WaterPIP
Water Productivity Improvement in Practice

# Drought Observe

## Near-real-time drought monitoring for Africa using FAO WaPOR datasets

### Background

Drought conditions in eastern African countries has left millions of people under severe poverty and food insecurity. The situation is expected to get worse with climate change predicted to result in increasingly variable rainfall and resultant crops failures. An estimated 11.7 million people are severely food insecure, forcing around 6 million people to be displaced internally due to droughts. Spatial maps of drought-affected areas demarcating zones based on drought intensity are used extensively by the agencies and ministries in charge of executing relief plans. However, the existing drought mapping platforms are generally based only on historical rainfall data and offer coarse resolution maps. Integrating recent rainfall data with satellite-based bio-physical indicators will offer a better understanding of stress on vegetation due to drought, which is of vital importance to the agriculture sector. The advancement of machine learning algorithms and the availability of high resolution satellite data is an opportunity to deploy near-real-time monitoring systems for vegetation stress due to drought.

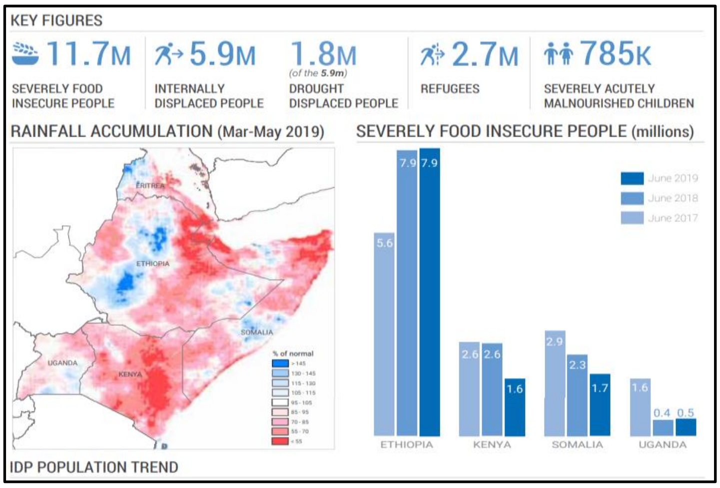

Figure 1: Drought situation in eastern Africa over the last three years

The WaterPIP Project has developed a drought monitoring system, named **Drought Observe**, which offers near-real-time high resolution spatial maps of drought intensities over Africa. The platform is currently piloted for three countries in Africa - Kenya, Ethiopia, and Mozambique.

### Approach

**Drought Observe** is developed using the near-real-time publicly accessible datasets offered by the FAO portal to monitor Water Productivity through Open access of Remotely sensed derived data (WaPOR) (https://wapor.apps.fao.org). The drought maps characterize the water stress on vegetation due to drought events at a monthly time scale with a spatial resolution of 250m. The methodology has two major steps – i) preparation of standardized precipitation actual evapotranspiration index (SPAEI) from long term dekadal (10 day) water surplus/deficit (precipitation minus the reference evapotranspiration, or P - RET) data which is aggregated to different time scales and adjusted by fitting to a log-logistic probability distribution; ii) a machine learning-based decision tree model that is developed by regressing SPAEI against the vegetation, climate, and biophysical data available in the FAO WaPOR database (phenology, land cover, precipitation, NDVI, & temperature). This model is then used to predict the drought-based stress on vegetation over the study area, producing a monthly drought map. The SPAEI model development and the prediction was implemented in Google Earth Engine (GEE).

### Outputs

A GEE based web application which disseminates the high-resolution drought maps (Figure 2) can be accessed via the URL https://waterpiporg.users.earthengine.app/view/dms. Currently, the application can display charts of temporal variation of modeled SPAEI and rainfall by clicking on a pixel. This gives an overview of the prolonged drought conditions in the area. The developed maps have a spatial resolution of 250m, which ensures that the spatial details at the village level could be extracted for further dissemination as reports to decision makers. The application also allows the user to interact and download the temporal SPAEI and rainfall values of a pixel.

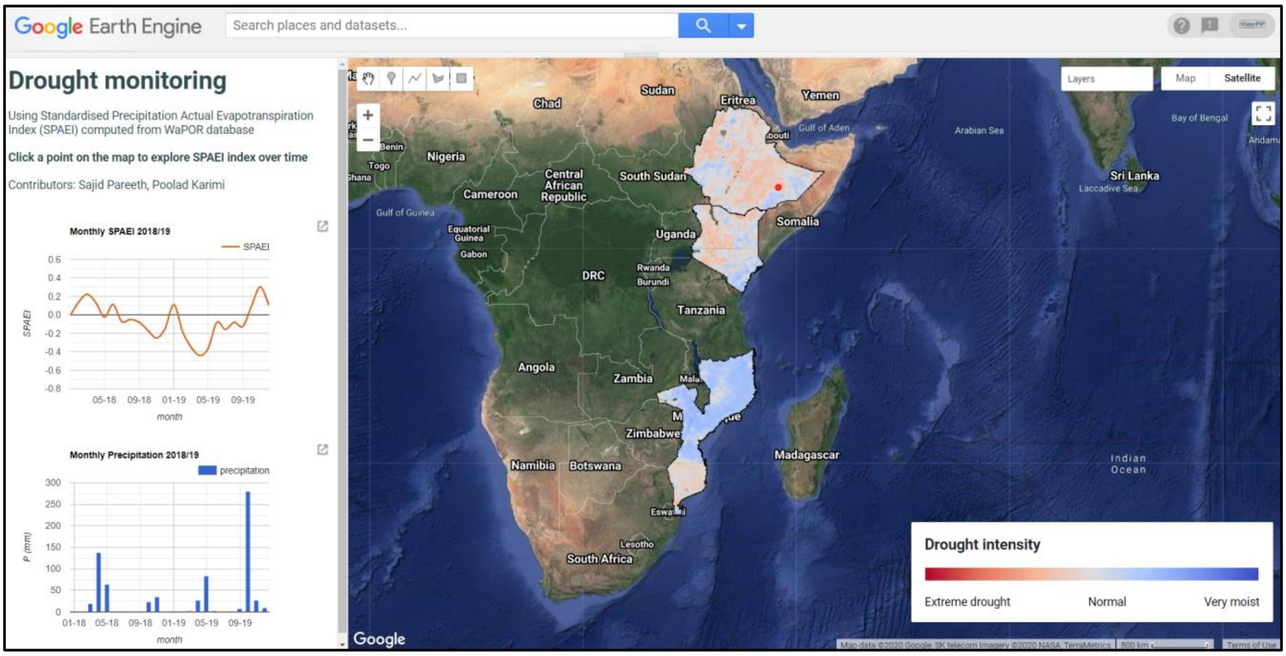


Figure 2: Drought Observe web application developed in Google Earth Engine

## Impact

**Drought Observe** is available for three countries in eastern Africa and can be used by decision makers, relief organizations, and other stakeholders to plan relief measures and prioritize areas according to drought intensities. The information both in spatial and temporal domains available near real-time can be used to monitor the impacts and plan the required interventions. Further, to mitigate the impacts of agricultural drought, this information is important for guiding the water management practices in both irrigated and rainfed areas. The data converted to reports can offer valuable information to practitioners, managers, and farmers by helping them take timely actions. The results obtained can help in achieving SDG 2 aiming at "zero hunger" by implementing timely actions to mitigate the effects of drought events.

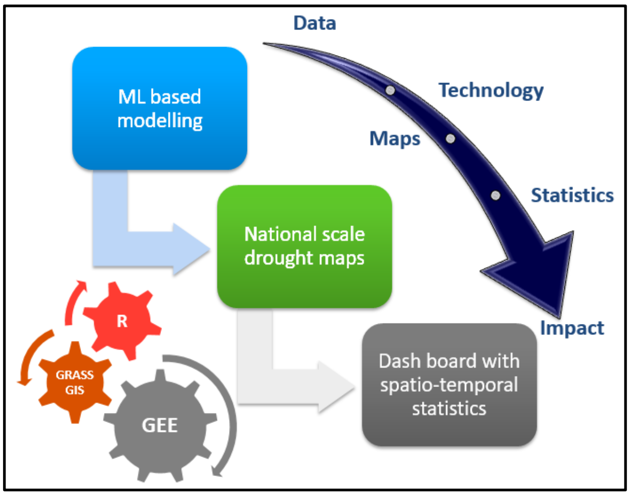


Figure 3: Technology to impact pathway of Drought Observe

## Next Steps

The developed approach to monitor drought intensity over Kenya, Ethiopia, and Mozambique will be extended to the entire African continent following the same method. A protocol will be developed to classify areas into different zones of risk based on spatial and temporal dynamics of drought events. These zones of varying risks will be updated and published with every new drought maps in a dashboard. This information can be used by authorities for planning the interventions.


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