Development of Drought Triggers for Agricultural Applications

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Identifying drought triggers and providing spatio-temporal information on anticipated water deficits is crucial for both food and energy security. To establish reliable drought triggers and water deficits over various space-time horizons, we propose two types of graphical models - (a) directed graphical models (homogeneous hidden Markov models) for capturing time dependence, and (b) undirected graphical models (Markov random fields) for preserving spatial dependence in the data. The models will be trained adaptively in the Bayesian framework. The probabilistic basis of these models will facilitate informed drought response decisions by quantifying uncertainty in drought states and projected deficits, that can be used for quantifying drought risks and impacts. This project will focus on studying the dependence between drought related-variables (specifically, precipitation, temperature, soil moisture, and streamflow) at the regional river- basin scale (specifically the combined Upper Mississippi River Basin (UMRB) and Ohio River Basin (ORB)).

This project will leverage the investigators past and on-going research, including a NSF funded project to develop web-based portal for drought information analysis and dissemination. We will collaborate with PDs from a minority institution to provide training to faculty and undergraduate students on the project. Through a multi-regional approach, this project will directly address the following priorities identified in the RFA for the Agricultural Water Science projects: (1) Development of a trigger or triggers that have broad applicability across the states and territories of the U.S.