medicinal plants, diversifying incomes for local communities while reducing

[51] https://www.un-redd.org/sites/default/files/2021-10/Uganda%20Forest%20Technical%20Report_mailversion-1%20OK.pdf?utm
[52] https://www.fao.org/redd/news/detail/en/c/1235141/?utm
[53] https://energytransition.org/2023/09/the-ugandan-energy-sector-renewables-enormous-potential-is-yet-to-deliver/?utm

reliance on deforestation-driven activities. These enterprises will prioritize women and youth, who often face the brunt of economic and environmental vulnerability, ensuring equitable access to resources and benefits.

To address the region's heavy reliance on biomass, **CATLER-Uganda** will foster partnerships with private sector actors and microfinance institutions to deploy renewable energy solutions, including rooftop solar photovoltaic (PV) systems and bio-latrines. These technologies will offer cleaner, more efficient energy alternatives while reducing the unsustainable harvesting of firewood and charcoal. Solar PV systems will enhance energy access for schools, health centers, and households, reducing anthropogenic GHG emissions and improving community well-being. The introduction of bio-latrines will not only address energy needs but also improve sanitation and waste management, contributing to broader health outcomes. By embedding these energy solutions within a framework of environmental conservation and enterprise development, the project ensures that renewable energy adoption becomes a viable and sustainable pathway for community transformation. Through these interventions, Component 2 builds on the foundational efforts of Component 1, creating synergies between improved agricultural productivity, water management, and sustainable forestry and energy practices. Component 2, thus, directly addresses barriers such as limited access to finance, inadequate technical capacity, and weak institutional coordination by integrating training, resource access, and governance mechanisms into its design. This comprehensive approach will not only restore critical ecosystems and reduce greenhouse gas emissions but also enhance livelihoods, improve resilience to climate shocks, and lay the groundwork for long-term sustainable development in Eastern Uganda.

Output 2.1: Reduced GHG emissions through adoption of renewable energy and forest restoration technologies.

Output 2.1 will be achieved by driving the adoption of renewable energy solutions to reduce greenhouse gas (GHG) emissions and reduce overall reliance on unsustainable biomass use, which is a significant driver of deforestation and environmental degradation in Eastern Uganda. This output focuses on installing 3 MW of rooftop solar photovoltaic (PV) systems across schools, health centres, and households, as well as introducing 30 bio-latrines to provide cleaner energy options and improve sanitation. These technologies directly address energy access barriers while reducing carbon emissions and deforestation pressures tied to firewood and charcoal consumption. Leveraging the institutional and community governance frameworks strengthened under Component 1, the project will establish partnerships with private sector actors and microfinance institutions to facilitate technology deployment, financing, and capacity-building for sustainable operation. By embedding these renewable energy interventions within the broader framework of climate adaptation and mitigation, Output 2.1 ensures a transformative shift toward low-carbon energy systems, enabling communities to reduce their carbon footprint while improving energy security and quality of life.

Activity 2.1.1: Establish New and Leverage Existing Partnerships to Deploy Renewable Energy Technologies.

This activity focuses on establishing new and leveraging existing partnerships to accelerate the deployment of renewable energy technologies and overcome systemic barriers that limit access to clean, affordable, and sustainable energy alternatives in Eastern Uganda. The project will facilitate formal agreements with private sector technology providers, microfinance institutions (MFIs), local government entities, and community organizations to enable the installation of 3 MW of rooftop solar PV systems and 30 bio-latrines across schools, health centres, and households. These partnerships are critical in addressing key challenges, including high upfront costs, lack of technical expertise, and fragmented energy infrastructure, which have hindered renewable energy adoption in off-grid and underserved communities. By integrating public-private collaboration, the activity will strengthen supply chains, improve the availability of financing mechanisms, and ensure the seamless deployment, operation, and maintenance of installed systems.

A core component of this intervention is expanding access to tailored financing options through MFIs and financial cooperatives, enabling low-income households and institutions to invest in renewable energy solutions. The project will work with financial institutions to design concessional loans, leasing arrangements, and targeted subsidies that reduce the financial burden associated with solar PV installations and bio-latrine adoption. In parallel, the project will leverage partnerships with established renewable energy service providers to ensure that equipment meets quality standards, installation is done efficiently, and post-installation support—such as maintenance and troubleshooting—is readily available. Additionally, the project will engage local governments and community organizations in identifying priority sites for installation, ensuring that interventions are contextually appropriate and aligned with existing energy policies and regional development plans.

To ensure the long-term functionality and sustainability of the deployed systems, the project will implement capacity-building initiatives targeting end-user groups, including school administrators, health centre managers, and community leaders. These training programs will focus on operation and maintenance (O&M), energy efficiency best practices, and system troubleshooting, equipping local stakeholders with the skills required to manage and sustain the renewable

energy installations beyond the project's duration. The project will also establish linkages with vocational training centres and technical institutions to create a pipeline of skilled technicians who can support ongoing maintenance and scale up renewable energy adoption in the region. By fostering cross-sectoral collaboration, this activity ensures a scalable and replicable model for renewable energy deployment, directly reducing greenhouse gas emissions, enhancing energy security, and improving the livelihoods of vulnerable communities.

Deliverable 2.1.1.1: Partnership agreements (MoUs) between government actors, technology providers, and end-users established to attract private sector investment and facilitate renewable energy deployment. These agreements will include clear terms for financing, technology provision, and community engagement to ensure transparency and accountability.

Deliverable 2.1.1.2: Deployment of 3 MW of rooftop solar PV systems across households, schools, and hospitals in districts like Kapchorwa and Soroti, reducing greenhouse gas emissions while improving energy access for critical services.

Deliverable 2.1.1.3: Installation of 30 bio-latrines in schools and hospitals across urban and rural areas with insufficient access to traditional energy sources, addressing sanitation challenges, reducing pressure on forest resources for fuelwood, and contributing to sustainable waste management.

Deliverable 2.1.1.4: Development of capacity-building materials and training programs based on a detailed assessment of local needs. These materials will support extension workers and end-users in the installation, operation, and maintenance of solar PV and bio-latrine systems, ensuring sustainable management of the technologies.

Activity 2.1.2: Incentivizing for Farmer-Managed Natural Regeneration (FMNR) in Forest Landscape Restoration

This activity integrates land allocation incentives, technical capacity-building, and targeted community engagement to facilitate Farmer-Managed Natural Regeneration (FMNR) on 50,000 hectares of degraded forest landscapes in Eastern Uganda. The intervention will commence with collaborating with the National Forestry Authority (NFA) to identify and incentivize land allocation for FMNR within existing forest management plans, ensuring that degraded landscapes in priority restoration zones are effectively rehabilitated. Given the extensive land-use pressures caused by agricultural expansion, firewood harvesting, and overgrazing, FMNR offers a low-cost, scalable solution that capitalizes on existing root systems, natural seed banks including tree seeds promoted under activity 1.1.1, and tree stumps to regenerate forests, restore soil fertility, reduce erosion, and improve water retention. These ecological benefits will directly enhance resilience against climate-induced hazards such as floods, droughts, and landslides, which disproportionately affect rural farming communities in the Lake Kyoga floodplain, the Lake Victoria Crescent, and other fragile landscapes. However, widespread adoption of FMNR has been hindered by unclear land tenure arrangements, financial constraints, and knowledge gaps, as identified in Uganda's Technology Needs Assessment (TNA) and Technology Action Plans (TAPs). To overcome these barriers, this activity will provide targeted incentives, including financial subsidies and technical assistance, enabling landowners and forest-adjacent communities to allocate land for regeneration while ensuring tangible socio-economic benefits.

Deliverable 2.1.2.1: Incentivized land allocation for FMNR, implemented in collaboration with the National Forestry Authority (NFA) to integrate restoration efforts within forest management plans and community land-use agreements, ensuring sustainability and policy alignment.

Deliverable 2.1.2.2: Restoration of 50,000 hectares of degraded forest landscapes through FMNR activities using tree stumps and climate-adapted tree seed species such as pine and eucalyptus.

Activity 2.1.3: Community-Led Awareness, Engagement, and Capacity Building for FMNR

This activity will raise awareness, strengthen community participation, and build technical capacity for Farmer-Managed Natural Regeneration (FMNR) in forest-adjacent sub-regions of Bugisu, Teso, and Bukedi, ensuring long-term ownership and sustainability of forest restoration efforts. Addressing key barriers such as knowledge gaps, cultural resistance, and social exclusion, this intervention will combine awareness campaigns with hands-on training to empower landowners, women, and youth as active participants in forest landscape restoration. Outreach efforts will leverage local councils, religious gatherings, and traditional leadership forums to promote the ecological and livelihood benefits of FMNR, while training programs will provide practical skills in pruning, regeneration monitoring, and sustainable forest management. By demonstrating the immediate and long-term benefits of FMNR, such as soil preservation, microclimate restoration, and improved access to non-timber forest products (NTFPs), the activity will foster local ownership and behavioural change. Integrating awareness creation with targeted capacity-building, this intervention will complement incentive-based mechanisms under Activity 2.1.2, ensuring that technical restoration

efforts are reinforced by strong community engagement and equitable participation, particularly among women and youth.

Deliverable 2.1.3.1: Organization of community awareness campaigns, training sessions, and cultural events at village, sub-county, and district levels to promote FMNR adoption.

Deliverable 2.1.3.2: Development and dissemination of FMNR-focused training materials and literature at community hubs and demonstration centres, ensuring widespread access to restoration knowledge.

Deliverable 2.1.3.3: Targeted training for women and youth on FMNR techniques, sustainable pruning, and regeneration monitoring, equipping them to lead and sustain restoration efforts.

Output 2.2: Strengthened economic resilience through sustainable nature-based enterprise development and improved market access.

Output 2.2 addresses the critical need to strengthen economic resilience in Eastern Uganda's forest-adjacent communities, where climate challenges such as deforestation, soil degradation, and erratic weather patterns have compounded socio-economic vulnerabilities. The overexploitation of forests for firewood, charcoal, and unsustainable agriculture has driven significant ecosystem degradation, leaving communities increasingly exposed to flooding, drought, and declining agricultural productivity. This situation is further exacerbated by limited livelihood options, forcing households to rely on environmentally harmful activities to meet basic needs. By promoting sustainable nature-based enterprises (NBEs) and improving market access, Output 2.2 offers an alternative pathway that aligns economic development with environmental conservation, directly addressing the dual challenges of poverty and ecosystem degradation. The introduction of diversified Forest-Based Enterprises (FBEs), such as honey production, sustainable timber, and agroforestry products, will reduce dependency on unsustainable forest extraction, helping to restore degraded landscapes and stabilize local micro-climates. This approach not only enhances community livelihoods but also builds resilience to climate variability by providing reliable income sources that are less vulnerable to environmental shocks.

The achievement of Output 2.2 hinges on a multi-faceted strategy that integrates resource provision, capacity-building, and institutional support. Targeted inputs such as seedlings for agroforestry, equipment for apiaries, and training in woodlot management will be distributed to FBEs, addressing the resource barriers that currently limit enterprise growth. Complementary investments in market infrastructure, including collection centres and buyer agreements, will create the conditions for FBEs to scale and commercialize sustainably produced goods. Financial institutions will be engaged to develop tailored products, enabling enterprises to overcome capital constraints and invest in efficient production practices. Capacity-building programs will train FBE management groups in areas such as sustainable resource use, financial literacy, and market access, prioritizing the inclusion of women and youth to ensure equitable participation. Partnerships with NGOs, CSOs, and local authorities will formalize coordination and streamline service delivery, ensuring a unified approach to supporting FBEs in sub-regions like Teso and Bugisu. Through these interconnected interventions, Output 2.2 will transform economic activities in forest-adjacent communities, creating a foundation for sustainable livelihoods while mitigating the region's pressing climate challenges.

Activity 2.2.1: Promote Access to Inputs and Services for Diversified Forest-Based Enterprises (FBEs)

This activity aims to remove key barriers to the establishment and scaling of Forest-Based Enterprises (FBEs) by ensuring that forest-adjacent communities have access to essential inputs, technical support, and market opportunities that promote sustainable livelihoods and forest conservation. The intervention specifically targets communities near Mount Elgon and in the Bugisu and Teso sub-regions, where deforestation and land degradation have been driven by unsustainable agricultural expansion, firewood harvesting, and limited economic alternatives. Despite the potential for sustainable forest enterprises, communities face significant obstacles—including lack of access to quality inputs such as agroforestry seedlings and apiary equipment, inadequate training in sustainable resource management, and weak market linkages—which hinder the transition from forest degradation to conservation-based livelihoods. The project will address these gaps by distributing critical inputs to 500 FBEs, ensuring that communities have the resources necessary to develop profitable and ecologically sustainable enterprises aligned with forest restoration goals.

Beyond input provision, the project will implement technical training programs tailored to the specific needs of FBEs, equipping enterprise owners with practical knowledge in sustainable agroforestry, beekeeping, and woodlot management. Training modules will emphasize climate-smart and biodiversity-friendly practices, such as selective harvesting, integrated tree cropping, and ecosystem-based business models, ensuring that enterprises generate economic benefits without degrading forest ecosystems. Additionally, the project will facilitate linkages between FBEs and extension service providers, strengthening technical support networks and enhancing access to market-driven information on value addition, product certification, and sustainable harvesting standards. By embedding these training

and support mechanisms into existing community structures and demonstration centers, the intervention will ensure that knowledge transfer is sustained beyond the project's lifespan, fostering a long-term shift toward conservation-oriented enterprise development.

To increase awareness and demand for FBEs, the project will conduct targeted awareness campaigns in forest-adjacent communities, using local information hubs, multimedia content, and knowledge-sharing platforms to highlight the economic and ecological benefits of sustainable enterprises. These campaigns will showcase successful FBE models, demonstrating their role in landscape restoration, economic resilience, and reduced pressure on natural forests. Messaging will be localized and tailored to different stakeholder groups, ensuring that youth, women, and indigenous communities are actively engaged in the transition toward sustainable forest-based livelihoods. Through this integrated approach—providing inputs, technical capacity, and awareness-building—this activity establishes a strong foundation for transforming forest-dependent economies, reinforcing landscape restoration while generating stable income streams for vulnerable communities.

Deliverable 2.2.1.1: Distribution of critical inputs and services, such as seedlings for agroforestry, equipment apiary, and training for sustainable woodlot management, to 500 FBEs. These inputs will directly support sustainable resource use and conservation practices.

Deliverable 2.2.1.2: Awareness campaigns on the ecological and economic benefits of FBEs conducted in forest-adjacent areas, with materials made accessible at local information hubs. Campaigns will highlight successful FBE models to inspire adoption in regions such as Bugisu and Teso.

Activity 2.2.2: Strengthening Market Infrastructure and Financial Access for Scaling Forest-Based Enterprises (FBEs)

This activity focuses on enhancing market infrastructure and expanding financial services to support the scaling of Forest-Based Enterprises (FBEs), ensuring their integration into formal markets and sustainable value chains while reinforcing climate-smart production practices. In forest-adjacent communities, limited market infrastructure and inadequate access to financing have hindered the growth and competitiveness of FBEs, restricting their ability to transition toward environmentally sustainable business models. To address these gaps, the project will establish collection and aggregation centres, enabling small-scale producers to centralize processing, improve product quality, and increase efficiency in distribution. These centres will reduce post-harvest losses, lower carbon emissions associated with fragmented transportation systems, and enhance economies of scale, making it easier for smallholder producers to meet market demand and negotiate better prices. Key products such as honey, essential oils, sustainably sourced timber, and other non-timber forest products (NTFPs) will benefit from these hubs, standardizing quality and strengthening regional supply chains. Complementing infrastructure improvements, the project will facilitate market linkages at the district level, supporting FBEs in establishing direct buyer agreements, accessing trade fairs, and integrating into cooperative networks, ensuring they can tap into larger, more stable markets for sustainably produced goods.

Recognizing that limited financial access remains a critical bottleneck to the growth of FBEs, the project will collaborate with microfinance institutions, cooperative banks, and development finance entities to design tailored financial products that reflect the unique needs and risks associated with nature-based enterprises. Traditional financing mechanisms often fail to account for longer investment cycles in sustainable forestry and agroforestry enterprises, making it difficult for FBEs to access capital for scaling operations, adopting renewable energy solutions, and investing in efficient processing technologies. To overcome these barriers, the project will work with financial partners to develop concessional loan schemes, risk-sharing mechanisms, and blended finance options, ensuring that FBEs have the liquidity necessary to expand sustainably while reducing financial vulnerability to climate variability. Additionally, capacity-building initiatives in financial literacy and business management will be provided, equipping enterprise owners with the skills to manage credit responsibly, optimize production costs, and increase long-term profitability. By integrating market infrastructure development with financial inclusion strategies, this activity ensures that FBEs are positioned for long-term success, contributing to forest restoration, sustainable livelihoods, and regional climate adaptation and mitigation goals.

Deliverable 2.2.2.1: Establishment of at least four (4) market aggregation centres in key forest-adjacent districts equipped with storage, processing, and quality control facilities to centralize collection, improve product standardization, and enhance market access for honey, essential oils, sustainably sourced timber, and other non-timber forest products (NTFPs).

Deliverable 2.2.2.2: Facilitation of at least 500 FBEs in accessing tailored financial products, including concessional loans, risk-sharing mechanisms, and blended finance options, through partnerships with

microfinance institutions, cooperative banks, and development finance entities, ensuring increased investment in sustainable production technologies and climate-resilient business models.

Activity 2.2.3: Strengthening Capacity for Forest-Based Enterprises (FBEs) Management Groups through Local Partnerships

This activity focuses on enhancing the technical, entrepreneurial, and organizational capacity of Forest-Based Enterprises (FBEs) by partnering with local NGOs, Civil Society Organizations (CSOs), and local authorities to provide structured training and business development support. Many FBEs in forest-adjacent communities face challenges related to limited technical expertise, weak business management skills, and lack of coordination among producers, which hinders their ability to scale and integrate into formal markets. To address these gaps, the project will deliver targeted capacity-building programs that equip at least 500 FBE owners with the skills necessary to establish, manage, and expand their enterprises sustainably. Training will focus on climate-smart resource management, value addition, financial literacy, cooperative development, and compliance with market standards, ensuring that FBEs can operate profitably while contributing to forest conservation goals.

To ensure that learning is practical and accessible, the project will integrate hands-on workshops and demonstration-based training sessions within the sub-regional demonstration centres established under Activity 1.2.2. These centres will provide on-site technical assistance, peer-to-peer learning opportunities, and mentorship from experienced entrepreneurs and extension officers, ensuring that FBE owners can apply best practices in real-world settings. Additionally, the project will support local business networks and producer cooperatives, strengthening coordination among FBEs to facilitate joint marketing efforts, bulk purchasing of inputs, and collective bargaining power. By embedding training within existing community structures and leveraging local expertise, this activity ensures that capacity-building efforts are sustainable and scalable, fostering locally-driven enterprise development and long-term resilience.

Deliverable 2.2.3.1: Implementation of structured capacity-building programs in partnership with local NGOs, CSOs, and local authorities, equipping at least 500 FBE owners with business management, climate-smart production, and cooperative development skills.

Deliverable 2.2.3.2: Integration of hands-on training sessions into sub-regional demonstration centres, ensuring that FBE owners gain practical experience in sustainable resource use, value addition, and market compliance.

Deliverable 2.2.3.3: Support for local business networks and producer cooperatives, enhancing market coordination, input accessibility, and joint marketing strategies to improve FBE sustainability and scalability.

Component 3: Enhancing Financial and Regulatory Frameworks for Sustained Climate-Smart Technology Adoption

Component 3 is pivotal in ensuring the successful adoption, transfer, and scaling of climate technologies by dismantling financial and regulatory barriers that have long inhibited their accessibility and sustainability in Eastern Uganda's agriculture and forestry sectors. It builds directly on the outputs and activities promoting environmentally sound technologies for enhanced resilience to climate change in key target sectors by addressing systemic constraints such as limited access to affordable financing, high upfront costs, and fragmented institutional coordination. These barriers have left smallholder farmers and rural enterprises struggling to invest in critical climate technologies, perpetuating reliance on unsustainable practices that degrade the environment and undermine resilience to climate shocks. Component 3 aims to bridge this gap by creating an enabling environment where financial systems, institutional frameworks, and stakeholder partnerships converge to support transformative climate technology adoption.

A core element of Component 3 is its focus on innovative financial mechanisms designed to de-risk investments in climate technologies and unlock access to capital for underserved groups. Through tailored solutions such as concessional loans, risk-sharing facilities, and performance-based subsidies, the component ensures that technologies like solar-powered irrigation systems, efficient forestry tools, and renewable energy systems become viable options for smallholder farmers and FBEs. These mechanisms not only reduce the perceived risks for financial institutions but also directly lower the cost barriers for end-users. For instance, farmers in forest-adjacent communities in Teso and Bugisu, who previously faced prohibitive costs for adopting energy-efficient cookstoves or sustainable agroforestry systems, will now have access to tailored credit products developed in collaboration with local microfinance institutions. This creates a pathway for scaling technologies that enhance productivity, reduce emissions, and restore degraded ecosystems.

On the regulatory front, Component 3 strengthens institutional coordination by formalizing partnerships and clarifying roles among government agencies, NGOs, and private sector actors. Memorandums of Understanding (MoUs) will streamline resource allocation and foster synergies in regulatory implementation, ensuring that tax incentives and other tools are consistently applied and equitably distributed. This approach reduces institutional bottlenecks and accelerates the deployment of climate technologies in priority regions like Mount Elgon and the Lake Kyoga basin, where fragmented governance has previously slowed progress. Furthermore, by establishing platforms for stakeholder dialogue, the component aligns public and private interests, enabling co-designed regulations that address both market dynamics and community needs. By directly addressing systemic financial and regulatory barriers, Component 3 creates the conditions necessary for sustainable climate technology adoption and scaling. It builds a solid foundation for earlier project interventions, ensuring that the technologies supported under Component 1 & 2 can thrive in a conducive economic and institutional environment. This transformative framework not only secures long-term agricultural productivity and resilience but also positions Uganda as a leader in integrating climate technology development with inclusive, sustainable development.

Output 3.1: Farmers and technology end-users can afford technology inputs and services long-term via financial support mechanisms established at the local and national levels.

Output 3.1 will be achieved by establishing a robust financial ecosystem that addresses the systemic constraints limiting the affordability and long-term adoption of climate technologies. This will involve transforming the financial landscape to create a supportive environment for technology providers, farmers, and end-users, ensuring sustained access to climate-smart solutions. Addressing the underlying issues of high costs, inaccessible credit, and perceived risks associated with climate technologies, the interventions under this output aim to shift the dynamics of technology affordability by integrating innovative financial mechanisms with capacity-building initiatives. These efforts will strategically link local and national financial systems to foster an inclusive framework where financial institutions, private sector actors, and smallholder communities collaborate to ensure long-term access to technologies essential for adaptation and mitigation.

Activity 3.1.1: Develop and Implement Tax Incentives and Other Subsidies for Long-Term Climate Technology Affordability

Activity 3.1.1 addresses the critical financial barriers to climate technology adoption by developing and implementing targeted tax incentives and subsidies that reduce the cost of essential components for end-users, particularly in the agricultural and renewable energy sectors. High import taxes and bureaucratic procurement processes, as highlighted in the TAPs, significantly inflate the costs of technologies like solar energy systems and agricultural equipment, rendering them inaccessible to smallholder farmers and institutions. This activity focuses on introducing structured tax reductions, including a 16% tax cut on solar components, to lower these costs and incentivize broader adoption of renewable energy technologies. By alleviating financial burdens on technology providers and streamlining procurement processes, the activity ensures that climate technologies become more affordable and accessible to farmers in vulnerable districts. The cascading effect of these incentives not only enhances the uptake of renewable energy for irrigation and storage but also stimulates market activity, encouraging private sector investment in technology deployment. This approach establishes a foundation for long-term affordability and scalability, enabling systemic integration of climate technologies into rural economies while promoting sustainable development and resilience to climate variability.

> **Deliverable 3.1.1.1:** Introduction of a 16% tax reduction on solar components, ensuring affordability and increasing accessibility to renewable energy technologies for farmers and technology providers.

Activity 3.1.2: Enhancing Financial Services and Capacity for Climate Technology Investment

This activity removes financial barriers to climate technology adoption by fostering strategic partnerships with private financial institutions and microfinance entities (MFIs) while simultaneously building their capacity to assess and invest in climate-smart solutions. Access to affordable credit remains a key challenge for smallholder farmers and last-mile users of climate technologies, as financial institutions often perceive these investments as high-risk due to uncertainties in returns and climate vulnerabilities. To address this, the project will establish formalized partnerships with MFIs and small and medium enterprises (SMEs) to design and offer tailored financial products, such as low-interest loans, flexible repayment plans, and agro-insurance schemes, specifically for climate-smart technologies in forest and agricultural landscapes. In parallel, capacity-building initiatives will equip financial institutions and SMEs with specialized risk assessment tools and training to enhance their ability to evaluate the long-term economic benefits and viability of financing climate technologies. This intervention ensures that financial institutions confidently invest in climate resilience while reducing perceived risks, ultimately strengthening the financial ecosystem for climate adaptation. The synergy between financial product development and institutional capacity building will accelerate technology uptake,

promote private sector engagement, and empower vulnerable communities to integrate climate solutions into their livelihoods.

Deliverable 3.1.2.1: Formalized partnership agreements with MFIs and SMEs to provide targeted financial products, such as low-interest loans, for purchasing and maintaining climate-smart technologies.

Deliverable 3.1.2.2: Development of training tools and capacity-building initiatives for SMEs and financial institutions, focusing on risk mitigation strategies and the long-term economic returns of climate investments.

Activity 3.1.3: Establish Long-Term Financing Schemes for Climate Technology Adoption

Activity 3.1.4 establishes long-term financing schemes designed to address systemic barriers to climate technology adoption by enabling smallholder farmers and enterprises to access and sustain investments in climate-smart solutions. The renewable energy revolving fund at the national level will provide a continuous source of low-interest financing for technologies such as solar-powered irrigation systems, solar drying racks, and energy-efficient storage facilities. This fund prioritizes districts with significant energy access gaps, ensuring equitable distribution of resources to underserved areas. The revolving structure ensures that as loans are repaid, funds are reinvested, creating a self-sustaining financial mechanism that supports the scaling of climate technologies over time. In addition, the provision of seed funding for village savings and loan associations (VSLAs) will directly empower rural communities to finance smaller-scale technology inputs and services independently. This intervention will allow farmers to pool resources and access financing for critical post-harvest technologies, such as solar dryers that reduce spoilage and improve product quality, and storage facilities that protect against climate-induced losses. These technologies address inefficiencies that the TAPs identified as major barriers to achieving sustainable productivity and market competitiveness in agriculture. The financing schemes will also promote value addition in activities such as agro-processing and capture fisheries, increasing market value and incomes for farming households. By creating tailored financial instruments and deploying resources at both national and community levels, this activity ensures that financing mechanisms are aligned with the unique needs of rural and agricultural stakeholders. These interventions will build on earlier efforts to reduce technology costs (Activity 3.1.1) and enhance financial institutional capacity (Activity 3.1.3), forming a cohesive system that supports technology affordability, adoption, and long-term maintenance. This comprehensive approach ensures that climate technologies become not only accessible but also integral to the resilience and productivity of rural economies in Uganda.

Deliverable 3.1.4.1: Establishment of a national renewable energy revolving fund to finance the adoption of climate-smart energy technologies, prioritizing areas where energy access gaps are pronounced.

Deliverable 3.1.4.2: Provision of seed funding to support VSLAs in financing technology inputs and services for smallholder farmers and vulnerable communities, fostering community-level financial autonomy.

Deliverable 3.1.4.3: Development of financing schemes to invest in post-harvest loss reduction technologies (e.g., solar drying and storage facilities) and value addition initiatives such as capture fisheries, ensuring farmers can increase productivity and market value sustainably.

Output 3.2: Strengthened Regulatory and Institutional Frameworks for Sustained Climate Technology Implementation

The establishment of a strong regulatory and institutional framework is vital to overcoming systemic barriers that impede the effective transfer and adoption of climate technologies, particularly in regions where fragmented governance and weak policy enforcement have historically undermined progress. Gaps in regulatory standards create inconsistencies in technology quality, safety, and implementation, which erode trust among end-users and hinder the scaling of solutions essential for building resilience in agriculture and renewable energy. This output focuses on addressing these gaps by standardizing procedures and norms to ensure the reliability and sustainability of technologies, providing a foundation for long-term success.

Achieving this requires a multifaceted approach that integrates the development of comprehensive regulatory standards with stakeholder engagement and capacity building. By formalizing consistent guidelines for technology safety and efficiency, the interventions ensure that renewable energy systems, irrigation technologies, and other climate-smart solutions meet defined quality benchmarks, fostering end-user confidence and private sector investment. Regulatory impact assessments and extensive consultations with local communities, government agencies, and private actors will refine these standards, ensuring they address site-specific needs while aligning with national climate priorities.

Furthermore, the development of complementary data tools to enhance monitoring and evaluation frameworks will enable real-time tracking of technology uptake and regulatory compliance, ensuring that gaps in implementation are

quickly identified and addressed. These efforts will be underpinned by a multi-institutional coordination framework, streamlining collaboration across sub-county, district, and national levels, and ensuring that policy enforcement is harmonized and actionable. This integrated strategy creates the necessary institutional infrastructure to support widespread, sustainable climate technology adoption.

Activity 3.2.1: Provide Support for the Standardization of Regulations, Procedures, and Norms

Activity 3.2.1 addresses the critical need for standardized regulations, procedures, and norms to ensure the safe, efficient, and sustainable adoption of climate technologies in Uganda. The absence of comprehensive regulatory frameworks, as highlighted in the TAPs, has led to inconsistencies in technology quality, implementation practices, and end-user trust, undermining efforts to scale climate-smart solutions. This activity focuses on updating and formalizing regulatory standards that incorporate parameters for safety, efficiency, and sustainability, ensuring that technologies such as solar PV systems and irrigation equipment meet defined quality benchmarks. These standards will provide clear guidelines for manufacturers, suppliers, and end-users, reducing uncertainties that deter private sector investment and slowing technology uptake. By aligning updated regulatory frameworks with Uganda's national development agenda and the specific needs of sub-regional contexts like Teso and Bugisu, this activity ensures that regulations are both context-appropriate and enforceable. It supports the integration of best practices into technology deployment, enhancing the credibility and usability of climate-smart technologies while fostering trust among end-users and stakeholders. This standardization also lays the groundwork for more cohesive enforcement mechanisms, enabling regulatory agencies to monitor and ensure compliance effectively. Through these efforts, Activity 3.2.1 establishes a critical foundation for the sustained and scalable adoption of climate technologies, ensuring their long-term development and integration into Uganda's broader climate resilience strategies.

> **Deliverable 3.2.1.1:** Developments and updates to regulatory frameworks, comprehensive climate technology standards and regulations, ensuring alignment with Uganda's national development agenda and specific sub-regional needs. These standards will provide clear guidelines for safe and effective technology adoption across sectors.

Activity 3.2.2: Conduct Regulatory Impact Assessments and Stakeholder Consultations

Activity 3.2.2 focuses on addressing barriers related to poor regulatory design and limited stakeholder engagement, which have hindered the effective implementation of climate technology policies in Eastern Uganda. As identified in the TAPs, the absence of rigorous regulatory impact assessments often results in standards that fail to address the technical, financial, and social realities of affected communities, while inadequate consultations limit buy-in from key stakeholders. This activity conducts detailed regulatory impact assessments to evaluate the practical implications of proposed standards, identifying potential gaps, unintended consequences, and areas requiring refinement. These assessments ensure that regulations are actionable, context-specific, and aligned with the diverse needs of end-users, technology providers, and local governments. Stakeholder consultations are integral to this activity, fostering dialogue among community members, institutional actors, and private sector stakeholders to ensure that proposed regulations gain widespread acceptance and relevance. These consultations directly inform the design and refinement of standards, bridging the gap between policy intentions and on-the-ground realities. The insights generated not only strengthen the credibility and effectiveness of regulations but also create alignment with other activities. For example, consultations ensure that the standards developed under Activity 3.2.1 are inclusive and address site-specific challenges. By creating a feedback-driven, participatory approach to regulatory design, Activity 3.2.2 establishes a solid foundation for policies that facilitate the sustainable adoption of environmentally sound technologies and enhance resilience in vulnerable districts.

> **Deliverable 3.2.2.1:** Completion of regulatory impact assessment reports that analyse the implications of updated regulations, ensuring they address technical, financial, and social barriers specific to the region. These reports will provide actionable insights to refine and implement regulations effectively.

Activity 3.2.3: Establish a Multi-Institutional Coordination Framework

Activity 3.2.4 is designed to address the fragmentation of governance and weak inter-institutional collaboration, as identified in the TAPs, which have been significant barriers to the effective transfer and uptake of climate technologies in Uganda. By establishing a multi-level coordination framework that spans sub-county, district, and national levels, this activity fosters collaboration and improves information exchange among key stakeholders, ensuring that efforts across different sectors and regions are harmonized. The framework will prioritize cross-sectoral integration, aligning the roles and responsibilities of various government bodies, NGOs, private sector partners, and community organizations, which is critical for the effective implementation of climate technology projects. This collaborative structure will facilitate the

management of shared resources, such as water for irrigation and energy for rural electrification and streamline efforts to address regional disparities in access to climate technologies.

This multi-institutional framework will also support the regulatory and financial mechanisms developed in earlier activities by ensuring that they are implemented cohesively and supported by all relevant stakeholders. Regular data sharing, joint planning sessions, and streamlined reporting channels will be incorporated into the framework to ensure that information flows efficiently across levels and that decision-making processes are informed by up-to-date data. By ensuring that there is clear communication and coordination between institutions at every level, this activity will reduce the fragmentation that has historically hindered the adoption and scalability of climate technologies. The establishment of this framework is critical for fostering sustained, unified action across districts where effective management and collaboration are essential for overcoming climate-related challenges and achieving long-term agricultural and environmental resilience.

> **Deliverable 3.2.4.1:** Establishment of a multi-institutional coordination framework to facilitate collaboration among stakeholders at all levels. This framework will prioritize cross-sectoral integration and include regular data sharing, joint planning sessions, and streamlined reporting channels to ensure unified action across the target districts.

Theory of Change (ToC) Diagram

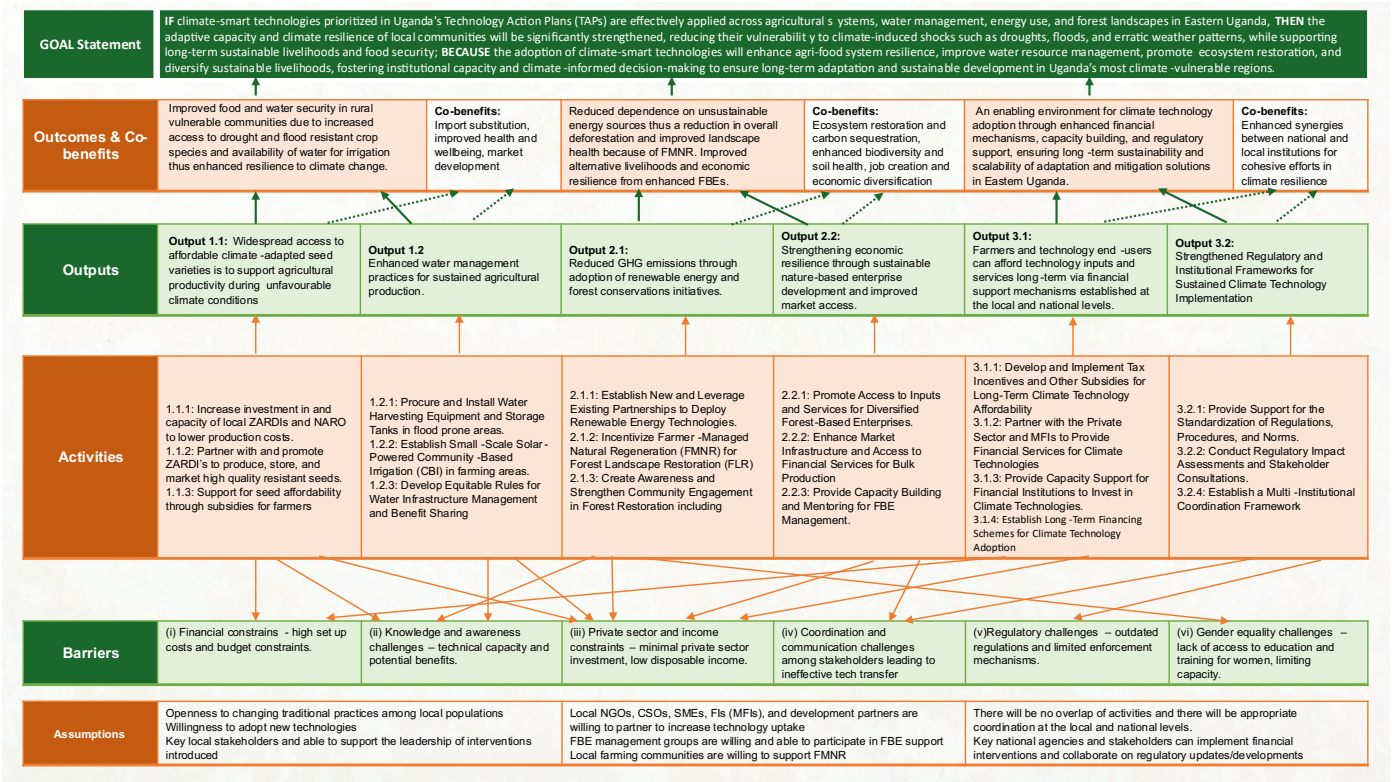

Figure 5: Theory of Change of the project.

B.2.2. Outcome mapping to GCF results areas and co-benefits categorization

Fill in the GCF results area table below to map each project/programme outcome identified in section B.2.1 to the contributing GCF results area(s) by referring to the description of eight results areas provided in the guidance note.

Output number	GCF Mitigation Results Area (MRA 1-4)				GCF Adaptation Results Area (ARA 1-4)			
	MRA 1 Energy generation and access	**MRA 2** Low-emission transport	**MRA 3** Building, cities, industries, appliances	**MRA 4** Forestry and land use	**ARA 1** Most vulnerable people and communities	**ARA 2** Health, well-being, food and water security	**ARA 3** Infrastructure and built environment	**ARA 4** Ecosystems and ecosystem services

Output 1.1	☐	☐	☐	☐	☐	☒	☐	☐
Output 1.2	☐	☐	☐	☐	☐	☒	☐	☐
Output 2.1	☐	☐	☐	☒	☐	☐	☐	☐
Output 2.2	☐	☐	☐	☒	☐	☐	☐	☐
Output 3.1	☐	☐	☐	☐	☐	☒	☐	☐
Output 3.2	☐	☐	☐	☐	☐	☒	☐	☐

If any co-benefits have been identified in section D.3, fill in the co-benefit table below to map each co-benefit to the corresponding category as defined in the FP guidance note.

Co-benefit number	**Co-benefit**					
	Environmental	**Social**	**Economic**	**Gender**	**Adaptation**	**Mitigation**
Co-benefit 1 Import substitution and agricultural market development	☐	☐	☒	☐	☐	☐
Co-benefit 2 Ecosystem restoration, carbon sequestration, and enhanced biodiversity	☒	☐	☐	☐	☐	☐
Co-benefit 3 Enhanced institutional synergies for cohesive climate action	☐	☒	☐	☐	☐	☐

B.3. Implementation / institutional arrangements (max. 750 words)

The Ministry of Water and Environment (Accredited Entity and Implementing Entity):

The Ministry of Water and Environment (MWE) is a key government institution in Uganda responsible for the management and sustainable utilization of the country's water and environmental resources. The ministry was formally established in 2007 following a restructuring of the former Ministry of Water, Lands, and Environment to provide a more focused approach to water resources management, environmental conservation, and climate resilience. The restructuring was aimed at improving governance in the water and environment sectors, ensuring sustainable resource use, and addressing the increasing challenges posed by climate change, pollution, and natural resource degradation. The MWE operates under the guidance of Uganda's Constitution and national development frameworks, working closely with other ministries, local governments, and international partners to implement policies that promote sustainable development and environmental conservation.

As the lead agency for water and environmental governance, the MWE is responsible for policy formulation, regulation, planning, and coordination of programs related to water supply, sanitation, environmental protection, and climate

adaptation. The ministry is structured into several directorates, including the Directorate of Water Resources Management (DWRM), the Directorate of Water Development (DWD), and the Directorate of Environmental Affairs (DEA), each tasked with overseeing different aspects of Uganda's natural resource management strategy. Through these directorates, the MWE implements programs that ensure safe and clean water access, integrated watershed and wetland management, sustainable forest conservation, and climate resilience initiatives across Uganda. The ministry's strategic objectives align with national and international frameworks, including Uganda Vision 2040, the Fourth National Development Plan (NDP IV), and Uganda's NDC commitments. Over the years, the MWE has played a crucial role in advancing Uganda's water and environmental sustainability agenda. It has spearheaded large-scale projects such as the Integrated Water Management and Development Project (IWMDP), which aims to improve water supply, sanitation, and water resource management in rural and urban areas, and the National Wetlands Restoration Program, which focuses on rehabilitating degraded wetland ecosystems. The ministry has also been instrumental in strengthening Uganda's climate adaptation and disaster risk management frameworks, supporting the development of climate resilience policies, afforestation initiatives, and nature-based solutions to environmental challenges. Through its diverse programs and collaborations, the MWE remains a pillar of Uganda's sustainable development efforts, ensuring the conservation and effective management of natural resources for current and future generations.

The project Management Unit (PMU):

The PMU will be established within MWE to oversee the implementation, coordination, and governance of the CATLER-Uganda project, ensuring that all project activities align with national climate adaptation priorities. The PMU will be responsible for strategic planning, budgeting, procurement, financial management, monitoring and evaluation (M&E), safeguards compliance, and reporting, ensuring accountability and efficiency in project execution. It will coordinate and integrate efforts across key executing entities, including the Science, Technology, and Innovation Secretariat (STI-OP), the Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF), the Ministry of Energy and Mineral Development (MEMD), and the National Forestry Authority (NFA), facilitating cross-sectoral collaboration and optimizing resource allocation. Additionally, the PMU will oversee stakeholder engagement, capacity-building initiatives, and knowledge-sharing platforms, ensuring that project interventions are institutionalized and sustained beyond the project's duration. Through its oversight, the PMU will ensure effective implementation, risk management, and impact tracking, guaranteeing that the project delivers long-term, climate-resilient benefits to Uganda's communities and ecosystems.

Composition of the PMU:

- **The Science, Technology, and Innovation Secretariat, Office of the President (STI-OP)**
  The Science, Technology, and Innovation Secretariat (STI-OP) operates under the Office of the President of Uganda, established in 2021 following the dissolution of the Ministry of Science, Technology, and Innovation. This restructuring aimed to streamline the coordination and implementation of Uganda's science, technology, and innovation (STI) agenda, ensuring that research, technology transfer, and innovation systems contribute directly to national development goals. The Secretariat is mandated to develop and oversee STI policies, promote research and development, facilitate technology adoption across key sectors, and position Uganda as a regional leader in innovation-driven economic transformation. Within the Project Management Unit (PMU) of the CATLER-Uganda project, STI-OP will be responsible for integrating technological advancements into climate adaptation strategies, supporting digital innovation in agriculture and water resource management, and fostering partnerships with research institutions and the private sector. By leveraging its expertise, STI-OP will ensure that project interventions incorporate cutting-edge, scalable, and sustainable technologies, enhancing Uganda's resilience to climate change while accelerating socio-economic transformation.

- **The Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF)**
  The MAAIF is the lead government institution responsible for policy formulation, regulation, and oversight of Uganda's agricultural sector, covering crop production, animal husbandry, and fisheries management. Established to enhance agricultural productivity, ensure food security, and promote agribusiness, MAAIF plays a pivotal role in implementing climate-resilient agricultural policies and fostering sustainable rural development. The ministry is structured into several directorates that oversee different aspects of Uganda's agricultural sector, including the Directorate of Animal Resources, which regulates livestock health and production; the Directorate of Crop Resources, which supports crop improvement and value chain development; the Directorate of Fisheries Resources, which oversees sustainable fisheries management; and the Directorate of Agricultural Extension Services, which facilitates farmer education and advisory services across the country. These directorates work in coordination with parastatal agencies and research institutions to develop and implement scientifically-backed, climate-adaptive agricultural practices that improve yields and enhance farmers' resilience to climate change.

As a co-executing entity in the CATLER-Uganda project, MAAIF will play a critical role in ensuring that climate-resilient agricultural interventions are effectively implemented at both policy and grassroots levels. The ministry will work in close collaboration with its affiliated research and extension institutions, including the National Agricultural Research Organization (NARO), the National Seed Certification Services (NSCS), the National Agricultural Advisory Services (NAADS), and Zonal Agricultural Research and Development Institutes (ZARDIs). NARO, Uganda's premier agricultural research institution, will provide scientific guidance and technological innovations tailored to the climate challenges faced in Eastern Uganda. Under NARO, the Buginyanya ZARDI (BugiZARDI) and Nabuin ZARDI will play key roles in conducting localized agricultural research and field trials to ensure that climate-smart technologies, improved seed varieties, and soil conservation techniques promoted in the project are well-suited to the specific agro-ecological conditions of the target regions. BugiZARDI, based in Bulambuli District, leads research in highland and southeastern agro-ecological zones, focusing on crops like potatoes, bananas, and beans, while Nabuin ZARDI, which operates in the semi-arid northeastern region covering Teso and Karamoja, specializes in drought-resistant crops, livestock resilience, and water-efficient farming systems.

To support seed quality assurance and certification, NSCS, which operates under MAAIF's Department of Crop Inspection and Certification, will ensure that all climate-resilient seed varieties introduced under the project meet national and international standards before they are distributed to farmers. This guarantees genetic integrity, improved crop yields, and resilience against pests and diseases exacerbated by climate change. Meanwhile, NAADS will bridge the gap between research and implementation by extending advisory services to farmers, supporting value chain development, and ensuring the adoption of climate-smart agricultural innovations. Through these institutions, MAAIF will oversee the introduction of drought-resistant crops, integrated pest management strategies, and sustainable water-use techniques, ensuring that smallholder farmers can effectively adapt to changing climatic conditions. The implementation arrangements within CATLER-Uganda will be structured to ensure seamless coordination between MAAIF, its research institutions, and farmers on the ground. MAAIF will lead policy alignment, stakeholder coordination, and national-level oversight, while ZARDIs and NARO will conduct research, field trials, and technology validation. NSCS will regulate seed certification and quality assurance, while NAADS will deliver farmer training, technical support, and extension services to ensure widespread adoption of climate-smart practices. By leveraging its extensive institutional framework and technical expertise, MAAIF will ensure that the project delivers tangible, long-lasting benefits to Uganda's agricultural sector, enhancing food security, boosting rural incomes, and increasing resilience to climate shocks in Eastern Uganda.

- **The National Forestry Authority (NFA)**
  The NFA was established under Section 52 of the National Forestry and Tree Planting Act of 2003 and officially launched on April 26, 2004, to oversee the sustainable management of Uganda's 506 Central Forest Reserves (CFRs), covering approximately 1,265,741 hectares. As the lead government agency responsible for forest conservation, afforestation, reforestation, and biodiversity protection, NFA plays a crucial role in implementing Uganda's forestry policies and strategies to ensure the long-term sustainability of the country's forest resources. The Authority provides technical guidance on sustainable forest management, monitors compliance with forestry regulations, and promotes forest-based enterprises (FBEs) that integrate conservation with economic resilience. Additionally, NFA works closely with local communities, private sector actors, and international conservation organizations to facilitate reforestation, agroforestry, and community-based forest management initiatives. These efforts contribute to climate change mitigation, soil stabilization, and the preservation of Uganda's natural ecosystems, which are critical for both environmental sustainability and rural livelihoods.

  Within the CATLER-Uganda project, NFA will play a pivotal role in restoring degraded forest landscapes through the implementation of Farmer-Managed Natural Regeneration (FMNR) under Component 2. FMNR is a low-cost, high-impact approach to forest restoration that focuses on protecting and managing existing tree rootstocks, natural seedbanks, and regrowth from stumps to accelerate natural reforestation without requiring large-scale tree planting. The project aims to restore 50,000 hectares of degraded forest land, and NFA will provide technical expertise in identifying suitable tree species, training communities on sustainable pruning and tree management, and monitoring forest regeneration progress. The Authority will also conduct site assessments and prioritize degraded forest reserves and communal lands where FMNR can be most effective, ensuring that restoration efforts align with both ecological needs and community land-use practices. NFA's experience in community-based forest management models will be instrumental in engaging local communities, landowners, and farmer groups to adopt FMNR techniques as a sustainable land-use practice that enhances both biodiversity conservation and economic resilience. A critical aspect of NFA's involvement

in the project is supporting the development of Forest-Based Enterprises (FBEs) as a means of integrating conservation efforts with sustainable economic development. Many forest-adjacent communities depend on forests for fuelwood, timber, medicinal plants, and non-timber forest products (NTFPs), but unsustainable exploitation has led to severe deforestation and ecosystem degradation. NFA will work to identify and support viable FBEs that promote sustainable forest management, alternative livelihoods, and value-added processing of forest products. Through its technical units, NFA will provide training in sustainable harvesting techniques, capacity-building programs for FBE operators, and market linkages that enhance the commercial viability of forest-based value chains. Additionally, NFA will distribute agroforestry seedlings, provide advisory services on woodlot management, and support community tree-growing initiatives, ensuring that reforestation efforts are not only successful but also beneficial to local economies.

- **The Ministry of Energy and Mineral Development (MEMD)**
  The MEMD is responsible for the sustainable management and development of Uganda's energy and mineral resources, ensuring they contribute to economic growth, industrialization, and environmental sustainability. Established to oversee the formulation and enforcement of policies governing energy generation, distribution, mineral exploration, and resource extraction, MEMD plays a critical role in expanding Uganda's energy infrastructure, increasing access to clean and affordable electricity, and promoting energy efficiency. The ministry is structured into three key directorates: the Directorate of Energy Resources, which spearheads renewable energy deployment, electrification, and energy regulation; the Directorate of Petroleum, which oversees oil and gas exploration; and the Directorate of Geological Surveys and Mines, which manages mineral prospecting, licensing, and regulation of the mining sector. In addition to overseeing large-scale hydropower development and electricity grid expansion, MEMD is increasingly focused on scaling up decentralized renewable energy solutions, such as solar mini-grids and off-grid electrification, to ensure universal energy access, particularly in rural communities. The ministry also facilitates public-private partnerships (PPPs) in energy infrastructure development, encourages investment in clean energy technologies, and regulates compliance with environmental and social safeguards, ensuring that energy projects align with Uganda's sustainability and climate adaptation goals.

  As a co-executing entity in the CATLER-Uganda project, MEMD will be responsible for overseeing the deployment of decentralized solar deployments and bio-latrine-based biogas systems under Component 2: Promoting Renewable Energy and Sustainable Land Management. The ministry will provide technical oversight in system design, procurement, installation, and grid integration, ensuring compliance with Uganda's energy access and renewable energy policies. By expanding solar-powered mini-grids to off-grid schools, health centres, and farming communities, MEMD will contribute to the national goal of increasing rural electrification and reducing dependence on traditional biomass fuels. Additionally, MEMD will support the establishment of bio-latrines in public institutions, which will produce biogas for clean cooking, reducing reliance on charcoal and firewood, while also improving sanitation and waste management. The ministry will further facilitate public-private partnerships to enhance the sustainability of these interventions, engaging local businesses in the renewable energy supply chain and ensuring that mini-grid users have affordable financing options for electricity access. Through its leadership in energy access expansion, renewable energy integration, and climate-smart energy solutions, MEMD will play a vital role in ensuring that the CATLER-Uganda project contributes to Uganda's long-term energy security and climate resilience agenda.

The Project Steering Committee (PSC)

The Ministry of Water and Environment (MWE) will establish a multi-sectoral Project Steering Committee (PSC) to provide high-level operational and policy guidance for the project. The PSC will convene at least twice annually to approve work plans and budgets, review implementation progress, and ensure adherence to relevant government policies, regulations, and strategies. The committee will be co-chaired by Permanent Secretaries (PSs) from MWE, the Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF), the Ministry of Energy and Mineral Development (MEMD), the Ministry of Finance, Planning, and Economic Development (MFPED), the Ministry of Gender, Labour, and Social Development (MGLSD), and the Ministry of Local Government (MoLG). Additionally, the Executive Directors of the National Forestry Authority (NFA) and the Science, Technology, and Innovation Secretariat, Office of the President (STI-OP), along with the Executive Director of the Climate Technology Centre and Network (CTCN), will be integral members of the PSC.

The Climate Technology Centre and Network (CTCN), as the implementation arm of the UNFCCC Technology Mechanism, is mandated to promote the accelerated transfer of environmentally sound technologies for climate change mitigation and adaptation in developing countries. By providing technology solutions, capacity building, and policy

advice tailored to individual country needs, the CTCN facilitates the development and deployment of climate technologies that align with national development priorities. Within the PSC, the CTCN will leverage its extensive global network of technology experts and institutions to offer strategic guidance on selecting and implementing appropriate technologies for the project. Its involvement ensures that the project benefits from cutting-edge innovations and best practices in climate technology, fostering sustainable and resilient development outcomes. Moreover, the CTCN's emphasis on collaborative networks and partnerships will enhance the project's capacity-building efforts, ensuring that implemented technologies are sustainable and effectively integrated into local contexts. This collaborative approach aligns with the CTCN's mission to stimulate technology cooperation and strengthen capacities in developing countries, thereby supporting the project's overarching goals.

District-Level Administration (Local Government)

At the district level, local governments will play a critical role in the implementation and coordination of the CATLER-Uganda project, ensuring that interventions are effectively integrated into local development plans, community structures, and resource management frameworks. District authorities will provide on-the-ground leadership, technical expertise, and oversight, ensuring that project activities are aligned with district-specific climate adaptation priorities and the needs of local communities. Under the guidance of the Chief Administrative Officer (CAO) and Resident District Commissioner (RDC), district governments will facilitate policy implementation, stakeholder engagement, and inter-agency coordination, ensuring that the project achieves its intended outcomes in a participatory and inclusive manner.

Key district technical officers, including District Agricultural Officers (DAOs), District Environmental Officers (DEOs), District Water Officers (DWOs), and District Forestry Officers (DFOs), will be instrumental in ensuring effective planning, technical guidance, and field-level execution of project components. DAOs will oversee the implementation of climate-smart agricultural practices, working closely with extension officers and farmer groups to promote drought-resistant crops, sustainable soil management techniques, and improved irrigation methods. DEOs will ensure that all project activities adhere to environmental conservation policies, providing technical support in wetland and ecosystem protection, and land use planning. DWOs will facilitate the implementation of community-based water management interventions, ensuring the successful deployment of rainwater harvesting systems, small-scale irrigation, and sustainable watershed management practices. DFOs, working under the guidance of the National Forestry Authority (NFA), will support the expansion of afforestation, agroforestry, and Farmer-Managed Natural Regeneration (FMNR) initiatives, ensuring that tree-planting efforts align with local ecological conditions and community priorities.

Beyond their technical responsibilities, district officials will coordinate community engagement efforts, mobilizing local leaders, farmer cooperatives, and civil society organizations to actively participate in project activities. They will also oversee monitoring and evaluation (M&E) efforts, ensuring that implementation progress is tracked, and that community feedback is incorporated into adaptive project management. Additionally, district governments will ensure compliance with social and environmental safeguards, mitigating risks associated with land-use changes, water resource allocation, and ecosystem restoration. By providing institutional leadership, technical expertise, and local-level governance, district governments will be essential in ensuring the sustainability of project interventions and embedding climate resilience practices into long-term local development planning.

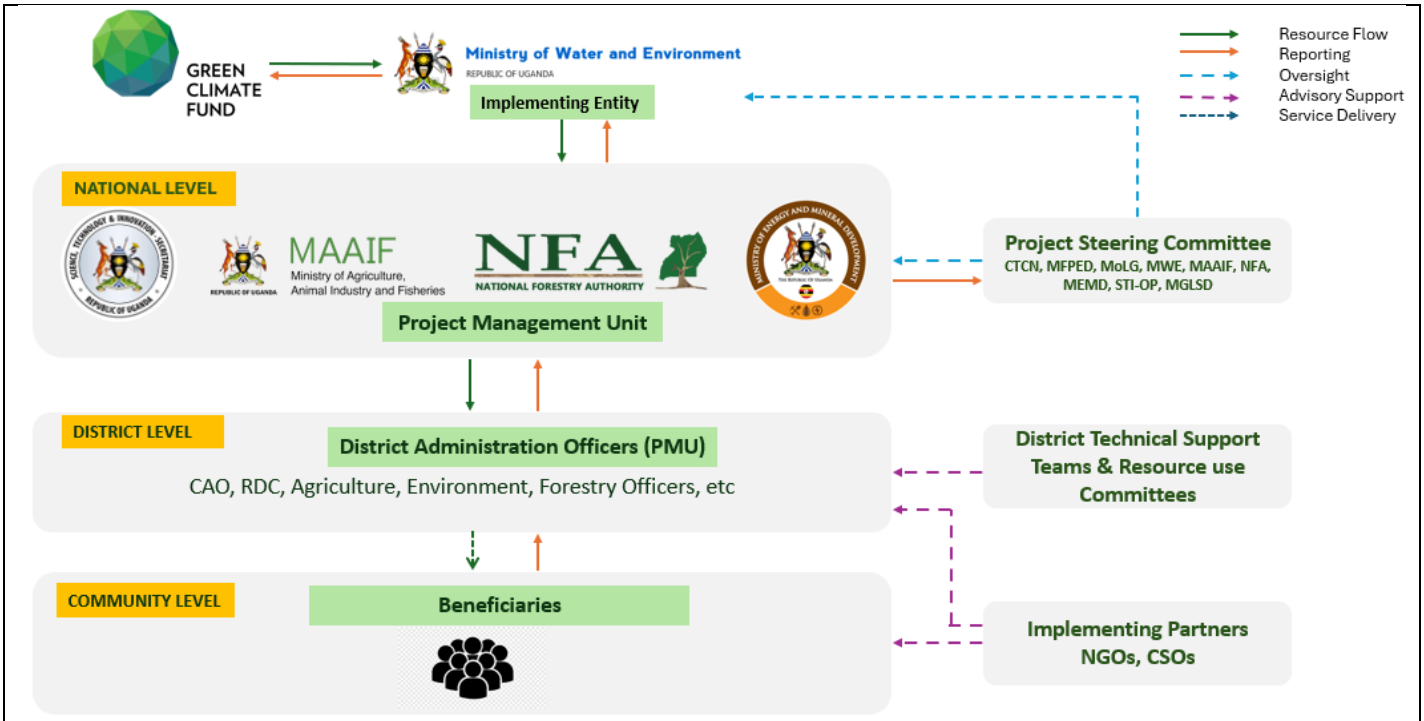

Figure 6: Implementation Arrangements of the Project

C. FINANCING INFORMATION

C.1. Total financing

(a) Requested GCF funding (i + ii + iii + iv + v + vi)	Total Amount: 25,000,000	Currency: million USD ($)

GCF Financial Instrument		Amount	Currency	Tenor & grace	Pricing
(i)	Senior loans	Enter amount	Options	Enter years	Enter %
(ii)	Subordinated loans	Enter amount	Options	Enter years	Enter %
(iii)	Equity	Enter amount	Options		Enter % equity return
(iv)	Guarantees	Enter amount	Options	Enter years	
(v)	Reimbursable grants	Enter amount	Options		
(vi)	Grants	25	million USD ($)		
		Total amount		Currency	

(b) Co-financing information[54]	Enter amount			Options		
Name of institution	**Financial instrument**	**Amount**	**Currency**	**Tenor & Grace**	**Pricing**	**Seniority**
Click here to enter text.	Options	Enter amount	Options	Enter years Enter years	Enter %	Options
Click here to enter text.	Options	Enter amount	Options	Enter years Enter years	Enter %	Options
Click here to enter text.	Options	Enter amount	Options	Enter years Enter years	Enter %	Options

(c) Total investment (c) = (a)+(b)	**Amount**	**Currency**
	Enter amount	Options
(d) Co-financing ratio (d) = (b)/(a)	Total co-financing / total GCF funding amount	
(e) Other financing arrangements for the project/programme (max ½ page)	*Please explain if any of the financing parties including the AE would benefit from any type of guarantee e.g. sovereign guarantee, MIGA guarantee, etc.* *Information on legal due diligence (taxes, insurance, etc.) shall be reported in Annex 9a.* *Please also include parallel financing associated with this project or programme* (refer to the co-financing policy).	

C.2. Financing by component

Please provide an estimate of the cost per component (in line with Components described in Section B.2.1 above) and disaggregate by sources of financing as Annex 3. Also, ensure consistency with the Logical Framework (Annex 2a) and Timetable (Annex 2b) of the project/programme.

Component	Output	Indicative cost Options	GCF financing		Co-financing		
			Amount Options	Financial Instrument	Amount Options	Financial Instrument	Name of Institutions
Component 1: Strengthening of Rural Agricultural Community Resilience to Climate Risks in Eastern Uganda	**Output 1.1:** Widespread access to affordable climate-adapted seed varieties to support agricultural productivity	Enter amount	Enter amount	Grants	Enter amount	Choose an item.	Click here to enter text.
	Output 1.2: Enhanced water access management practices for sustained	Enter amount	Enter amount	Grants	Enter amount	Choose an item.	Click here to enter text.

[54] If the co-financing is provided in different currency other than the GCF requested, please provide detailed financing information and a converted figure in the GCF requested currency in the comment box. Please refer to the date when the currency conversion was performed and the reference source.

	agricultural production.						
Component 2: Empowering Communities through Sustainable Enterprise Development and Environmental Restoration	**Output 2.1:** Reduced GHG emissions through adoption of renewable energy and forest restoration technologies.	Enter amount	Enter amount	Grants	Enter amount	Choose an item.	Click here to enter text.
	Output 2.2: Strengthened economic resilience through sustainable nature-based enterprise development and improved market access.	Enter amount	Enter amount	Grants	Enter amount	Choose an item.	Click here to enter text.
Component 3: Enhancing Financial and Regulatory Frameworks for Sustained Climate-Smart Technology Adoption	**Output 3.1:** Farmers and technology end-users can afford technology inputs and services long-term via financial support mechanisms established at the local and national levels.	Enter amount	Enter amount	Grants	Enter amount	Choose an item.	Click here to enter text.
	Output 3.2: Strengthened Regulatory and Institutional Frameworks for Sustained Climate Technology Implementation	Enter amount	Enter amount	Grants	Enter amount	Choose an item.	Click here to enter text.
Indicative total cost (USD)		25,000,000	25,000,000		Enter amount		

This table should match the one presented in the term sheet and be consistent with information presented in other annexes including the detailed budget plan and implementation timetable.

C.3 Capacity Building and Technology development/transfer

If the project/programme is envisaged to support capacity building and technology development/transfer, please specify the total requested GCF amount for these activities respectively in this section.

C.3.1 Does GCF funding finance Capacity building activities?	Amount:____ Choose an item.
C.3.2. Does GCF funding finance Technology development/transfer?	Amount:____ Choose an item.

C.4. Justification for GCF funding request (max. 500 words)

Uganda is striving to achieve a 24.7% reduction in greenhouse gas emissions below the Business-as-Usual (BAU) scenario by 2030, as outlined in the Uganda's Nationally Determined Contributions (NDC) 2022. To meet this target, Uganda has prioritized climate adaptation and resilience-building in critical sectors, including agriculture, water, forestry, energy, and infrastructure. Despite these efforts, Uganda faces significant financial constraints in mobilizing the estimated USD 28.1 billion required to finance both conditional and unconditional adaptation and mitigation measures by 2030. The funding is vital to facilitate technology development, transfer, and capacity building across multiple sectors to strengthen climate resilience.

One of the main barriers to achieving these ambitious climate goals is Uganda's rising public debt, which reached 52% of GDP (USD 25 billion) as of June 2023 (IMF, 2023).[55] This high level of indebtedness significantly restricts the government's ability to fund its climate strategy independently, thereby emphasizing the need for international financial support to meet climate adaptation and mitigation targets. The need for external funding is particularly pronounced in Eastern Uganda, where vulnerable communities are heavily reliant on agriculture and natural resources, sectors that are particularly sensitive to climate variability.

Challenges in Accessing Adaptation Finance and Financial Gaps

Uganda faces considerable challenges in accessing finance, both public and private, for its climate initiatives. The perception of high risks and low returns has deterred significant private sector investment in climate technologies, which is critical for scaling up climate resilience initiatives. Financial institutions in Uganda are generally unwilling to offer favourable financing terms for climate-related projects. High interest rates, stringent collateral requirements, and the limited awareness and technical expertise among private sector actors regarding the potential benefits of climate investments further compound the financial gap. This has particularly affected smallholders and SMEs in rural areas, limiting their access to essential financing for climate adaptation and mitigation measures.

Moreover, Uganda's financial landscape is characterized by limited options for long-term concessional finance, which is crucial for the development and adoption of climate-smart technologies. The complexity and administrative burden of accessing climate finance further restricts vulnerable communities, SMEs, and local institutions from securing the necessary funding. The Technology Action Plans (TAPs) have identified several barriers, including insufficient infrastructure, high production costs of climate-adapted seeds, and inadequate water management technologies. Without targeted financial support, these barriers will persist, hindering Uganda's capacity to build resilience against climate shocks.

Appropriateness of the GCF Grant

The Green Climate Fund (GCF) is uniquely positioned to bridge this financial gap, given its strategic mandate to support Least Developed Countries (LDCs) like Uganda in pursuing low-emission and climate-resilient development. GCF's emphasis on providing concessional finance aligns directly with Uganda's need for affordable, low-risk funding to implement its Technology Action Plans (TAPs) and achieve its NDC targets. The GCF grant will specifically support the development and deployment of critical climate technologies in the agriculture and water sectors of Eastern Uganda, where vulnerability to climate impacts is particularly acute.

By providing concessional funding, GCF will play a crucial role in reducing the financial risks associated with climate investments, thereby encouraging private sector participation. This risk-sharing mechanism is essential for unlocking private capital to co-finance the deployment of climate-smart technologies, such as solar-powered irrigation systems, rainwater harvesting infrastructure, and climate-adapted seed varieties. The GCF grant will enable public-private partnerships, ensuring that financial resources are leveraged effectively to address existing barriers, such as high production costs for climate-resilient seeds and the lack of accessible, scalable water management solutions.

The GCF funding will also be instrumental in addressing structural financial barriers that prevent smallholder farmers and vulnerable communities from accessing adaptation finance. By integrating targeted subsidies and local financing

[55] Uganda's Public Debt Dilemma: What Lies Ahead in 2024, International Monetary Fund (IMF), 2024

schemes into the CATLER-Uganda project, the GCF will ensure that climate-resilient seeds and technologies are affordable to smallholders, thus promoting the adoption of climate-smart practices at the grassroots level. Additionally, the GCF grant will support the establishment of local information hubs and capacity-building initiatives, which are crucial to building the technical expertise required for long-term sustainability.

Given Uganda's limited fiscal space due to its rising debt burden, GCF's concessional funding offers a unique opportunity to catalyse climate investments without exacerbating the country's debt levels. The proposed project also aligns with the GCF's strategic focus on supporting LDCs and African nations in building climate resilience, especially in the agricultural sector, which is a critical pillar for food security and economic development in Uganda. The GCF grant will ensure sustained investment in climate resilience, promote the widespread adoption of climate-smart technologies, and foster long-term sustainable development in Uganda, particularly in the most vulnerable sub-regions in the east.

Risk-Sharing and Sustainable Financing

The proposed project includes a risk-sharing structure that leverages GCF funding to de-risk climate investments, thereby creating opportunities for private sector engagement and co-financing. GCF's concessional funding will help reduce the perceived investment risks, encouraging financial institutions to extend favourable financing terms to smallholders and SMEs. The integration of public-private partnerships is essential for creating sustainable financial pathways for scaling up climate technologies and closing the current financing gap.

By enabling the integration of financial instruments such as subsidies and tailored loan schemes under the Parish Development Model (PDM) and local Village Savings and Loan Associations (VSLAs), **CATLER-Uganda** seeks to establish a comprehensive financing mechanism that supports the equitable distribution of and access to climate technologies to the most vulnerable. This model also addresses the structural financial barriers faced by rural communities, enhancing accessibility and affordability for climate technology adoption.

In summary, the GCF grant is the appropriate funding mechanism for this project, given its strategic focus on supporting LDCs, providing much needed concessional climate finance, and enabling public-private partnerships to advance climate adaptation. The project addresses significant financial gaps in Uganda's climate resilience strategy by providing the much-needed resources to overcome barriers related to climate technology access, affordability, and private sector engagement. By supporting the development, transfer, and adoption of climate technologies, GCF funding will directly contribute to Uganda's progress toward achieving its NDC targets and advancing sustainable development in the face of increasing climate risks.

C.5. Exit strategy (max. 300 words)

The exit strategy for CATLER-Uganda is meticulously designed to ensure a seamless transition of responsibilities to local communities, institutions, and private sector actors, allowing for the continuation and scaling of project benefits beyond the initial funding period. The project's approach focuses on community ownership, institutional capacity building, and fostering public-private partnerships, ensuring that all project elements are sustained independently once the GCF's involvement concludes.

To effectively exit, the project will facilitate a phased transfer of ownership and responsibilities. Community members, particularly women and youth, will be empowered to take full ownership of the climate-smart technologies developed through the project. This will be achieved by ensuring that community members, including extension workers and technical staff, receive comprehensive training on the operation, maintenance, and troubleshooting of key project investments such as solar-powered irrigation systems, rainwater harvesting (RWH) units, and seed banks. Training will be provided continuously throughout the implementation period to ensure that community members are fully prepared to take on operational responsibilities before the exit.

The project also seeks to institutionalize operations and maintenance protocols by developing and implementing sustainability plans for all infrastructure and key assets. These plans will include detailed roles and responsibilities, maintenance schedules, and provisions for spare parts to ensure that all infrastructure remains functional and effective long after the project ends. Local leaders and extension workers will receive specialized training on these sustainability plans to ensure that they can oversee and manage infrastructure maintenance.

The project will also foster public-private partnerships and facilitate financial incentives such as subsidies and seed funding for Village Savings and Loan Associations (VSLAs). These mechanisms will reduce the financial burden on end-beneficiaries and attract private sector actors to continue supporting the delivery and affordability of climate-smart inputs, even after GCF funding has ceased.

Sustaining the Intervention After Exit

Following project exit, CATLER-Uganda's sustainability relies on several strategic pillars that are designed to ensure that all outcomes and benefits are not only maintained but also scaled over time.

Community Ownership and Empowerment: By emphasizing inclusive participation from the beginning, CATLER will ensure that local communities, including smallholders, women, and youth, are vested in the outcomes of the project's interventions at the Sub-county level. Community empowerment is further reinforced by involving community members in all decision-making processes related to technology adoption and infrastructure use. This strong sense of ownership will motivate local communities to maintain and expand the use of climate-smart technologies. Training materials and handbooks promoted and popularized during the project will be housed in district-level information hubs to ensure that knowledge and expertise are accessible and transferable. These hubs will serve as permanent learning centres, facilitating continuous access to information and ensuring that community members are well-prepared to sustain and expand project outcomes.

Financial Sustainability: To address the issue of financial sustainability, the project integrates subsidies, seed funding, and favourable loan terms into existing local financial structures, such as the Parish Development Model. This integration will ensure continued access to affordable financing for climate-smart technologies, enabling farmers to continue adopting and investing in climate resilience. Additionally, targeted tax incentives for climate technology components will continue to encourage private sector participation. The promotion of nature-based enterprises, such as agroforestry and eco-tourism, will also provide communities with sustainable income opportunities, reducing their dependence on vulnerable agricultural practices and fostering economic independence.

Institutional Strengthening: National and local institutions—such as NARO, ZARDIs, and other decentralized research centres—will play a critical role in the continuation of the project's outcomes. Investments in research & development, capacity building and institutional strengthening will ensure that these institutions can continue developing and distributing climate-adapted seeds and technologies beyond the project's lifecycle. By generating valuable data on the social, economic, and environmental benefits of climate technologies, these institutions will also promote broader adoption and scale-up of project interventions.

Operations and Maintenance of Infrastructure: CATLER will develop detailed operations and maintenance protocols for key infrastructure investments, such as rainwater harvesting, solar-powered community irrigation units, and bio-latrines. These protocols will be institutionalized through sustainability plans, which define clear roles and responsibilities for local leadership in overseeing maintenance efforts. Community leaders and extension workers will be responsible for the regular maintenance of infrastructure, with community-level training ensuring that technical know-how is not lost. Equitable rules of engagement for shared resources, such as water infrastructure, will be codified in a manual to prevent conflicts and ensure fair access, further supporting the long-term sustainability of the infrastructure investments.

Policy and Regulatory Environment: The policy and regulatory environment is key to sustaining and expanding project outcomes. By aligning interventions with national development goals and NDC targets, and by conducting regulatory reviews and establishing inter-agency coordination mechanisms, the project will lay a foundation for the diffusion and replicability of climate-smart technologies across Uganda. Strengthening the policy framework will facilitate the scaling of project interventions and ensure that climate resilience becomes mainstreamed into local and national development planning.

Contribution to Paradigm Shift

The project's sustainability and exit strategy also aim to contribute to a lasting paradigm shift in climate resilience. By embedding ownership at the community level, strengthening institutional capacities, and creating enabling financial and regulatory frameworks, CATLER-Uganda ensures that climate-smart technologies are effectively adopted, scaled, and replicated independently. The project's focus on public-private partnerships, inclusive financial models, and capacity building ensures that the paradigm shift towards climate-resilient development continues long after the project ends.

Through strategic community empowerment, institutional capacity building, financial sustainability, and the establishment of supportive policies, CATLER-Uganda aims to ensure that its interventions are sustainable, scalable, and integrated into Uganda's broader development framework. This approach not only guarantees the sustainability of project outcomes but also creates a foundation for enhanced resilience across Uganda, setting a strong path towards achieving national climate targets and building a sustainable future for vulnerable communities in Eastern Uganda.

C.6. Financial management/procurement (max. 300 words)

Describe the project/programmer's financial management including financial accounting standards, disbursement and procurement arrangements (details in Annex 8 for procurement). Explain how the AE will ensure that its fiduciary standards (based on its accreditation type) are adhered to at all times. Explain the methodology and frequency of the periodic financial reviews, reporting of the project expenditures including the audit requirements and the frequency of the audit to ensure that funds are used for the intended purposes and project complies with the covenants, if any.

D. EXPECTED PERFORMANCE AGAINST INVESTMENT CRITERIA

D.1. Impact potential (max. 300 words)

The impact potential of the CATLER-Uganda project reflects its capacity to produce transformative changes for both institutions and beneficiaries by delivering outputs aligned with Uganda's climate goals and the GCF objectives. By integrating adaptation and mitigation interventions, the project aims to enhance the resilience and adaptive capacity of vulnerable communities in Eastern Uganda while promoting low-emission sustainable development pathways. The project addresses critical climate vulnerabilities in agriculture, water, forestry, and energy sectors, ensuring long-term sustainability and alignment with Uganda's updated NDCs. The envisaged impacts include measurable improvements in community resilience, strengthened institutional systems, and significant reductions in GHG emissions, contributing directly to the GCF's strategic result areas.

Adaptation Impact

The project will directly benefit 871,600 people, including 352,100 women (40%) and vulnerable groups such as smallholder farmers and youth, representing a significant proportion of the region's population. Indirectly, an additional 4,487,000 individuals, including 2,253,000 women, will benefit from enhanced ecosystem services and economic opportunities generated by the project's interventions. These beneficiaries will experience reduced vulnerability and increased resilience through several key measures:

- **Agricultural Productivity and Climate Resilience**: The promotion of climate-smart agricultural practices across 12,000 hectares will directly reduce farmers' exposure to drought and erratic rainfall. Demonstration centres established in four sub-regions will disseminate knowledge and hands-on training on drought-tolerant crops, efficient irrigation systems, and sustainable soil management, improving food security and household incomes while fostering long-term adaptive capacity.
- **Water Security and Ecosystem Restoration:** Interventions such as solar-powered irrigation units and rainwater harvesting systems will ensure consistent water access during dry spells, reducing community vulnerability to recurrent droughts. These systems will increase water availability for domestic and agricultural purpose.
- **Livelihood Diversification:** The integration of climate-resilient enterprises such as agroforestry, forest-based value chains, and renewable energy technologies will households with sustainable income streams. By enhancing economic stability and diversifying livelihoods, the project addresses both immediate vulnerabilities and long-term resilience.

The project will also strengthen institutional and regulatory systems for climate-responsive planning, particularly through the development of standardized regulations, data-driven monitoring and evaluation frameworks, and multi-institutional coordination mechanisms. These improvements will enable Uganda to implement adaptive strategies effectively, reducing exposure to climate risks while enhancing the adaptive capacity of local and national systems.

Mitigation Impact

The project contributes significantly to Uganda's low-emission sustainable development pathway by addressing deforestation, promoting renewable energy, and improving sustainable land use practices. Its mitigation potential is quantified through measurable outcomes:

- **Reforestation and Forest Management:** The reforestation of 12,000 hectares of degraded land will sequester approximately 680,007 tons of CO_2 equivalent annually, based on estimates in Annex 14, contributing directly to Uganda's emissions reduction target of 24.7% below the business-as-usual (BAU) scenario by 2030. Improved forest management practices will further enhance biodiversity, water retention, and soil stability, creating long-term ecological benefits.
- **Renewable Energy Deployment:** The project will install 3 MW of solar-powered systems, providing clean energy to households, schools, and health facilities. This intervention will reduce biomass dependency,

preventing deforestation and associated emissions. The renewable energy capacity installed is expected to serve households, increasing access to low-emission energy while creating a scalable model for clean energy transition.

- **Post-Harvest and Value Addition Technologies:** By reducing post-harvest losses through technologies like solar drying racks and storage facilities, the project prevents waste-related emissions while enhancing the efficiency of agricultural systems. This reduces the carbon footprint of agricultural activities and supports sustainable food systems.

Long-Term Resilience

To ensure scalability and sustainability, the project incorporates measures to strengthen institutional capacities, create innovative financing mechanisms, and foster awareness of climate risks and adaptation strategies. Knowledge hubs and demonstration centres will act as focal points for disseminating best practices, ensuring that the benefits extend beyond the immediate target areas. Financing schemes, including a renewable energy revolving fund and village savings and loan associations (VSLAs), will provide sustainable financial resources to maintain and expand interventions over time. These measures position Eastern Uganda to become a leader in climate-resilient development, reducing vulnerability, mitigating emissions, and achieving long-term sustainability in alignment with GCF's strategic objectives.

D.2. Paradigm shift potential (max. 300 words)

The paradigm shift potential of **CATLER-Uganda** lies in its ability to introduce transformative changes across Eastern Uganda's agriculture, forestry, water, and energy sectors by addressing systemic barriers, scaling innovative solutions, and fostering an enabling environment for climate resilience and low-emission development. The project is strategically designed to create long-term impacts that transcend its immediate scope, catalysing a shift toward sustainable, climate-resilient practices and systems.

Potential for Scaling Up and Replication

The project demonstrates significant potential for scalability and replication by employing innovative solutions and approaches that can be adapted to other regions and sectors. For example, the deployment of small-scale solar-powered irrigation systems and bio-latrines represents scalable models that reduce dependency on biomass and enhance water access. These interventions address systemic barriers such as high technology costs and limited access to renewable energy, creating a pathway for scaling low-emission solutions. The reforestation of 12,000 hectares using Farmer-Managed Natural Regeneration (FMNR) is another example of a cost-effective, community-led solution that can be replicated in other degraded landscapes across Uganda. By embedding these solutions within local institutions and providing technical and financial support, the project ensures scalability without proportionally increasing costs. The integrated knowledge hubs and demonstration centres established across 10 districts will act as focal points for disseminating best practices, further enhancing replication potential across sectors and regions.

Contribution to Climate-Resilient Pathways

The project aligns closely with Uganda's NDCs and National Adaptation Plan for Agriculture (NAP-Ag), creating a framework for expanding climate-resilient pathways. By reducing the risks associated with adopting climate technologies through financial incentives, capacity-building, and regulatory support, the project lowers entry barriers for smallholder farmers and local enterprises. For example, the revolving fund and village savings and loan associations (VSLAs) provide sustainable financing models that mitigate investment risks and encourage broader adoption of renewable energy and climate-smart agricultural technologies. The project's interventions in water harvesting and landscape restoration address not only immediate vulnerabilities but also long-term risks, such as biodiversity loss and ecosystem degradation, which are critical to sustaining resilience. These structural elements can be applied to other sectors, such as fisheries and urban water management, showcasing the project's ability to adapt and expand its impact.

Potential for Knowledge and Sharing Lessons Learned

The project actively contributes to the creation of knowledge and collective learning processes. Knowledge hubs and demonstration centres will facilitate the dissemination of lessons learned, equipping stakeholders with the skills to

replicate successful models. The project also integrates a robust plan for knowledge sharing, with reporting structures that connect local, district, and national levels. These efforts ensure that lessons on effective financing mechanisms, community-led restoration, and technology deployment are captured and disseminated, creating a ripple effect that extends beyond the project's geographic and temporal scope.

Contribution to an Enabling Environment

By addressing systemic barriers to climate technology adoption, the project establishes a foundation for sustained and financially viable outcomes. For instance, the introduction of tax incentives and subsidies reduces the cost of renewable energy technologies, while capacity-building for financial institutions ensures the long-term availability of financing products tailored to smallholder farmers. The establishment of multi-institutional coordination frameworks fosters collaboration across sectors and regions, reducing inefficiencies and aligning efforts toward shared climate goals. The project also catalyses new market opportunities by integrating climate-resilient value chains and renewable energy solutions, incentivizing private sector participation. These actions create lasting changes in market dynamics, shifting incentives for stakeholders to adopt low-emission and climate-resilient practices.

Contribution to the Regulatory and Institutional Framework

The project strengthens regulatory and institutional frameworks by developing and standardizing regulations for climate technology safety, efficiency, and sustainability. Activities such as regulatory impact assessments and stakeholder consultations ensure that regulations are inclusive, actionable, and context-specific. The project also mainstreams climate considerations into decision-making processes by integrating climate-smart regulations into local and national governance structures. For example, the project's focus on establishing comprehensive M&E frameworks ensures that regulatory compliance is monitored and enforced, creating accountability and reinforcing the credibility of climate interventions. By aligning these efforts with Uganda's broader climate strategies, the project contributes to a systematic shift toward integrating climate resilience and low-emission development into policies and regulations, ensuring sustained impact beyond the project's duration.

D.3. Sustainable development (max. 300 words)

CATLER-Uganda offers a transformative contribution to sustainable development by addressing the interlinked challenges of climate change, environmental degradation, and socio-economic vulnerability in Eastern Uganda. By leveraging climate-smart agriculture, sustainable water management, reforestation, and capacity-building initiatives, the project delivers wide-ranging co-benefits that align with several United Nations Sustainable Development Goals (SDGs), including SDG 13 (Climate Action), SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), SDG 5 (Gender Equality), and SDG 8 (Decent Work and Economic Growth). These interventions are designed to generate measurable environmental, social, and economic outcomes while fostering gender equity and inclusivity.

Environmental Co-Benefits
The project addresses pressing environmental challenges by restoring ecosystems, enhancing biodiversity, and promoting sustainable natural resource use.

- **Ecosystem Restoration and Carbon Sequestration:** Through the reforestation of 50,000 hectares of degraded land, the project will sequester approximately XX tons of CO_2 annually (final estimates pending), contributing directly to Uganda's NDC mitigation targets. The restored landscapes will bolster biodiversity, stabilize soils, and regulate hydrological cycles, mitigating the impacts of climate-induced droughts and floods.
- **Water Resource Management:** Interventions like rainwater harvesting and improved irrigation systems will reduce water scarcity and enhance water quality for agricultural and domestic use. These systems will support efficient water use, particularly in regions experiencing increasing aridity due to climate change, ensuring long-term environmental sustainability.
- **Biodiversity and Soil Health:** The restoration of degraded lands will combat soil erosion, enhance fertility, and reduce sedimentation in rivers, directly supporting ecosystem health and agricultural productivity. These efforts improve local food systems and contribute to broader ecological stability.

Social Co-Benefits
The project integrates measures to improve health, education, and social inclusion while building the adaptive capacity of vulnerable communities in the project area.

- **Improved Health and Well-Being:** Access to clean water through rainwater harvesting systems and improved sanitation facilities will significantly reduce waterborne diseases. Additionally, reduced reliance on biomass for cooking, facilitated by renewable energy solutions, will improve indoor air quality, reducing respiratory illnesses.
- **Community Resilience:** By training communities in climate-smart agricultural practices and sustainable resource management, the project strengthens adaptive capacity and reduces vulnerability to climate shocks. Women and youth, often marginalized in climate planning, will benefit from increased participation and access to resources, fostering greater social inclusion.
- **Education and Awareness:** Knowledge hubs and community engagement initiatives will enhance awareness of climate risks and solutions, enabling informed decision-making and fostering a culture of resilience at the household and community levels.

Economic Co-Benefits
Economic growth and poverty reduction are central to the project, achieved through job creation, income diversification, and strengthened local economies.

- **Job Creation and Economic Diversification:** The project will create new green jobs in agriculture, forestry, and renewable energy, directly benefiting women, youth, and vulnerable groups. These jobs will enhance local economies by building skills in climate adaptation, renewable energy, and sustainable land management.
- **Enhanced Agricultural Productivity:** Climate-smart technologies introduced by the project will boost crop yields and improve food security, reducing reliance on imports and strengthening local supply chains. Agroforestry and forest-based enterprises will diversify income streams, increasing economic stability for rural communities.
- **Sustainable Market Development:** The project promotes green businesses and value addition, such as solar-powered drying and storage facilities, enhancing the competitive capacity of local agricultural products in national and regional markets.

Gender-Sensitive Development Impact

CATLER-Uganda adopts a gender-responsive approach that addresses the unique vulnerabilities of women and youth while fostering equitable participation in climate resilience and sustainable development efforts. By empowering at least women through targeted capacity-building initiatives, the project ensures their active involvement in adopting climate-smart practices, managing natural resources, and leading community-based adaptation efforts. Women's inclusion in water and land management committees ensures that their priorities are integrated into decision-making, promoting more inclusive and effective resource governance. Additionally, the project reduces gender disparities by alleviating traditional burdens such as water collection through improved water access and firewood collection through renewable energy solutions, freeing time for educational, economic, and leadership opportunities. By fostering equitable access to resources, knowledge, and decision-making platforms, the project creates systemic shifts that enhance the resilience and agency of women and youth, contributing to more cohesive and climate-resilient communities in Eastern Uganda.

D.4. Needs of recipient (max. 300 words)

Eastern Uganda is highly vulnerable to the impacts of climate change, with over 8 million people at risk from the increasing frequency and intensity of climate-related disasters such as landslides, floods, and prolonged droughts (UNMA 2023). The region's reliance on rainfed agriculture exacerbates its vulnerability, as irregular rainfall patterns lead to crop failures, food insecurity, and loss of livelihoods. In regions like Bududa, frequent landslides displace communities and destroy agricultural land, deepening the economic hardship of local populations. The high population density in these areas further amplifies the risk, with large numbers of people living in zones prone to natural disasters (World Bank 2020). The project aims to address these vulnerabilities directly by introducing climate-resilient agricultural practices such as drought-tolerant crops, improved water management systems, and the restoration of degraded landscapes, all crucial for sustaining livelihoods in the face of climate change.

Vulnerability of the Country

The vulnerability of Uganda is compounded by socio-economic factors, including widespread poverty, with approximately 10.7% of the population living below the poverty line. Most households rely on subsistence farming, making them highly susceptible to climate impacts. The lack of financial resources and access to climate-smart technologies further exacerbates this vulnerability, limiting the population's ability to adapt to changing climate conditions (FAO 2020). The project will focus on the most vulnerable communities, with a particular emphasis on women and youth, who are often the hardest hit by climate change. By improving access to climate-resilient technologies,

enhancing capacity through training, and promoting sustainable livelihoods, the project seeks to empower these groups and enhance their resilience.

Vulnerability of Beneficiary Groups

Eastern Uganda's agricultural sector, which forms the backbone of its economy, is heavily dependent on rainfall, making it highly vulnerable to the effects of climate variability. Smallholder farmers, especially women, are most affected by unpredictable weather patterns that disrupt crop production and threaten food security. Women, in particular, are responsible for farming, water collection, and household management, but often lack access to resources and decision-making power, which increases their exposure to climate-related risks (UNDP 2021). The project addresses these gender disparities by providing training and support to empower women and youth, helping them take a more active role in climate adaptation efforts.
The project will directly benefit these vulnerable groups by improving agricultural productivity, restoring ecosystems, and enhancing access to clean water, all while fostering greater social inclusion and economic opportunities. The introduction of climate-resilient agricultural practices and the promotion of sustainable land management will reduce these groups' exposure to climate-induced risks, improving both their livelihoods and their long-term resilience.

Economic and Social Development Constraints

Eastern Uganda's economic development is hindered by the high dependency on subsistence agriculture, which is extremely susceptible to climate change. Poverty, combined with limited access to climate-resilient technologies and financial resources, restricts the region's ability to address climate change effectively. Additionally, the institutional capacity to manage and implement climate adaptation interventions is limited, particularly in local government bodies. This project aims to bridge these gaps by providing the necessary training and resources to local authorities and communities, enabling them to implement sustainable climate adaptation strategies and ensure long-term economic development.
The project will also target economically disadvantaged groups, particularly women and youth, by offering new income-generating opportunities through green jobs, climate-smart agriculture, and sustainable natural resource management. By improving access to resources and enhancing the skills of these groups, the project will contribute to reducing poverty and fostering economic resilience.

Absence of Alternative Sources of Financing

The Ugandan government's fiscal capacity to address climate change challenges is limited, with substantial dependence on foreign aid and remittances. The lack of alternative sources of financing, coupled with the country's limited access to capital markets, restricts its ability to fund large-scale climate adaptation projects independently. The project will leverage financing from the Green Climate Fund (GCF) to fill this gap and catalyse further investment in climate resilience. By focusing on sustainable financing mechanisms such as the establishment of revolving funds and partnerships with the private sector, the project aims to ensure that the interventions are financially viable in the long term.

Need for Strengthening Institutions and Implementation Capacity

The Ugandan government and local institutions face significant challenges in integrating climate change adaptation in to their policies and planning processes. There is a need for greater technical expertise in climate risk assessment, m onitoring, and the implementation of adaptation strategies. Additionally, there is limited coordination between govern ment agencies, non-governmental organizations, and local communities in addressing climate risks.

D.5. Country ownership (max. 500 words)

Contribution to the Achievement of Uganda's NDC Goals

The CATLER – Uganda project aligns with Uganda's Updated Nationally Determined Contributions (NDC) 2022, particularly in its priority adaptation actions for agriculture, forestry, water, and disaster risk reduction, as outlined in Section 2.2 of the NDC. The project's activities contribute to Uganda's NDC in the following ways:

Agricultural Adaptation (Table 2-7, Updated NDC): The project enhances climate resilience in agriculture through improved seed systems and water-efficient irrigation. It supports research institutions like NARO and decentralized ZARDIs to develop drought-tolerant and pest-resistant crop varieties tailored to the agro-ecological zones in Eastern Uganda. This contributes to Uganda's NDC priority to enhance food security through climate-

resilient crops and sustainable seed systems. Additionally, the project promotes small-scale solar-powered irrigation and rainwater harvesting, aligning with Uganda's NDC targets to improve water management in agriculture.

Forestry Adaptation (Table 2-9, Updated NDC): The project implements Farmer-Managed Natural Regeneration (FMNR) and supports Forest-Based Enterprises (FBEs) to restore degraded landscapes, particularly in the Mount Elgon and Teso regions. This aligns with Uganda's NDC commitment to increasing forest cover and integrating agroforestry in agricultural systems. By diversifying rural livelihoods through non-timber forest products such as honey and medicinal plants, the project reduces pressure on forests, directly supporting Uganda's afforestation and sustainable land management goals.

Water Resource Management (Table 2-4, Updated NDC): The project introduces 700 household rainwater harvesting tanks and 120 solar-powered community-based irrigation (CBI) units, increasing water availability for both agriculture and domestic use. These actions directly contribute to Uganda's NDC adaptation target to promote sustainable water access, protect catchment areas, and integrate climate-resilient water harvesting technologies.

Contribution to Uganda's Fourth National Development Plan (NDP IV) Strategic Direction (2025/26 – 2029/30)

Uganda's National Development Plan IV (NDP IV) (2025/26–2029/30) aims to drive the country toward sustainable industrialization for inclusive growth, employment, and wealth creation. Building on the vision of transforming Uganda into a modern and prosperous society by 2040, NDP IV emphasizes increasing agricultural productivity, enhancing value addition, developing strategic infrastructure, fostering private sector-led growth, and improving human capital. The plan recognizes the critical need to integrate climate resilience into national development, focusing on sectors such as agriculture, water resources, and infrastructure, which are highly vulnerable to climate change impacts.

The CATLER-Uganda project aligns closely with NDP IV by enhancing agricultural productivity through the adoption of climate-smart technologies. The project promotes the use of drought-tolerant seeds, soil conservation practices, and small-scale solar-powered irrigation systems, contributing to NDP IV's goal of improving agricultural resilience and reducing dependence on rainfall. These interventions directly address the plan's strategic objective of increasing production and productivity in agriculture (Sub-Strategy 1.1.1), ensuring food security, and sustaining livelihoods in Eastern Uganda. Additionally, the project supports water resource management by installing rainwater harvesting systems, aligning with NDP IV's focus on sustainable water access and efficient resource use (Sub-Strategy 1.1.5).

Beyond agricultural improvements, CATLER-Uganda fosters private sector growth and human capital development, key priorities under NDP IV. The project establishes partnerships with local seed producers and agro-input dealers, enhancing market access for smallholder farmers and promoting inclusive financing mechanisms through revolving funds. This aligns with NDP IV's strategy of strengthening public-private partnerships and promoting MSME participation in the economy (Strategy 3.4). Furthermore, the project's training programs for farmers and extension officers contribute to the institutionalization of manpower planning and skills development (Sub-Strategy 2.7), ensuring that local communities are equipped with the knowledge and technical capacity needed for climate-resilient agriculture. By integrating these targeted interventions, CATLER-Uganda advances NDP IV's strategic objectives, supporting Uganda's vision of inclusive and sustainable socio-economic transformation.

Alignment with the National Adaptation Plan for Agriculture (NAP-Ag) 2018

Uganda's National Adaptation Plan for the Agriculture Sector (NAP-Ag) seeks to enhance climate resilience in the agricultural sector by promoting climate-smart cropping systems, sustainable water and land management, early warning systems, and improved value chains. The CATLER-Uganda project aligns with these strategic priorities by integrating solar-powered irrigation systems, rainwater harvesting infrastructure, and climate-resilient seed adoption to mitigate the impacts of erratic rainfall and prolonged droughts, directly supporting the NAP-Ag's goal of promoting climate-resilient cropping systems and value chains (Section 5.4.1). Additionally, the project's establishment of four sub-regional demonstration centres for farmer training and knowledge transfer

contributes to the NAP-Ag's focus on capacity building for climate adaptation, ensuring that farmers and extension officers acquire practical skills in sustainable land and water management (Section 5.4.5). By emphasizing decentralized water resource management through solar-powered community-based irrigation units, the project also advances NAP-Ag's objective of strengthening climate-adaptive water management strategies (Section 5.4.2), addressing Uganda's vulnerability to recurrent droughts and water scarcity.

Uganda's Third National Communication (TNC) to the UNFCCC 2022

Uganda's Third National Communication (TNC) to the UNFCCC identifies the agriculture sector as one of the most vulnerable to climate change, emphasizing the urgent need for climate-resilient cropping systems, improved soil and water management, and sustainable farming practices (Section 3.6.1.1). The CATLER-Uganda project aligns with these priorities by supporting the adoption of drought-tolerant crop varieties, soil conservation techniques, and small-scale irrigation systems to mitigate the effects of erratic rainfall and prolonged droughts. The project's focus on strengthening seed systems and climate-smart agricultural extension services ensures that smallholder farmers have access to the necessary resources and knowledge to adapt to climate variability, directly contributing to the TNC's goal of enhancing agricultural resilience through improved farming inputs and agronomic practices (Section 3.6.1.4).

The TNC also highlights the importance of sustainable forest management and ecosystem restoration in reducing climate vulnerability, particularly through reforestation, agroforestry, and improved land-use planning (Section 3.6.5.1). The CATLER-Uganda project directly contributes to these objectives by implementing farmer-managed natural regeneration (FMNR) initiatives, afforestation programs, and agroforestry systems that restore degraded lands while integrating productive tree species that enhance both biodiversity and rural livelihoods. These efforts align with the TNC's emphasis on restoring deforested landscapes and promoting sustainable land-use practices to build ecological resilience and improve carbon sequestration (Section 3.6.5.3). Additionally, by promoting community-based forestry enterprises, the project ensures that rural communities benefit economically from sustainable forest management, reinforcing the TNC's strategy of integrating livelihood diversification into adaptation planning.

Water resource management is another key priority identified in the TNC, which underscores the need for enhanced water conservation, catchment restoration, and improved irrigation infrastructure to address increasing water scarcity and extreme weather patterns (Section 3.6.2.1). The CATLER-Uganda project contributes to this national priority by installing decentralized rainwater harvesting systems, rehabilitating wetlands, and expanding access to small-scale irrigation technologies, ensuring sustainable water access for both agriculture and domestic use. These interventions align with the TNC's objective of enhancing water security for climate adaptation while also supporting nature-based solutions for flood and drought risk management (Section 3.6.2.4). Through these strategic interventions in agriculture, forestry, and water resource management, the CATLER-Uganda project directly supports Uganda's climate resilience goals as outlined in the TNC, ensuring that adaptation actions are integrated into national development planning and benefit the most climate-vulnerable communities.

Uganda Vision 2040

Uganda Vision 2040 is the country's long-term development blueprint aimed at transforming Uganda into a modern and prosperous upper-middle-income nation by 2040. The Vision identifies agriculture, water resource management, energy, infrastructure, and technology innovation as key drivers of economic transformation, with a strong emphasis on sustainable natural resource management, climate resilience, and industrialization. Recognizing that climate change poses a significant threat to these development goals, Vision 2040 calls for climate-smart agricultural systems, large-scale afforestation, modern irrigation technologies, and expansion of renewable energy to enhance national productivity while ensuring environmental sustainability. The CATLER-Uganda project directly supports these ambitions by enhancing agricultural productivity, promoting sustainable forestry practices, strengthening water resource management, and expanding access to clean energy technologies, all of which align with the Vision's strategic direction for sustainable development.

One of the core priorities of Vision 2040 is modernizing agriculture to ensure food security, increase household incomes, and enhance Uganda's agro-industrial potential. The CATLER-Uganda project contributes to this goal by introducing climate-smart agricultural techniques, such as improving access to drought-tolerant and high-yield

crop varieties, enhancing soil conservation, and expanding irrigation systems. The project's investment in solar-powered community irrigation units ensures that farming communities have reliable access to water, reducing their dependence on erratic rainfall patterns, which is essential for Uganda to achieve its Vision 2040 target of increasing national irrigation coverage from less than 3% to over 15%. Additionally, the project promotes sustainable land management practices, including agroforestry and farmer-managed natural regeneration (FMNR), which enhance soil fertility and increase agricultural resilience to climate shocks. These interventions directly support Vision 2040's objective of transforming agriculture from subsistence-based to a market-oriented, high-value sector through sustainable intensification.

The project also aligns with Vision 2040's focus on renewable energy development and access, which is critical for supporting Uganda's industrialization and economic transformation agenda. Vision 2040 targets increasing electricity access to 80% by 2040 and expanding the share of renewable energy in Uganda's energy mix, particularly through solar and biomass-based technologies. CATLER-Uganda contributes to this ambition by installing 3 MW of solar photovoltaic (PV) systems across rural households, schools, and healthcare centers, ensuring that off-grid communities benefit from clean, affordable, and reliable electricity. The project also incorporates bio-latrines and other waste-to-energy solutions, directly supporting Vision 2040's strategy to promote alternative energy sources and reduce dependence on traditional biomass fuels, which are a major driver of deforestation and land degradation. Furthermore, the project fosters public-private partnerships in the renewable energy sector, leveraging investment opportunities to scale up green energy adoption, in line with Vision 2040's call for private sector-driven growth in clean energy infrastructure.

Water resource management and environmental sustainability are central pillars of Vision 2040, as Uganda's long-term economic growth depends on ensuring reliable water availability for agriculture, industry, and domestic use while mitigating the risks of floods and droughts. The CATLER-Uganda project supports this goal by expanding decentralized rainwater harvesting systems, rehabilitating wetlands, and integrating sustainable catchment-based water resource management strategies, ensuring that rural communities have long-term access to clean water for both agricultural and household consumption. The project's emphasis on restoring degraded watersheds and implementing ecosystem-based adaptation solutions contributes to Vision 2040's target of reversing environmental degradation and improving Uganda's natural capital for long-term resilience. By implementing integrated solutions in agriculture, energy, water, and environmental conservation, the CATLER-Uganda project significantly contributes to Uganda's long-term development vision, ensuring that climate resilience and sustainability are at the core of national economic transformation.

D.6. Efficiency and effectiveness

D.6.1. Estimated cost per t CO_2 eq, defined as total investment cost / expected lifetime emission reductions (Mitigation and Cross-cutting)	(a) Total project financing	US$_25,000,000
	(b) Requested GCF amount	US$ 25,000,000_
	(c) Expected lifetime emission reductions	28,575,404 tCO_2eq
	(d) Estimated cost per tCO_2eq (d = a / c)	US$_____ / tCO_2eq
	(e) Estimated GCF cost per tCO_2eq removed (e = b / c)	US$_____ / tCO_2eq
D.6.2. Expected volume of finance to be leveraged by the proposed project/programme and as a result of the Fund's financing, disaggregated by public and private sources (Mitigation and Cross-cutting)	(f) Total finance leveraged	US$_____
	(g) Public source finance leveraged	US$_____
	(h) Private source finance leveraged	US$_____
	(i) Total Leverage ratio (i = f / b)	_____
	(j) Public source leverage ratio (j = g / b)	_____
	(k) Private source leverage ratio (k = h / b)	_____

D.6.3. Describe how the financial structure is adequate and reasonable in order to achieve the proposal's objective(s), including addressing existing bottlenecks and/or barriers; providing the minimum concessionality; and without crowding out private and other public investment. (max. 500 words)

The proposed project presents a cost-effective approach to enhancing climate resilience and adaptation in Eastern Uganda by targeting the most vulnerable populations and employing proven climate-smart interventions. The financial

structure has been designed to ensure the efficient use of resources, providing the minimum concessionality required to achieve project objectives while mobilizing complementary funding sources to address existing barriers to resilience.

The total project cost reflects a balanced allocation between capital-intensive activities, such as infrastructure for climate-smart agriculture and water management, and capacity-building initiatives that strengthen local institutional and community resilience. This integrated approach ensures that project outcomes are both impactful and sustainable.

Economic and Financial Viability

The primary economic benefits stem from improved agricultural productivity, reduced losses from climate-induced disasters (e.g., floods and droughts), and enhanced water-use efficiency. Indirect benefits include strengthened community resilience, reduced healthcare costs due to better water quality, and job creation through green economic activities.

Innovative and Proven Technologies

The project integrates best practices and proven technologies to ensure efficiency and effectiveness. Climate-resilient agricultural practices, such as drought-tolerant seed varieties, agroforestry, and sustainable land management, have been selected based on their proven success in similar agroecological contexts. These practices are complemented by improved water management systems, including rainwater harvesting and micro-irrigation, which optimize resource use while reducing vulnerability to erratic rainfall.

Additionally, the project incorporates innovative digital tools, such as mobile-based platforms for climate information dissemination and decision-making support for farmers. These technologies ensure that beneficiaries have access to timely and actionable data, further enhancing the effectiveness of interventions.

Minimizing Costs and Maximizing Impact

The financial structure of the project has been carefully designed to leverage existing resources and align with national priorities. Co-financing from the Government of Uganda and other development partners ensures the sustainability of interventions, while the Green Climate Fund (GCF) funding addresses critical gaps that cannot be financed through domestic resources.

The project also builds on existing community-based structures to reduce costs and maximize impact. For example, local cooperatives and farmer groups will play a key role in implementing and monitoring project activities, ensuring local ownership while reducing implementation costs. This participatory approach ensures that interventions are tailored to the needs of beneficiaries and are more likely to be sustained post-project.

Sustainability and Replicability

By building local capacity and strengthening institutions, the project creates the conditions for long-term sustainability. Extensive training programs for government officials, community leaders, and farmers ensure that skills and knowledge are retained within the country. Furthermore, the project's emphasis on integrating climate resilience into local and national development plans ensures that its impact will extend beyond the project's geographic and temporal scope.

In conclusion, the project is designed to deliver high-value climate adaptation outcomes while optimizing resource use. Its combination of cost-effective interventions, strong co-financing commitments, and integration of best practices ensures that it is both efficient and effective, contributing significantly to Uganda's climate resilience and sustainable development goals.

E. ANNEXES

E.1. Mandatory annexes

☐	Annex 1	NDA No-objection Letter(s) (Template)
☐	Annex 2	Pre-feasibility (or feasibility) study (Guidance)
☐	Annex 2a	Logical Framework (Template)
☐	Annex 2b	Timetable (Template)
☐	Annex 3	Budget plan that provides breakdown by type of expense including AE fees (Template)
☐	Annex 4	Gender assessment and action plan (Template)
☐	Annex 5	Co-financing commitment letter if applicable (Template)
☐	Annex 6	Term sheet including a detailed disbursement schedule and, if applicable, repayment schedule
☐	Annex 7	Risk assessment and management (Template)
☐	Annex 8	Procurement plan model (Template)
☐	Annex 9a	Legal Due Diligence (regulation, taxation and insurance) (Template)
☐	Annex 9b	Legal Opinion/Certificate of Internal Approvals (Template)

E.2. Other annexes to be submitted when applicable/requested

☐	Annex 10	Economic and/or financial analysis (Guidance) (mandatory for private-sector proposals)
☐	Annex 11	Appraisal, due diligence or evaluation report for proposals based on up-scaling or replicating a pilot project
☐	Annex 12	Environmental and Social Action Plan (ESAP) (Template)
☐	Annex 13	Operations manual for EDA projects (guidance)
☐	Annex 14	Assessment of GHG emission reductions and their monitoring and reporting (for mitigation and cross cutting-projects)[56]
☐	Annex xx	Other references

***** Please note that a funding proposal will be considered complete**

only upon receipt of all the applicable supporting documents. ***

[56] Guidance on GHG emission reduction calculations for GCF projects/programmes is available on the GCF Programming Guidance (https://www.greenclimate.fund/sites/default/files/document/gcf-programming-manual.pdf), Box 12 “How to estimate greenhouse gas emission reductions for GCF”. This annex is mandatory for Mitigation and Cross-cutting projects