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Developing Hybrid Tools to Analyze Agricultural Drought in the Southeast

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RCEU SUMMER 2017 PROJECT PROPOSAL

Title: ***Developing Hybrid Tools to Analyze Agricultural Drought in the Southeast***

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Project Summary:

While the Southeastern U.S. has on average abundant water resources, it continues to be impacted by sporadic droughts that have plagued agriculture (McNider et al 2015). Particularly hard hit has been agriculture because of relatively poor water holding soils and lack of widespread irrigation.

Irrigation is the fastest growing water use sector in Alabama (OWR 2010), and it is expected to continue to grow since it is required to produce competitive yields on a national market. Analysis and tools are needed to examine the scale, frequency and duration of drought to explore the vulnerability of irrigation, public and industrial water supply to droughts and mitigation strategies such as storage, water transfer and water insurance programs.

In most years, because of relative low soil water capacity in the Southeast, short-term agricultural droughts can occur against a backdrop of relatively normal hydrologic water availability (McNider et al 2015). Water is likely available for the modest irrigation needs in the Southeast. However, how often does the need for irrigation coincide with extreme hydrologic drought when water may not be available? And, how would these agricultural withdrawals impact the hydrological drought and thus other water use sectors in extreme drought?

The proposed project will engage the student in developing research tools and geographic information systems (GIS) to assist analysis and definition of hydrologic availability and agricultural water needs in Alabama. Research will focus on using datasets from remotely sensed Earth observations data in models for drought planning and response for the State of Alabama and the Southeast. While current tools address various sectors and provides metrics for classifying drought, there has been little quantification given to the role of water withdrawals on hydrologic drought. This project will utilize data from an existing hydrologic model using USGS anthropogenic withdrawal data and a coupled crop model for irrigation demand to estimate the impact of withdrawals on watersheds. These models previously developed under NASA, NSF and USDA support utilize MODIS greenness, NASA Land Information System (LIS) moisture, temperatures and evaporation and a GOES satellite derived insolation.

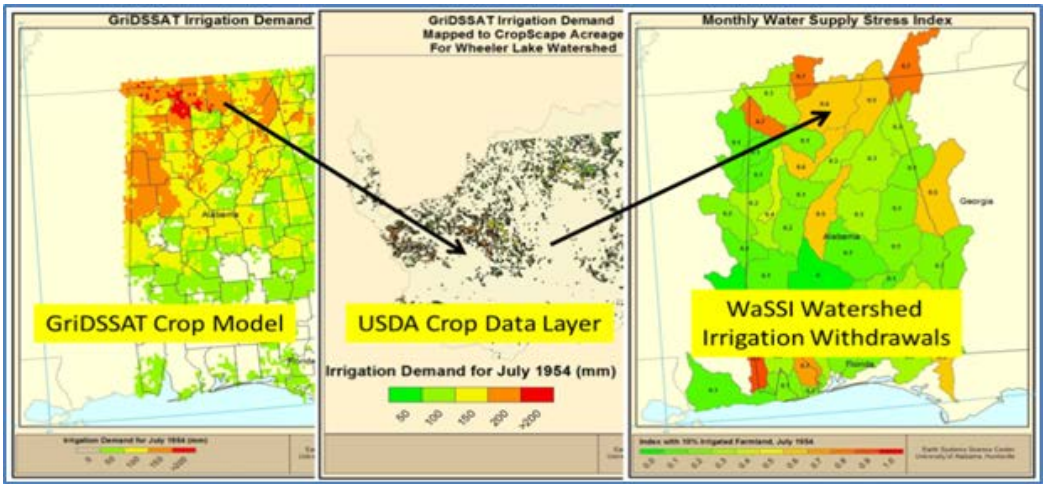

Figure 1: The dynamic irrigation linkage between the GriDSSAT Crop Model and WaSSI is through the Crop Data Layer.

Student Prerequisites:
Experience with GIS tools is a plus but students are not expected to come in with specific technical skills or knowledge sets apart from a genuine interest in the topic area and basic computer skills. Students from all academic standings are eligible.

Student Duties:
To ensure that the student has the appropriate understanding and experience to conduct the research, the 12-week summer term will be divided into an educational and research phases, scaling up from basic review of contemporary issues in agriculture/water resources and learning and practicing GIS skills, to finally working to come up with creative ways to use agricultural/water model datasets for research and analysis.

***First phase**:*
The student will work with Cameron Handyside to review the current drought definition products. These include the U.S. Drought Monitor map, state drought reports, and USDA drought reports. The student will also review observed datasets. Overlaid on these, the student will learn about model products utilized at UAH, including the GriDSSAT crop model and WaSSI watershed hydrologic model. These are products that may be used to develop a clearer picture of drought in Alabama and the Southeast. During this first phase, the student will also learn basic GIS techniques and data manipulation, focusing on how to best illustrate and share data. Using both open-source and UAH-licensed software, the student will learn how to process and derive useful information from these datasets, as well as geodatabase management and application.

Second Phase:
In the final phase the student will select individual datasets imagery from both observed and model data; overlaying to develop a hybrid view of agricultural drought and learn to share this geospatial data such that it adds value to stakeholders involved in drought response.

Benefit to the Student:
The student will get exposure and training on a wide range of datasets and software packages, including ArcGIS, the primary commercial software for conducting geospatial analyses; the student will have the opportunity to work as part of an active research team in the Earth sciences, collaborating with professional researchers, graduate and undergraduate students; the student will also learn how research is conducted in a "real-world" setting. The student will receive mentoring concerning public speaking and presentation of research results, and professional development.

Student Contribution:
The student will be responsible for interacting with research group members, dedicating the time and effort to learning the software and techniques, developing creative methodologies that add value to the current drought definition products. The student will also deliver presentations and written reports, explaining their research and results.

Faculty Supervision and Interaction:
The student will be supervised throughout the duration of the project by Cameron Handyside. Cameron received his Master's in Environmental Engineering. For the last 9 years, he has been researching the many impacts irrigation can have on the Southeast and specifically, Alabama agriculture, economics and environment. He is also working to couple a spatial crop model to a hydrology model to research the impact expanding irrigation will have on local watersheds. Cameron will supervise the student at the NSSTC facility where he and the student will work and review progress in weekly team meetings. The student will also benefit from other student-researchers who will be present throughout the summer and will be available to assist the student.