DAR SILA ORACLE: DESIGNING AN EARLY WARNING SYSTEM FOR DROUGHT CONDITIONS IN DAR SILA REGION OF EASTERN CHAD

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ABSTRACT:

Dar Sila and its capital Goz Beida, is located in the Southeastern part of the Republic of Chad. It borders the Salamat Region of Chad in the North, Ouaddaï Region in the South East and Darfur Region of Sudan to the West (total area about 200x200 km^2). In this area, the livelihood heavily depends on subsistence farming, primarily sorghum and millet, and maintenance of livestock. Extreme weather events, such as floods and droughts, disrupt food production chain and cause major shifts in regional food security, nutrition, health, and political stability. For example, the significant drought of 1984-85 led to livestock and crops loss, human displacement and other significant livelihood changes. While the 1984/85 drought was the most dramatic event in recent history, the region had also experienced severe droughts in the past in mid-1910s, mid-1970s, and recently in 2000, 2006, 2010, and 2012. It is likely that proper preparation will help to reduce the adverse effects of severe weather in these vulnerable communities and maintain better standards of living for ingenious population.

The early warning prediction of drought and food insecurity has the potential to be a very important tool in maintaining regional food stability and, when needed, providing timely international assistance. At the same time, the short-term prediction of a drought is notoriously difficult analytically and could turn into a high-risk affair in case of false positive alarms. Analytical difficulties related to the rigor of an accepted definition of drought conditions that can be dynamic and location-specific. There were numerous attempts to

construct drought indexes suitable for large territories, including a global terrestrial drought severity index and a perpendicular drought index. We are unaware of reliable drought indexes developed for relatively small regions in sub-Saharan Africa and sensitive to local meteorological and climatic conditions. In this work we aim to design, build and verify an automated early drought warning system tailored to specific conditions of Dar Sila region.

To accomplish this task we proposed to develop an interactive process of real-time data scraping, verification, and analysis supported by a decision-making platform. The design consists of four essential components: synchronization module (SM), preprocessing module (PM), decision support engine (DSE), and notification module (NM). SM provides unsupervised data scraping of regularly updated datasets of normalized vegetation indexes, gross primary productivity, intraday land surface temperature, soil humidity and rainfall. PM provides validation, clean up, aggregation, projection, and extraction of metaparameters from satellite-borne datafeeds into normalized forms suitable for the analysis. Decision engine then applies non-parametric statistical and time series methods to estimate the maximum likelihood probability of the season's drought and loss of crops. Then it uses this data to update its parameters, self-adjusting to new information it receives. NM analyzes an output from the decision engine and provides location specific notifications to government officials, stakeholders and policy makers

The proposed design allows us to build an automated self-organized system for early drought warning that does not require frequent operator's intervention, can adapt to changing conditions, and capitalize on expert inputs.