U-LEARN

Application of Climate Smart Agriculture approaches in Uganda's refugee response

March 2025

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About the Uganda Refugee Resilience Initiative (URRI)

The Uganda Refugee Resilience Initiative (URRI) is designed to strengthen the resilience and self-reliance of refugees and host communities in Uganda. Key objectives include strengthening livelihoods, improving infrastructure and services, promoting social cohesion, fostering environmental sustainability, and building resilience against shocks. URRI is a collaborative effort involving the Ugandan government, international organizations, NGOs, and funded by the Government of Denmark.

About U-Learn

The FCDO-funded U-Learn consortium is led by U-RIL, in partnership with IRC and IMPACT Initiatives. Its objective is to generate and encourage uptake of evidence and insights for the Uganda refugee response. U-Learn is a public good designed to promote improved outcomes for refugees and host communities in Uganda. In collaboration with the government and a wide range of stakeholders, U-Learn focuses on facilitating learning, conducting assessments, and amplifying refugee voices and priorities. U-Learn specializes in Accountability to Affected Populations (AAP), Research and Learning.

Acknowledgements

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Cover picture: Credit:FtF IAM

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Abbreviations

ADRA	Adventist Development and Relief Agency
AID	Albertine Interventions for Development
CBO	Community-Based Organisations
CRRF	Comprehensive Refugee Response Framework
CSA	Climate-smart agriculture
DCA	DanChurchAid
DEWS	Drought Early Warning System
GDP	Gross Domestic Product
GHG	Greenhouse gases
FAO	Food and Agriculture Organisation
FFS	Farmer Field Schools
INGO	International non-governmental organisations
ISFM	Integrated soil fertility management
KRC	Kabarole Research and Resource Centre
L/NNGO	Local or National Non-Governmental Organisation
LWF	Lutheran World Federation
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NARO	National Agricultural Research Organisation
NNGO	National Non-Governmental Organisations
NRC	Norwegian Refugee Council
OPM	Office of the Prime Minister
PICS	Perdue Improved Crop Storage
PPB	Permanent planting basins
QDS	Quality Declared Seed
RISE	Response to Increased Demand in Government Service and Creation of Economic Opportunities in Uganda
RLO	Refugee-Led Organisations
RRF	Rwamwanja Rural Foundation
SACCO	Savings and Credit Cooperative Society
SLM	Sustainable Land Management
WHH	Welthunger Hilfe
WRM	Water resource management
UCSAT	Uganda Climate Smart Agriculture Transformation
UNHCR	UN Refugee Agency
VSLA	Village savings and loans

Executive summary

Agricultural production contributes to Uganda's economic development and the food security of many households. Smallholder farmers are vulnerable to climate change, particularly refugee and women-headed households, as they rely on rainfed agriculture and have few resources to adapt. Climate-smart agriculture (CSA) has been introduced within the refugee response to strengthen livelihoods in the face of a changing climate. The purpose of this desk review is to enhance the understanding of CSA and the ways it is applied in the refugee response.

CSA has three mutually reinforcing objectives to increase agricultural productivity, to build resilience and adapt to climate change, and to reduce greenhouse gas emissions. The CSA approach helps to assess the trade-offs to find solutions that promote the greatest synergies in the three areas. CSA has increasingly appeared in Uganda's policies and plans since 2010, recognising the link between climate change and agriculture. Though treated differently in each, there are recurring themes of promoting irrigation, agroforestry, climate-resilient varieties, and low-carbon value chains.

© Credit: FtF IAM. Practical field demonstrations.

Improving agricultural production is a common strategy to strengthen livelihoods in the refugee response. This review has identified 33 initiatives in 12 refugee-hosting districts that have a CSA component. Initiatives are being carried out in 12 of the 13 refugee-hosting districts. Actors are building the capacity of refugee and host communities in climate-smart practices in crop productions, such as crop rotation, Zero tillage, intercropping, and permaculture. They are supported to improve the adoption and access to technologies such as improved seed varieties and climate information. There has been some support for integrated crop and livestock systems, incorporating poultry, goats or oxen into the farm activity.

Most initiatives include practices to better manage the natural resources that sustain agriculture, particularly water, soil and forests. Simple irrigation systems and small-scale infrastructure technologies improve the efficient use water. Soil management techniques like contour bunds and the use of organic material for fertilisers are also used to improve soil fertility, conserve soil moisture, and store carbon. Agroforestry has a triple benefit of providing additional revenue sources, improving soil fertility and productivity, and storing carbon. Refugee and host communities are supported to plant climate-adapted and indigenous tree varieties or those with additional benefits for food, medicine, timber, fuel or water filtration.

The CSA approach can be applied throughout the agricultural value chain from inputs to final consumption and waste. There has been some support to improve post-harvest handling, storage and processing, using more energy-efficient technologies or techniques to reduce food waste and loss. Biogas has also been promoted as a way to use agricultural waste to create clean energy and reduce greenhouse gases.

There are barriers for smallholder farmers to adopt CSA approaches, such as the perception that it is labour intensive and the limited availability of quality inputs. However, the successes show that local farmers can be producers of quality seed, that simple irrigation systems can have a big impact on productivity, and that vegetable growing can be profitable on the limited land available. The main gaps in CSA in the refugee response are: lack of harmonised framework, limited application of CSA along the entire value chain, and lack of a knowledge hub on CSA.

I. Introduction

Agricultural production contributes to Uganda's economic development, as well as to the livelihoods and food security of many households. In 2023, the agricultural sector contributed to nearly a quarter (24%) of the country's Gross Domestic Product (GDP),[1] accounted for 35% of all exports, and employed 68% of the working population directly or indirectly.[2] The sector is dominated by rain-fed agriculture and smallholder farmers (predominantly male) who use rudimentary tools to cultivate the land.[3]

The agricultural sector is vulnerable to climate change. Average temperatures in Uganda have risen by 1.3°C since the 1960s and are expected to increase further by 0.6-1.5°C by 2039. Rainfall is highly variable, but seasonal rainfall has declined (March-May) and prolonged dry spells and droughts have increased. The Western, Northern and Eastern regions have experienced longer lasting drought conditions over the past two decades. Rainfall is expected to continue decreasing in the Northern region, while the risk of intense rainfall events causing flooding is expected to increase in Western and Central regions.[4] These changes are resulting in crop losses, soil degradation, heat stress in animals, invasion by pests and increased incidence of animal diseases.[5] Smallholder famers are particularly vulnerable to climate change, as they have fewer resources to adapt and recover from its impacts.[6] Vulnerability is higher among refugee and women-headed households involved in agriculture.

Uganda has a progressive policy toward refugees. Refugees have the right to work and are offered a small plot of land (30x30 meters) within one of the 13 refugee settlements around the country. It is estimated that at least 29% of refugee households are involved in agriculture-based livelihoods as the main source of household income, with many more engaging in agriculture as a secondary livelihood.[7]

Uganda's response is guided by the Comprehensive Refugee Response Framework (CRRF), which promotes refugees' resilience and self-reliance. One of the strategies to increase self-reliance is through agricultural production. Climate change, however, will make it more difficult for refugee households to achieve self-reliance due to its impact on agriculture and the natural resources that support it, like soil, water, wetlands and forests. The situation is exacerbated by the growing refugee population and the increased demand for land for settlement and wood fuel for cooking, which is accelerating deforestation and wetland loss around refugee settlements.[8]

© Credit: FtF IAM. Watermelons harvest in Palabek Refugee Settlement

1.3°C
Temperature rise in Uganda since 1960

1.7 million
refugees living in Uganda

30x30m
size of plot of land offered to refugees in Uganda

1 The World Bank, 2024, World Development indicators. Agriculture, forestry, and fishing, value added. Accessed September 20, 2024. https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=UG

2 International Trade Administration. 2023. Uganda – Country Commercial Guide. https://www.trade.gov/country-commercial-guides/uganda-agricultural-sector#:~:text=Eighty%20percent%20of%20Uganda's%20land,and%2035%25%20of%20export%20earnings

3 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture. Community of Practice Guide. https://careclimatechange.org/wp-content/uploads/2021/06/The-Climate-Smart-Agriculture-book-2021.pdf

4 World Bank Group, 2021, Climate Risk Country Profile: Uganda. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-05/15464-WB_Uganda%20Country%20Profile-WEB%20%281%29.pdf

5 USAID, 2020, Climate Risk Profile. East Africa. https://www.climatelinks.org/sites/default/files/asset/document/2020_USAID_ATLAS_CRP-East-Africa-Regional.pdf

6 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture. Community of Practice Guide. https://careclimatechange.org/wp-content/uploads/2021/06/The-Climate-Smart-Agriculture-book-2021.pdf

7 UNHCR, 2022, Uganda: Socioeconomic assessment of refugees through Individual Profiling Exercise - Home Visits, 2022.

8 CIFOR-ICRAF, 2023, Response to increased environmental degradation and promotion of alternative energy sources in refugee hosting districts in Uganda. https://apps.worldagroforestry.org/downloads/Publications/PDFS/PB23010.pdf

Climate-smart agriculture (CSA) has been introduced within the refugee response to strengthen livelihoods of smallholder farmers in refugee-hosting districts in the face of a changing climate. CSA is an approach to farming that sustainably increases productivity while enhancing resilience to the impacts of adverse climate events and reducing greenhouse gases (GHG).[9] While it provides a frame to design farming activities, it can be applied differently depending on the context and organisation.

Climate-Smart Agriculture is an approach to farming that sustainably increases productivity, enhances resilience to the impacts of climate change and reduces or removes greenhouse gas emissions. Climate-Smart Agriculture is not only about improving crop productivity to ensure food security. For practices and technologies to be considered 'climate-smart' they must also support at least one of the other two objectives: adaptation and/or mitigation (GIZ, 2021).

The purpose of this desk review is to enhance the understanding of CSA and the ways that the approach is applied in the refugee response. The desk review includes a summary of the evolution of CSA within national policies and strategies in Uganda and a preliminary mapping of actors that are known to be implementing CSA initiatives in Uganda's refugee response. The review identifies CSA practices and technologies being applied in the refugee response and identifies learning and gaps to inform future programming. This is not an exhaustive review or analysis of CSA practices that can be scaled, but rather a summary of the type of CSA practices being applied in the refugee response.

As part of the desk review, more than 25 documents were reviewed that contain information on CSA generally and application within Uganda. This includes training manuals, project reports, and good practice guides. In addition, the review included stories and project information available online. Twelve key informant interviews were conducted with representatives from International Non-Governmental Organisations (INGO), UN agencies, national government, and development agencies to complement the desk review. The main limitation of the desk review is the lack of detailed information about CSA initiatives being carried out within refugee settlements, particularly analysis of their effectiveness and lessons learned.

II. What is climate-smart agriculture?

Climate-smart agriculture (CSA) was developed by the Food and Agriculture Organisation (FAO) in 2010 as a unified approach to address the interrelated challenges of climate change and food security. The concept stems from the recognition that agricultural intensification has resulted in environmental degradation, that climate change is challenging the ability to produce enough food to sustain the population, and that agriculture itself is a significant contributor to climate change through the emission of greenhouse gases.

Greenhouse gases are any gas that absorbs infrared radiation in the atmosphere. It includes carbon dioxide (CO^2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3), among others.

CSA is widely agreed to have three mutually reinforcing objectives:[10]

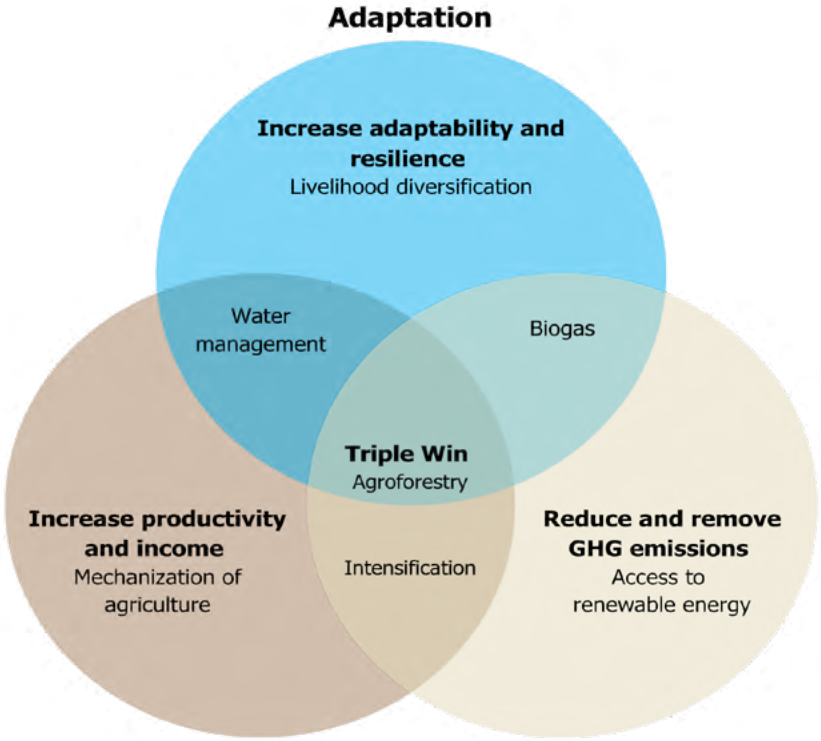
9 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture. Community of Practice Guide.
10 Food and Agriculture Organisation (FAO), 2024, Climate-Smart Agriculture. https://www.fao.org/climate-smart-agriculture/overview/faqs/history/en/

CSA contributes to the broader goal of sustainable agriculture, which is farming that aims to "meet the needs of existing and future generations, while ensuring profitability, environmental health, and economic equity."[11] However, it has a more specific focus on adapting production systems to be better suited to the changing climate conditions, enabling the farming population to withstand, cope with, and recover from the impacts of climate change, and shifting to low-carbon agri-food systems.[12]

CSA is an approach used to transform and reorient existing agricultural practices, adopting practices that can best respond to the new realities of climate change.[13] The approach helps to identify practices and technologies that will achieve benefits in two or more of the objectives. It recognises that not all practices will achieve "triple wins," i.e. productivity, adaptation, and mitigation, and it will be necessary to balance the benefits and trade-offs of each action.[14]

For example, agricultural practices like the use of diesel-powered machinery may increase productivity but will also increase GHG emissions. Conversely, there are practices that will help mitigate GHGs, like installing solar panels, but may not improve the ability of farmers to adapt or cope with climate change. The CSA approach helps to assess the trade-offs to find solutions that promote the greatest synergies in the three key areas and minimise adverse effects (see Figure 1).

Figure 1: Three objectives and examples of climate-smart agriculture



There is no single typology of practices that are considered climate smart. Many resources discuss CSA in relation to the types of farming practices or agricultural sectors, while a few discuss CSA as an approach that guides actions within the broader agri-food system. In this broader approach, the practices applied in CSA can be viewed in the following four dimensions as proposed by the FAO[15]:

1. The **production and management** of crops, livestock, aquaculture and fisheries.
2. The **management of natural resources** and ecosystems that sustain agriculture (water, soil and land, forests).
3. The components and linkages in the wider **agri-food system and value chains**.
4. The **services and support** for farmers and land managers to better manage the risks and impacts of climate change.

11 Food and Agriculture Organisation (FAO), 2024, Sustainable Food and Agriculture https://www.fao.org/sustainability/en/#:~:text=To%20be%20sustainable%2C%20agriculture%20must,and%20social%20and%20economic%20equity
12 Food and Agriculture Organisation (FAO), 2024, Climate-Smart Agriculture.
13 Lipper L, Thornton P, Campbell BM, Torquebiau EF., 2014, Climate-smart agriculture for food security. Nature Climate Change 4:1068-1072
14 GIZ, 2021, Climate Smart Agriculture Training Manual. https://www.ugandalandcare.org/wp-content/uploads/2021/03/CSA-Training-Manual-.pdf
15 Food and Agriculture Organisation (FAO), 2024, Introducing Climate-Smart Agriculture.

This desk review uses these four dimensions as the frame to explore the potential and existing climate smart practices and technologies being used within the refugee response in Uganda. Though each dimension is discussed separately, the practices applied in CSA are often linked to more than one. CSA is often said to apply a landscape or ecosystem-based approach, which looks at the entire ecosystem and the different ways stakeholders use, benefit from, and value nature.[16] The desk review will summarise practices applied in the refugee response within each of the four dimensions. Due to the limited information available, these practices will be discussed generally for the refugee response across the country. However, it is recognised that the adoption of CSA practices varies regionally depending on the suitability to the different agro-ecological zones within the country.

Adopting an ecosystem approach to agriculture views the farm as a system. This approach favours integrated management practices where the product of one farming component acts as an input for another component of the system. An example is integrated crop and livestock systems that use animal waste as fertiliser to improve crop production.[17] Many integrated agricultural management practices fall under the umbrella of CSA, where they also contribute to the goals of adaptation and/or mitigation. Table 1 highlights some of the agricultural management practices that are commonly applied as part of the CSA approach.

Table 1: Agricultural management practices that are commonly applied within the climate-smart agriculture approach[18]

Conservation Agriculture	A set of farming practices that minimise mechanical soil disturbance, maintain a permanent organic soil cover, diversify and rotate plant species, and enhance natural biological processes.
Sustainable Land Management (SLM)	The use of land resources (soil, water, animals, plants) to produce goods and provide services to meet human needs while maintaining their productive potential and environmental functions over the long-term.
Integrated soil fertility management (ISFM)	Making soil nutrients available by adding fertilisers and organic inputs (e.g. compost, crop residue, nitrogen-fixing legumes) and reducing nutrient loss through soil and water conservation.
Integrated pest management	An ecosystem approach to crop production that combines different management practices to grow healthy crops and minimise the use of pesticides.
Water Resource Management (WRM)	Methods to use, conserve and manage water, land and living resources in a watershed to maintain a water supply crucial for ecosystem and human health.

III. National frameworks for climate-smart agriculture

Agriculture is recognised as the backbone of Uganda's economy. Agriculture is a key sector that is understood to be impacted by climate change and also one of the main contributors to the country's GHG emissions.[19] In Uganda, the agricultural sector contributes 46% of the country's total greenhouse gas (GHG) emissions, coming mainly from methane from livestock (42%), manure left on the pasture (31%) and burning savanna (13%).[20]

16 FAO, 2024, Managing landscapes for Climate-Smart Agriculture systems. https://www.fao.org/climate-smart-agriculture-sourcebook/concept/module-a3-landscapes/chapter-a3-3/en/ ; International Rice Research Institute (IRRI), 2022, An Ecosystem-Based Approach to Climate-Smart Agriculture with Some Considerations for Social Equity. CGIAR Initiative on Climate Resilience https://cgspace.cgiar.org/items/a201b541-07cc-405b-b397-b72ec0f6bf9c;

17 Food and Agriculture Organisation (FAO), 2024, Introducing Climate-Smart Agriculture;

18 FAO, 2024, Conservation Agriculture https://www.fao.org/conservation-agriculture/overview/what-is-conservation-agriculture/en/; MAAIF, 2020, Scaling Sustainable Land Management https://catalogue.unccd.int/1571_Scaling_Sustainable_Complete_July_17_2020_Light.pdf ; FAO, 2023. Climate-Smart Agriculture Sourcebook. https://openknowledge.fao.org/server/api/core/bitstreams/b21f2087-f398-4718-8461-b92afc82e617/content ; Turyasingura, et. al., 2024, Climate-smart water management practices for sustainable agriculture in Uganda. Journal of Water and Climate Change (2024) 15 (7): 2940–2960 https://doi.org/10.2166/wcc.2024.471 ; Abousamra, F., 2020, Ecosystem approach for the management of water resources. UNEP https://www.fao.org/fileadmin/user_upload/groundwatergovernance/docs/Amman/Presentations/PS4_Fouad_Abou_Samra.pdf

19 FAO, 2016, Eastern Africa Climate-Smart Agriculture Scoping Study. Ethiopia, Kenya, and Uganda. https://openknowledge.fao.org/server/api/core/bitstreams/d6c327dd-e353-4ca3-85ba-f8bb9129f109/content

20 Feed the Future (FTF), 2017, Climate-Smart Agriculture in Uganda. https://climateknowledgeportal.worldbank.org/sites/default/files/2019-06/UGANDA_CSA_Profile.pdf

Agriculture and climate change are well integrated into the country's national development plans and policies, though they are often treated as separate but interlinking priorities. Since the term was coined in 2010, climate-smart agriculture has been increasingly visible in Uganda's national policies. The evolution of Uganda's strategic focus on climate-smart agriculture is reflected in various national policies and programmes highlighted below.

2013 **National Agricultural Policy**: The mission in the policy is to "transform subsistence farming to sustainable commercial agriculture." Climate change is identified as an emerging threat impacting agricultural productivity and there is a recognised need to develop capacity to address climate change and its impact on agriculture.[21]

2015 **Uganda National Climate Change Policy (UNCCP):** This policy was approved by Cabinet in 2015 to guide the country in addressing the impacts of climate change. It clearly identifies measures for climate change mitigation and adaptation across key sectors, including agriculture. It calls for strategies to enhance sustainable agricultural systems, such as promoting adaptive crop varieties, irrigated agriculture, diversification, improved post-harvest handling and storage, access to climate information, and innovative insurance schemes.[22]

Uganda National Climate-Smart Agriculture Programme (2015-2025): The vision for the CSA Programme is a "climate-resilient and low-carbon agricultural and food system contributing to increased food security, wealth creation and sustainable economic growth." Key focus areas include increasing agricultural productivity through climate-smart agricultural practices and increasing the sector's contribution to low-carbon development pathways.[23]

National Development Plan II (NDP II): In the second National Development Plan (2016-2021) there was recognition of the need to address climate change to enhance sustainable development. Agriculture is identified as a priority sector, with an aim to increase agricultural production, productivity and value-addition. It does not make reference to CSA but acknowledges the effect on agricultural production and food security and commits to adopting measures to mitigate climate change and adapt to its impacts.[24]

2016 **Agriculture Sector Strategic Plan (ASSP):** The ASSP is part of Uganda's broader vision to transform the agricultural sector into a competitive, profitable, and sustainable part of the economy. It recognises the need to sustain agricultural productivity under the pressures of climate change and implementing activities within the above-mentioned national CSA programme. These include technical support to farmers on climate-smart practices, research to breed climate-resilient and nutrient-enriched varieties, adoption of low carbon development pathways, and strengthening the enabling environment for CSA. [25]

2017 **Uganda Green Growth Development Strategy (2017/18-2030/31):** The strategy aims to achieve inclusive low-emissions economic growth in priority sectors, including agriculture. The strategy promotes sustainable agriculture, prioritising increased access to irrigation, integrated soil fertility management, agroforestry, and upgrading the value chain for priority commodities. It promotes practices such as sustainable land management (SLM), the development of watershed management plans, rehabilitation of degraded agricultural landscapes, agroforestry and afforestation, and the use of energy-efficient cookstoves.[26]

21 Ministry of Agriculture, Animal Industry and Fisheries, 2013, National Agriculture Policy. https://www.agriculture.go.ug/wp-content/uploads/2019/04/National-Agriculture-Policy.pdf

22 Ministry of Water and Environment, 2018, Uganda National Climate Change Policy. https://www.mwe.go.ug/sites/default/files/library/National%20Climate%20Change%20Policy%20April%202015%20final.pdf

23 Ministry of agriculture animal industry and fisheries, Ministry of water and environment, 2015, Uganda climate smart-agriculture country program 2015-2025. https://cgspace.cgiar.org/items/9aba00f7-d384-4c8e-a6c1-99a7e996659e

24 Republic of Uganda, 2015, Second National Development Plan 2015/16-2019/20. https://faolex.fao.org/docs/pdf/uga151369.pdf

25 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2016, Agriculture Sector Strategic Plan Strategic Plan 2015/16-2019/2020. https://faolex.fao.org/docs/pdf/uga181565.pdf

26 Government of Uganda, 2017, The Uganda Green Growth Development Strategy 2017/18-2030/31. https://faolex.fao.org/docs/pdf/uga184391.pdf

2018

Uganda's National REDD+ Strategy (Reducing Emissions from Deforestation and forest Degradation): The strategy aims to promote sustainable forest management, biodiversity conservation and enhancement of forest carbon stocks. It includes CSA as a strategic component. The strategy promotes three CSA techniques: 1) Sustainable Land Management/Use of Agroforestry Practices; 2) Rainwater harvesting with collection tank and drip irrigation; 3) Greenhouse cultivation of vegetables. Other related strategies are sustainable fuelwood and charcoal production and energy-efficient cooking stoves.[27]

National Adaptation Plan for the Agricultural Sector: The plan assesses the vulnerability of the agriculture sub-sectors (crop production, livestock, fisheries, water, forestry) to climate change and identifies adaptation actions for each. The plan recognises that CSA practices have been promoted, but there has been limited adoption. Though the actions proposed are not labelled as CSA, the plan promotes the adoption of climate-resilient cropping systems and value chains, climate-resilient livestock production and fisheries, sustainable natural resource management, and strengthening climate information and early warning.[28]

2020

National Development Plan III (NDP III): Uganda's NDP III (2020/21 – 2024/25) lays the foundation for the country's long-term strategic goals, which focus on increasing household incomes and improving the quality of life for Ugandans. The plan has separate strategic directions for agro-industrialisation and climate change. The plan briefly recognises a national growing need for CSA "which promotes a green economy". However, the plan does not explicitly mention the strategies to implement CSA implementation, apart from agroforestry, or even dedicated resources to support it. [29]

2022

Nationally Determined Contributions (NDC): Uganda's NDC was first submitted in 2015, and then updated in 2022. The NDC seeks to transition the country to a low-carbon, climate-resilient and green economy. The NDC identifies priority adaptation measures in agriculture, including scaling up CSA for climate resilient cropping systems and value chains, and promoting climate-resilient livestock production systems. The NDC also identifies mitigation measures in CSA that are aligned with the REDD+ Strategy (sustainable land use management and agroforestry; rainwater harvesting and irrigation; and greenhouse cultivation of vegetables). Mitigation measures listed were to promote a climate-smart dairy livestock value chain, improve livestock feed quality, and manure management.[30]

Sustainable Energy Response Plan for Refugees and Host Communities: The SERP aims to increase refugee and host communities' access to affordable, reliable and clean energy. The strategy promotes renewable energy as a productive use of energy to enhance agricultural productivity. The plan does not mention CSA directly but aims to support livelihoods by increasing access to sustainable energy for agriculture, among other sectors.[31]

2023

Refugee Livelihoods and Resilience Sector Strategy: The goal of this strategy is that by 2025, refugees and host communities will live in harmony, and progressively attain self-reliance. Agricultural production is central to the strategy to attain self-reliance. The strategy focuses on three key outputs: increasing the agricultural land available for refugees to use, improving productivity, and access to markets. The strategy promotes sustainable climate-smart agriculture and other technologies to increase agricultural productivity.[32]

The national policies demonstrate a growing interest in climate-smart agriculture for the country and within the refugee response. CSA is treated differently in each policy and strategy, but recurring themes are found, such as the promotion of irrigation, agroforestry, climate-resilient varieties, low-carbon value chains, and sustainable land management.

27 Ministry of Water and Environment, 2017, National REDD+ Strategy and Action Plan. https://redd.unfccc.int/media/final_-_uganda_redd_strategy_and_action_plan-october_2017.pdf

28 MAAIF, 2018, National Adaptation Plan for the Agricultural Sector. https://www.agriculture.go.ug/wp-content/uploads/2019/09/National-Adaptation-Plan-for-the-Agriculture-Sector.pdf

29 Republic of Uganda, 2020, Third National Development Plan (NDPIII). 2020/21-2024/25. https://www.npa.go.ug/wp-content/uploads/2023/03/NDPIII-Finale_Compressed.pdf

30 Ministry of Water and Environment, 2022, Updated Nationally Determined Contribution. https://unfccc.int/sites/default/files/NDC/2022-09/Updated%20NDC%20_Uganda_2022%20Final.pdf

31 Ministry of Energy and Mineral Development, 2022, Sustainable Energy Response Plan for Refugees and Host Communities. https://energypedia.info/wiki/File:The_Sustainable_Energy_Response_Plan_for_Refugess_and_Host_Communities_2022-2025.pdf

32 UNHCR, 2023, Refugee Livelihoods and Resilience Sector Strategy (2022-2025).

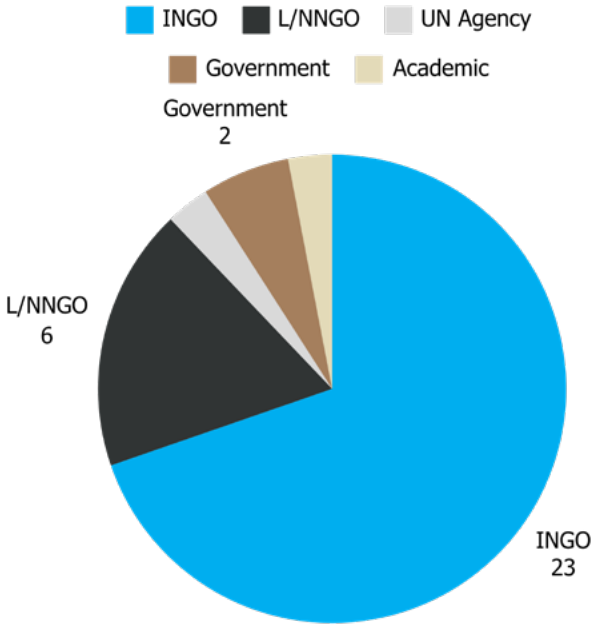
IV. Climate-smart agriculture in Uganda's refugee response

There are many actors working on CSA across the country, including Government, research institutions, International Non-Governmental Organisations (INGOs), national NGOs, and the private sector. Within the refugee response, there were 177 different actors working in the Livelihoods and Resilience sector in 2024, according to the Office of the Prime Minister (OPM)'s registry.[33] Of these organisations, at least 53 were providing support related to agricultural production (not necessarily CSA). These include 29 INGOs, 14 National Non-Governmental Organisations (NNGOs), three Refugee-Led Organisations (RLO), three Community-Based Organisations (CBO), three UN agencies, and one Government Agency.

Box 1: The Uganda Climate Smart Agriculture Transformation (UCSAT) project

The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) is spearheading the Uganda Climate Smart Agriculture Transformation (UCSAT) project funded by the World Bank, which works in 69 districts, including six refugee hosting districts (Kikuube, Kiryandongo, Kyegegwa, Kamwenge, Isingiro, Adjumani). The project aims to strengthen 13 priority value chains through CSA: dairy/beef, coffee, aquaculture and fisheries, cocoa, poultry, mangoes, citrus, bananas, vegetables, sorghum, cassava, soybean, and maize.

Figure 2: Type of organisations implementing CSA initiatives in the refugee response



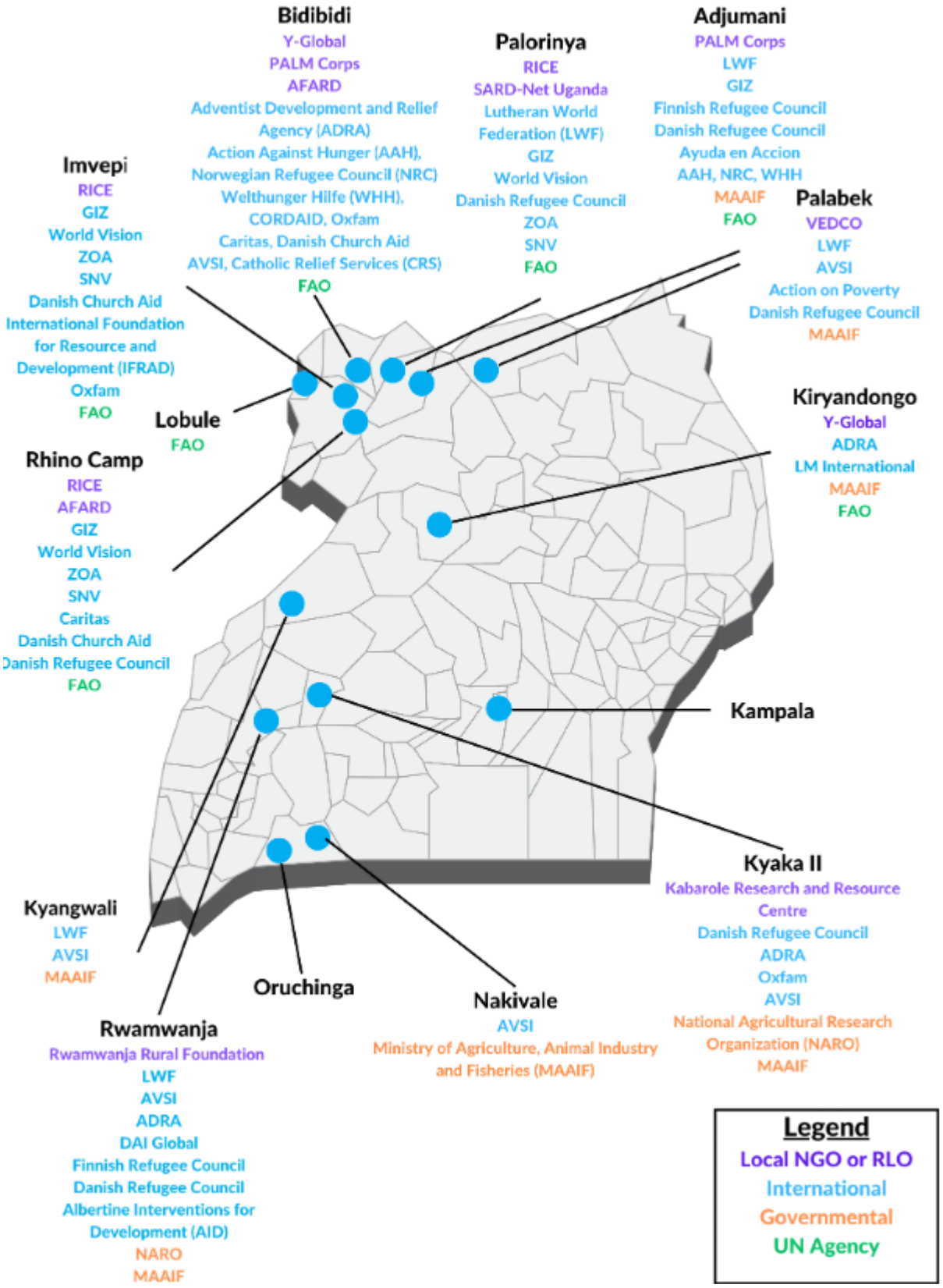
The desk review found that between 2020-2024, there were at least 34 actors implementing initiatives with a CSA component within refugee-hosting districts. Of these, 23 were INGO actors and seven were Local or National NGOs (L/NNGO) (see Figure 2). The representation of L/NNGOs adopting a CSA approach may be underrepresented in this analysis due to the lack of publicly available information about their project's activities.

The preliminary mapping exercise focused only on actors and initiatives that used the term 'climate-smart agriculture' in their descriptions, or actions that were 'climate-resilient.' However, there are many more actors working on related topics, such as good agricultural practices, access to clean energy or livelihoods, that were not included in this preliminary mapping.

The actors identified are implementing CSA initiatives in 12 of the 13 refugee-hosting districts (see Figure 3). The most initiatives were found in Yumbe (Bidi Bidi Refugee Settlement), Kamwenge (Rwamwanja Refugee Settlement), and Adjumani. There were no initiatives found in Oruchinga. The list of initiatives is found in Appendix 1.

33 Office of the Prime Minister, 2024. Livelihood partners as of April 2024.

Figure 3: Map of actors working on CSA in refugee-hosting districts of Uganda



V. Agricultural production and management

© Credit. U-Learn. CSA trainings cover a range of topics including climate change and agronomic techniques

Actors applying CSA are most commonly focusing their actions at the production stage of the value chain. There are many good farming practices that can be applied to increase crop production while also adapting to climate change, reducing greenhouse gases, or both.

In the refugee response, there are many interventions aiming at improving practices in the sectors of crop production and to some extent livestock management. This review found little evidence of CSA initiatives in aquaculture and fisheries in the refugee response. This section will highlight climate-smart practices and technologies used in crop production and livestock management.

A. Crop production

Actors working in the refugee response are most commonly providing capacity building support to farmers in climate-smart practices to improve crop production. Farmer Field Schools (FFS) were carried out by several actors like AVSI Foundation to teach CSA practices to refugee and host communities. In the FFS approach, a demonstration plot or experimental garden is established to practice the techniques being taught, providing a hands-on learning experience and in some cases the opportunity to sell the products to "earn while you learn".[34] The CSA trainings covered a range of topics including climate change and agronomic techniques through to post-harvest handling[35] and marketing.[36] While addressing production challenges to increase activity, an adapted FFS methodology (Farmer Field and Business School) observes the need to conserve natural resources and reduce GHG emissions.

Climate-Smart Crop Production Practices

The CSA initiatives in refugee and host communities promote a similar mix of agronomic practices and technologies, often referred to as conservation agriculture, summarised below.

Crop rotation: A mix of crops is planted in a field, which are then rotated from season to season. Crop rotation helps maintain soil health and reduce pest build-up. By mixing crops like cereals (e.g. maize) and legumes (e.g. beans or groundnuts), there is less risk of a total crop failure, increasing resilience to variable climatic conditions.[37]

Zero or minimum tillage: Zero tillage practices minimise soil disturbance, reduce soil erosion, and maintain soil biodiversity. Farmers are taught techniques to prepare the land by slashing existing vegetation, by making holes with a hoe or stick, and planting without ploughing deeply into the soil.[38] By avoiding the use of heavy machinery, it also avoids emissions of greenhouse gases.

34 Stella, N., 2024, Healing the Land through Climate-Smart Agriculture in Refugee Settlements. World Environment Day Magazine. https://uganda.lutheranworld.org/content/climate-smart-agriculture-106

35 GIZ, 2021, Climate Smart Agriculture Training Manual.

36 NURI Coordination Function, 2022, Northern Uganda Resilience Initiative. Programme completion report; Northern Uganda Resilience Initiative (NURI), 2023, Development work in refugee hosting areas – northern Uganda. Lessons in operation and implementation.

37 GIZ, 2021, Climate Smart Agriculture Training Manual.

38 GIZ, 2021, Climate Smart Agriculture Training Manual. Uganda; Gabiri G, Luswata KC, Sebuliba E, Nampijja J., 2022, Climate-Smart Agriculture in Uganda; AICCRA Accelerating Impacts of CGIAR Climate Research in Africa (AICCRA). Uganda. CGIAR. https://cgspace.cgiar.org/server/api/core/bitstreams/2800c735-bbf6-4d7a-8173-bc515e5b5e53/content

Mulching: The soil surface is covered with a layer of organic residues, such as the vegetation removed through minimum tillage, which allows for eventual decomposition. The practice improves moisture retention during dry conditions, reduces emissions from the uncovered soil surface, and reduces probability of crop loss.[39]

Crop variety selection: Farmers are guided to plant crop varieties based on characteristics that are well-suited to the climatic conditions, such as low and variable rainfall. Other varieties are selected because they are high-value or high-yielding to generate more income on less land, enhancing their capacity to withstand climatic stresses. One variety that has been promoted in the refugee response is the green gram (mung bean), a legume that has multiple benefits: it thrives in hot and dry conditions, it has high protein, and is versatile to be grown for seeds, green manure, and forage.[40]

Cover cropping: Leguminous plants are used as cover crops because they fix atmospheric nitrogen, boost soil fertility, protect the soil from erosion and moisture loss and suppress weeds. In Uganda, some cover crops that are promoted are the velvet bean, jack bean, sun hemp, and pigeon pea, among others.[41]

Vertical farming/gardens: Vertical farming is a space-saving agricultural technique to grow crops vertically in stacked layers or container gardens. Refugees in Kiryandongo Refugee Settlement are being supported to maintain vertical gardens to maximise production on the limited land available.[42]

Integrated pest management: Farmers are encouraged to use local and organic materials to control pests, such as red pepper. This minimises the use of chemical pesticides that are transported across large distances and that degrade soil and water quality.

Intercropping: Intercropping is the technique to grow two annual crops together in the same field in alternating rows or strips.[43] This includes mixing annuals with annuals (e.g. cereals and legumes), annuals with perennials (e.g. fruit trees with legumes); or perennials with perennials (e.g. fruit trees with coffee). In Kiryandongo Refugee Settlement, refugees and host communities were supported to grow high-value crops of passionfruit and groundnuts.[44]

© Credit: FtF IAM. Sunflower field in Palabek Refugee Settlement.

39 Gabiri, G., et. al., 2023, Climate-Smart Agriculture in Uganda. Uganda. CGIAR.
40 Kanavi, M., et. al., 2023, Identification of Promising drought tolerant genotypes in green gram. International Journal of Tropical Agriculture. Volume 41. Number (1-2). P. 139-144. https://www.cabidigitallibrary.org/doi/pdf/10.5555/20230264519#:~:text=Green%20gram%20is%20an%20important,et%20al.%2C%202022.
41 GIZ, 2021, Climate Smart Agriculture Training Manual.
42 FAO, 2024, Inclusion through agriculture for refugees in Uganda. https://www.fao.org/newsroom/story/Inclusion-through-agriculture-for-refugees-in-Uganda/en
43 FAO, 2018, Climate-smart agriculture training manual – A reference manual for agricultural extension agents. Rome. https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1177064/#:~:text=Training%20Manual.-,A%20Reference%20Manual%20for%20Agricultural%20Extension%20Agents,climate%2C%20agriculture%20and%20food%20security.
44 Global Compact on Refugees, 2024, Agricultural livelihoods as a pathway for durable solutions. https://globalcompactrefugees.org/good-practices/agricultural-livelihoods-pathway-durable-solutions

Permaculture: Permaculture is an agricultural management approach to efficiently utilise land and resources in a way that mimics natural ecosystems and does not produce waste. Permaculture is being promoted in Nakivale and Rwamwanja Refugee Settlements (See Box 2)[45]. In Nakivale, they have practices that promote improved soil conditions using worms to compost food waste, improving the production of maize, beans, lettuce, and vegetables like spinach and cabbage. [46]

Box 2: Permaculture in Rwamwanja Refugee Settlement

The availability of land is a limitation for most refugees who want to get into farming. The Rwamwanja Rural Foundation (RRF) is promoting permaculture to increase resilience, restore local ecosystems, and maximise the use of space and resources available. Refugees are trained to produce fast-growing, nutritious oyster mushrooms, which are used for meals, medicines, and spicy powders. The mushrooms can be grown in small spaces that would not otherwise be used for cultivation, such as in barrels, trays, on rooftops and even under beds. They are grown in a closed loop system to produce Zero waste. They are grown on a locally sourced substrate of agricultural waste (corn cobs, cotton husks, banana leaves) and unused mushroom blocks are composted and fed back into the vegetable garden. The mushrooms contribute to household nutrition and allow the refugees to earn an income.

© Credit. IRC. Climate-smart farming is critical for onion farming in dry contexts.

Climate-smart technologies used in crop production

The CSA technologies for crop production that are available and applied in the refugee response are the following.

Improved seed varieties: Improved seed varieties have been bred to have desirable genetic traits to withstand climate-related conditions (e.g. drought, flood, heat, cold), resist diseases and pests, to mature early, or improve yield. In Uganda, improved crop varieties that are available include drought-tolerant maize and rice varieties, disease-resistant beans, soybean and cassava varieties, pest-resistant sorghum, sweet potato and plantain varieties, and drought-tolerant iron-rich beans.[47] In the refugee response, actors are commonly providing drought-resistant and pest-resistant seed varieties to refugee and host communities. In Adjumani Refugee Settlement, for example, refugees have adopted rice varieties that are tolerant to drought, resistant to pests and diseases, and are early maturing (e.g., China short, Wita g, Met 20, Met 13, and Met 1).[48]

45 Generation Restoration, 2024, Refugee Empowerment in Uganda through Regenerative Approaches. https://genr.world/refugee-empowerment-in-uganda-through-regenerative-approaches-rwamwanja-rural-foundation/ ; https://unffe.org.ug/healthy-and-sustainable-agriculture-practices-in-uganda/#:~:text=Definition%3A%20Permaculture%20designs%20agricultural%20landscapes,resources%20and%20energy%2Defficient%20technologies

46 Muzaliwa, 2023, Permaculture Training is Leading the Way at Nakivale. https://unidosprojects.org/impact-stories/permaculture-training-is-leading-the-way-at-nakivale/

47 GIZ, 2021, Climate Smart Agriculture Training Manual, Uganda; Najjingo, D., 2023. A Market Systems Approach to Climate-Smart Agriculture in Uganda https://www.climatelinks.org/blog/market-systems-approach-climate-smart-agriculture-uganda

48 Oxfam, 2024. Refugee Farmers Sowing Seeds of Change. https://uganda.oxfam.org/latest/stories/refugee-farmers-sowing-seeds-change

Quality seed production/multiplication: One of the challenges to improving production is access to high-quality, climate-resilient seeds. High-quality seeds are not often available in local markets; they are imported or received from humanitarian organisations.[49] Actors are working with farmers to be quality seed producers and multipliers (see Box 3). The availability of inputs in local communities reduces the GHG emissions from transportation and increases the potential for adaptation and improved yields.

Box 3: Access to climate-resilient seeds

With support from the Uganda Response Innovation Lab, Albertine Interventions for Development (AID) piloted Climate-resilient Seed Varieties (CSV) in Rwamwanja Refugee Settlement to improve refugee and host community farmers' access to certified, climate-resilient seeds. The project is improving access to climate-resilient and certified seed varieties that are early maturing, disease- and pest-resistant, and open pollinated. AID conducted stakeholder engagement sessions with the target beneficiaries who identified and selected their preferred seed varieties and formed 4 farmer groups (2 for refugees and 2 for host community). These groups were trained on good agronomic practices and supplied with the selected seed varieties. AID worked with the farmer groups to become certified Quality Declared Seed (QDS) producers and multipliers so that all farmers in targeted communities can access quality seeds for crops such as beans, sweet potatoes, and groundnuts. An evaluation of the prohect used qualitative methods, including FGDs, KIIs, and document reviews, supported by SHINE-IT from U-RIL, to assess the pilot's outcomes. Respondents reported high yields, improved agronomic knowledge, and ongoing adoption of CSV due to linkages with the National Agricultural Research Organisation. Link to report - https://static1.squarespace.com/static/5d7fba1a7dc0f278f09832df/t/6751607dc943b834ed4bf4c3/1733386380367/Innovation+Pilots+on+Climate+Adaptive+Programming+and+Disaster+Risk+Reduction.pdf

Climate information: Weather forecasts help farmers to adjust agricultural practices, such as the schedules of land preparation, planting and harvesting, to minimise losses. In Bidi Bidi Refugee Settlement, Caritas is helping to improve farmers' knowledge of climate change effects and access to weather and climate services.

Demonstration gardens with nutrient dense crops: As a way of adapting to the harsh climatic conditions and fighting malnutrition, the Kabarole Research and Resource Centre (KRC) established demonstration gardens of nutrient dense crops at ECCD centres in Kyaka II Refugee Settlement. This includes iron rich beans, orange flesh sweet potatoes, and other vegetables. The demo gardens are expected to improve food security, foster a sense of community involvement and promote sustainable agricultural practices.

Many initiatives include other actions to increase the refugee's resilience to climate change impacts, though they do not increase agricultural productivity. The actions include, for example, diversifying to off-farm livelihood activities and setting up village savings and loans (VSLA) groups, which provide income and savings to cope with losses of crops or income from climate shocks.

© Credit. World Vision International

49 Najjingo, D., 2023. A Market Systems Approach to Climate-Smart Agriculture in Uganda.

B. Livestock management

© Credit. U-Learn. small-scale poultry keeping

Livestock are a large source of GHG emissions from the agriculture sector in Uganda. A large part (42.8%) comes from enteric fermentation, part of the digestive process in ruminant animals like cattle, and which is affected by factors such as feed quality, animal size and environmental temperature. Manure left on the pasture is another key contributor to GHG emissions (31%).[50] Climatic conditions, such as heat and drought, affect livestock by causing heat stress or reduce the availability of their feed. Improved livestock breeds, grazing and manure management, and improved feeds can help reduce emissions.

There were few projects identified in refugee settlements that had a focus on climate-smart livestock management. The projects supported farmers with poultry, goats, oxen or beekeeping aparatus. The limited information about the climate-smart practices and technologies used is summarised below.

Integrated crops and livestock systems: Integrating crops and livestock in the farming system provides multiple benefits that contribute to CSA goals. It diversifies income, making households more resilient. Crop residue is fed to livestock and manure is composted to use as fertiliser in crop production.[51] The projects supporting refugee and host farmers to raise chickens enhance food security by providing households with a source of protein from eggs. In one project, families were provided oxen because of the added benefit of using animal (draught) power in place of manual labour or fossil-fuel powered machines (see Box 4)[52]

Box 4: Increasing productivity with oxen

The Response to Increased Demand in Government Service and Creation of Economic Opportunities in Uganda (RISE) project led by Action Against Hunger together with Norwegian Refugee Council (NRC), Welthunger Hilfe (WHH), and PALM Corps aimed to build resilience and food security of refugees and host communities in Adjumani, Yumbe and Arua Refugee Settlements.

Through Farmer Field Schools, refugees learned how to manage livestock and how to use it to improve farm productivity. They were provided oxen and ox plows, which allowed them to cultivate fields in less than a quarter of the time it took with hand hoes. The oxen were also used to transport goods to market and grind cassava on a large scale.

50 Feed the Future (FTF), 2017, Climate-Smart Agriculture in Uganda.
51 GIZ, 2021, Climate Smart Agriculture Training Manual.
52 Action Against Hunger, 2023, Learning through Farmer Field Schools: How Ugandan Communities Found Self-Sustainability https://www.actionagainsthunger.org/story/learning-through-farmer-field-schools-how-ugandan-communities-found-self-sustainability/

Improved livestock management: There is little detail on the livestock management practices applied in the refugee response. Refugees have been supported with improved breeds, which can enhance productivity and reduce methane production. The improved management, storage, or composting of manure reduces GHGs and improves soil fertility.[53]

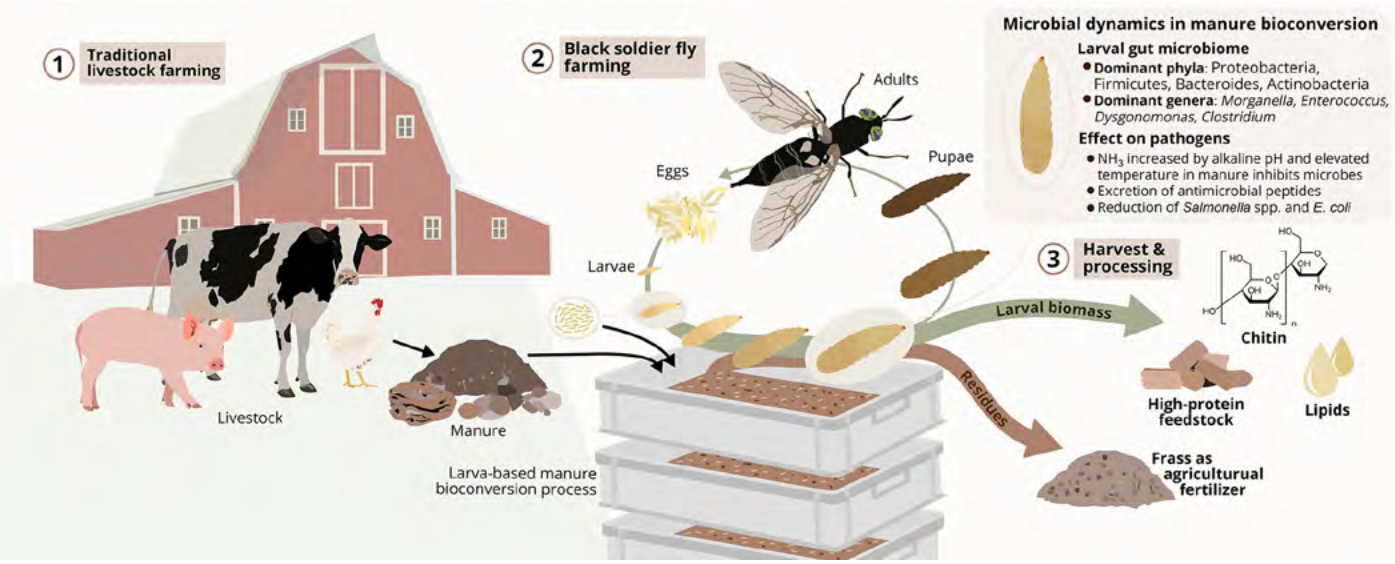
Solar-powered hatchery: In a pilot project funded through the Smart Communities Coalition Innovation Fund, a solar-powered hatchery business was set up in Kiryandongo Refugee Settlement for hatching poultry eggs. The hatchery is powered by a solar home system and operated by the Yelekeni SACCO (Savings and Credit Cooperative Society).[54] Solar-powered hatcheries are a triple win as a strategy to increase resilience and food security while avoiding GHG emissions.

Box 5: Black Soldier Fly waste management facility

The Black Solider Fly initiative was piloted by Green-Growth Plus Investment Limited in Palabek Refugee Settlement, Lamwo district, Northern Uganda. The overall objective was to provide alternative poultry feeds and compost fertiliser to refugee and host community poultry farmers. A waste management facility was established to decompose organic waste from the community markets, restaurants and hotels, using the Black Soldier Fly larvae. At the larvae stage, the Black Soldier Fly can transform organic waste into a high-quality protein. This is then used as a protein additive in animal feed, providing inexpensive and sustainable feed for poultry. The company also trained the refugee and host community farmers on rearing and application of the Black Soldier Fly larvae plus supported 3 refugee farmers to set up rearing facilities at their homes.

Organic animal feed: The Black Soldier Fly larvae is being used to convert organic waste into a high-quality protein, which is then used as a protein additive in animal feed (see Box 5).[55] Having a locally made, inexpensive feed produced from organic waste provides a clean and sustainable food source for livestock, reduces GHG emissions from food waste and transportation, and enables farmers to be more profitable and resilient.

Figure 4: Black Soldier farming process overview. Science of The Total Environment Journal, 2022



53 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture. Community of Practice Guide.
54 EnDev, 2021, The Smart Communities Coalition Innovation Fund (SCCIF). https://endev.info/wp-content/uploads/2021/12/EnDev_SCCIF_Winning-Solutions-for-Energy-in-Refugee-Settings.pdf
55 Ojara, O, 2024, Turning Waste into Wealth through Black Soldier Fly Farming. https://www.africanchangestories.org/2024/02/06/turning-waste-into-wealth-through-black-soldier-fly-farming/

VI. Natural resource management

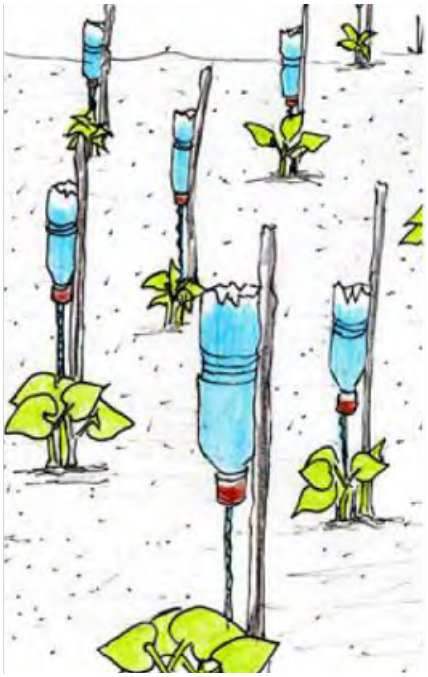
CSA is concerned not only with farming practices but also the management of the natural resources and ecosystems that sustain agriculture. Three key resources are water, soil, and forests. The three systems are interrelated and practices that make improvements in one resource often benefit others, such as practices that promote moisture retention in soils, which in turn improves crop productivity. The three systems are discussed separately but are inter-related.

A. Water management

The changing precipitation patterns, such as longer dry periods and more intense rain events, have a significant impact on the ability to produce food. Water management practices aim to use water resources more efficiently and to increase the availability of water when it is most needed. There are a number of technologies and practices to improve the efficient capture, storage, distribution, and control of water that contribute to adaptation and/or mitigation. In the refugee response, the technologies used for improved water management are as follows.

Simple irrigation systems: Irrigation systems are being installed or expanded to improve water use, plant water-intensive crops, and increase yields. Irrigation enables farmers to maintain productivity throughout the year, irrespective of seasonal variations. In some refugee settlements, farmers are shown how to create simple, low-cost irrigation systems to moisten their crops all year long. The simple drip irrigation system uses recycled water bottles that allow water to seep slowly into the soil close to the plant roots (Figure 5).

Figure 5: Simple drip irrigation system



Solar-powered irrigation systems: Solar-powered water pumps are a triple win that use renewable energy to pump water from the source to irrigate gardens, increasing productivity, adapting to variable precipitation patterns, while also avoiding GHG emissions. Surface water solar irrigation systems have been promoted in Kyangwali Refugee Settlement, which has experienced prolonged dry spells. Organisations like Adventist Development and Relief Agency (ADRA) and Lutheran World Federation (LWF) have piloted solar-powered irrigation systems in select refugee settlements. The types of systems that have been used are Solar powered SF2 future pumps and Solar Surface Water Papellion Irrigation System.

Water harvesting: Water harvesting is the collection and storage of water, such as rainwater, to have water available during dry periods. In Nakivale Refugee Settlement, they practice collective water harvesting. In Bidi Bidi Refugee Settlement, refugees were trained in water harvesting and conservation and supported to construct reservoirs.[56]

Small-scale and green infrastructure: Small-scale infrastructure projects can be used to control the flow, capture, storage, and distribution of water, including stormwater and runoff, to be used more efficiently for agriculture (see Box 6).[57]

© Credit. U-Learn. Field visit to refugee maize farmer.

56 Caritas Uganda, 2024, Food Income and Livelihood Program – Yumbe Project https://caritasuganda.org/hi-flip.php
57 NURI Coordination Function, 2022, Northern Uganda Resilience Initiative. Programme completion report; Northern Uganda Resilience Initiative (NURI), 2023, Resilience Design: Lessons in infrastructure management and food forest activities.

Box 6: Climate-smart water infrastructure

The NURI project used a resilience design approach to build climate-smart water infrastructure in eight micro-catchments in northern refugee-hosting districts. Projects were selected in consultation with stakeholders based on the micro-catchment management plans. The infrastructure projects selected aim to improve water supply and conservation, reduce flooding, use stormwater runoff efficiently, prevent soil erosion, and improve soil moisture. The types of infrastructures projects carried out were:

Water ponds: Excavation of ponds with half-moon 'smile' berms for vegetation growth, shallow infiltration pits, and check dams.

Protected springs: Construction at the site of natural springs and establishment of water recharge systems.

Bioswales: Bioswales are vegetated, shallow channels to capture and filter stormwater runoff, which can prevent flooding and soil erosion.

Road-water harvesting: Using runoff water from roads for agricultural production, including permaculture gardens, through bioswales, infiltration pits, silt traps, and mitre drains.

Gravity flow scheme: Water supply system using gravity to move water from a spring to nearby communities, through distribution mains to public standpipes.

Picture below is extracted from a Resilience Design for Water and Landscape Training presentation. Danish Refugee Council, 2020. https://www.youtube.com/watch?app=desktop&v=WI4DkU3i4ek

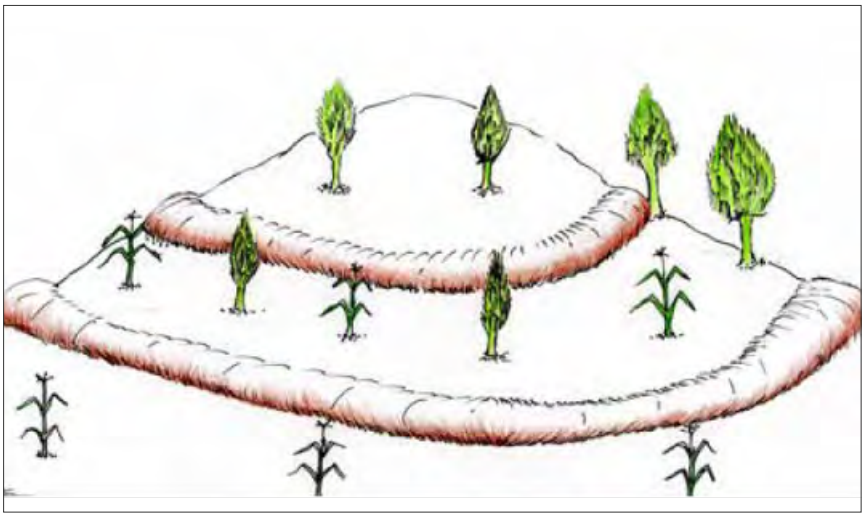
B. Soil management

Good soil management practices can improve water storage, reduce soil erosion, and increase fertility, in order to improve yields and adapt to weather variability. Good soil management also reduces GHGs because carbon can be stored in the soils.[58] Sustainable Land Management (SLM) has been a focus area in Uganda. The Uganda Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) has created a compendium of SLM technologies and approaches in Northern Uganda.[59] Highlights of the practices used in the refugee response are as follows.

58 FAO, 2023. Climate-Smart Agriculture Sourcebook.
59 MAAIF, 2020, Scaling Sustainable Land Management.

Contour bunds and grass bunds: A contour bund is an embankment or ridge built across a slope along the contour, preventing water from flowing down the slope and allowing it to percolate in the soil (Figure 6).[60] In Kiryandongo Refugee Settlement, refugees were supported to rehabilitate degraded lands and establish demonstration gardens for maize and beans. Contour bunds and grass bunds (with elephant grass) were used to control the erosion in the gardens. The improved soil moisture resulted in improved yields of maize.[61]

Figure 6: Contour bunds (picture from GIZ, 2021)



Permanent planting basins: Permanent planting basins (PPB) is a crop management method that enhances the capture and storage of rainwater by creating holes to concentrate water from early rainfall around the seeds. It allows for the precise application of limited nutrients and is often used in combination with mulching to reduce evaporation loss.[62] The techniques of PPB and mulching were applied in Kiryandongo Refugee Settlement to improve soil moisture and water holding capacity.

Soil water conservation techniques: Many of the farming techniques used to improve crop production help to increase the soil moisture content and soil fertility. The main techniques used are crop rotation, mulching, and cover crops, to reduce evaporation from soil and prevent erosion from wind and rain.

Organic material: Using locally available organic materials to improve soil fertility, is a practice that improves yield, adapts to climatic conditions that reduce soil fertility, and reduces the use of chemical fertilisers, thereby also reducing GHG emissions. The practices promoted include the use of compost made out of organic waste, including leaves, weed manure, and food waste, or 'green manure' from legume cover crops that are incorporated into the soil either directly or after composting.[63] Refugees in Bidi Bidi Refugee Settlement, for example, have been trained in a combination of soil management techniques, including compost-making, and mulching.[64]

© Credit: FtF IAM. Refugee woman harvesting veggies.

60 GIZ, 2021, Climate Smart Agriculture Training Manual.
61 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture. Community of Practice Guide.
62 GIZ, 2021, Climate Smart Agriculture Training Manual.
63 Knowledge Transfer, 2024, Green Manures in India and Uganda https://www.ews-kt.com/project-green-manures-in-india-uganda/
64 CORDAID, 2024, Building Sustainable Livelihoods Through Climate Resilient Agriculture in Ugandan Refugee Settlements. https://www.cordaid.org/en/story/climate-resilient-agriculture-in-uganda/

C. Agroforestry

Agroforestry is "a farming system that integrates crops and livestock with trees and shrubs."[65] The incorporation of trees into farming systems improves soil quality, prevents soil erosion, improves water infiltration and quality, provides habitat for wildlife, shields crops from destruction by wind, provides shade and shelter for livestock, and provides fodder for grazing animals.[66] The increased soil moisture and humidity improve crop yields under variable conditions. Tree biomass increases carbon storage, and reduces pressure on forests, thereby avoiding deforestation. Agroforestry is of particular interest in the refugee response, where the reliance on fuelwood for cooking is accelerating deforestation.

© Credit. Finish Refugee Council. Circular gardens

Agroforestry is promoted in the refugee response as part of the CSA approach, as well as through programs that aim to address environmental degradation and improve natural resource management. The following are a few agroforestry practices identified in the refugee response.

Selecting climate-adapted tree varieties: Certain tree species are selected because of their suitability to the changing climate, particularly to drought conditions. In Northern Uganda, 11 climate adaptive species are promoted: mango, avocado, orange, eucalyptus, jackfruit, teak, giant lira, neem, kikobe, and grevillea.[67]

Diversifying tree species: Planting a mix of trees and shrubs can help to diversify income and increase resilience to variable climatic conditions and crop yields. Tree and shrub species are selected for their potential products and properties, including fruit, timber, fuel, fibre, fodder, medicinal and nitrogen-fixing properties.[68] The diversification of tree species provides additional options for income generation and nutrition. A study in and around Rhino Camp and Imvepi Refugee Settlements found that the communities prioritised four use categories of trees: construction, firewood, shade, and edible plants. The tree species prioritised by the communities were teak, neem, eucalyptus, pine, mango, melia, moringa, and avocado.[69]

Planting medicinal trees: Some trees are planted and marketed for their medicinal value, which can increase income for households. Species like eucalyptus, macadamia, and grevillea are selected because of their medicinal value, as well as their resilience to drought. The moringa trees are used to treat malaria, while eucalyptus trees and mango leaves are used to treat coughs. The moringa trees have added value in water purification (see Box 7).

Box 7: Water purification with moringa seeds

A project to improve refugee women's access to clean water was piloted by Tusafishe Limited in Nakivale Refugee Settlement, Isingiro district, Southwestern Uganda. The project established a water tower and a water purification system using moringa seeds. The moringa seeds have a positive charge that attract suspended dirt particles and then pull them to the bottom by gravity. The company trains refugee women on the use of water filters and supports them to install domestic water filters in their homes. The company will also plant moringa trees in the settlement to promote reforestation and supply of moringa seeds to the refugee women to support water purification.

65 Mutua, J., Muriuki, J., Gachie, P., Bourne, M., and Capis, J., 2014, Conservation Agriculture with Trees: Principles and Practice. World Agroforestry (ICRAF) https://resources.peopleinneed.net/documents/657-icraf-conservation-agriculture-with-trees.pdf
66 Mutua, J. et. al., 2014, Conservation Agriculture with Trees: Principles and Practice.
67 NURI Coordination Function. 2022. Northern Uganda Resilience Initiative. Programme completion report
68 NURI Coordination Function. 2022. Northern Uganda Resilience Initiative. Programme completion report
69 Duguma, et. al., 2019, Restocking woody biomass to reduce social and environmental pressures in refugee-hosting landscapes: Perspectives from Northwest Uganda. Working Paper No. 298. World Agroforestry, Nairobi. http://dx.doi.org/10.5716/WP19032.PDF

Establishing food forests: In the West Nile subregion, refugee and host communities were supported to develop food forests, an alternative to traditional mono-species woodlots. Food forests include a variety of tree species, including fruit trees, in order to mimic natural forests. The food forests provide a source of food, income, and timber, while also capturing carbon and maintaining a balanced ecosystem that is more resilient to climatic variability and pests.

Reforestation: In the Bidi Bidi Refugee Settlement, Caritas supported reforestation and afforestation as part of its CSA component.[70] A forest landscape management plan for the Bidi Bidi Refugee Settlement has since been developed with the support of FAO and UNHCR. The proposed strategies in the plan include the establishment and management of woodlots and the restoration of degraded forest and farmland through agroforestry and silvo-pastoral systems (integrated trees and grazing livestock operations).[71]

Establish tree nurseries: To facilitate the distribution of tree seedlings for agroforestry, tree nurseries have been established in refugee-hosting districts (see Box 8).[72]

Box 8: Integrating agroforestry into the CSA approach

The Lutheran World Federation (LWF) is working with refugee and host communities around five refugee settlements (Palabek, Adjumani, Palorinya, Kyangwali and Kamwenge). LWF takes an integrated and inclusive approach to CSA, providing support to farmers along the value chain process. The organisation provides capacity building support in practices to improve crop production and agroforestry.

LWF maintains central tree nurseries to grow and distribute seedlings to households, communities, and institutions, such as schools. A variety of species are grown for different purposes, including timber trees (teak, eucalyptus, and Gmelina arborea), fruit trees (cashew, citrus, jackfruit, mango, and papaya), and multipurpose trees (senna, moringa, neem). Due to limited land access, refugees are encouraged to plant fruit trees. The host communities are encouraged to plant timber trees, as they have more space for woodlots.

Through the initiative, nearly half a million seedlings were planted in 2023 and three quarters survived. The initiative was coupled with efforts to reduce demand for wood by promoting the use of energy-efficient cooking stoves.

© Credit. Cordaid. refugees are encouraged to plant trees.

70 Caritas Uganda, 2023, Humanitarian Integrated Food security, Income and livelihood program (HIFILP) report.
71 FAO, 2023, Forest Landscape Management Plan for the Bidi Bidi Refugee Settlement, Uganda: 2023–2028. https://data.unhcr.org/fr/documents/details/102097
72 Stella, N., 2024, Healing the Land through Climate-Smart Agriculture in Refugee Settlements. World Environment Day Magazine

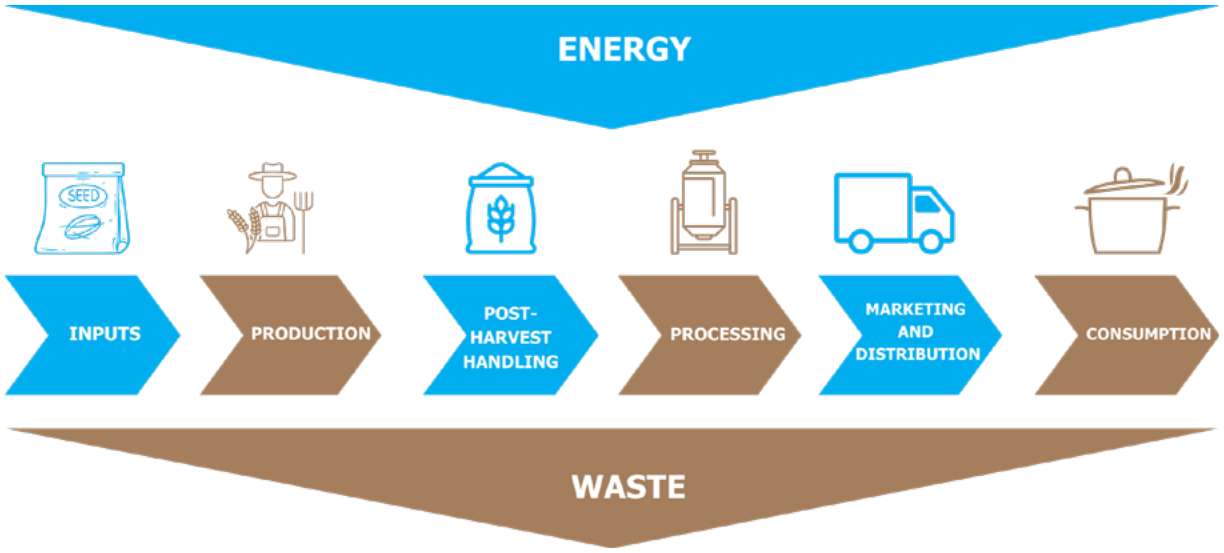
VII. Agri-food systems and value chains

A broad CSA approach explores the opportunities to improve adaptation and mitigation in the entire agri-food system. While many initiatives focus on the production stage where most GHG emissions occur, there is more energy used in later stages of the value chain. A CSA approach views adaptation and mitigation potential along the agricultural value chain from post-harvest handling, processing, distribution, cooking, and waste management (Figure 7).[73]

A value chain can be defined as the full range of activities which are required to bring a product or service from conception, through the different phases of production, delivery to final consumers, and final disposal after use.

This section will highlight practices in refugee-hosting districts from the post-harvest handling and beyond.[74]However, at the later stages in the value chain, few initiatives have been identified that adopt a CSA approach. Rather, the initiatives have tended to fall within approaches related to clean and alternative energy adoption, which were not explored in this desk review. More information can be found in previous U-Learn research studies, including Productive Use of Energy, Energy for Household Uses, and Energy Practices in Ugandan Settlements Amid Environmental Challenges.

Figure 7: Agriculture value chain (adapted from U-Learn's Value Chain Assessment)



A. Post-harvest handling

Following harvest, farmers in Uganda lose up to 40% of their products to mold, rot, disease, and pests due to inadequate handling and storage techniques. Without storage, farmers must sell their products when prices are low, losing income and reducing adaptive capacity.[75] The food waste also emits GHG as it decomposes. The higher temperatures and changes in moisture content associated with climate change can increase the possibility of pests and spoilage. In the refugee response, there has been some support within the post-handling stage within CSA initiatives, focusing on improved drying and storage. Appropriately harvested, dried, sorted/graded and stored produce fetches farmers higher prices.

Natural solar drying: In various settlements, refugees utilise traditional methods for drying maize, such as sun drying. This practice helps in preserving and making it suitable for long-term storage and consumption, which is crucial for food security. Farmers often hang maize cobs on top of roofs or place them on grass-thatched roofs for continuous drying. Additionally, cribs are being made to protect produce by keeping it elevated and preventing contact with the ground.

73 FAO, 2023, Climate-Smart Agriculture Sourcebook.
74 Kaplinsky, R. and Morris, M., 2001, A Handbook for Value Chain Research. Institute of Development Studies, University of Sussex, Brighton, UK, 113.
75 World Food Programme (WFP), 2016, Logistics Capacity Development: Post-Harvest Food Loss Reduction in Uganda through improved Storage and Handling at the start of the Supply Chain. https://www.wfp.org/operations/200836-logistics-capacity-development-post-harvest-food-loss-reduction-uganda-through#:~:text=Due%20predominantly%20to%20inadequate%20handling,%2C%20health%2C%20and%20financial%20impacts.

Improved sacks: Two types of improved sacks have been used in the refugee response. Double-coated sacks with a silver lining have been used to store products at home and protect against pests. In West Nile, the airtight Perdue Improved Crop Storage (PICS) bags have been used to store dried seeds at home, preventing spoilage from pests and fungus.[76]

Storage: Organisations like LWF have supported the construction of better-quality storage facilities. Traditional granaries are raised to at least half a meter with rat guards installed to help avoid pest infestation. Some model farmers invest in silos, which are containers designed to provide a conducive environment and protective measures against pest damage and rotting, ensuring food remains safe for long periods. Through its Uganda Climate Smart Agricultural Transformation Project (UCSATP), the MAAIF is promoting the use of solar-powered cold storage and climate-smart grain storage to minimise losses.[77]

Bulking: The WFP has supported the construction of satellite-market collection points, a community warehouse where farmer groups can aggregate and store goods in 750L 'Smart Silos' and sealed grain bags.[78] While high-quality bulking storage facilities are too expensive for most communities, some farming groups have turned to community-managed bulking facilities. Farmers are building the facilities independently using local materials to create manageable and cost-effective storage solutions. This community-managed approach ensures that farmers take ownership and see the importance of these structures. In Kiryandongo, the farmers formed a SACCO which they used to bulk and sell their harvest at a better price.[79]

B. Processing

Clean energy processing equipment: There are a number of clean energy technologies available to reduce labour and increase efficiency while avoiding GHG emissions in the production process. Energy-efficient equipment includes solar-powered milling, maize shelling, coffee pulping, oil seed processing, and milk churning machines. There was little mention of these within CSA initiatives, with the exception of the MAAIF's USCAT project that aims to increase access to clean energy equipment, as well as sustainable packaging, to improve shelf life of products and reduce GHG emissions throughout the value chain.[80]

Drying for value addition: Vegetables and fruit can be dried to create a value-added product**.** The Rwamwanja Rural Foundation supports farmers in creating dried and powdered mushrooms that can be used for porridge, coffee, or flavouring, which retails at a higher price per kilogram, increasing income for households.[81] Though not specific to the refugee response, a Ugandan company, Fruits of the Nile, has trained farmers in organic farming and fruit drying using solar dryers. They have reduced emissions along the chain by drying fruit and retaining waste at the point where it is grown and transporting it in bulk within Uganda when it is lighter and does not require chilled storage.[82]

C. Consumption

Energy-efficient cookstoves: A few CSA projects incorporate the adoption of energy-efficient cookstoves to reduce the use of firewood and curb deforestation. The LWF promotes the use of Lorena energy-saving cooking stoves, which use less firewood than the traditional three-stone fires method used in refugee settlements. KRC has been promoting and supporting Kyaka II, Rwamwanja, and Kyangwali with household energy efficient stoves.

© U-Learn. Homemade firewood stove commonly used in Refugee Settlements

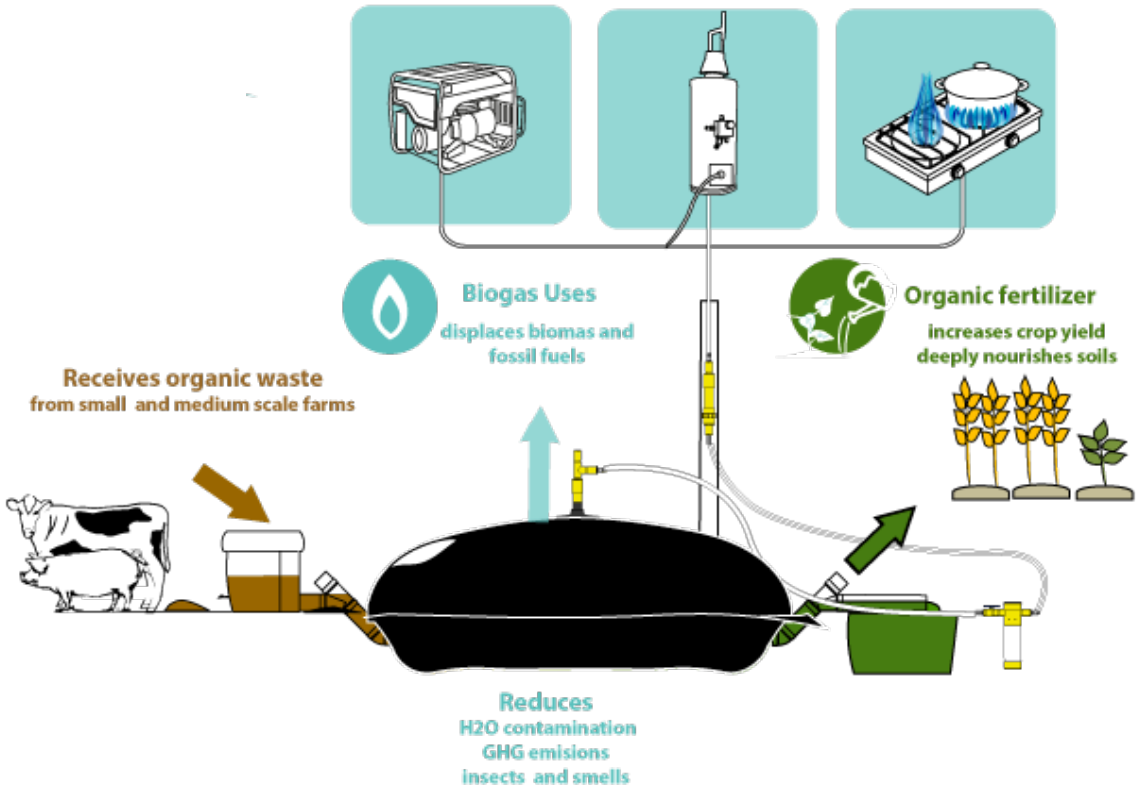
76 NURI Coordination Function, 2022, Northern Uganda Resilience Initiative. Programme completion report; GIZ, 2021, Climate Smart Agriculture Training Manual.
77 MAAIF, 2024. Climate Smart Agricultural Transformation Project (UCSATP). https://www.agriculture.go.ug/ucsatp/
78 https://www.wfp.org/stories/farmers-fighting-food-loss-uganda
79 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture. Community of Practice Guide
80 MAAIF, 2024, Uganda Climate Smart Agriculture Transformation Project
81 Jorgensen, J., 2024, How to be a refugee, with mushrooms. RunningWithMushoom. https://www.runningwithmushrooms.com/p/mushrooms-and-refugees
82 Appropedia, 2024. Solar drying in Uganda. Accessed Sept 20, 2024. https://www.appropedia.org/Solar_drying_in_Uganda

Previously institutions that consumed a lot of fuel wood were also supported with institutional cook stoves and a tremendous reduction of firewood consumption was registered in Kyaka II.
Other options include stoves that use charcoal or biomass briquettes, as well as solar-powered cookstoves. Most of the initiatives focus on the household use of energy-efficient stoves, but there are also productive commercial uses to make value-added products, such as bread, that can be sold as another income generating activity.

D. Waste

Biogas: Organic matter, agricultural waste and animal dung can be used to create biogas, a process that cuts methane emissions while producing renewable energy. Biodigesters use a process of anaerobic digestion to break down the organic waste, purify the gases (methane, carbon monoxide and hydrogen), and harness the gases to generate heat.[83] It further reduces GHG emissions by serving as alternative to burning firewood and reducing the amount of organic waste going to landfills. The bi-products can be used as a bio-slurry organic fertiliser to improve soil fertility. Small-scale household biodigesters have been promoted in refugee-hosting districts to create biogas from cow dung.[84] Waste is also being used to create bio-based fertilizer and feedstocks (see figure 8 and Box 9).

Figure 8: Biodigester system developed by the private sector company Sistema Bio.



Box 9: The Uganda Biorefinery pilot project

Kabarole Research and Resource Center (KRC) is piloting a technology of extracting protein from grass. The project ensures a closed-loop system where outputs from one process serve as inputs for another, maximising resource efficiency-a key attribute for climate smart farming. The process involves planting high protein legumes and Napier grass which is crashed to extract the protein out of the grass—producing press cake for the cattle, whey juice for the pigs and piglets and protein concentrate for the poultry. The whey is also used for soil amendment. These climate adaptation technologies are particularly vital in Uganda's cattle corridors, where drought conditions often lead to severe livestock losses. By developing and storing this protein-rich feed, KRC aims to provide a sustainable food source for livestock even during harsh climate conditions. Formal feed trials are underway with the aim of scaling up of the products country-wide including refugee settlements.

83 Tushabe, S., 2023, Empowering Rural Communities and Combating Climate Change with Biogas. https://www.undp.org/rwanda/blog/empowering-rural-communities-and-combating-climate-change-biogas
84 Habersbrunner, K., Mirembe, A., Ruhlemann, A., 2018, Affordable, Empowering and Sustainable Decentralised Renewable Energy Solutions: Potentials of energy communities in Uganda; SNV, 2023, Biogas Project in Uganda celebrates milestone completion. https://www.snv.org/update/biogas-project-uganda-celebrates-milestone-implementation

VIII. Institutional support and services

The implementation of a CSA approach requires a supportive enabling environment. This includes the institutional support, services, and policies that incentivise the adoption of CSA and help manage risk from a changing climate. In Uganda, the institutional support for CSA is at a national level and not specific to the refugee response.

Climate information systems: Through the UCSAT project, Uganda is working towards improving the agro-meteorological information services, including establishing functional automated weather stations, developing agroclimatic and climate smart digital tools, and establishing soil organic carbon monitoring reporting and verification system.[85]Having improved climate information systems would enable farmers to make informed decisions about climate-smart practices to increase productivity and minimise loss.

Early warning systems: With support from DanChurchAid (DCA) and other actors, a Drought Early Warning System (DEWS) was established in the Karamoja district. Using weather forecasts, data from district officials, and input from local communities, DEWS provided timely information to take early action.[86] Following this initiative, the Government of Uganda worked with partners to develop a system to predict crop failure in order to unlock financing to provide timely support to vulnerable farming communities. Using the Global Agriculture Monitoring System to aggregate data on vegetation, rainfall, and temperature to analyse crop conditions.[87]

© Credit: AVSI. The implementation of a CSA approach requires a supportive enabling environment

Insurance: Crop and livestock index-based insurance has been introduced in the country, which helps farmers cope with climate-related losses.[88] The insurance, however, is not currently an affordable option for many smallholder farmers, especially refugees.

Research and innovation: The National Agricultural Research Organisation (NARO) is leading research in the generation of improved seed varieties. NARO has advanced on the following varieties:

1. Seven new rice varieties that have a high yield potential and resistance to diseases, such as yellow mottle virus, rice blast, and bacterial leaf streak.
2. Four drought-tolerant maize varieties with a high yield potential, early maturing, and tolerance to common diseases, such as grey leaf spot and common rust disease.
3. Two sorghum varieties that are tolerant to drought, have a high yield potential, and resistance to pests like stem borer
4. Trials of an anti-tick vaccine for livestock.[89]

In addition, KRC Uganda conducts Participatory Action Research (PAR). This is research involving farmers from problem identification and devising researchable solutions together with scientists. This type of knowledge co-creation is vital in enhancing farmers' awareness of the climate-related challenges they are facing and can consequently devise practical CSA practices.

85 MAAIF, 2024, Uganda Climate Smart Agriculture Transformation Project.
86 DCA, 2013. Drought early warning system can prevent hunger in Karamoja, Uganda. Reliefweb. https://reliefweb.int/report/uganda/drought-early-warning-system-can-prevent-hunger-karamoja-uganda
87 Earth Observations Risk Toolkit, 2022, Ugandan crop monitoring system enables early drought response. https://earth-observation-risk-toolkit-undrr.hub.arcgis.com/pages/drought-early-warning-in-uganda
88 Feed the Future (FTF), 2017, Climate-Smart Agriculture in Uganda.
89 National Agricultural Research Organisation (NARO), 2024, Technology and Innovation. https://naro.go.ug/research/technology-innovation/

Incentivising green value chains. Certain crops are being incentivised through different programs and policies because their value chains are considered 'green' or climate smart. Bamboo is a strategic resource as it matures quickly, sequesters more carbon than trees[90], and is an alternative to wood, thereby reducing deforestation. It has multiple uses in construction, agriculture, fuelwood or briquettes, and household products (e.g. baskets, furniture). Enabel, the Belgian Development Agency, is promoting the production of bamboo in Uganda as part of agroforestry strategies. Uganda has also developed a 10-year National Bamboo Strategy and Action Plan, which aims to promote the growth and use of bamboo due to its economic and environmental benefits.[91] At an international level, the EU has developed the EU Regulation on Deforestation-free Products. The regulation aims to stop the importation of goods that cause deforestation, which will further incentivise alternatives like bamboo and encourage improved forest management practices.

© Credit. Ministry of Water and Environment of Uganda & the International Bamboo and Rattan Organisation (INBAR)

Community-led regulations: Communities have established bylaws and ordinances, such as prohibiting uncontrolled bush burning, to guide environmental conservation efforts. These bylaws are developed and enforced by the communities through sub-counties and districts. Community leaders, with the help of partners, ensure valuable trees are protected. It is prohibited for any community member to cut down eucalyptus, mango, or moringa trees due to their importance.

90 Dombeu Kaam, R., et. al., 2024. The contribution of bamboo to climate change mitigation and household livelihood improvement in Cameroon. Wageningen University and Research. https://research.wur.nl/en/projects/the-contribution-of-bamboo-to-climate-change-mitigation-and-house

91 CGIAR, 2020. Uganda now has a new 10-year National Bamboo Strategy and Action Plan. December 7, 2020 https://www.foreststreesagroforestry.org/news-article/uganda-now-has-a-new-10-year-national-bamboo-strategy-and-action-plan/

IX. Learning from CSA in Uganda's refugee response

The CSA approach is being promoted in Uganda and within the refugee response. Though it has great potential to manage the impacts of climate change, the adoption of CSA practices is slow[92] [93] [94] [95] [96].

Five key barriers to CSA

1

Resource limitations: CSA often requires initial resources and inputs that are out of reach of many refugees (e.g. solar-powered irrigation systems)

2

Land limitations: Although Uganda's refugee policies grant access to land, refugees typically do not have long-term land ownership rights. This discourages investments in CSA practices.

3

Labour intensive: Many CSA practices such as row planting and contour buds are labour and time intensive.

4

Culture and tradition: CSA practices may diverge from traditional farming practices known to refugees.Traditional practices like bush burning are persistent.

5

Availability of quality inputs: Access to quality agro-inputs is a common challenge. Quality, improved seeds are not always available to refugees and price can be a barrier.

Despite these barriers, there have been successes in raising awareness of CSA, increasing yields and incomes, improving degraded landscapes, and improving the food security of many refugee households. **Highlights of learning from these initiatives are as follows:**

- **Simple irrigation systems are effective**. They can be made from locally available material, are affordable, and increase yields. Irrigation enables farmers to maintain productivity throughout the year, even in periods of drought or variable rainfall.
- **Seed quality improvement increases access to climate-resilient seeds**. The use of quality seeds that are resilient to climate-related conditions (droughts, pests, diseases) are crucial to adapt to a changing climate. Programs to support the local production or multiplication of seeds will help overcome the barrier to access.
- **Integrated CSA practices have positive synergistic effects**. CSA practices such as mulching and crop cover, crop-livestock integration, and agroforestry have synergistic effects on the ecosystems that support them. Integrated practices have triple wins, improving soil fertility and water retention, which in turn improves productivity, enhances resilience, while also storing carbon.
- **Vegetable growing can be profitable, even on a small piece of land**.[97] Applying CSA practices, including permaculture or vertical gardens, productivity can be improved sufficiently to satisfy household needs and earn an income from sales.
- **Integrating tree planting with other crops has economic, environmental and nutritional benefits**.[98] Trees can be planted for multiple purposes, including for timber, food, and medicinal purposes. Agroforestry can reduce deforestation, improve soil quality and conditions for livestock, and provide additional sources of income. Fruit trees with shorter maturity periods can be selected to support livelihoods in the shortest time possible.[99]
- **The selection of viable crop species enhances sustainability**. Important factors to consider when choosing a crop are the crop's suitability to the area's climate and agroecology, market availability, average prices, and participating farmers' knowledge of the crop. The selection of a profitable crop that is well-suited to the local environment will increase the sustainability of the investment.

Additional lessons learned from CSA in the NURI project were found in How Localisation and Resilient Design Fueled the Success of Climate-Smart Agriculture Programmes in Uganda's Refugee Response

92 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture: Community of Practice Guide.
93 LandLinks, 2015. Land Tenure and Climate-Smart Agriculture. https://www.land-links.org/issue-brief/land-tenure-and-climate-smart-agriculture/
94 GIZ, 2024. Reshaping the Future. Gender-responsive Climate Smart Agriculture Options for Northern Uganda. https://www.giz.de/en/downloads/giz2024-en-gender-responsive-climate-smart-agriculture-options-for-northern-uganda.pdf
95 Mercy Corps, 2018 Mercy Corps, 2018. Pilot Evaluation Report. Demonstrating a Market Systems Approach in Bidibidi and Palorinya Settlements. https://www.mercycorps.org/sites/default/files/2020-01/MSD_in_Refugee_Response_Pilot_Evaluation.pdf
96 GIZ, 2021, Climate Smart Agriculture Training Manual.
97 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture. Community of Practice Guide.
98 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture. Community of Practice Guide.
99 NURI Coordination Function, 2022, Northern Uganda Resilience Initiative. Programme completion report.

X. Gaps and recommendations

Climate-smart agriculture has the potential to increase the resilience and self-reliance of refugee and host communities working within the agricultural sector in the face of a changing climate. The CSA approach provides a frame to prioritise practices that are synergistic and seek the triple win of increased productivity, adaptation, and mitigation. The integrated approach enhances productivity to address immediate needs while also building a long-term sustainable environment to meet the needs of future generations.

An increasing number of actors work on CSA in refugee-hosting districts. They are focused primarily on agricultural production practices to increase crop production, and related strategies to improve soil quality and water management. The most common technologies adopted are improved climate-resilient seeds and irrigation systems, which range from simple systems to more advanced solar-powered systems.

The CSA initiatives are showing success and there are many stories of refugees and hosts that have improved productivity and income as a result. However, the desk review also identified gaps. Three key gaps and recommendations for potential actions are described below.

Gap 1: Lack of harmonisation of a CSA approach between actors and sectors

CSA is incorporated into national frameworks on agriculture and climate change, but there is no guiding framework to unify the implementation of CSA. There are many actors implementing CSA initiatives, including the MAAIF, but they are implemented independently with little coordination between them. There are organisations and ministries working on related topics, such as the promotion of energy-efficient technologies and cookstoves, access to clean energy, and reforestation, but these are de-coupled from CSA. Greater coordination and harmonisation of CSA approaches could enable the scale up and adoption of CSA among farmers and more broadly through the agri-food system.

Recommendations

a) Develop a multi-sector CSA framework to scale up CSA in the country, and specifically within the refugee response.
b) Enhance coordination across sectors, particularly energy and agriculture, to find synergies, share information, and align efforts.
c) Define a common training program. Scale up training of extension officers or other local stakeholders to support the implementation of CSA in refugee-hosting districts.

Gap 2: Limited application of CSA along the entire value chain

Most CSA initiatives within the refugee response focus on practices and technologies in the production stage of the value chain. There has been less focus on the opportunities to adapt or mitigate GHGs along later stages of the value chain from post-harvest handling through to consumption. Applying CSA throughout the value chain can improve opportunities for income generation, reducing loss, and enhancing resilience.

Recommendations

a) Take a value chain approach that examines the climate-related risks and opportunities for adaptation and mitigation from the initial stage of inputs through to consumption.
b) Explore and promote commodities in 'green' value chains that have lower carbon footprints and are more adapted to the changing climate.
c) Integrate support for improved post-harvest handling, storage, and bulking into initiatives adopting the CSA approach.

Gap 3: Lack of a knowledge hub on CSA in Uganda

There are many actors working on CSA in Uganda and within the refugee response. While there have been some efforts to document good practices and develop training manuals in Uganda, they are dispersed in organisation's websites. There is no consolidated hub of information about CSA practices and technologies being applied, nor any data on their effectiveness or performance.

Recommendations

a) Compile technical manuals, reports, and other resources from actors working on CSA-related topics in the refugee response
b) Bring together actors working on CSA to share successes and challenges to implementation
c) Create a hub to share key documents and information on CSA in Uganda.
d) Compile a list of the technologies available in Uganda, specifically the improved seed varieties and animal breeds, including information about their performance and where they can be found.

Appendix 1: List of projects that integrate a CSA approach

Organisation	Project/Initiative
Action Against Hunger, Norwegian Refugee Council (NRC), Welthunger Hilfe (WHH), PALM Corps	Response to Increased Demand in Government Service and Creation of Economic Opportunities in Uganda (RISE) Resilience Enhancement and Advocacy Program (REAP)
Adventist Development and Relief Agency	Program for Education, Advocacy, Counselling and Economic empowerment (PEACE)
AFARD	Secure Livelihoods for South Sudanese Refugees and Host Communities in West Nile Region, Uganda (2017-2022)
Albertine Interventions for Development (AID)	Climate-Resilient Seed Varieties in Uganda (CSV-Uganda) Innovation Project
AVSI Foundation	Graduating to resilience
Caritas	Humanitarian Integrated Food security, Income and livelihood program (HIFILP)
Caritas Uganda	Training refugees on climate-smart agriculture
Catholic relief services (CRS)	The Uganda regreening communities in Yumbe
CGIAR	Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA)
CORDAID and AVSI	Skilling in Agri-preneurship for Increased Youth Employment
DAI Global	Feed the Future-Iam activity; Market Systems Development and Entrepreneurship
Danish Church Aid	Agroecology for Sustainable Food Production and Livelihoods Resilience among Refugees and Host Communities in West Nile Uganda. Protection and Restoration of the Environment & Promotion of Safe Access to Sustainable Energy and Green Livelihoods in Refugee and Host Communities
Danish Refugee Council	NURI Northern Uganda Resilience Initiative
FAO	Refugee Agricultural Value Chains for Economic Self Reliance Climate Resilient Livelihood Opportunities for Economic Empowerment of Women in Karamoja and West Nile subregions
Finnish Refugee Council	Enhancing Economic Opportunities through Climate Smart Agriculture production
GIZ	Response to Increased Demand on Government Service and Creation of Economic Opportunities in Uganda (RISE)
IFRAD (International Foundation for Resource and Development)	Train farmer groups on Climate Smart Agricultural practices
Kabarole Research and Resource Centre (KRC)	Waste recycling for soil amendments, promotion of Agro-ecological principles and nutrient dense crops
Lutheran World Federation	Climate-smart agriculture in Palabek, Adjumani, Palorinya, Kyangwali and Kamwenge
Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)	Uganda Climate Smart Agricultural Transformation (UCSAT) Project 2022 Sustainable Land Management project

National Agricultural Research Organisation	NARO Refugee project
Oxfam	LEAP II, Leadership, Power, Access and Protection
Rwamwanja Rural Foundation	Transforming lives through permaculture principles and land use design-Livelihood
SARD-Net Uganda	Sustainable Agriculture/Agri-preneurship
VEDCO, Action on Poverty	Building Climate Resilience for Refugee and Host Communities in Northern Uganda
World Agroforestry (ICRAF)	Sustainable use of natural resources and energy in the refugee context Agroforestry with refugees in Northern Uganda 2018-2024 Response to Increased Environmental Degradation and Promotion of Alternative Energy Sources in Refugee Hosting Districts (RED Project) Scaling up Agroforestry and Other Nature-based Solutions in Refugee Settlement Landscapes of Northwestern Uganda - Phase 2
World Vision (with ZOA, SNV, RISE-CN, Vision Fund international)	Strengthening, Protection and Economic Empowerment in Uganda (SUPREME) Livelihood Component

Annex 1: Annotated bibliography

Duguma, et. al., 2019, Restocking woody biomass to reduce social and environmental pressures in refugee-hosting landscapes: Perspectives from Northwest Uganda**. Working Paper No. 298. World Agroforestry, Nairobi.**
http://dx.doi.org/10.5716/WP19032.PDF

With the influx of refugees to Uganda, the demand on woody vegetation for various uses and the need to create space for newcomers have progressively denuded the landscape. The study aimed to understand the perceptions of refugee and host communities towards deforestation and the options to address the wood fuel shortage. The majority of respondents agree that deforestation is taking place. The solutions proposed were tree planting and growing, conserving existing trees, and promoting natural regeneration of trees with sprouting stumps. They noted that they would need planting materials and farm equipment, training in the management of trees, and refugees would need additional land for trees.

Food and Agriculture Organisation (FAO), 2024, Introducing Climate-Smart Agriculture.
https://www.fao.org/climate-smart-agriculture-sourcebook/concept/module-a1-introducing-csa/a1-overview/en/?type=111

The course material introduces the concept of climate-smart agriculture, its link to food security and sustainability, and its application in agricultural production and food systems. CSA is not a new agricultural system, but rather an innovative approach to make the sector more productive and sustainable. It is a way to address the intertwined challenges of increasing productivity to meet demand, adapting to climate change, and reducing greenhouse gases. The approach contributes to the implementation of the 2030 Agenda for Sustainable Development.

FAO, 2023. Climate-Smart Agriculture Sourcebook**.** https://openknowledge.fao.org/server/api/core/bitstreams/b21f2087-f398-4718-8461-b92afc82e617/content

The guide provides an overview of the context for CSA, describing as an approach to achieving sustainable agricultural development and food security under climate change. The sourcebook is a reference tool for planners and practitioners, giving guidance on adopting a climate-smart approach to agricultural sectors. The sourcebook details technologies and approaches to farm management in the management of natural resources (landscape, water, soil, and energy), and in agricultural sectors (crop production, livestock, fisheries, forests). It provides guidance on the enabling environment, including options for policy and finance.

FAO, 2016, Eastern Africa Climate-Smart Agriculture Scoping Study**. Ethiopia, Kenya, and Uganda.**
https://openknowledge.fao.org/server/api/core/bitstreams/d6c327dd-e353-4ca3-85ba-f8bb9129f109/content

The report summarises findings from a CSA study in three countries. The study had the objective of identifying CSA initiatives, technologies, practices and stakeholders in Ethiopia, Kenya and Uganda. The farming systems in the three countries is similar, characterised by rain-fed cropping systems and small-scale farmers. Practical climate-smart techniques being applied in the region include mulching, intercropping, minimum tillage, crop rotation, integrated crop and livestock management, and agroforestry. There are opportunities to promote CSA in Eastern Africa and to include policies like soil fertility management into the university curriculum.

Gabiri G, Luswata KC, Sebuliba E, Nampijja J., 2022, Climate-Smart Agriculture in Uganda**; AICCRA Accelerating Impacts of CGIAR Climate Research in Africa (AICCRA). Uganda. CGIAR.**
https://cgspace.cgiar.org/server/api/core/bitstreams/2800c735-bbf6-4d7a-8173-bc515e5b5e53/content

The report provides an overview of climate information system (CIS) tools in Uganda, as well as existing CSA technologies. The Uganda National Meteorological Authority (UNMA) produces daily weather summaries to decadal agrometeorological forecasts.

The existing CSA technologies and practices in Uganda include land restoration and agroforestry, water harvesting and management, integrated soil fertility management, crop diversification, post-harvest handling, and sustainable bio-energy. The report suggests interventions to increase the adoption of technologies, such as improved access to information for adaptation and mitigation, and the compilation of CSA practices and CIS tools.

GIZ, 2021, Climate Smart Agriculture Training Manual. https://www.ugandalandcare.org/wp-content/uploads/2021/03/CSA-Training-Manual-.pdf

The training manual is a comprehensive and practical guide that explains the CSA practices and technologies. It introduces readers to climate science and climate change impacts on food security. The manual provides guidance on community-based natural resource action planning. It details CSA practices and technologies that are relevant for the Ugandan context in the areas of water and soil management, improved livestock management, crop production, and post-harvest handling.

GIZ, 2024. Reshaping the Future. Gender-responsive Climate Smart Agriculture Options for Northern Uganda.
https://www.giz.de/en/downloads/giz2024-en-gender-responsive-climate-smart-agriculture-options-for-northern-uganda.pdf

The report provides a gender analysis of the political, social, cultural, institutional, environmental, agricultural, and economic context of the project area. The study found that climate change is a concern in Northern Uganda due to the effect of drought on agriculture. There is limited collaboration among actors engaged in environment and climate change actions, the adoption rate of CSA options is lower among females. The report recommends options for gender-responsive CSA, such as adjusting soil and water nutrient management, and improving women's equitable access to and control over agricultural inputs, information, and technology.

International Rice Research Institute (IRRI), 2022, An Ecosystem-Based Approach to Climate-Smart Agriculture with Some Considerations for Social Equity**. CGIAR Initiative on Climate Resilience**.
https://cgspace.cgiar.org/items/a201b541-07cc-405b-b397-b72ec0f6bf9c

The brief provides an overview of the impacts of climate change on agriculture. It introduces the concept of climate-smart agriculture and its three interlinking objectives. The authors draw the link between ecosystem management and CSA, analysing and reducing trade-offs among various ecosystem services, climate change mitigation and adaptation measures, and food security. CSA also raises social equity concerns, and points to a need to pay attention to disparities among social groups when implementing policy interventions to transition to CSA.

Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), 2021, Climate Smart Agriculture. Community of Practice Guide**.**

https://careclimatechange.org/wp-content/uploads/2021/06/The-Climate-Smart-Agriculture-book-2021.pdf
The guide provides a compilation of practices and lessons from CSA initiatives implemented across 9 agroecological zones (AEZ). The guide documents CSA technologies and practices that are being applied in the country in value chains such as passion fruit, banana production, potato tubers, coffee, tea, maize, and piggery production. It highlights practices like conservation agriculture, agroforestry, contour bunds, irrigation, rainwater harvesting, compost manure, intercropping, and improved seed varieties.

MAAIF, 2020, Scaling Sustainable Land Management https://catalogue.unccd.int/1571_Scaling_Sustainable_Complete_July_17_2020_Light.pdf

The guide provides a collection of Sustainable Land Management (SLM) techniques and technologies applied in Uganda. It introduces the concept of SLM, including SLM technology and SLM approach. The guide documents SLM approaches in the categories of forestry, water management, soil fertility management, and soil and water conservation. Techniques used include row planting, rotational grazing, mulching, integrated apiculture and forestry, low-cost irrigation, energy-saving ground stoves, wooden water reservoirs, and domestic biogas plants.

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