Indaba Agricultural Policy Research Institute
POLICY BRIEF
Number 68 Lusaka, Zambia December, 2014
(Downloadable at http://www.iapri.org.zm

Climate Trends and Farmers' Perceptions of Climate Change in Zambia

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Key Points/Summary

- Despite some overlap between farmers' observations and climate patterns found in the meteorological records, the meteorological data do not support the perception that is an increase in intra-season variability in rainfall. Therefore, a complete picture of climate change requires contributions from multiple knowledge systems.

- To address climate variability, farmers in different regions employ different strategies. For example in at least two locations, conservation agriculture seems to be a widely recognized *toolbox* of potential responses to climate change. This underscores the need for region-specific policy responses to facilitate climate change adaptation in Zambia.

- Farmers find it difficult to isolate the effects of climate change from other environmental stressors such as declining soil fertility, for which climate change is not the primary cause. Hence, development efforts must address climate change without losing sight of these other sources of tension in the smallholder production system.

INTRODUCTION: In Zambia, as in many developing countries, the agricultural sector is highly dependent on rain-fed production and therefore vulnerable to weather shocks. Maize is the primary staple crop in Zambia, and is widely grown by smallholder farmers throughout the country, with a dual cassava-maize regimen found only in the northern region. Among the smallholder farmers, almost all production is rain-fed with very few farmers using mechanized irrigation (Chabala, Kuntashula, and Kaluba. 2012). Climate change, therefore, has the potential to significantly reduce agricultural production and exacerbate poverty and food insecurity. There is a growing literature on climate change impacts on smallholder agriculture in Zambia, with most studies incorporating very limited qualitative analysis (e.g. Jain 2006; Muchinda 2001). Yet, qualitative research is important as it helps illuminate how changes are perceived at the local level. This is crucial to anticipating the impacts of climate variability/ change and likely responses, as only farmers who perceive a problem will implement strategies to adapt to it.

This study makes several contributions to the existing literature on how best to interrogate climate trends, impacts, and adaptation strategies amongst smallholder farmers in Zambia by addressing the following objectives: (1) to compare evidence in meteorological records with farmers' observations regarding climate variability and change; and (2) to document the perceived impacts of climate change on agricultural households in Zambia, and the main adaptation strategies employed. Ultimately, this paper intends to offer guidance for an improved policy and research agenda related to climate change in Zambia.

DATA AND METHODS: This study was conducted in three provinces (Eastern, Northern, and Southern), each representing an Agro-Ecological Region (AER). With guidance from Zambia Agricultural Research

Institute, two districts from each province were selected, with consideration that the selected districts are a good representation of each AER. The study incorporates information from two sources: Firstly, in late 2011 and early 2012, we convened a series of focus groups to elicit farmers' perceptions of climate change and experiences with adaptation in the six selected districts. Two districts from each province representing an agro-ecological region were selected.[1]. Secondly, we select one meteorological station from each location and analyze the historical records of rainfall and average maximum (daytime) and minimum (nighttime) temperature. These dekad-level (10 day) data, collected by the Zambia Meteorological Department cover a period from 1950-2011.

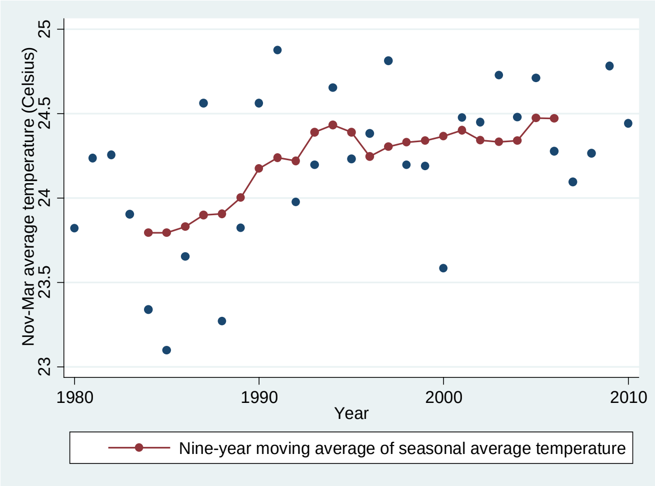
We use econometric methods[2] to detect changes in climate over time, as well as validate the results. Further, we analyzed the information from the focus group discussions in order to assess farmers' perceptions of climate change, and the various adaptation strategies they employ to mitigate its impact on agricultural production.

RESULTS AND DISCUSSION:

Comparison of Farmers' Observations and Historical Meteorological Trends: Generally, we find more consistency among observations related to temperature, with statistical evidence corroborating accounts of rising temperatures in all sites and more frequent extremes in Eastern Province (figure 1).

With regards to temperature, there is clear overlap between farmers' observations and patterns found in the meteorological records.

Figure 1. Chipata Average Temperature - 1980-2010[3]



Source: Zambia Meteorological Department

However, the meteorological data do not support the perception that the rainy season used to begin earlier, and with the 10 day rainfall records used in this analysis, we generally do not detect an increase in intra-season variability in rainfall. There are several reasons that explain the observed discrepancies. We offer a few plausible explanations below

(1) Farmers are not able to accurately track probabilistic changes in climate. It is possible that farmers perceive a trend when there is none, or vice versa. According to Weber (2010), "Climate change, as a slow and gradual modification of average climate conditions, is a difficult phenomenon to detect and track accurately based on personal experience." This is because memory can be faulty, with unique events attributed to climate change while incremental change goes unnoticed. Farmers are more likely to recall recent years of unusual rainfall, as well as classic droughts, rather than the rainfall events in intermediate years. It is likely that farmers recall several recent seasons of unusually extreme events such that their perception of long-term climate events is obscured.

(2) Members of the focus groups feel compelled to offer a story in line with a dominant narrative of climate change. Perceptions of climate change may also be

[1] The following districts were selected: Sinazongwe and Siavonga representing region 1; Chipata and Petauke representing region 2; and Mpulungu and Mungwi representing region 3

[2] Readers interested in the methods are referred to the full working paper available at: http://www.iapri.org.zm/index.php/working-papers/doc_view/429-climate-trends-and-farmer-

[3] Full results are presented in the working paper.

influenced by dominant narratives, as expectations of change or stability can color one's capacity to detect probabilistic changes (Weber 2010). Particularly in group interviews, a narrative of declining rainfall or an increasingly shorter rainy season may be a well-established narrative from both local and international sources (Mertz et al. 2009). For this reason, members of the group may feel obliged to relate a story of change, even if they have not perceived any change in climate.

(3) Farmers' accounts and meteorological data refer to different climate-related phenomena; hence, both farmers' recollections and the meteorological records are correct. For example, similar to this study, Marin (2010) finds disparities between Mongolian herders and the statistical trends detected in meteorological records. In Zambia, it seems reasonable that farmers are focused on the concept of *agricultural drought* and not *meteorological drought*. Thus, rising temperatures in the month of October may result in reduced soil moisture during planting, even without a decrease in October rainfall. It may be this change that farmers interpret as a decrease in October rainfall.

Perceived Impacts and Adaptation Strategies: Farmers attributed yield increases to better information on management practices, improved seeds, access to fertilizer, and conservation agriculture practices (e.g., planting basins and ripping). At the same time, they attribute declining yields to changes in rainfall patterns, along with more frequent pest problems and soil degradation. Thus, farmers that use fertilizer may have seen an increase in maize yields while a neighbor without fertilizer experienced a decline. By extension, this implies that farmers perceive technological advances and improved crop management as ways to mitigate the negative effects of climate change. Although not solely due to climate change, soil degradation stands out as a consistent problem across all locations.

In response, farmers have adopted a range of behaviors to actively mitigate the perceived impacts of climate change (Table 1). For example, all groups listed the use of early-maturing varieties as a response to climate change. In Northern Province, farmers have begun to plant maize in stages as a way of spreading the risk of losing an entire harvest due to unpredictable rainfall.

Table 1. Climate Change Adaptation Strategies

Adaptation measure	Rationale given
Plant early-maturing crop varieties	These require a shorter rainy season
Plant open-pollinating crop varieties	Tend to be drought resistant
Plant in stages	Reduce the risk of loss due to unpredictable rainy season onset
Conservation agriculture	Crops more readily survive dry spells and droughts
Planting basins and ripping	
Mixed cropping	Spread the risk of crop failure
Diversify into gardening	Gardens can be irrigated more easily than field crops
Diversify into livestock	Less dependent on rainfall
Diversify into fish farming or fishing	Less dependent on rainfall
Diversify income sources (sell second-hand clothes or charcoal)	Less dependent on rainfall

Source: Authors' summary.

Farmers in Southern/Lusaka and Eastern Provinces also cite conservation agriculture practices, such as planting basins and ripping, as response strategies. These tillage methods involve minimal soil disturbance, and because land preparation can be completed during the dry season, planting can take place at the very beginning of the rainy season.

CONCLUSION AND POLICY IMPLICATIONS: Generally, farmers offer remarkably consistent reports of a rainy season that is growing shorter and less predictable. In all sites, some farmers have observed rising temperatures. To address climate variability, farmers adopt new seed varieties, management practices, and livelihood portfolios, and in at least two locations, conservation agriculture seems to be a widely recognized *toolbox* of potential responses to climate change. Given the wide range of adaptation strategies employed by farmers, region-specific policy responses to facilitate climate change adaptation in Zambia is key. Such decisions range from what currently available seed varieties should be promoted or made available in different regions, to how agricultural research institutions in Zambia should prioritize the development of seed varieties with specific characteristics (e.g., drought- versus heat-tolerance).

Farmers find it difficult to isolate the effects of climate change from other environmental stressors, such as declining soil fertility, for which climate change is not the primary cause. The policy implication seems to be that development efforts must address climate change without losing sight of these other sources of tension in the smallholder production system.

The comparison of qualitative and quantitative narratives of climate change suggests that the study of climate change should not be left to expert judgment or scientific observation only. Rather, local systems of knowledge contribute different parameters that cannot be tracked by measuring only rainfall or temperature, and offer a more contextual interpretation of these climate parameters.

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ACKNOWLEDGEMENTS

The Indaba Agricultural Policy Research Institute (IAPRI) is a non-profit company limited by guarantee and collaboratively works with public and private stakeholders. IAPRI exists to carry out agricultural policy research and outreach, serving the agricultural sector in Zambia so as to contribute to sustainable pro-poor agricultural development. Financial and substantive support of the Swedish International Development Agency (SIDA) and the United States Agency for International Development (USAID) in Lusaka are greatly appreciated. Technical and capacity building support from Michigan State University and its researchers is also acknowledged.