

# Impacts of diverting water by hand-dug channels in the Nile watershed on agriculture and food security in the Kamuli District of Uganda

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## Introduction

- The Nile River is a critical resource used by subsistence farmers in the Kamuli District of Uganda to enhance local food security.
- Farmers create hand-dug channels (Fig. 1), diverting water from the river to their farms for crop irrigation during the dry season.
- In the dry season channels are vital for irrigation because it provides necessary water to grow crops; however, during the rainy season channels over-flood, flowing into neighboring farm-lands.
- Common crops like rice, maize, potatoes and beans are destroyed from irrigation channels flooding, reducing yields and income and threatening local food security.



Figure 1: Irrigation Channels

### Key questions:

- How do irrigation channels and economic status impact agriculture practices in the Kamuli district?
- Are rural farmers aware of water diversion impacts?
- What are their flooding mitigation strategies?

## Methods

**Location of Study:** This study was conducted in 21 rural villages in the Kamuli District of Uganda (Fig. 2). The District of Kamuli is a warm tropical climate with two rainy and dry seasons, which are significant drivers of the flooding and draining cycle. Farmers included in the survey were close enough to the Nile River to use irrigation channels on their farms should they choose.

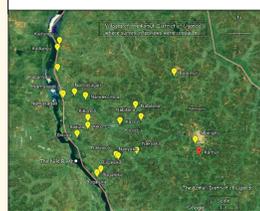
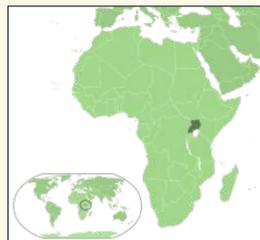


Figure 2: Upper, map of Africa with Uganda highlighted; Lower, map of villages in the Kamuli District of Uganda where farmers were interviewed.

**Survey Design:** I developed a series of three, open-ended surveys to investigate farmer awareness of water diversion, mitigation strategies to reduce flooding, and annual production and earnings from cash crops. I conducted surveys during summer 2018. Surveys were evaluated using descriptive methods (i.e., counts) to identify general trends.

## Results and Discussion

I surveyed 41 farmers in the Kamuli District. General trends from the surveys revealed that farmers are aware that water diversion for irrigation during the dry season results in flooding during the wet season (Figs. 3 & 4, Table 1). Their mitigation strategies are simple: create more drainage channels, which facilitates more flooding potential in neighboring fields and in subsequent seasons (Table 1, Fig. 5). This cycle reduces crop yields and income, impacting local food security (Table 2, Fig. 6). Results also suggest that flooding conditions threaten farmer livelihoods by flowing over and eroding roads, creating impassable conditions for market access and traders called, middle men, who trade directly on a farmer's land (Table 2, Fig. 7). Many farmers surveyed use slash and burn practices to clear natural vegetation, which may increase the area for flooding by decreasing available biomass that catches excess water (Table 1).



Figure 3: Over-flooded irrigation channel



Figure 4: Flooded bean field

Table 1: Survey results of farmer awareness of water diversion

| General Trend   | Number of Farmers |
|---|-------------------|
| Had irrigation channels on their land   | 41                |
| Were aware of water source being the Nile River   | 16                |
| Were aware of water's destination from irrigation channels  | 30                |
| Were aware of irrigation channels flooding into neighboring farm-lands during the rainy season      | 30                |
| Located in lowest elevation points who experienced more extreme flooding                            | 11                |
| Knew water from irrigation channels evaporates or infiltrates into the ground during the dry season | 30                |
| Used slash and burn practices of natural vegetation   | 39                |
| Created more water channels to drain excess water   | 41                |

Table 2: Survey Results of flooding impacts on agriculture and food security

| General Trend  | Number of Farmers |
|--|-------------------|
| Crops were flooded from irrigation channels during the rainy season                        | 41                |
| Had lower yields than previous seasons due to flooding of irrigation channels              | 39                |
| Had reduced access to markets because of decreased yields                                  | 30                |
| Didn't have access to traders because of flooding conditions on roads                      | 11                |
| Food security was decreased due to flooding from irrigation channels                       | 41                |
| Received a yearly income of about 100,000-500,000 Ugandan Shillings (\$33.33-\$166.67 USD) | 20                |
| Received a yearly income of about 1-2 million Ugandan Shillings (\$333.33-\$666.67 USD)    | 12                |
| Unsure of yearly income received due to lack of financial records                          | 9                 |



Figure 5. Iowa State University—Uganda Program Staff member, Martin Lukwata, standing next to one irrigation channel to reflect average channel sizes. This picture was from the village, and is owned by a very wealthy farmer who grows rice and sugarcane mainly. This farmer owns more than 40 acres of land, with channels interconnected all through out. Results from this specific survey showed large scale flooding of smaller, neighboring farmlands.



Figure 6. This picture is from the village, Bwiiza, which is believed to be the lowest elevation in the Nile watershed within the Kamuli District of Uganda. Farmers in Bwiiza reported "crops being so flooded they could not drain the land to save them," and that the "water floods too much and drowns all of the crops." When asked about their perception of the source of the flooding one farmer responded with: "It comes from other fields when the rain is too much."



Figure 7. An example of an impassable road due to excess flooding from irrigation channels during the rainy season. A farmer that relied on "Middle Men" [traders] to purchase crops directly from his farm reported that, "sometimes the roads are so full of water not even a boda-boda [Ugandan motorcycle] can pass." Another farmer attested that when road conditions are too muddy from the floods, "our chances to make it to the market and sell our crops are ruined, and we have long periods of no income or food, because our crops were destroyed from water."

## Conclusions and Future Research

- Rural farmers in the Kamuli District of Uganda impact local food security by creating irrigation channels to ensure water is available for crops during the dry season. These same farmers exacerbate an unsustainable flooding and draining cycle, that negatively impacts crop production, livelihoods, and food security in the wet season.
- Working with farmers to identify suitable solutions to overcome this challenge could enhance food security and livelihoods in Kamuli. Exploring opportunities with local farmers to strategically place native vegetation and to moderate irrigation may be important. More research about specific interventions, such as planting Napier grass along channel edges and increasing plant biomass, are valuable next steps in this research.