changing farming for
a changing climate

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INFORMATION BRIEF:

Agricultural Drought and Climate Smart Agriculture

This information brief highlights key findings in the Vuna report "Agricultural Drought and Climate Smart Agriculture" by Sue Walker (October 2016).
Online: http://www.vuna-africa.com

Key points

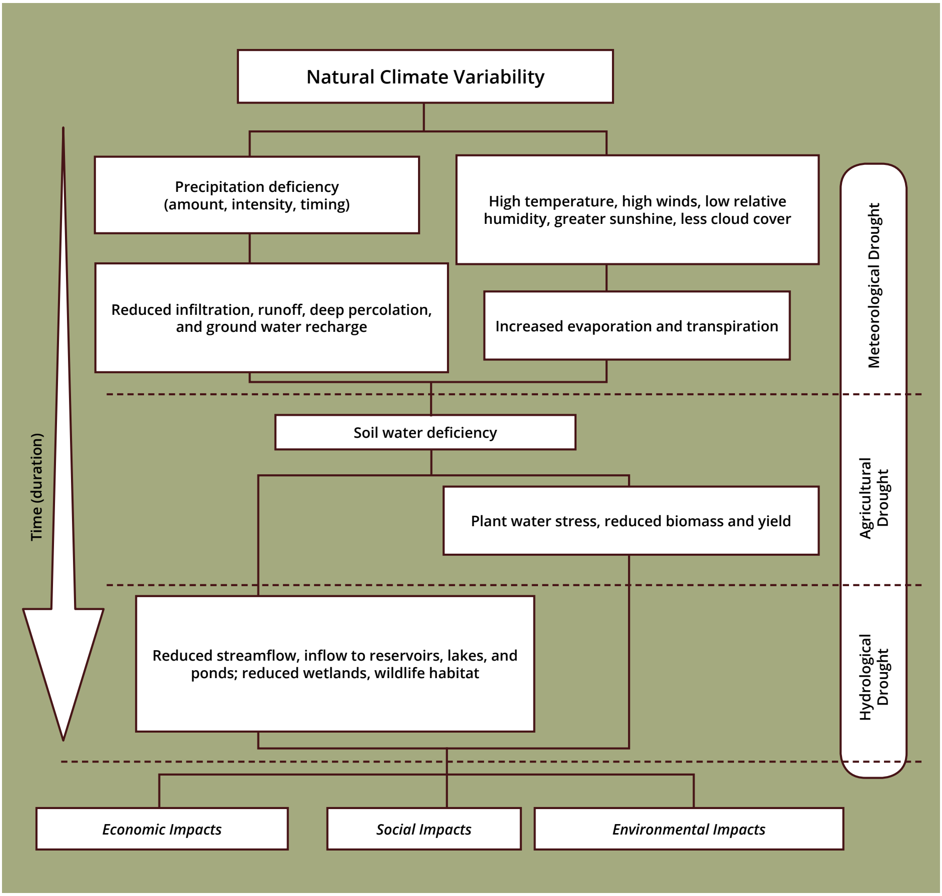
- Drought is the single greatest climate risk faced by most farmers in Eastern and Southern Africa.
- In discussions of climate risk, it is crucial to distinguish between meteorological drought (lower-than-average annual or seasonal rainfall) and agricultural drought (insufficient water at critical stages of crop growth).
- Global climate change models do a poor job predicting either type of drought (or flooding), and there appears to be little relationship between drought and rising levels of greenhouse gases.
- Drought and flooding are more closely correlated with El Niño-Southern Oscillation (ENSO) events, which appear to predate global warming.
- Investment is needed to better understand and predict the likelihood of agricultural drought and to help farmers respond to it.

Introduction: What is drought?

In terms of the frequency of the problem and the number of people affected, drought is the most common cause of crop yield loss in Eastern and Southern Africa. Yet it is still poorly understood and difficult to predict.

A better understanding of drought—including its relation to greenhouse gases, climate change, and El Niño cycles—can improve the prioritisation of interventions for climate smart agriculture among smallholder farmers in Eastern and Southern Africa (ESA).

First, it is essential to understand the difference between various types of drought. The most common measure discussed in climate change literature is *meteorological drought.* This is a measure of a shortage of rainfall relative to the annual or seasonal average at a specific location. This measure fails to account for intra-seasonal shortfalls. If the rain falls at the wrong time during the season, crops may suffer from lack of water even if there is no meteorological drought. This commonly happens in many parts of ESA when rains start late or end early, or when farmers encounter a long midseason dry spell. *Hydrological drought*, which measures the availability of water in a catchment or watershed, similarly tracks the level of annual or seasonal water availability rather than the timing of rainfall.



Source: National Drought Mitigation Center, 2016

Figure 1: Comparison of types of drought and duration with resultant impacts

By contrast, *agricultural drought* considers the availability of water at critical stages of crop growth, especially germination, flowering, and grain fill. The timing of rainfall within the cropping season is particularly important, but agricultural drought also depends on the type of crop grown, soil characteristics, and crop management practices.

ENSO and climate change

The impacts of greenhouse gases on climate change are most commonly assessed with general circulation models (GCMs), which make projections of future climates under different scenarios of future greenhouse gas emissions.

According to the Intergovernmental Panel on Climate Change (IPCC), GCMs unambiguously predict rising temperatures across Africa. This has implications for agricultural drought. Higher temperatures increase evaporation of water from soil as well as the evapotranspiration rate from plants, leaving less water available for crop growth.

> **Efforts are improving in ESA to disseminate high-quality seasonal rainfall outlook forecasts, but farmers need help in understanding how to use this information.**

GCMs are much less certain in predicting the effects of greenhouse gases on rainfall (IPCC 2014b). ENSO offers a much better predictor of seasonal rainfall, particularly in Southern Africa. Under El Niño conditions—which involve higher sea surface temperatures (SST) in the equatorial zone of the central and eastern Pacific Ocean and a negative Southern Oscillation Index (SOI)—much of Southern Africa tends to experience a later start to the rains, longer midseason dry spells, and fewer rainy days, all of which contribute to higher levels of agricultural drought. La Niña conditions generally produce higher seasonal rainfall.

Current GCMs do not represent SST variability well enough to accurately project El Niño or La Niña events. However, seasonal predictions of agricultural drought are improving with better understanding of ENSO dynamics and improvements in short-term weather forecasting.

Coping with agricultural drought

There are many good options for adapting farming practices to cope with the risks of agricultural drought.

Lower amounts of rainfall can be addressed by making the most of the water that does fall by using mulch, intercropping or low-tillage systems to limit evaporation from soil, removing weeds that can compete for water, using rainwater-harvesting technology, or choosing different crops or cultivars that require less water. Farmers can adapt **to shorter rainy seasons** by selecting earlier-maturing crops and varieties that yield a harvest within the confines of the shorter season. Farmers can offset the risks of **prolonged midseason dry spells** by planting multiple fields at intervals after the start of rains, thus spreading flowering or grain-fill over a longer period.

Technology choice is complicated, however, because different types of drought occur in different years. One season may start late, and the next season may be long but interrupted by a midseason dry spell. Improvements in short-term weather forecasting may reduce this uncertainty. Better forecasting now allows improved opportunities for *response farming*, a system in which farmers rely on seasonal and intra-seasonal predictions of rainfall to guide their cropping decisions (Admassu et al., 2014; Walker, 2006).

Efforts are improving in ESA to disseminate high-quality seasonal rainfall outlook forecasts, but farmers need help in understanding how to use this information. Farmers and extensionists need to work together to define the technology options most suited to local environments and market conditions (Stigter et al., 2013).

Droughts are already endemic in ESA, and they remain the most prevalent and significant climate risk farmers face. Implementing better solutions to today's droughts will improve the capacity to cope with future droughts, whatever their cause.

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