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# UGANDA CLIMATE CHANGE VULNERABILITY ASSESSMENT *EXECUTIVE SUMMARY*

## BACKGROUND

During the coming decades Uganda's agricultural households will continue to face significant challenges, including a deteriorating natural resource base and eroding ecosystem services, and reduced access to land due to a rapidly rising population – in addition to the ongoing threats of conflict and economic crisis. While fully recognizing the importance of all of these factors, this assessment focuses on the additional pressure that Uganda's agricultural households will face as a result of current and potential future impacts of climate change.

The U.S. Agency for International Development (USAID)/African and Latin American Resilience to Climate Change (ARCC) Project conducted the Uganda Climate Change Vulnerability Assessment in 2012. Field research focused on Gulu, Lira, Luweero, Mbale, Isingiro, and Kasese – six USAID/Feed the Future priority districts that include important cropping systems, represent different agro-ecological zones, and are near weather stations that have collected consistent rainfall and temperature data.

The study employed a mixed-method approach that included historical climate analysis and projections; a value chain analysis of eight key crops and a phenological review (i.e., how climate change affects the growth cycle of each of those crops); a livelihood survey of 800 households; 80 focus group discussions; key informant interviews with representatives from district and national levels; and a desktop assessment of water use for agriculture.

This research and analysis show how current climate patterns shape—and how future climate patterns may influence—key crop value chains and the livelihoods of households that depend on them. Along with the results of this assessment, this report includes recommendations enriched by options generated by key stakeholders from government, donor agencies, research organizations, and civil society during a participatory multi-stakeholder options analysis meeting that took place in Uganda on January 31, 2013.

## KEY FINDINGS

**Climate:** Uganda lies within a relatively humid equatorial climate zone, and the topography, prevailing winds, and lakes and rivers cause large differences in rainfall patterns across the country. Changes in sea surface temperatures in the distant tropical Pacific, Indian and, to a lesser extent, Atlantic Oceans strongly influence annual rainfall amounts and timing. Key findings include the following:

#### Rainfall:

- Current and past trends indicate that the timing of rainfall can vary considerably; the onset of rainy seasons can shift by 15 to 30 days (earlier or later), while the length of the rainy season can change by 20 to 40 days from year to year.
- No significant change in average annual rainfall could be detected in the 60-year historical record.
- Similarly, no significant change in average annual rainfall is projected for the 2015-2045 period.
- The most consistent finding was the projection of an increase in rainfall in December, January, and February, which is typically a dry season in all locations. This increase could have strong impacts on agriculture, especially with respect to tree crops (e.g., coffee) and post-harvest activities such as drying and storage.
- There is a potential for an increase in the frequency of extreme events (e.g., heavy rainstorms, flooding, etc.)

#### Temperature:

- An analysis of average annual temperatures between 1951-1980 and 1981-2010, shows a notable increase of approximately 0.5-1.2 °C for minimum temperatures and 0.6-0.9 °C for maximum temperatures.
- This warming trend is projected to continue, with some models projecting an increase of more than 2 °C by 2030. It will likely have a strong impact on agriculture and livestock, increasing the risk of disease and pest infestations.

**Crop value chain analysis and phenological review:** The crops considered in this assessment are those most widely grown in Uganda, and many are vulnerable to the projected rising temperatures and increasing dry season rainfall. Of the crops analyzed in this assessment, Arabica coffee is the most vulnerable, while cassava is the least. Overall, from most to least sensitive crops, they are: Arabica Coffee, robusta coffee, rice, maize, East African Highland Banana (matooke), beans, sorghum, sweet potatoes, and cassava. Other key findings follow:

- **Coffee:** Rising temperatures and erratic rainfall increase the risk of disease and pest infestations in coffee.
- **Rice:** Two major rice diseases (blast and bacterial leaf blight) affect rice yields and are significantly aggravated by weather conditions such as higher temperatures, air humidity, or soil moisture.
- **Maize:** Aflatoxin contamination represents a serious threat to the marketing of maize and will likely worsen if dry season rainfall increases.
- **East African Highland Banana (matooke):** While matooke is less vulnerable to increasing temperatures than coffee is, the potential impact of pests and diseases on the crop is significant.
- **Beans:** Beans are vulnerable to fungal and viral diseases when excessive rain falls during critical growing periods.
- **Multiple Grains:** Erratic rain could increase post-harvest storage losses of crops typically dried in the sun (e.g., maize, beans, coffee, rice, etc.), due to increased pests and rotting.
- **Sorghum:** Coupled with irregular precipitation, increased temperatures could result in the proliferation of striga, a parasitic weed that affects sorghum and is prevalent in areas with degraded soils.
- **Sweet potatoes and cassava:** Both crops grow well at temperatures much higher than current ones, but are also vulnerable to pests and disease.

**Household Vulnerability:** None of the households studied have significant buffers against additional stress. Village focus group results indicate that they all face important challenges indirectly related to climate, such as declining soil fertility and increasing land pressure. Households reported, on average, being food insecure for almost three months in 2011. Specific attributes make some households more sensitive to climate variability and change. More vulnerable households are those with many of the following characteristics:

- Lower proportion of able-bodied (working) members;
- Less well educated;
- More likely to be headed by females;
- Less likely to sell a portion of their crops or livestock;
- Less access to loans;
- Participate less frequently in community groups such as producer associations, cultural or labor savings groups, and religious organizations; and
- Earn income less frequently from off-farm sources (and when they do, that income is less than the amount that more secure households earn).

The systemic vulnerability of households studied also stems from the fact that they depend heavily on crops whose value chains are sensitive to climate variability and change; any change in food production critically increases overall vulnerability. For example, maize is an essential part of the diet of the most vulnerable households, and they sell a small portion of their harvest; yet this small amount of maize they sell represents a significant source of cash for the household. Less vulnerable households plant maize more often, sell a greater portion of their harvest, and have other more important sources of income. Similarly, the most vulnerable households in coffee-growing districts sell coffee less often, but they rely more heavily on it for income.

**Adaptive Capacity:** The level of income diversity affects the ability of households to adapt to climate change. The assessment concludes that households with greater adaptive capacity manage more diverse agricultural portfolios; they plant more crops and invest in livestock. They also have a more varied mix of on-farm and off-farm income sources. Marked differences by districts significantly affect this diversity. Access to land plays a strong role in on-farm diversification; as a result, land pressure in more densely populated districts such as Mbale increases vulnerability. Proximity to urban centers also increases off-farm income and thus significantly reduces vulnerability to climate variability and change.

The assessment identified a wide range of measures that households employ to adapt to climate variability and change. They modify their management practices by shifting planting dates, preparing soil differently, or changing the mix of crops farmed on the same plot. Households also address risks by planting additional crops and crop varieties, and by investing in livestock or fruit trees. Additionally, households seek sources of income outside of agriculture, both through short-term ‘coping’ strategies, such as hiring themselves out as manual labor or by producing charcoal; and through longer-term strategies, such as migration and investments in the education of their children.

## CONCLUSIONS AND RECOMMENDATIONS

Adaptive strategies developed at national scales might not be locally appropriate, particularly when climate impacts and adaptation responses are local (i.e., influenced by ecosystems and social and cultural relations unique to the area). National programs that are not complemented by locally relevant and tested adaptive strategies are unlikely to produce useful strategies for most farming communities. On the other hand, this assessment reiterates that while adaptation occurs farm by farm, the identification and dissemination of adaptation options—and enabling of their adoption—requires a national effort. Similarly, with regard to time horizons, although some adaptations and adaptation policies are short

term and require more immediate action, other policies and practices will yield adaptive benefits over the long run. These geographic and time-scale considerations led the assessment team to identify specific recommendations summarized below according to activity focus: a) establishing the national context for adaptive agriculture; b) expanding research and learning across stakeholder groups; and c) strengthening and diversifying livelihoods. Please see the full report for a detailed list of recommendations.

## **NATIONAL CONTEXT FOR ADAPTIVE AGRICULTURE**

This set of recommendations refers to establishing policies and investment strategies that address large-scale, long-term threats to value chains, livelihoods, and agricultural institutions. It includes recommendations that facilitate local adaptation over shorter time periods, with an emphasis on improving the content and pathways for communicating information between researchers, scientists, and farmers. Primary recommendations follow:

1. **Build the capacity of the Uganda Department of Meteorology (DOM); Climate Change Unit (CCU); and Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF) to improve the production, distribution, and use of climate information that responds to the needs of decision makers, as well as those of farmers and other stakeholders.**
  - Provide necessary technical and financial support to the DOM and CCU for the development of the national climate datasets and information.
  - Build capacity of Ugandan institutions to develop and routinely use downscaled climate projections.
  - Develop a platform/mechanism for results (current trends and projections) to be shared at regional, national, district, and local levels.
2. **Assist the Government of Uganda to organize and develop a high-level, multi-sectoral body to support the CCU to strengthen the climate change agenda and guide policy development.**
  - Create a multi-sectoral coordinating committee, led by the CCU, to regularly meet and plan cross-sector coordination and strategic investment regarding long-term climate change impacts.
  - Mainstream a climate change perspective into the programming of agricultural and natural resource management services.

## **RESEARCH AND OUTREACH AT THE NATIONAL, DISTRICT, AND COMMUNITY LEVELS**

This set of recommendations refers to how knowledge and information related to climate change adaptation is generated and shared. Consistent with the framework, recommendations encourage the decentralization and democratization of innovation and planning, while also improving the exchange of information among all actors concerned with adaptation, and quickening the pace at which they learn from each other:

1. **Develop a wide range of high-yielding and climate appropriate crop varieties, farm management strategies (focused on diversification and intensification of farming), and post-harvest storage strategies from which farmers can choose.** Ideally, multi-stakeholder dialogues and platforms, similar to the one recommended above, shape the evolution of the choices generated with and for farmers. Adaptive choices should meet the locally specific challenges of the following items:

- A gradual increase in temperature is the top priority given the certainty of the outcome and its likely impact on key crops. Therefore, we recommend:
    - investment in varieties of maize and beans that resist rising temperatures (and continue to meet local preferences);
    - investment in shading and other temperature-reducing management techniques, a top priority for coffee and matooke; and
    - improvements in soil moisture management to offset expected increases in evapotranspiration.
  - Changing rainfall patterns and intensities affect soil moisture, crop growth at different stages, post-harvest storage conditions, and especially increases in “dry season” rainfall. Therefore, we recommend:
    - development and promotion of pest-/disease-resistant varieties in all districts, with an emphasis on pests and diseases that thrive in moist environments;
    - promotion of improved soil management (moisture and fertility) techniques;
    - prevention of disease and pests associated with increasing temperatures and variable rainfall by maintaining reserves of protected or treated seeds and plants that are disease- and pest-free at district research centers, which improves recovery after disease outbreaks and protects planting material for the next season; and
    - development of management strategies that reduce pest and disease risk (i.e., improve storage facilities).
  - Many agro-ecosystem services, such as the provision of clean water, creation of fertile soil, and maintenance of micro-climates/habitats, are deteriorating. Therefore, we recommend:
    - a clearer definition of challenges and needs in each district based on local conditions in order to develop appropriate research agendas, and
    - promotion of synergy between formal agricultural research with farmer-led innovation.
2. **Strengthen the capacity of farmer groups to experiment with new ideas and to adapt them to local environmental and social conditions.** Promote active participation and leadership by women and men, old and young, and poor and “better-off” to assure the best mix of adaptive innovations. Pilot programs for farmer experimentation and innovation can be undertaken where local social capital is strong but overall vulnerability is high. These programs can provide lessons for setting up innovation systems elsewhere.
  3. **Strengthen the capacity of farmer organizations to link laterally (amongst themselves) and vertically (with other research institutions at district and national levels)** to scale up the dissemination of successful innovations and adaptations.

## LIVELIHOOD STRENGTHENING AND DIVERSIFICATION

This set of recommendations addresses the need to develop and diversify livelihood assets as a strategy for reducing household sensitivity to crop-related stresses. The goal is to build on existing livelihoods strengthening programs and improve the capacity of farmers to strengthen and diversify their livelihoods. Primary recommendations for strengthening livelihoods and diversification follow:

1. **Provide opportunities to spread financial risk in agriculture to allow for greater innovation and adaptation.** This includes financial instruments, such as strengthening loan and insurance programs, and strengthening farmer organizations and their links to markets.

2. **Strengthen assets to encourage innovation, diversify livelihoods, and improve adaptive capacity.** Assets are a key variable that distinguishes most vulnerable from least vulnerable households. Investing in asset growth for the most at-risk will greatly reduce their vulnerability. Some of the most important assets noted in the vulnerability assessment follow:
  - *Financial assets.* Expand savings and loan programs, micro-grants for tree planting, or livestock purchasing programs.
  - *Human capital.* Expand training and technical backstopping to encourage local investments in agricultural processing and marketing, particularly in areas where human capital is weak and where off-farm opportunities are weak.
  - *Social capital.* Promote and strengthen community-based organizations—farmers’ associations and self-help and watershed management groups—and contract farming with preferred consumers in areas where social capital may be significant, but where links to climate change-related issues are weak.
3. For Government of Uganda ministries (Finance, Planning and Economic Development, Trade, Industry & Cooperatives, Local Government, and Education), nongovernmental organizations, community-based organizations, and the private sector, to **invest in less climate-dependent livelihoods.** Investments should target locations where agriculture-based livelihoods are under the most pressure from climate change and other environmental and social developments. Target areas should also consider, however, whether or not non-agricultural livelihoods are promising. Specific recommendations follow:
  - Promote agricultural processing.
  - Develop apprenticeship programs for youth.
  - Support functional numeracy and literacy training along with basic business skills training where there are opportunities for commercial activities.
  - Support programs that improve school assistance and retention rates, particularly for girls.

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