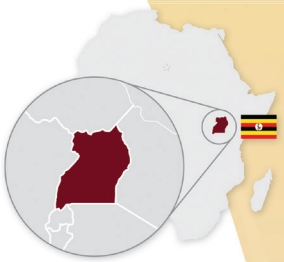
FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative



Climate-Smart Agriculture in Uganda

Climate-smart agriculture (CSA) considerations

A P — Agriculture in Uganda is mainly rain fed and based on subsistence farming; challenging the sustainability and food security of farmers, and making the sector highly vulnerable to weather variability, climate hazards (particularly droughts) and climate change.

A P — Crop diversification, small-scale irrigation, permanent planting basins, green manuring, conservation agriculture (rotations, intercropping, mulching and reduced tillage) and agroforestry are among the most common climate-smart practices being promoted in the country to improve productivity, food availability and resilience to climate hazards.

A P M — In livestock production, climate-smart agriculture (CSA) practices that have been promoted include silvopastoral systems, adoption of improved breeds, improved feeding regimes, grazing land management and integration of biogas. Since, livestock production encompasses the highest contributor of agricultural greenhouse gases (GHG) emissions in Uganda, these and other livestock based practices present good opportunities to reduce agricultural emissions in the country.

A P M — Efforts to identify and implement system-level CSA interventions, rather than simply plot level interventions, have been explored as a means of improving whole farm climate-smartness; providing an opportunity to address trade-offs and synergies among CSA practices.

A I — To support climate change adaptation efforts, the country has been working towards enhancing the delivery of meteorological services, particularly in relation to early warning alerts for climate-related disasters (such as drought and floods) and capacity building of extension actors on understanding and disseminating climate information.

$ I — Uganda has made progress on integrating climate change into national development plans, as well agricultural policies and programmes. This has included the development of a National CSA Framework Programme, the launching of the agriculture sector National Adaptation Plan process, and the formulation of a national Climate Change Policy. National and international finance (public and private) as well as technical support will be crucial in ensuring that these plans and policies achieve their desired objectives.

$ I — Although there are numerous examples of national and project finance for agricultural climate change adaptation and mitigation efforts, financial services and risk transfer mechanisms are limiting at farmer level, presenting a significant barrier for CSA adoption. Initiatives such as crop and livestock index-based insurance have been introduced aimed at offsetting losses due to climate-related conditions, and more could be done to scale up access.

I — There are numerous organisations undertaking climate-smart agriculture related projects and programmes in the country, and the importance of coordination of these actors through various platforms such as the National Climate-Smart Agriculture Task Force and the Climate Change Department has been recognised. Continued financial and operational support to CSA coordination will be crucial to ensure complementarity and sustainability of the work of various actors.

A Adaptation M Mitigation P Productivity I Institutions $ Finance

The climate-smart agriculture (CSA) concept reflects an ambition to improve the integration of agriculture development and climate responsiveness. It aims to achieve food security and broader development goals under a changing climate and increasing food demand. CSA initiatives sustainably increase productivity, enhance resilience, and reduce/remove greenhouse gases (GHGs), and require planning to address trade-offs and synergies between these three pillars: productivity, adaptation, and mitigation [1].

The priorities of different countries and stakeholders are reflected to achieve more efficient, effective, and equitable food systems that address challenges in environmental, social, and economic dimensions across productive landscapes. While the concept is new, and still evolving, many of the practices that make up CSA already exist worldwide and are used by farmers to cope with various production risks [2]. Mainstreaming CSA requires critical stocktaking of ongoing and promising practices for the future, and of institutional and financial enablers for CSA adoption. This country profile provides a snapshot of a developing baseline created to initiate discussion, both within countries and globally, about entry points for investing in CSA at scale.

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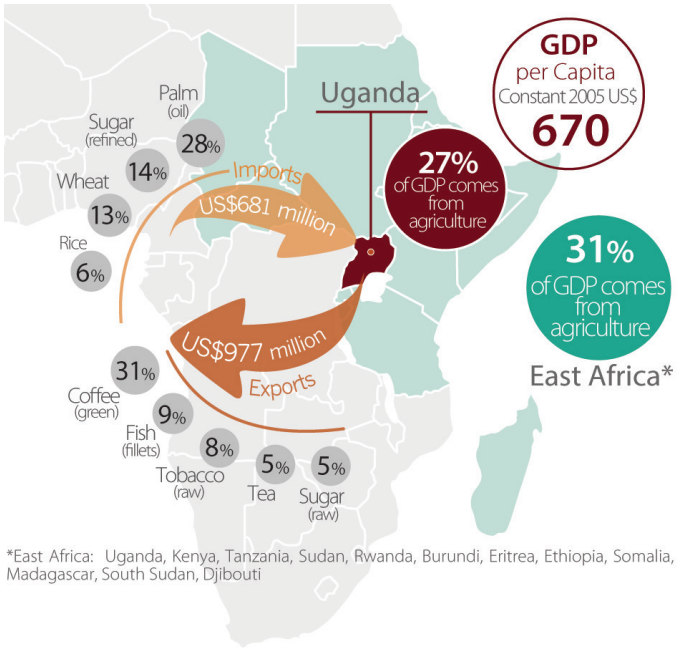
National context

Economic relevance of agriculture

Agriculture is the main economic sector, accounting for 27% of gross domestic product (GDP) and employing 73% of the labor force [3]. Since the 1980s, agriculture share to GDP on average has experienced a slow but almost steady decline from 53.7% in 1982 to 23.7% in 2015 due to growth in the industrial and service sectors [4, 5]. Despite this decline, agriculture remains the key source of exports contributing 46% of total exports. The country has also made significant progress in relation to women's engagement in the agricultural sector in the five domains of empowerment (5DE): agricultural production, resources, income, leadership and time [6]. This is evidenced by the steady decline in the female share of youth illiterate in the population from 58% in 2010 to 52% in 2015 [7]. Despite their critical and potentially transformative role in agricultural growth, Ugandan women are relatively disadvantaged with regards to land ownership and labor market participation [8]. Women constitute only 16.3% of the total agricultural landholders [9].

Economic relevance of agriculture in Uganda [7, 10, 11]

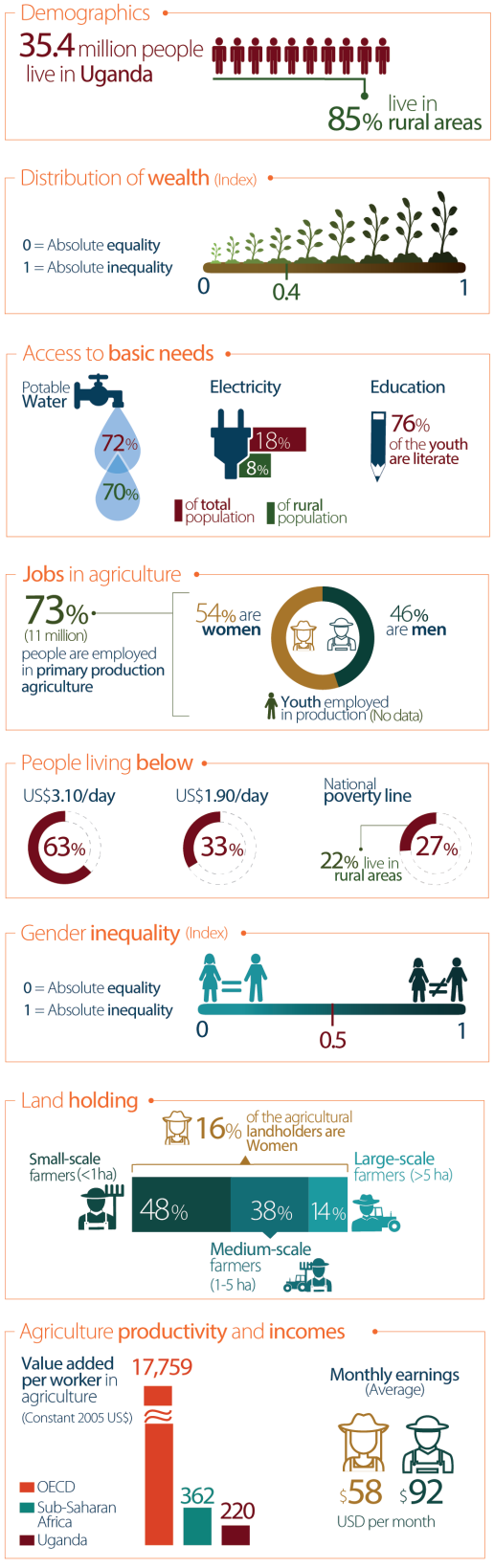


*East Africa: Uganda, Kenya, Tanzania, Sudan, Rwanda, Burundi, Eritrea, Ethiopia, Somalia, Madagascar, South Sudan, Djibouti

People, agriculture, and livelihoods

Uganda still faces considerable challenges in meeting its poverty eradication objective of reducing absolute poverty to less than 10% of the population by 2017 [12]. The proportion of the national population living below the poverty line dropped from 56% in 1992 to about 24.5% in 2013 (7.5 million) [13]. The rural areas account for 85% of the population and 94.4% of the poor, while the urban areas account for 15% of the population but only 5.6% of the poor. In Uganda, agriculture supports the livelihoods of 73% of the households and provides employment for about 33.8% of the economically active population, and over 80% of the poorest of the population [14]. The country's agriculture is characterized by smallholder farming with hand hoe as the major production tool and with landholdings averaging two hectares [6].

People, agriculture and livelihoods in Uganda [7, 8, 9, 10, 15, 16, 17]

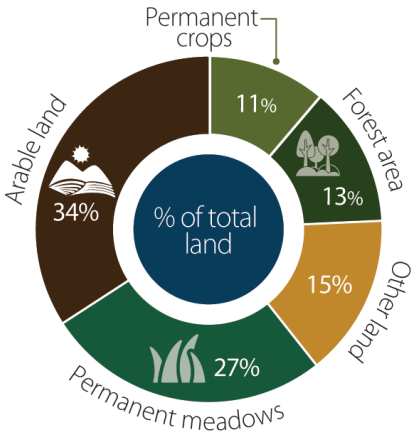


Land use

Uganda has a total area of 241,550,000 ha. Agricultural land occupied 11,962,000 ha (60%) of the total area in 1994 and increased significantly to 14,415,000 ha (72%) in 2013 at an annual growth rate of 0.3% [3]. Arable land increased from 0.54% annual growth in 2000 to 2.36% in 2012, while permanent cropland area decreased from an annual growth rate of 1.69% to 0.72%. Notably in the last decade, agricultural land has steadily increased at a rate of 1% per annum, and if this rate continues agricultural land will account for 90% of Uganda's land by 2040 [24]. Natural forest cover has declined drastically from 54% in the 1950s to 20% of the total area, while grassland has increased by 28.18% during 1996–2013 [18]. About 41% of the country's total area is experiencing degradation, of which 12% is in a severe state of degradation [19]. The most common form of land degradation is soil erosion, found on around 85% of degraded land [18]. Areas severely affected by soil erosion (85–90%) include the highlands of Kabale and Kisoro, while the badly affected ones (75–80%) include Mbale, Rakai and the cattle corridor districts. Forest cover loss of about 25 million tons of wood consumed annually translates into 50% degradation of all tropical high forests on private land and 15% in forest reserves [7].

Land use in Uganda [7, 10]

Agricultural area
14,415,000 ha
= 72% of total land area

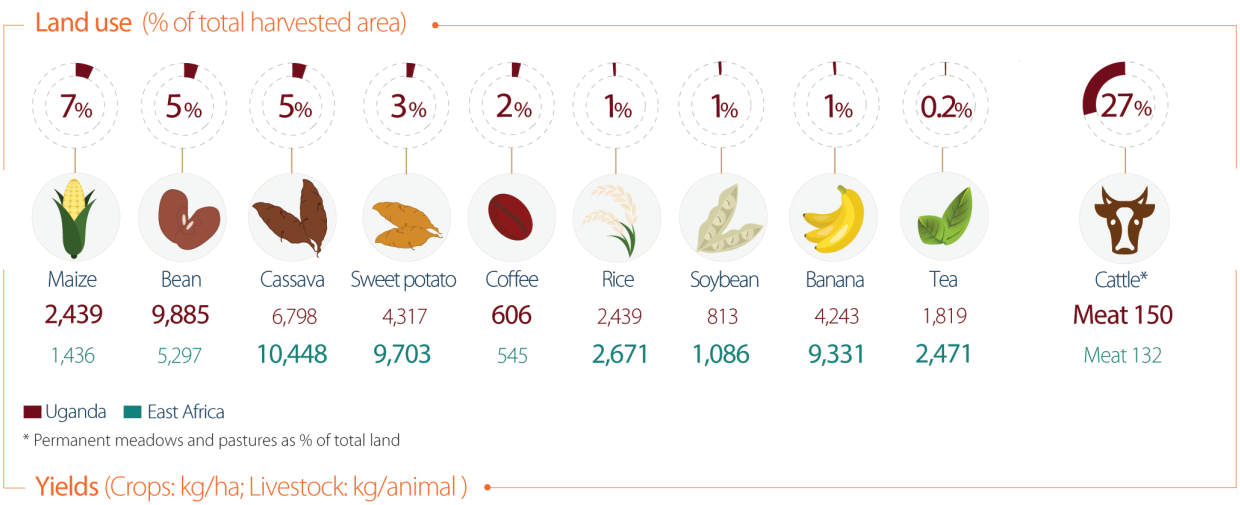


Agricultural production systems

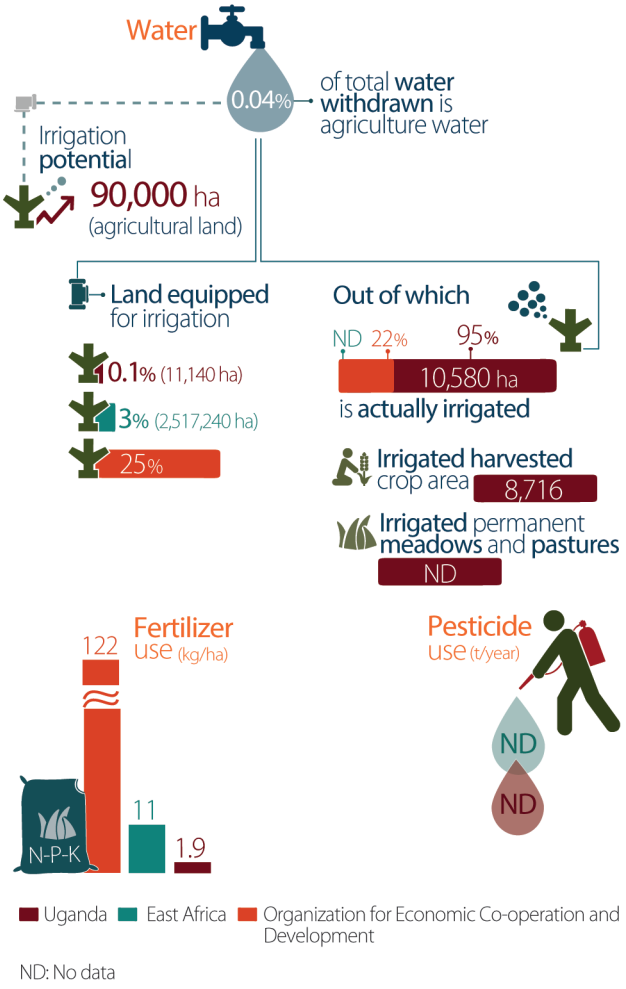
Agricultural production in Uganda is primarily based on small-scale subsistence farming (4.0 million households), comprising a system of mixed agriculture with perennial and annual crops, as well as grazing throughout most of the districts across ten agro-ecological zones (AEZs). The AEZs include: the North-eastern dry lands with an average annual rainfall of 745 mm (where beans, field peas, groundnuts, passion fruits, simsim and sorghum are grown); the North-eastern savannah grasslands receiving 1197 mm (cocoa, millet, tobacco, bee keeping); the North-western Savannah grasslands receiving a range of 1340 mm – 1371mm (coffee, Irish potatoes, rice); the Para-savannahs receiving 1259 mm (cassava fishing, sorghum, peas, tobacco, livestock); the Kyoga plains receiving 1215 mm - 1328 mm of rainfall (sweet potatoes, dairy); the Western savannah grasslands (banana, maize, goats); and the Lake Victoria Crescent, South-western farmlands, Highland ranges, and Pastoral rangelands with rainfall below 1000 mm and characterized by short grassland with nomadic extensive pastoralism (pastoral livestock). However, these systems are dynamic due to climate-related hazards, high population growth rates of 3.2% per annum, as well as external political and economic factors [3, 46].

In these zones, agriculture is mainly rainfed; irrigated agriculture comprises only 0.1% of total cultivated land. The main crops are cereals (maize, sorghum, millet, rice) on over 1.7 million ha for the two cropping cycles, or almost 32% of the area cropped in 2008-2009 [20], root crops (25%), bananas (17%), as well as pulses, oil seeds, coffee, vegetables and fruits. Export crops include coffee, tea, tobacco, cotton cut flowers and cocoa. Livestock also is a key component of the primary sector with over 26 million heads in 2014 [3], not including poultry. Food crop production dominates the agriculture sector, contributing over 55% of the agricultural GDP, while cash crops contribute 17% and livestock 15% [21]. Despite the dominance of food crop production, only one-third is marketed with exports being less than 7% of food production. Imported food are mainly wheat and rice, accounting for less than 5% of total food requirements [2].

Production systems key for food security in Uganda [7]



Agriculture input use in Uganda [7, 10, 22]



Food security and health in Uganda [7, 9, 10, 16, 25, 26, 27, 28]

Food security

Score 0-100*

Global**	56
Uganda	46
East Africa	34

1 of 4 people is undernourished

* Takes into account aspects of affordability, availability, and quality
** Refers to the 109 countries included in the Index

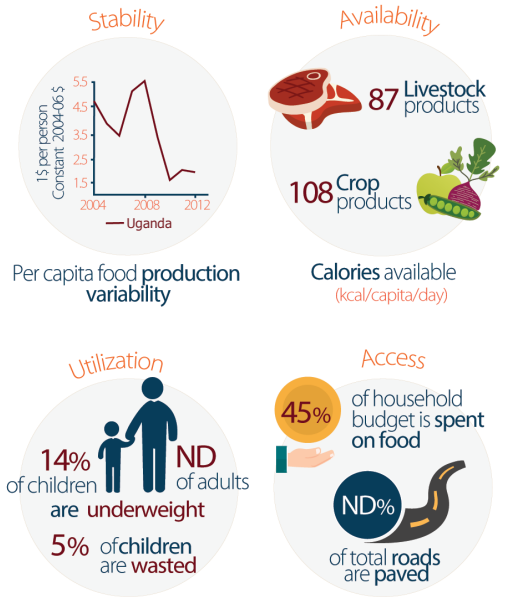
Food aid (2012)

60,622 metric tons (cereals 84%)

Emergency 27,914 mt
Project aid 32,708 mt
Programme aid No data mt

Changes in total food aid (from 2012 to 2011) -29%

Food security indicators (selection)



ND= No data

Health

Access to clean energy sources

85% of the population has access to clean energy sources (non-solid fuels) for cooking

Child Mortality rate

Under-five mortality rate (per 1,000 live births): 137

Adolescent fertility rate

115 births per 1,000 women, ages 15-19

Prevalence of HIV infections

7% people infected with HIV

5% are women (age 15+)

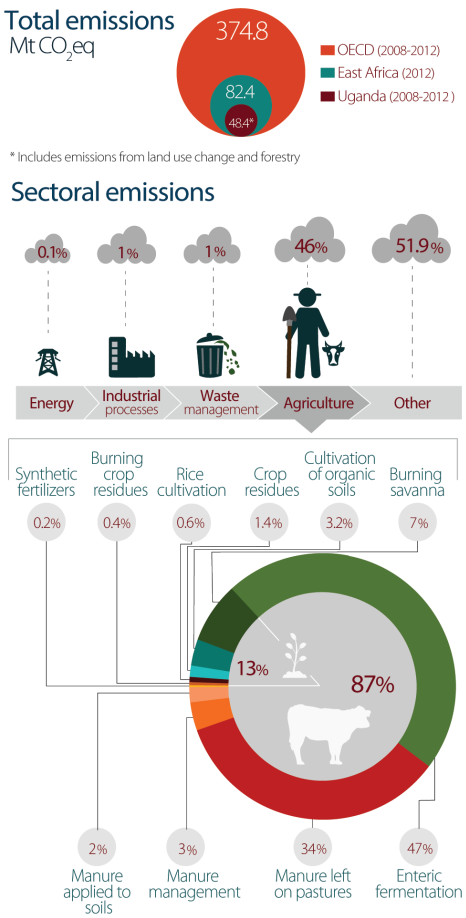
Food security and nutrition

According to the Global Hunger Index 2015, a score of 27.6 suggests that Uganda is not yet self-sufficient in food production. Many households and specific segments of the population suffer from food insecurity and high levels of malnutrition [23]. The most food-insecure region of the country is the Northern followed by the Eastern region with the lowest levels of dietary energy consumption (1,999 and 2011 kcal/person/day respectively). The sub-region estimates reveal that 59%, 19% and 11% of households in the North East, Mid-North and West Nile, respectively, consume one meal per day. Uganda's median dietary energy consumption (DEC) stands at 2160 kcal/person/day in urban areas consuming slightly more than their rural counter parts at 2156 kcal/person/day [24]. Uganda's food security projections indicate that the number of food-insecure people will grow from 7 million (20%) in 2015 to 30 million (60%) in 2025. Mainly driven by the country's high population growth of 3.4% per year in the near term and 3% per year by 2025 [23].

Agricultural greenhouse gas emissions

Uganda has one of the lowest GHG emissions per capita in the world, estimated at 1.39 tons carbon dioxide equivalent, far below the global average of approximately 7.99 tons of carbon dioxide equivalent; yet the country is most vulnerable to global warming and climate change impacts. Uganda's contribution to world's total GHG emissions is estimated at 0.099%. Between 1990 and 2012, Uganda's GHG emissions grew 50% with average annual change of 4% from the agricultural sector [29]. The total national GHG emissions including land-use change and forestry is about 48.38 Mt CO2e, which is 58.7% of the 82.4 Mt CO2e regional GHG emissions [30]. The agricultural sector has the highest emissions, contributing about 46.25% (22.38 Mt CO2e) to the country's total GHG emissions [30]. The four main sources of GHG emissions from the agricultural sector include enteric fermentation at 42.8%, manure left on the pasture 31.1%, burning savanna 12.9% and cultivation of organic soils at 4.8% [3]. In spite of these low emissions rates, the country is highly committed, through its' Nationally Determined Contribution (NDC), to contribute to global efforts to reduce GHG emissions. As a mitigation strategy, Uganda has then focused on implementing of a series of policies and measures in the agriculture, energy supply, forestry and wetland sectors. For instance, strategies to reduce emissions include protecting the existing forests and implementing the agro-forestry plan countrywide. Similarly from pastoralism, methane emissions have been reduced by improving pastoral livestock keeping practices, such as the use of improved breeds and feeding regimes.

Greenhouse gas emissions in Uganda [7, 31]



Challenges for the agricultural sector

The underdevelopment of the agricultural sector has been identified in Uganda Vision 2040, among major bottlenecks constraining the country's development. Despite efforts to increase agricultural productivity, the sector is characterized by low yields. This is partly a result of poor agricultural technology development. For instance, despite soil fertility being a key ingredient for improved agricultural production, the national fertilizer application rate is low at an average of 1 kg /ha/year, compared to 5kg/ha in Tanzania and 30 kg/ha in Kenya, and far less than the world average of 100kg/ha. Also the use of improved seeds stands at 6.3% of farmers, while agro-chemicals are at a meager 3.4% [32].

In Uganda, the challenge of poorly functioning pest, vector and disease control is a major cause of losses in the agriculture sector. For instance, the 2008 Livestock Census revealed that each Ugandan livestock farmer may be losing a startling USD 155 a year due to disease. In the crop sub-sector for instance, coffee wilt disease, which started in 1993, has destroyed about 56% or 160 million of the old Robusta trees, equivalent to some 1.5 million bags or about USD 170 million [21]. This inability to control endemic disease outbreaks means that Uganda fails to meet international trade standards and so loses many market opportunities.

Widespread degradation of land resources is another challenge in Uganda. In 1991, studies estimated that soil erosion accounted for over 80% of the annual cost of environmental degradation equivalent to USD 300 million per year [18]. In 2003, the annual cost of soil nutrient loss due primarily to erosion was estimated at about USD 625 million per year. Productivity losses per year for maize from soil erosion have been estimated in some places as high as 190 kg/ha [21]. The degradation of land resources, while having a large impact on agricultural production and productivity, also reduces the ability to sequester carbon and contribute to mitigation of agriculture and land use related greenhouse gas emissions.

Uganda is faced with market and value addition constraints for agricultural products. For instance, the proportion of Uganda's agricultural commodities and products processed is less than 5% of products produced [21]. The sector also has poorly functioning regulatory services, inputs market and distribution systems. For instance, the quality of seed in the market may be unknown as quality cannot be determined through visual inspection.

The sector is also faced with constraints related to the enabling environment for improving agricultural production and productivity, such as an uncertain policy environment, poor agricultural technology delivery and adoption, lack of capacity for policymaking and planning, lack of capacity for climate change analysis and decision making and low productivity of sector personnel. Given the heavy dependence on agriculture, the effects of climate change could clearly put millions of people at greater risk of poverty and hunger.

The sector is also faced with institutional development constraints, such as a weak institutional framework and lack of capacity to implement the sector development plans, geographically fractured state of the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and its agencies, and low productivity of sector personnel to ensure efficient and effective delivery of sector goals and objectives.

Agriculture and climate change

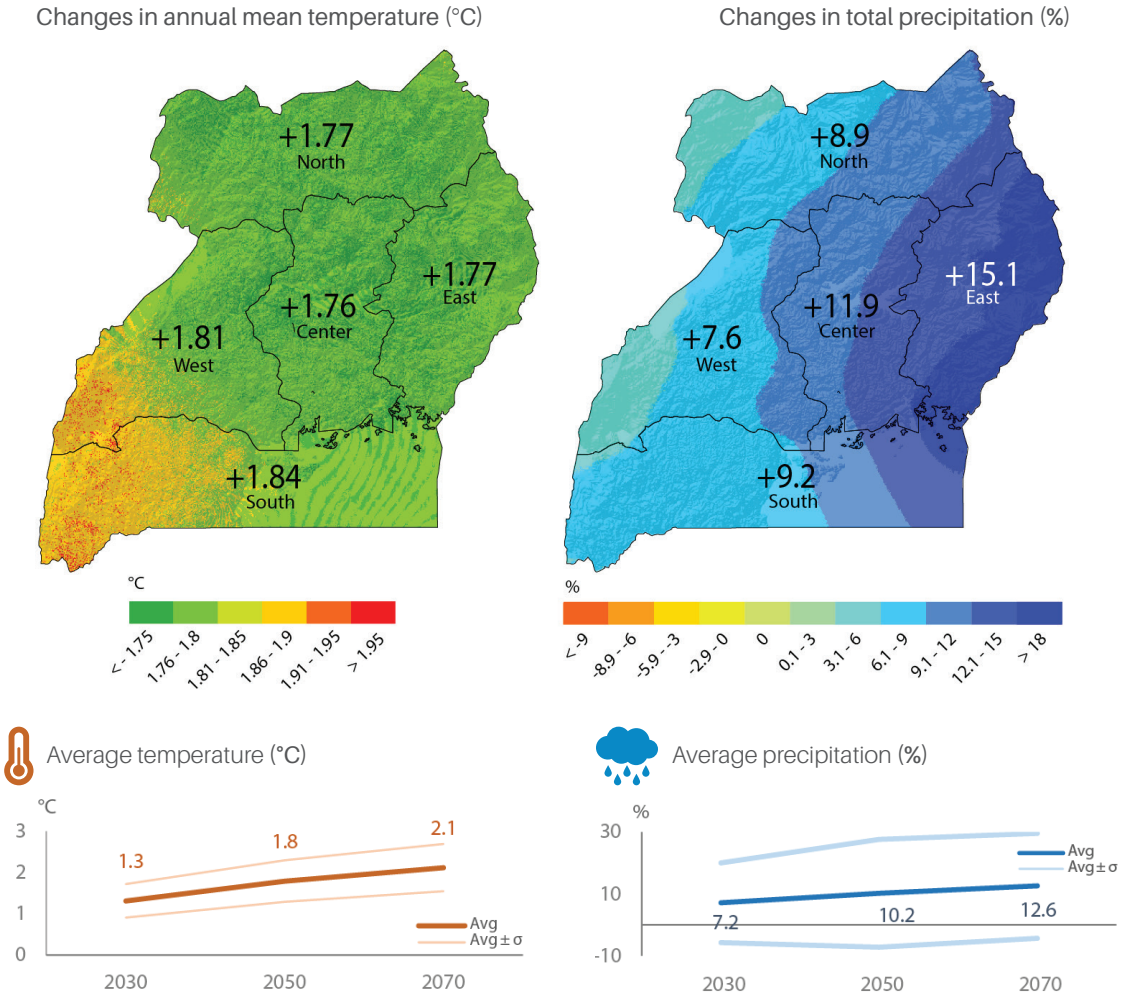
Uganda experiences relatively humid conditions and moderate temperatures throughout the year, with mean daily temperatures

of 28 °C [33, 34]. The long-term mean near-surface temperature is around 21 °C, with the average monthly temperatures ranging from a minimum of 15 °C in July to a maximum of 30 °C in February. The highest temperatures are observed in the North, especially in the North-East, while lower temperatures occur in the South. A significant warming has been measured in Uganda for instance, the Uganda's National Adaptation Programme of Action (NAPA) cites an average temperature increase of 0.28 °C per decade in the country between 1960 and 2010, being January and February the most affected by this warming trend, averaging an increase of 0.37 °C per decade. The frequency of hot days in the country has increased significantly, while the frequency of cold days has decreased [35, 36].

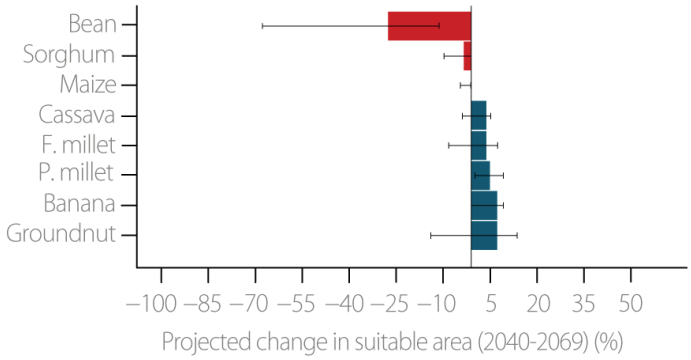
The annual rainfall totals vary from 500 mm to 2800 mm; mean annual rainfall ranges between less than 900 mm in the driest districts to an average of above 1,200 mm per year in the wettest districts located within the Lake Victoria Basin, eastern and the north-western parts of Uganda (37, 38). This climate is bimodal in the south to central parts of Uganda, exhibiting two rainy seasons (March–June and October–January), with the exception of the northern-easterly region, which experiences one long rainy season [37]. Floods and droughts are the most frequent climate hazards. For instance, the cattle corridor, which is located in the dry-land region, is prone to drought, while the northern region is especially vulnerable to both floods and droughts [39]. While trends are uncertain and data remain limited, the main climate change impacts expected to affect agriculture in Uganda in the future include higher temperatures, more erratic and heavy rainfall, changes in the timing and distribution of rainfall, and an increase in the frequency and duration of droughts. For instance, the FAO Crop Water Assessment (FAO-CROPWAT) indicated up to 46% reductions in optimal banana yields due to soil moisture deficits within banana plantations.

Climate projections for the country based on the same models used in the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) indicate the possibility of an increase in the country's near-surface temperature in the order of +2 °C in the next 50 years, and +2.5 °C in the next 80 years using Representative Concentration Pathway (RCP) 4.5 scenarios. Whereas for RCP 8.5 the projected temperature increases are in the order of +2.5 °C in the next 50 years, and +4.5 °C in the next 80 years. They also predict a slight decrease in total annual rainfall in most of the country, with slightly wetter conditions over the west and north-west under both RCP 4.5 and RCP 8.5 scenarios. Rainfall totals might drop significantly over Lake Victoria (-20% from present) [44]. Overall, Uganda is highly vulnerable to climate change and weather variability; the country already being susceptible to unreliable rainfall, frequent drought, periodic floods and seasonal bush fires

Projected changes in temperature and precipitation in Uganda by 2050 [40, 41, 42]



Projected change in suitable area in Uganda (2040–2069)



CSA technologies and practices

CSA technologies and practices present opportunities for addressing climate change challenges, as well as for economic growth and development of the agriculture sector. For this profile, practices are considered CSA if they enhance food security as well as at least one of the other objectives of CSA (adaptation and/or mitigation). Hundreds of technologies and approaches around the world fall under the heading of CSA.

A range of CSA technologies are being promoted and implemented across farmer typologies and agro-ecological zones in Uganda. Notable practices include integrated soil fertility management, agro-forestry, crop diversification, conservation agriculture (crop rotation, mulching, use of green cover crops and minimum tillage), intercropping coffee-banana and legumes with other crops, seasonally adapted planting times and effective field water management in rice production. Under livestock management, the existing practices include; improved silvopastoral systems (i.e. converting degraded extensive, treeless pastures into a richer and more productive environment, where trees and shrubs are planted interspersed among fodder crops such as grasses and leguminous herbs), rotational grazing and forage conservation (silage). Use of livestock dung for household biogas production has also been promoted and practiced, particularly in intensive livestock areas with benefits not only for climate change mitigation, forest conservation and energy provision but also in terms of reducing the workload and improving the health of women and children. The bio-slurry removed from the digester can also be used as organic fertilizer to improve crop productivity. The predominant users of CSA practices are small-scale farmers whose primary goal is to increase crop productivity. This corroborates with evidence indicating that resource-poor farmers are risk evaders by nature, who habitually seek for solutions to problems through innovation.

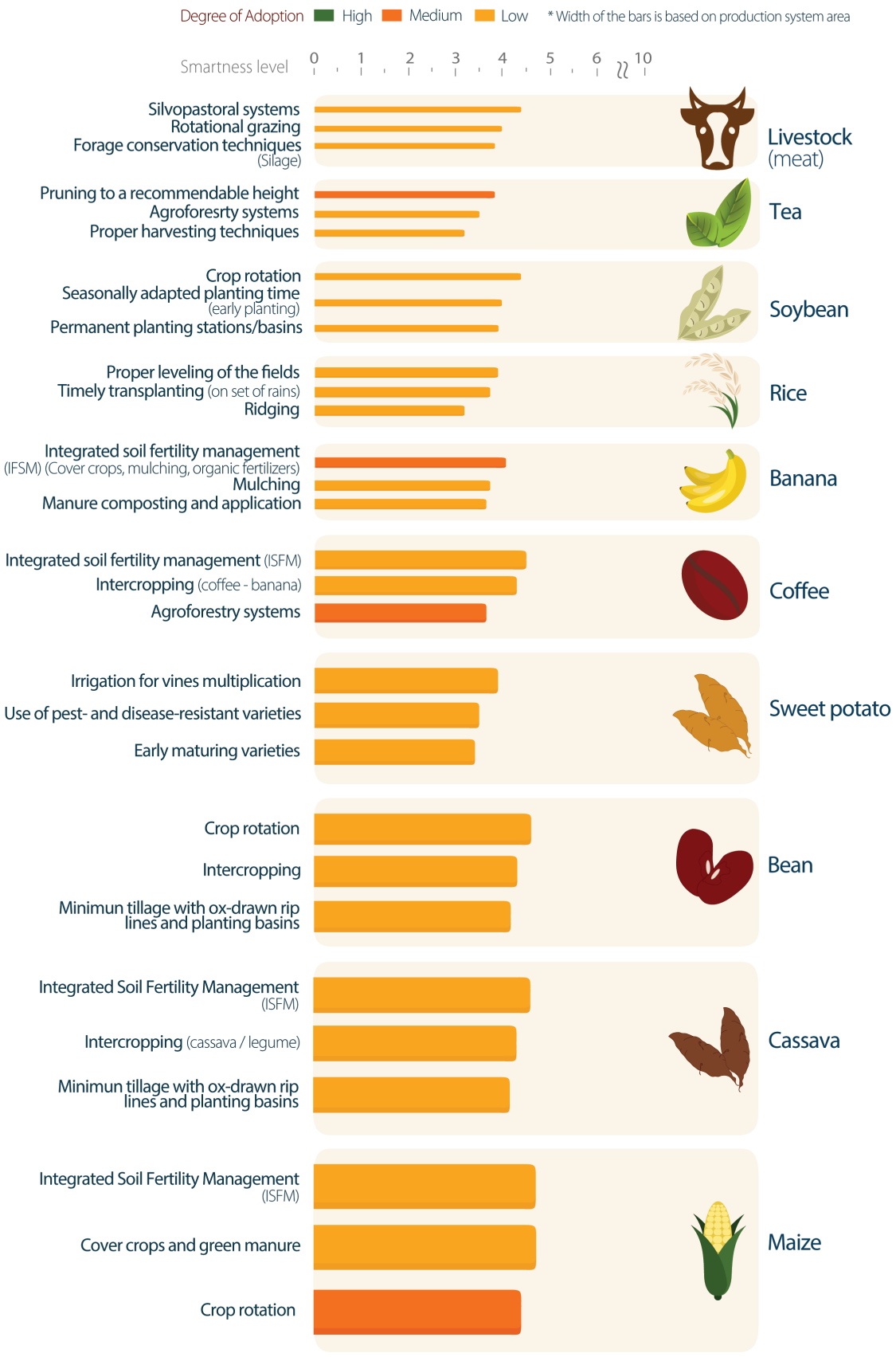
Off-farm CSA related services include crop weather index based insurance, using automated weather stations to monitor specific parameters and triggers. Strengthening climate information and early warning systems has also been a focus of various actors and has been highlighted in various national documents such as Uganda's NAPA of 2007.

In this context, CSA is not a novel approach per se, but rather a compendium of indigenous solutions developed over time by smallholders to sustainably maximize crop production amidst diminishing farm size, pest and disease pressure and soil fertility decline. Nevertheless, adoption of many CSA practices remains generally low (30%) because of policy gaps. Other constraints to CSA adoption include limited extension services, inadequate knowledge, inadequate technology, labor and capital, inaccessible input markets and declining farm size.

The following graphics present a selection of CSA practices with high climate smartness scores according to expert evaluations. The average climate smartness score is calculated based on the individual scores of the practices on eight climate smartness dimensions that relate to the CSA pillars: yield (productivity); income, water, soil, risks (adaptation); energy, carbon and nitrogen (mitigation). A practice can have a negative / positive / zero impact on a selected CSA indicator, with 10 (+/-) indicating a 100% change (positive/ negative) and 0 indicating no change. Practices in the graphics have been selected for each production system key for food security identified in the study. A detailed explanation of the methodology and a more comprehensive list of practices analyzed for Uganda can be found in Annexes 3 and 4, respectively.

Farmers' level of adoption of practices with high climate smartness has been generally low as most farmers still depend on the traditional subsistence farming systems [21]. However, the Uganda Vision 2040 (2013) recognizes the critical issues addressed by CSA technologies, which are aimed at boosting resilience to harsh climatic conditions. Investment in research towards improved pest- and disease-free seeds and varieties has been promoted by both government agencies such as the National Agricultural Research Organization (NARO) and international organizations such as the International Institute of Tropical Agricultural (IITA) [43].

Selected CSA practices and technologies for production systems key for food security in Uganda



Case study: Inclusive stakeholder planning through learning alliances

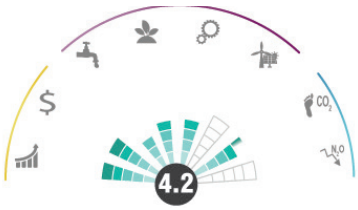
The Policy Action for Climate Change Adaptation (PACCA) project aims to provide a deeper understanding of how to approach CSA interventions at a systemic rather than at a plot level. Working closely with both local and national stakeholders, IITA and other partners on the PACCA project developed a framework for vertically and horizontally integrating CSA interventions through inclusive stakeholder engagements. Learning alliances (LAs) are multi-stakeholder spaces established at national and district levels, with the aim of promoting science-policy dialogue, climate change capacity enhancement, and building synergies to develop solutions to problems that cannot be solved individually.

LAs encourage consolidated efforts to tackle climate-change-related issues that no single institution would accomplish on its own. For example, civil society organizations within the LA supported the scenario-guided review of the Agriculture Sector Strategic Plan, which was important for mainstreaming climate change in the plan. LA also contributed finances to support activities that led to COP21, which enabled LA representatives to participate in the development of Uganda's position in the COP21 climate change negotiations in Paris, France. In addition, LAs have provided an opportunity to harmonize and coordinate climate change work done by different organizations, often with duplication of mandates.

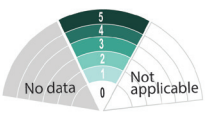
Within the framework of the PACCA project, national policy dialogues are informed by district level evidence and climate change scenarios. For instance, the National Climate Change Policy requires that the district focal point ensures that climate change actions and plans by district stakeholders are captured in the District Development Plans (DDP). However, there has been a missing link between policy makers, implementers, scientists and other stakeholders, which has underscored the role of LAs in connecting the concerned parties. To aid these linkages, the PACCA project partnered with four Local Governments (Rakai, Luwero, Nwoya and Mbale) to identify the key local actors to involve in the district planning process. During planning, stakeholders were supported to identify distinct zones for implementation of locally prioritized and appropriate climate-smart agricultural practices. As a result the district technical planning committees have been able to prioritize relevant practices in their respective DDPs; actions that are key for supporting the scaling-up of climate-smart agriculture.

Photo: E. van de Grift (CCAFS)

Table 1. Detailed smartness assessment for top ongoing CSA practices by production system as implemented in Uganda.

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Bananas (1% of total harvested area)				
Integrated soil fertility management (IFSM) (Cover crops, mulching, organic fertilizers)	Central, eastern and south-western humid highlands 30-60%	S		**Productivity** Water conservation and use for organic fertilizer results in improved yields. **Adaptation** Preserves soil moisture (water retention) and soil fertility through accumulation of organic matter. **Mitigation** Maintains and/or improves soil carbon stocks and reduces external input use.
Mulching	Central, eastern and south-western humid highlands <30%	S		**Productivity** Increased yields and income. **Adaptation** Promotes soil and water conservation during dry seasons. Increases soil organic matter upon decomposition. Prevents erosion. **Mitigation** Maintains and/or improves soil carbon stocks and soil organic matter content.
Beans (5% of total harvested area)				
Crop rotation	Eastern <30%	S		**Productivity** Contributes to product diversification and increases yields under certain contexts. **Adaptation** Conserves soil nutrients and moisture. Improves soil fertility and reduces pest and disease risks. **Mitigation** Maintains and/or improves soil carbon stocks. Reduces the need for nitrogen fertilizers use when leguminous crops are introduced.
	South Western (Kisoro) <30%	S		
Intercropping	Eastern <30%	S		**Productivity** Reduces economic vulnerability by diversifying production. Increases yields and income. **Adaptation** Improves soil quality (biological, physical and chemical). Increases efficiency in water and soil use. **Mitigation** Nitrogen fixation through leguminous plants reduces nitrogen fertilizer requirements. Contributes to increases of soil organic matter and soil carbon stock.
	All of Uganda <30%	S		

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Cassava (5% of total harvested area)				
Integrated soil fertility management (ISFM)	All of Uganda <30%	S		**Productivity** Water conservation and use for organic fertilizer results in improved yields. **Adaptation** Preserves soil moisture (water retention) and soil fertility through accumulation of organic matter. **Mitigation** Maintains and/or improves soil carbon stocks and reduces external input use.
Intercropping (cassava / legume)	All of Uganda 30-60%	S		**Productivity** Reduces economic vulnerability by diversifying production. Medium- to long-term soil fertility increases can lead to higher yields. **Adaptation** Improves soil quality (biological, physical and chemical characteristics). Increases efficiency in water and soil use. **Mitigation** Nitrogen fixation through leguminous plants reduces nitrogen fertilizer requirements. Contributes to increases of soil organic matter and soil carbon stock.
Coffee (2% of total harvested area)				
Integrated soil fertility management (ISFM)	Eastern and central <30%	S M		**Productivity** Greater yield stability despite climate variability. **Adaptation** Increases water retention capacity through accumulation of organic matter. Improves chemical, biological and physical properties of the soil. **Mitigation** Maintains and/or improves soil carbon stocks and reduces external input use.
Intercropping (coffee - banana)	Eastern and central <30%	S		**Productivity** Increases in product quality, minimal changes in current coffee production. Diversifies livelihoods (fruits). **Adaptation** Increases soil organic matter content and improves water balance (buffers the climate temperature). **Mitigation** Increases carbon sequestration and carbon storage both above- and below-ground. Benefits by reducing chemical inputs.



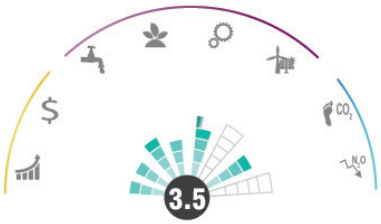
Yield Income Water Soil Risk/Information Energy Carbon Nutrient

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Maize (7% of total harvested area)				
Cover crops and green manure	Northern Uganda <30%	S		**Productivity** Medium- to long-term soil fertility increases can lead to higher yields and income. **Adaptation** Improves soil structure alleviating compaction and erosion. Improves capacity of water retention of the soil. **Mitigation** Improves biomass, which may promote carbon sequestration.
Integrated soil fertility management (ISFM)	All of Uganda <30%	S		**Productivity** Greater yields and stability of food production. **Adaptation** Increases water retention capacity through accumulation of organic matter. Improves chemical, biological and physical properties of the soil. **Mitigation** Maintains and/or improves soil carbon stocks and reduces external input use.
	Northern Uganda <30%	S		
Cattle (meat) (NA)				
Rotational grazing	Southwest cattle corridor and Central Uganda <30%	S		**Productivity** Increases productivity and income per unit of product. **Adaptation** Reduces soil compactation and erosion, Better soil and grass quality. **Mitigation** Increases production efficiency reducing GHG emissions per unit of product.
Silvopastoral systems	Southwest cattle corridor and Central Uganda <30%	M		**Productivity** When accompanied with rotation, it can significantly increase stocking rates and meat production. Diversifies livelihoods (timber, fruits). **Adaptation** Increases soil organic matter content and improves water balance. Buffers the climate temperature (shade for cattle). **Mitigation** Significant above- and below-ground carbon sequestration. Reduces the use of nitrogen and other inputs.

Yield Income Water Soil Risk/Information Energy Carbon Nutrient

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Soybean (1% of total harvested area)				
Crop rotation	Northern and Eastern Uganda <30%	S		**Productivity** Medium- to long-term soil fertility increases can lead to higher yields. **Adaptation** Improves soil moisture. Improves soil fertility by recycling soil nutrients. Reduces pest and disease risks. **Mitigation** Maintains and/or improves soil carbon stocks. Reduces the need for nitrogen fertilizers by using leguminous crops.
Seasonally adapted planting time (early planting)	Northern, Eastern and Western Uganda <30%	S		**Productivity** Increases land and crop productivity per unit of water. **Adaptation** Improves efficient use of rainwater. Reduces the risk of crop failure. **Mitigation** Rainwater supply can reduce energy needs for irrigation.
Rice (1% of total harvested area)				
Proper leveling of the fields	Northern, Central and Eastern Uganda <30%	S		**Productivity** Increased land and crop productivity per unit of water. **Adaptation** Increases resilence to drought by efficiently using irrigation water. **Mitigation** A reduction in energy required for irrigation could reduce the emissions intensity per unit of product.
Timely transplanting (on set of rains)	Northern, Central and Eastern Uganda <30%	S		**Productivity** Some impact on fertilizers, water and other inputs by enabling timely fertilizer application. Increases income. **Adaptation** Increases resilience to extreme natural events such as drought or floods. **Mitigation** Reduces GHG emissions such as methane by minimizing periods of flooding. However, supplementary irrigation would be required to ensure water availability but can also possibly lead to higher energy consumption.

Yield Income Water Soil Risk/Information Energy Carbon Nutrient

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Tea (0.2% of total harvested area)				
Agroforestry systems	Central and Western region <30%	S		**Productivity** Crop diversification can improve yields. Potential benefits for food and nutrition security and income diversification (timber, fruits). **Adaptation** Increases soil organic matter content. Improves water balance (buffers the temperature). **Mitigation** Increases carbon sequestration and storage both above- and below-ground. Benefits by reducing chemical inputs.
Pruning to a recommendable height	Central and Western region 30-60%	S M		**Productivity** Increases productivity. Reduces crop exposure to foliar diseases and facilitates crop management. **Adaptation** Contributes to weed control. Increases in soil organic matter can facilitate soil restoration and maintains soil moisture. **Mitigation** Increases carbon sequestration and storage both above- and below-ground.
Sweet potato (3% of total harvested area)				
Irrigation for vines multiplication	Northern, Central and Eastern Uganda <30%	S		**Productivity** Increases productivity by maintaining optimum conditions for planting material. **Adaptation** Reduces risk of crop failure due to water stress. Increases responsiveness to extreme weather events and unpredictable weather patterns. **Mitigation** Improves emissions intensity levels due to productivity increases.
Use of pest- and disease-resistant varieties	Northern, Central and Eastern Uganda <30%	S		**Productivity** Reduces risk of crop losses. Increases in yields and reduced investment in pesticides. **Adaptation** Increases in crop resistance to pests and diseases. Less water consumption. **Mitigation** Improves emissions intensity levels due to productivity increases.

Yield | Income | Water | Soil | Risk/Information | Energy | Carbon | Nutrient

Institutions and policies for CSA

Climate change impacts in Uganda require joint management efforts of all stakeholders from public, private sectors, civil society and communities. The climate-change-related institutional framework in the country can be classified at three levels with climate-related activities as a secondary objective. The first level involves government institutions that are responsible for the implementation of the policies and actions set out by the government; the second level involves development partners who provide funds to implement programs; and the third level involves nongovernmental organizations (NGOs) and communities that participate in the implementation of projects and programs.

The government institutions that work on CSA-related activities include MAAIF, which plays a leading role in developing and promoting climate change policies. Other government ministries also linked to mainstreaming of climate change adaptation and mitigation strategies into national policy frameworks include the Ministry of Finance, Planning and Economic Development (MoFPED) and the Ministry of Water and Environment (MWE), among others. The Ministry of Water and Environment (MWE) is the climate change focal point and liaises climate change issues with the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) as well as coordinating with other government, development partners, other UN institutions and NGOs.

Various national institutions are contributing to different CSA pillars by strengthening farmer capacity to manage climate risks, developing context-suitable agricultural practices, and sustainable value chains. These are mainly departments in ministries such as the National Agricultural Research Organization (NARO), which is the country's leading agriculture research organization facilitating the adoption of CSA practices, Makerere University Center for Climate Change Research and Innovations (MUCCRI) a hub of academic, professional development, and research excellence in climate science, climate adaptation and related disciplines; the Climate Change Department (CCD), established in 2008 to strengthen Uganda's implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (KP).

Development partners provide funding of various projects that, on one hand, influence economic and social development and, on the other hand, also address climate change. A wide range of projects across the country focus on enhancing the livelihoods of smallholder farmers and, because of the strong linkages between CSA and food security, many of these initiatives encompass climate risk management practices to some degree. For instance, the USAID Feed the Future "Enhancing Climate Resilience for Agricultural Livelihoods" Project, working with farmers to develop site-specific climate-smart adaptation practices for banana, coffee, maize, bean systems in both high and low land areas.

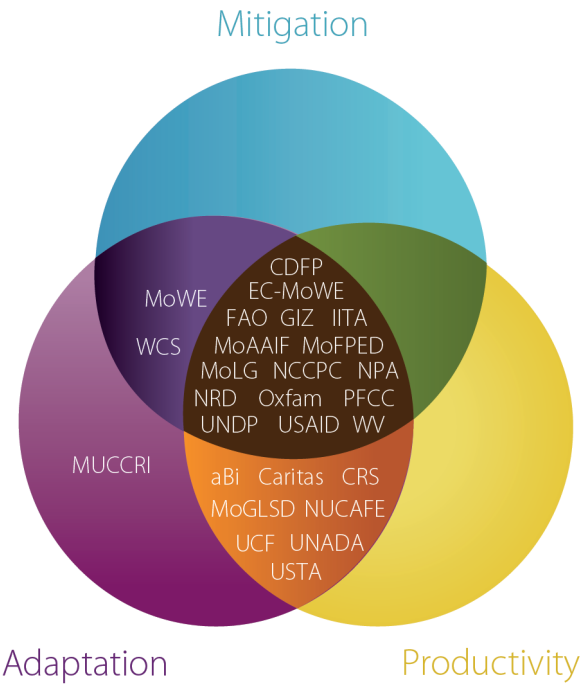
Faith-based organizations are also involved in CSA promotion, for example through the Farming Gods Way and Islamic Farming principles that mostly promote conservation agriculture. These are undertaken by organisations such as Uganda Faiths Network on Environment Action (UFNEA) who play a crucial role in climate-smart agriculture training and awareness raising. Private organisations involved in climate-smart agriculture training and awareness include Rural Enterprises development services (REDS) Uganda, who have been supporting conservation agriculture training, awareness raising and equipment access through the Conservation Agriculture Regional Programme (CARP), which is funded by the Norwegian Government.

Given the variety of organizations involved in agricultural climate change adaptation and mitigation related work in Uganda, coordination is therefore a key and important aspect of the countries efforts to tackle climate change. A positive development on the partnership and coordination front is the formation of a Climate-Smart Agriculture Task Force comprised of various key stakeholders on CSA and chaired by the Sustainable Land Management (SLM) Unit of MAAIF. Within this platform, have been the organization of various awareness raising and advocacy events for example the holding of the Uganda National Agricultural Show of 2015 with the theme "Climate-Smart Agriculture for Sustainable Food Security and Wealth Creation". The platform has also been a basis for discussion of key issues related to CSA scaling and improved coordination in the country. In addition, MWE has developed guidelines for integrating climate change into government institutions. The National Planning Authority (NPA) has re-enforced this call by requesting government institutions to factor climate change into the development plans, and the Ministry of Finance, Planning and Economic Development (MoFPED) is expected to respond to this call by making explicit financial provisions in budget allocation of departments and ministries. At the same time, there is still need for greater capacity building of all institutions (government, international, private and civil society) on climate change adaptation and mitigation and how to integrate this into their daily work.

Farmer' organizations such as the Uganda National Farmers Federation (UNFFe) and various smallholder coffee cooperatives are also involved in CSA promotion mostly through advocating for agroforestry, irrigation and intercropping. Private sector organisations such as Rural Enterprise Development Services (REDS) are involved in supporting farmers to implement conservation agriculture, although this work is also donor funded.

The following graphic highlights key institutions whose main activities relate to one, two or three CSA pillars (adaptation, productivity and mitigation). More information on the methodology and results from interviews, surveys and expert consultations is available in Annexes 5 and 6.

Institutions for CSA in Uganda



aBi Agribusiness Initiative **CDPF** Climate Department Focal Point **CRS** Catholic Relief Services **EC_MoWE** Environmental Commitees-Ministry of Water and Environment **FAO** Food and Agriculture Organization of the United Nations **GIZ** German Society for International Cooperation **IITA** International Institute of Tropical Agriculture **MoAAIF** Ministry of Agriculture, Animal Industry and Fisheries **MoFPED** Ministry of Finance, Planning and Economic Development **MoGLSD** Ministry of Gender, Labour and Social Development **MoLG** Ministry of Local Government **MoWE** Ministry of Water and Environment **MUCCRI** Makerere University Center for Climate Change Research and Innovations **NCCPC** National Climate Change Policy Committee **NPA** National Planning Authority **NRD** National Resources Department **PFCC** Parliamentary Forum on Climate Change **UCF** Uganda Coffee Federation **UNADA** Uganda National Agro-Inputs Dealers Association **UNDP** United Nations Development Programme **USAID** United States Agency for International Development **USTA** Uganda Seed Trade Association **WCS** Wildlife Conservation Society **WV** World Vision

Having ratified the UNFCCC and the Kyoto Protocol agreements, Uganda's approach to climate change is highly linked to its international engagement with climate change politics. Uganda submitted its First National Communication to UNFCCC in 2002 and it's Second National Communication in 2014. The country also submitted its National Adaptation Program of Action (NAPA) to the UNFCCC in 2007 and the (Intended) Nationally Determined Contribution ((I)NDC) in 2015. The (I)NDC prioritises agriculture as an adaptation area and specifically mentions expansion of climate-smart agriculture along with crop and livestock diversification and climate information as key areas for action. While not explicitly including agriculture among the mitigation focus areas, many of the priority actions for agricultural adaptation will also have mitigation co-benefits. Uganda has also launched a process for developing its National Adaptation Plan (NAP), and this was followed in 2016 by the launch of an FAO and UNDP project to support eight developing countries (including Uganda) to integrate agriculture into their National Adaptation Plans. The project is funded through the International Climate Initiative (ICI) and aims to increase collaboration between agriculture, environment, planning and finance ministries as well as developing national capacity for mainstreaming climate into planning and budgeting, improving economic valuation and conducting impact assessment of agricultural adaptation initiatives.

Uganda has also made efforts to domesticate other international instruments and agreements related to climate, agriculture and the environment such as the United Nations Convention on Biological Diversity (CBD); and the United Nations Convention to Combat Desertification (UNCCD). The CBD having been domesticated through formulation of a National Biodiversity Strategy and Action Plan (NBSAPII, 2015-2025) which highlights the need to address climate change as a key emerging issue.

Although not specifically targeting climate change issues, some of the countries environment and forestry related legislation can be said to have indirectly addressed climate change issues. Such legislation included the following:

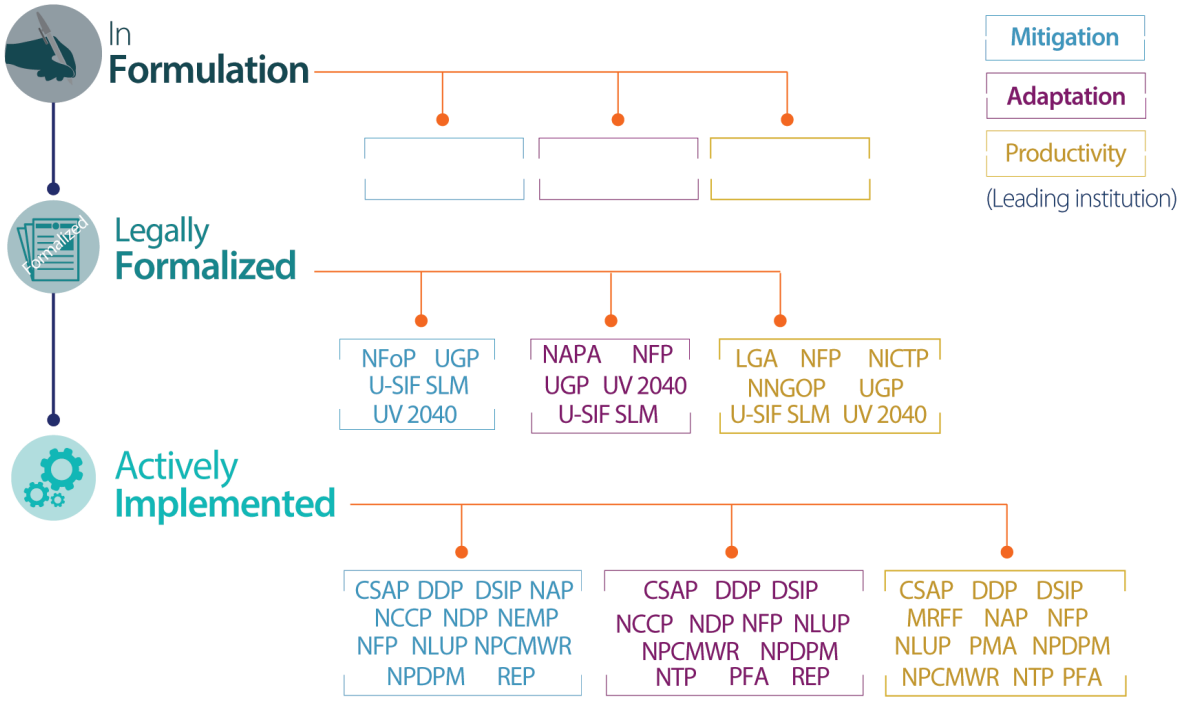
- The National Forest Policy (NFP) of 2001 whose goal was to achieve "an integrated forest sector that achieves sustainable increases in the economic, social and environmental benefits from forests and trees by all the people of Uganda, especially the poor and vulnerable related legislation.
- The National Environment Management Policy (1994, and currently under review) whose overall goal is "sustainable development which maintains and promotes environmental quality and resource productivity for socio-economic transformation" and includes activities related to payment for ecosystem services (PES), sustainable land management (SLM) and specifically mentions climate-smart agriculture as a key area of focus.

However, until 2007, Uganda's climate change policy discourse was generally underdeveloped. To cope with the challenges of economic development, poverty, food security and climate change, various climate change specific policy instruments have since been adopted. For instance, the National Development Plan (NDP, 2010) was the first macro-policy planning document to provide for specific policy objectives, strategies and intervention actions on climate change. Since the NDP was launched in 2010, the government has formulated relevant national policy instruments, namely, the National Policy on Climate Change, Uganda Vision 2040 and the Agriculture Sector Strategic Plan (ASSP) 2015/16-2019/20 and the National CSA Framework Programme. It is under the ASSP that climate-smart agriculture issues are directly addressed under the national policy framework. As of 2016, Uganda through support from various partners has committed to ensure that the second national development Plan (NDPII, 2016-2020) takes climate change into consideration. In 2015 for example, FAO assisted the Government of Uganda in conducting a study aimed at supporting the mainstreaming of climate change into the Second National Development Plan.

Regionally, being part of the East African Community, Uganda is subject to the East African Community Climate Change Policy (EACCCP), which aims to strengthen meteorological services and improve early-warning systems; increase preparedness for disaster risk management; and scale up efficient use of water and energy resources, irrigation, crop and livestock production among others.

Climate change in Uganda is a fundamentally multi-sectoral issue, hence a proactive approach in mainstreaming climate change into its development policies and strategies has been taken. For instance, the National Climate Change Policy developed a framework for the harmonization and coordination of the various sectoral efforts already underway and to be put forth in the future, with adequate attention paid to capacity building requirements and development of financial mechanisms and tools required to respond to climate change challenges along these policy directions at the national level. So far priorities in the National Climate Change Policy have been integrated in the Second National Development Plan (NDP II) 2015-2020. In addition in January 2016, the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) validated Climate Change Mainstreaming Guidelines for the Agricultural Sector. In the long term, Uganda has the overarching objective of ensuring that all stakeholders address climate change impacts and their causes through appropriate measures, while promoting sustainable development and green growth.

Policies for CSA in Uganda



CSAP Climate-Smart Agriculture Programme 2015-2025 (2015) (MoAAIF) **DDP** District Development Plans (2011) (MoLG) **DSIP** Agricultural Sector Development Strategy and Investment Plan 2010-2014 (2010) (MoAAIF) **LGA** Local Government Act (2010) (Districts) **MRFF** Mandatory Regulation for Food Fortification (2012) (MoH-NWGFF) **NAP** National Agricultural Policy (2013) (MoAAIF) **NAPA** National Adaptation Programme of Action (2010) (NCCTC) **NCCP** National Climate Change Policy (2013) (MWE) **NDP** National Development Plan (2011) (NPA) **NEMP** National Environment Management Policy (1994) (NEMA) **NFoP** National Forestry Policy (2001) (NFA) **NFP** National Fisheries Policy (2004) (MoAAIF) **NICTP** National Information Technology Authority Policy (2012) (NITA-UCC) **NLUP** National Land Use Policy (2008) (MoLHUD) **NNGOP** National Non-Governmental Organization Policy (2012) (The NGO Board-MIA) **NPCMWR** National Policy for Disaster Preparedness and Management (1995) (MoEND) **NPDPM** National Policy for Disaster Preparedness and Management (2010) (OPM) **NTP** National Trade Policy (2007) (MoTTI) **PFA** Prosperity For All (2007) (MoAAIF) **PMA** Plan for Modernisation of Agriculture (2000) (PMA) **REP** Renewable Energy Policy (2002) (NEC) **UGP** Uganda Gender Policy (2007) (MoLGSD) **U-SIF SLM** Uganda Strategic Investment Framework for Sustainable Land Management 2010-2020 (2010) (MoAAIF) **UV 2040** Uganda Vision 2040 (2010) (NPA)

Financing CSA

In Uganda, climate change strategic interventions have, to some extent, been addressed through existing development interventions with funding from the government and development partners. The funding sources include public, international, bilateral and multilateral donors and private sector finance. Public finance to climate change actions is through the national budget and, as such, spending is closely aligned with national policy setting and domestic institutional arrangements. Since national expenditure is managed on the basis of an individual ministry or another institution, rather than by sector, ministries and agencies most likely to be active in the identified policy areas were considered. In addition to ministry-level expenditure, relevant spending is channeled through agencies under the relevant ministries [45].

National private sector finance includes two categories of funders: the public-private and private funders. These funders include commercial banks, Uganda Breweries Limited, Sugar Factories and Eco-fuel Africa Limited. Whereas under the public-private funded schemes, we have: Oil Palm Uganda Limited (OPUL), Kimba Rice Scheme, and Youth Livelihood Fund by MoFPED in collaboration with various banks.

Financial support is also provided by international development partners through bilateral and multilateral agreements, and private sector philanthropy. Meanwhile, private sector philanthropy initiatives funding multi-sector CSA activities include Bill & Melinda Gates Foundation, Gatsby Charitable Trust, Rockefeller Foundation, The Nature Conservancy, McKnight Foundation, Oxfam International, Conservation International and Clinton Foundation.

Potential finance

Uganda prioritizes reducing vulnerability of its population, environment and economy by implementing adaptation and resilience building actions. A recent emphasis has been placed on supporting climate-smart agriculture scaling in the country and hence the need to attract and direct funding towards this area of work. Funding for climate-smart agriculture has been largely dependent on short term programmes whose impact on long term resilience is sometimes not apparent. Government has however continued to lobby for long-term adaptation financing from the international community as well as trying to ensure local budgetary allocation for climate change adaptation initiatives. So far it is expected that 70 percent of the cost implementation strategy for the National Climate Change Policy will be raised from donors. Locally, Uganda finances climate related activities through collaboration and engagement with traditional development partners such as the European Union. For instance, there have been seventeen major adaptation projects implemented in partnership with the government since 2001, at a value of approximately US$ 59 million. An example of such a CSA related project in Uganda is the €11 million Global Climate Change Alliance Project jointly funded by the Government of Belgium and the European Union and whose project components include improving water access for cattle, supporting climate focused farmer field schools for coffee farmers, and the promotion of sustainable commercial-scale tree plantations for the production of fuelwood and charcoal.

For mitigation, Uganda intends to meet its commitments partially through the use of international market mechanisms where appropriate, building upon the experience of the Clean

Financing opportunities for CSA in Uganda

ACP-EU African, Caribbean and Pacific-European Union Energy Facility **AFD** French Development Agency **AFD-WS** French Development Agency-Water and Sanitation **AusAID** Australian Agency for International Development **AXA IM** AXA Investment Managers - Real Assets **BioCF** Bio Carbon Fund of the World Bank **BMGF** Bill & Melinda Gates Foundation **CARE** Cooperative for Assistance and Relief Everywhere **CDB** China Development Bank **CDCF** Community Development Carbon Fund **CDM** Clean Development Mechanism **CF** The Clinton Foundation **CI** Conservation International **EA** Eco-fuel Africa **ENRTP** Environment and Sustainable Management of Natural Resources Thematic Programme **FAO** Food and Agriculture Organization of the United Nations **FCPF** Forest Carbon Partnership Facility **FIP** Forest Investment Program **FSF** Japan's Fast-Start Finance **GCCA** Global Climate Change Alliance **GCF** Gatsby Charitable Foundation **GEF** Global Environment Facility **GIZ** German Society for International Cooperation **IFAD** International Fund for Agricultural Development **IFC** International Finance Corporation **IKI** International Climate Initiative **JICA** Japan International Cooperation Agency **KfW** German Development Bank International Climate Initiative **MBBCG** Macquarie Bank Bio Carbon Group **McKnight-FPI** McKnight Foundation International Programme **MoAAIF** Ministry of Agriculture, Animal Industry and Fisheries **MoFPED** Ministry of Finance, Planning and Economic Development **MoGLSD** Ministry of Gender, Labour and Social Development **MoLG** Ministry of Local Government **MoH** Ministry of Health **MoLHUD** Ministry of Lands, Housing and Urban Development **MoTIC** Ministry of Trade, Industry and Cooperatives **MoWE** Ministry of Water and Environment **MoWT** Ministry of Works and Transport **NAADs** National Agricultural Advisory Services **NDF** Nordic Development Fund **NEMA** National Environment Management Authority **NFA** National Forestry Authority **NORAD** Norwegian Agency for Development and Cooperation **OPIC** Overseas Private Investment Corporation **OPM** Office of Prime Minister **PCF** Prototype Carbon Fund **PPCR** Pilot Program for Climate Resilience **REA** Rural Electrification Agency **RF** The Rockefeller Foundation **SIDA** Swedish International Development Cooperation Agency **SREP** Scaling Up Renewable Energy in Low Income Countries Program **TNC** The Nature Conservancy **UKICF** United Kingdom International Climate Fund **UNDP** United Nations Development Programme **UNEP** United Nations Environmental Programme **UNMA** Uganda National Meteorological Authority **UPI** Uganda Presidential Initiative **UN REDD** United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation **USAID-DGP** United States Agency for International Development – Development Grants Program **USAID-FF** United States Agency for International Development – Feed the Future **VCS** Verified Carbon Standard **VODP** Oil Development Project

Development Mechanism and other existing market mechanisms [44]. An example of a CDM project in Uganda is the Uganda Nile Basin Reforestation Project which is funded by partners such as The World Bank, The BioCarbon Fund, and various developing country governments. The project involved establishment of timber plantations and community forestry, and was expected to generate certified Emissions Reductions (CERs) and cumulatively capture emissions of 50,000 tCO2 a year. This project, launched in 2009, made Uganda the first country in Africa to undertake a reforestation project in the context of the Kyoto Protocol.

The NBSAPII, also highlights the need for generating climate finance through carbon credit programmes and projects related to land restoration and protection, but more needs to be said about the linkages of such projects with agriculture. Other potential opportunities for attracting CSA related finance include the existence of the National CSA Framework Programme whose vision is a "climate-resilient and low-carbon agricultural and food system contributing to increased food security, wealth creation and sustainable economic growth in line with the National Vision 2040"; as well the efforts made in 2015 to integrate climate-smart agriculture into the Agriculture Sector Development Strategy and Investment Plan (DSIP). These represent strategic opportunities for the Government of Uganda to allocate funds to climate-smart agriculture from within the national budget and use these as a catalyst of larger private and international agricultural climate change adaptation and mitigation related finance. Although the DSIP has now been replaced by the ASSP, the same considerations are likely to still hold. The screening of the DSIP indicated that it was most responsive to slow-onset climate change and thus greater effort could be made to ensure the inclusion of more activities and/or budget for activities aimed at responding to extreme events as well as contributing to climate change mitigation [47].

The graphic highlights existing and potential financing opportunities for CSA in Uganda. The methodology and a more detailed list of funds can be found in Annex 7.

Outlook

In Uganda, climate change impacts are expected to be felt greatly on the agriculture sector, which is a key sector of the economy as well as a key livelihood and employment source for the majority of the country's people. In line with this The Government of Uganda has developed various initiatives to address climate change in the agriculture including through mainstreaming of climate change into agricultural policies and programmes as well as in national development plans. More needs to be done to monitor the impact of such initiatives on the long term resilience and productivity of the agriculture sector as well as on its contribution to greenhouse gas emissions reductions.

CSA actions are context-specific and depend on local priorities. In Uganda, system-level CSA practices such as agroforestry, water harvesting, conservation agriculture or silvo-pastoralism have the potential to increase whole farm performance, while at the same time improving livelihoods and reducing greenhouse gas emissions. Integration of practices such as biogas into such systems can provide added benefits and advantages in terms of use of bio slurry as fertiliser, provision of household energy and reduction in methane emissions. In order to make informed CSA investment decisions, effective targeting and prioritization for these CSA practices needs to be undertaken, and implementation supported by robust agro-advisory services and a private sector that is aware of the costs and benefits of investment in identified priority areas. Although private sector is an important stakeholder for scaling up CSA, more needs to be done to involve private sector organisations in the design, implementation and support of CSA programmes particularly through micro insurance and microfinance as well development of CSA-related input and output markets.

The long term success of current efforts to promote CSA will largely depend on the availability and sustainability of financing. Numerous funding opportunities exist, however much of the funding has been for short periods (two to five years). Long term funding instruments are needed from national to local levels to allow participating farmers to grasp the concepts fully and realize the benefits of these interventions, thus catalyzing further uptake and investment by other farmers and stakeholders.

While efforts have been made to improve coordination of organizations working on agricultural climate change adaptation in the country, there is still need to strengthen the financial and operational capacity of institutions such as the Climate Change Department of MWE and the Climate-Smart Agriculture Task Force so they can perform their coordination function adequately. Improvement of institutional coordination is still needed for inter-ministerial and local governments, and to enhance partnerships with private sector, civil society organizations and development agencies.

Improving and gearing the national agricultural extension system and ensuring its staff have adequate capacity on issues of climate change and in particular climate-smart agriculture, will be a key action area. Along with this, ensuring adequate and timely access to weather and climate information for smallholder farmers will be crucial and this will also require good linkages between the Uganda National Meteorological Authority (UNMA) and various extension service providers (government, private and civil society).

Works cited

[1] FAO. 2010. "Climate-Smart" Agriculture. Policies, practices and financing for food security, adaptation and mitigation. Rome: Food and Agriculture Organization of the United Nations (FAO).

[2] FAO. 2013. Climate-smart agriculture sourcebook. Rome: FAO.

[3] FAOSTAT. 2016. Uganda. Available at: http://faostat3.fao.org/download/R/OE/E

[4] Zenere G. 2014. Agriculture in Kenya and Uganda: Relevance, Behavior, and Performance. Global Majority E-Journal 5(2): 104–116. Available at: http://bit.ly/2g7fwuc

[5] WB. 2016. World Development indicators. The World Bank. Available at: http://bit.ly/1ciVlx8

[6] IFPRI. 2012. Women's empowerment in agriculture index. International Food Policy Research Institute (IFPRI). Available at: http://bit.ly/NTkU1r

[7] FAO. 2012. FAOSTAT Database. Rome: Food and Agriculture Organization of the United Nations (FAO). Available at: www.faostat.org/

[8] UNDP. 2013. Human Development Reports. United Nations Development Programme (UNDP). Available at: http://bit.ly/1nwKJGt

[9] UBOS. 2010. Uganda Census of Agriculture, 2008/2009. Agricultural Household and Holding Characteristics Report, Vol. III. Republic of Uganda. Uganda Bureau of Statistics (UBOS). Available at: http://bit.ly/2g7fd2r

[10] WB. 2012. World Development Indicators. Washington, DC: The World Bank (WB). Available at: http://bit.ly/1aS5CmL

[11] MIT. 2015. The Observatory Economic Complexity indicators. Massachusetts Institute of Technology (MIT) Media Lab. Available at: http://atlas.media.mit.edu/en/

[12] MoFPED.2002. Uganda Poverty Reduction Strategy Paper Progress Report. Available at: https://goo.gl/XDD7mM

[13] MoFPED. 2014. The Poverty Status Report 2014. Ministry of Finance, Planning and Economic Development (MOFPED). Available at: http://bit.ly/2gaRiM2

[14] MAAIF; MWE. 2015. Uganda Climate-Smart Agriculture Country Program 2015-2025. Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). Ministry of Water and Environment (MWE). Uganda.

[15] UNICEF. 2012. Uganda fast facts.

[16] EIU. 2015. Global Food Security Index. The Economist Intelligence Unit (EIU). Available at: http://bit.ly/1U3NT2C

[17] ILO. 2013. ILOSTAT Database. International Labour Organization (ILO). Available at: www.ilo.org/ilostat

[18] NEMA. 2004. State of the Environment Report for Uganda 2004/05. Available at: www.nemaug.org/

[19] Vågen T-G; Winowiecki LA; Tondoh JE; Desta LT; Gumbricht T. 2016. Mapping of soil properties and land degradation risk in Africa using MODIS reflectance. Geoderma 263:216–225. DOI: 10.1016/j.geoderma.2015.06.023

[20] UBOS. 2012. Uganda National Household Survey 2009/2010. Uganda Bureau of Statistics. Available at: http:// bit.ly/2fc2Q0r

[21] MAAIF. 2010. Agriculture for Food and Income Security. Agriculture Sector Development Strategy and Investment Plan: 2010/11–2014/15. Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). Uganda.

[22] OECD. 2012. Organization for Economic Co-Operation and Development (OECD) Statistics Available at: https://stats.oecd.org/

[23] USDA. 2015. International Food Security Assessment: Past Progress and Prospects through 2025. United States Department of Agriculture (USDA). Available at: http://bit. ly/2g65RQR

[24] UBOS. 2014. Uganda National Household Survey 2012/2013. Kampala Uganda. Uganda Bureau of Statistics (UBOS). Available at: http://bit.ly/2fcbdsW

[25] IEA. 2010. Global Tracking Framework. International Energy Agency (IEA). Available at: http://bit.ly/1RA9dH2

[26] CIA. 2015. The World Factbook: Roadways. Available at: www.cia.gov

[27] **USAID. 2011.** Uganda Demographic and Health Survey: Addendum to Chapter 11, 1–9. Uganda Bureau of Statistics and ICF International Inc.

[28] WFP. 2013. 2012 Food Aid Flows. World Food Programme. Available at: http://bit.ly/2fQarmV

[29] MWE. 2015. Uganda's Intended Nationally Determined Contribution (INDC). Uganda. Ministry of Water and Environment (MOWA).

[30] WRI. 2016. CAIT Climate Data Explorer. World Resources Institute (WRI). Available at: http://cait.wri.org/

[31] WRI. 2012. CAIT Climate Data Explorer. World Resources Institute (WRI). Available at: http://cait.wri.org/

[32] Hundsbæk RP; Spichiger R; Alobo S; Kidoido M. 2012. Land Tenure and Economic Activities in Uganda: A Literature Review. Danish Institute for International Studies (DIIS). Working Paper 2012:13.

[33] UNFPA. 2009. The State of Uganda Population Report 2009. Addressing the Effects of Climate Change on Migration Patterns and Women. United Nations Population Fund. Available at: http://bit.ly/2g7d1bb

[34] UNDP; BCPR. 2013. Climate Risk Management for Sustainable Crop Production in Uganda: Rakai and Kapchorwa Districts. NY. United Nations Development Programme (UNDP), Bureau for Crisis Prevention and Recovery (BCPR). Available at: www.iisd.org/pdf/2013/crm_ uganda.pdf

[35] McSweeny C; New M; Lizcano G. 2010. UNDP Climate Change Country Profiles: Uganda. Available at: http://bit.ly/2fsJ3Lc

[36] Kamesse GN. 2015. Uganda rally to kick polluters out of climate talks. Uganda. Available at: http://bit.ly/2f0Q2yL

[37] **Republic of Uganda. 2007.** Climate Change: Uganda National Adaptation Programmes of Action. GEF, UNEP and Environmental Alert.

[38] NEMA. 2008. State of Environment Report for Uganda. National Environment Management Authority (NEMA).

[39] Kasimbazi E. 2013. Reality Check. Uganda's Economic Development. The Challenges and Opportunities of Climate Change. Konrad-Adenauer-Stiftung, Uganda Programme. Uganda. Available at: http://bit.ly/2gvVT02

[40] Collins M; Knutti R; Arblaster J; Dufresne JL; Fichefet T; Friedlingstein P; Gao X; Gutowski WJ; Johns T; Krinner G; Shongwe M; Tebaldi C; Weaver AJ; Wehner M. 2013. Long-term climate change: Projections, commitments and irreversibility. In: Climate change. The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Stocker TF; Qin D; Plattner GK; Tignor M; Allen SK; Boschung J; Nauels A; Xia Y; Bex V; Midgley PM. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. pp. 1029–1036. Available at: http://doi.org/10.1017/CBO9781107415324.024

[41] Ramírez-Villegas J; Jarvis A. 2008. High-resolution statistically downscaled future climate surfaces. International Center for Tropical Agriculture (CIAT); CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Cali, Colombia.

[42] Ramírez-Villegas J; Thornton PK 2015. Climate change impacts on African crop production. Working Paper No. 119. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Copenhagen, Denmark. Available at: http://hdl.handle.net/10568/66560

[43] NPA. 2013. Uganda Vision 2040. National Planning Authority (NPA). Available at: http://bit.ly/2fQbljt

[44] MWE. 2015. Ministry of Water and Environment Uganda's Intended Nationally Determined Contribution (INDC), https://goo.gl/hDd9ce

[45] Tumushabe, G., Muhumuza, T., Natamba, E., Bird, N., Tumushabe, G., Muhumuza, T. Jones, L. (2013). Uganda National Climate Change Finance Analysis, (September).: https://goo.gl/aX4MDc

[46] Agriculture Sector Strategic Plan (ASSP) 2015/16 to 2019/20 Draft MAAIF

[47] FAO. 2016. Eastern Africa Climate-Smart Agriculture Scoping Study: Ethiopia, Kenya and Uganda. Njeru, E., Grey, S. and Kilawe, E. Addis Ababa, Ethiopia http://www.fao.org/3/a-i5485e.pdf

For further information and online versions of the Annexes:

Annex 1: Uganda's agro-ecological zones
Annex 2: Selection of agriculture production systems key for food security in Uganda (methodology and results)
Annex 3: Methodology for assessing climate smartness of ongoing practices
Annex 4: Long list of CSA practices adopted in Uganda
Annex 5: Institutions for CSA in Uganda (methodology and results)
Annex 6: Policies for CSA in Uganda (methodology and results)
Annex 7: Assessing CSA finances

This publication is a product of the collaborative effort between the International Center for Tropical Agriculture (CIAT) – lead Center of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) – and the Bureau for Food Security, United States Agency for International Development (BFS/USAID) to identify country-specific baselines on CSA in Africa (Ethiopia, Ghana, Mali, Niger, Senegal and Uganda). The publication is based on the previous work commissioned and lead by the World Bank Group to identify country-specific baselines and entry points for scaling out CSA, through data analysis and series of dialogues with national stakeholders. The work complements the CSA Profiles series developed since 2014 by the World Bank, CIAT and CCAFS for countries in Latin America, Asia, Eastern and Central Europe, and Africa (https://ccafs.cgiar.org/publications/csa-country-profiles).

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Main author: Judith Asiimwe, David Amwonya, Laurence Jassogne, Alexander Elphinstone and Dennis Ochola

Editors: Andreea Nowak (CIAT), Sebastian Grey (CIAT) and Miguel Lizarazo (CIAT/CCAFS)

Original figures and graphics: Fernanda Rubiano (independent consultant)

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