KAZAVA

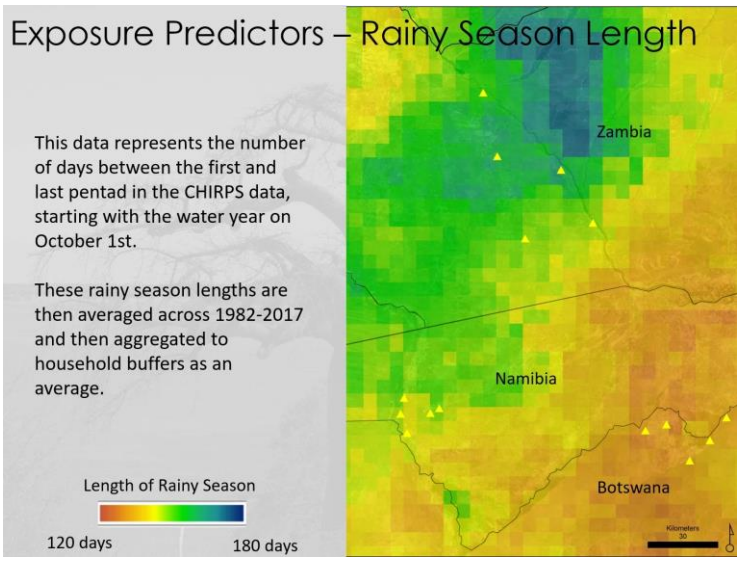
Kavango-Zambezi Vulnerability and Adaptation

Project Overview

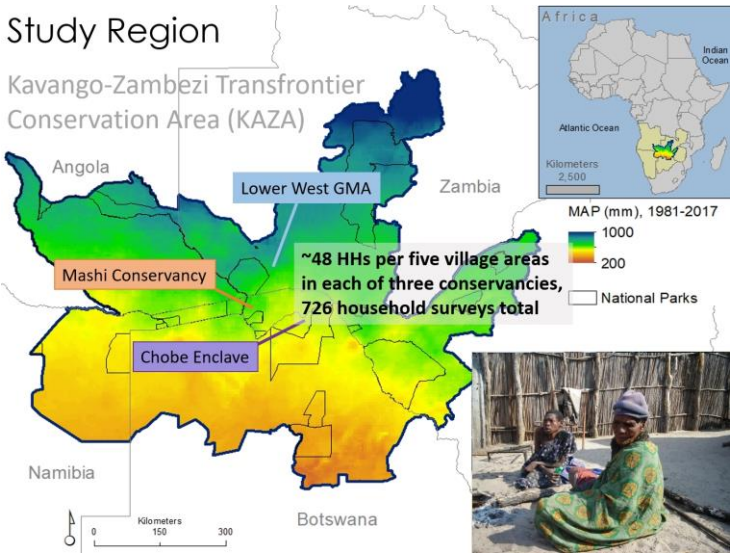
KAZAVA is an interdisciplinary research program studying interactions among communities and their households, land use, and climate in the Kavango-Zambezi Transfrontier Area (KAZA) of Southern Africa. We study the outcomes of these interactions in order to suggest pathways for more adaptive and less vulnerable livelihoods. Our work aims to facilitate a broader understanding of how livelihoods, land use and its history, and the environment are changing in this region. Our team collaborates with partner organizations and has members from the U.S., Botswana, Zambia, and Namibia.

In 2017, team members visited Chobe Enclave, Botswana and Mashi Conservancy, Namibia. In 2018, team members visited the Lower West Zambezi Game Management Area (LWZ-GMA), Zambia. With local partners, field assistants, and enumerators, we began to build a network of collaboration and communication to identify how objectives for KAZAVA could complement ongoing efforts in the region, and conducted field work to supplement research being conducted using remote sensing and modeling.

The main goal of the KAZAVA work is to determine leverage points that might mitigate how land-use decisions and land-cover change affect vulnerability in the face of uncertainty. Once discovered, these leverage points should be linked to policy such that decision-makers can implement targeted and efficient programs to better support households experiencing environmental changes. The following sections provide an overview of the goals of the project and the data collection to support it.



Rainy season length greatly determines crop choice, vegetation conditions, and food security baselines between countries.



KAZAVA has three study areas spread across a gradient of mean annual precipitation (MAP), LWZ-GMA, Zambia, Mashi Conservancy, Namibia, and the Chobe Enclave communities, Botswana. A total of 726 household surveys were completed in June and July, 2017-2018, and supplemented with remotely sensed data.

Vulnerability and Adaptation – *A Conceptual Framework*

One of the key features of the project is a primary focus on "operationalizing" a study of household vulnerability with respect to food security. As researchers we have identified key physical gradients that affect growing seasons, such as mean annual precipitation and average rainy season lengths (see Figures). However, vegetation conditions, household members and their education, access to natural resources, and more all interact to affect households and their access to food.

Across this region we identified multiple characteristics that fit into a livelihoods-oriented conceptual framework that describes household vulnerability to food security. This framework considers three key components of households that interact to define *Vulnerability:* 1) *Exposure* to some environmental and natural variability through a household's land uses; 2) *Sensitivity* to that land use exposure based on the degree to which a household depends on and benefits from those land uses; and 3) *Adaptive Capacity*, or the other components of households that provide opportunities to mediate vulnerability through non-land-use oriented activities (e.g. tourism, remittances, businesses, etc.).

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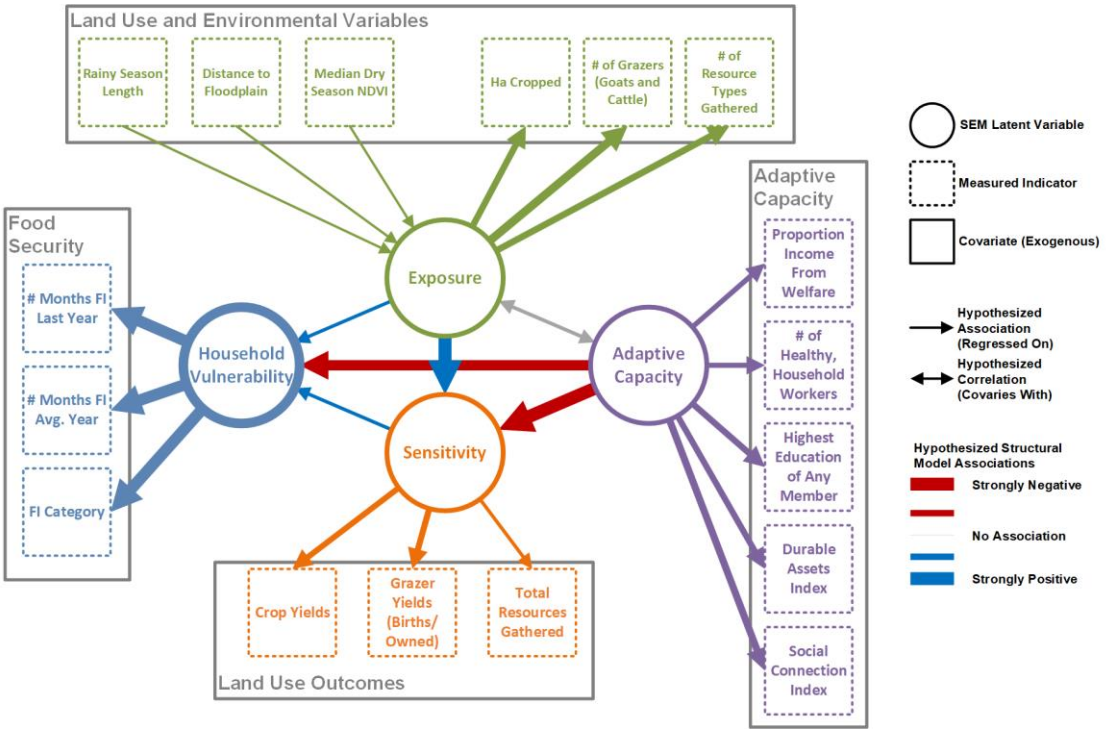
KAZAVA Vulnerability and Adaptation Framework. The model to the right represents the initial framework around which data were collected from household surveys and remotely sensed data. The relationships between *Exposure*, *Sensitivity*, *Adaptive Capacity*, and *Household Vulnerability* as it relates to food security are measured by specific items from the surveys and biophysical or remotely sensed data. We consider that these terms are quite general and are difficult to measure directly, yet are highly predictive of the items in the boxes that we do measure. The arrows are testable hypotheses.



Household Surveys – *Lower West Zambezi GMA*

Household surveys were conducted in five communities in each country. These surveys were designed to measure household livelihoods (economic, human, natural, physical, and social capitals) and vulnerability to food security. Surveys were part of an integrated framework to understand and quantify various aspects of land uses, the resulting impacts on households with respect to food security, and subsequent household responses. The sample design and survey protocols included the following:

- Selection of the five communities within each study area
- Random sampling of approximately 50 households in each
- Implementation of surveys by six or more trained enumerators hired from the communities, but who only worked in communities they did not reside within

Identifying and Mapping *Resource Gathering Areas*

Surveys recorded common place names for all areas where respondents and their household members gathered resources, such fuelwood, thatching grass, and fish. Upon the completion of the household surveys, we compiled the the place names to create five lists of all resource areas reported by respondents from each village area. We consulted with an Area Induna or knowledgeable area resident to confirm that no important resource areas had been omitted from these lists.

Biophysical Reference Sample Protocol

On-going analyses with the household data will be combined with remotely-sensed, land cover analyses for the study areas. To calibrate these remotely-sensed data sets and accurately interpret the images, we collected reference samples of various land cover types throughout the study areas. To do this, we traveled to areas with a variety of vegetation types and levels of human impacts and recorded details about the land cover in these locations, in addition to flying unmanned, aerial surveys where local and governmental permissions were received.

Modeling and Leverage Points

Field data collection in Zambia, Namibia, and Botswana is now complete, but there is work remaining. The household data will be integrated with the biophysical data from the other country sites. We are now fitting the model using statistical techniques. These models will identify the strength of the interactions (arrows) and allow us to report back to stakeholders throughout the regions on which aspects of households most strongly impact food security, and how future changes might impact it. Following the completion of data analyses we will communicate these insights to our government and development partners in technical reports, and to our study communities in further short research briefs.

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