

Pre-Proposal Application Form
2019–2020 TWRI Graduate Student Research Programs

Basic Information:

Which program are you applying for (only select one option)?

- Mills Scholarship Program (Texas A&M, Galveston or Qatar student requesting tuition only)
 USGS Research Program (any Texas university requesting categorical funds and/or tuition)
 Either program will fit my needs and eligibility

1. Title of pre-proposal: **Multi-spectral and thermal remote sensing of crop stress for quantifying water use and irrigation needs of row crops**
2. Student name, contact information (email and phone number), university, department, degree being pursued as well as degree starting year and expected year of graduation.

Jeffrey Siegfried

Ph. D. Student (Agronomy); Department of Soil and Crop Science; Texas A&M University
Starting Year: Summer 2018; Expected Graduation: Spring 2021

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3. Faculty advisor or committee chair name, title, contact information (email and phone number), university and department.

Dr. Nithya Rajan

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4. Would these funds be initiating new research or supporting ongoing research? If ongoing, please briefly explain where you are at in the research and project timeline.

Funding through this scholarship would allow me to expand my ongoing research on using unmanned aerial remote sensing for crop phenotyping to applications related to irrigation water management.

5. Abstract (200 words)

Depletion of water resources is a major problem in Texas. With stringent restrictions on irrigation water use, field-specific irrigation recommendation is necessary to maximize the efficiency of water use and conserve regional water resources. The goals of this project are (1) Develop methods to detect biotic and abiotic stresses of row crops (cotton and corn) using unmanned aerial multispectral and thermal remote sensing, (2) Use crop stress indices to adjust crop coefficients for accurate estimation of irrigation water needs, and (3) Assess the utility and efficacy of this method through field evaluation. We will conduct field studies (cotton and corn) with different irrigation rates at the Texas A&M Research Farm. A rotary wing UAS will be used to acquire high-resolution multispectral and thermal imagery. Crop stress indices developed using these images will be used to adjust crop coefficients for irrigation demand calculations. Implementation of the proposed method would allow any farmer to receive an irrigation management product that is customized to his/her field.

6. Description of the student's proposed research, emphasizing how it will address water resources-related concerns (particularly how, if possible, it will benefit Texas), including:

a. Statement of Critical Regional or State Water Problem.

Depletion of water resources is a major problem in Texas. Ground water and surface water are the primary sources for irrigation of agricultural crops in Texas, but depletion of water resources since the 1950's has caused a decline in irrigated farmland around the state. With stringent restrictions on irrigation water use, field-specific irrigation recommendation is necessary to maximize the efficiency of irrigation scheduling and conserve regional water resources.

Nature, Scope and Objectives of the Research, including a timeline of activities.

To maximize the efficiency of irrigation water use, crop water demand and crop stress should be evaluated on a field-by-field basis that can account for non-standard conditions. Currently, there is no operational system to provide this information to farmers in Texas.

The objectives of the proposed work are as follows:

1. Develop methods to detect biotic and abiotic stresses of row crops (cotton and corn) using unmanned aerial systems-based multi-spectral and thermal remote sensing
2. Use crop stress indices to adjust crop coefficients for accurate estimation of irrigation water needs
3. Assess the utility and efficacy of this method through field evaluation

Timeline of activities.

2019: Objectives 1 and 2; 2020: Objective 3

b. Methods, procedures and facilities.

Objective 1: Field studies (cotton and corn) with different irrigation rates will be conducted at the Texas A&M Research Farm. We will fly a rotary wing UAS to acquire multispectral and thermal imagery. Data will be collected at weekly intervals.

Objective 2: We will analyze remote sensing imagery and develop crop stress indices. These indices will be used for adjusting crop coefficients, which are critical for accurate estimation of crop water use.

Objective 3: Evaluate the efficacy of the developed method by comparing it against other commonly used irrigation-scheduling approaches.

c. Statement of expected results or benefits.

Implementation of the proposed method would allow any farmer to receive an irrigation management product that is customized for his/her field. The availability of such a system would contribute to the advancement of information-based irrigation management.

7. Intended career path the student anticipates pursuing.

- Academia (Teaching, Research and Extension)

8. Academic qualifications of the student: current degree plan/grades, unofficial transcript or list of courses taken and grades. *Note: This item is not included in the 3-page limit.*

- Expected grade in current courses at Texas A&M: A
- M.S. GPA (Colorado State University): 3.637/4

Please see the attached MS and Ph.D. transcripts for details.

9. Budget

a. Please indicate your specific funding needs (only check one):

- i. Tuition support is needed
- ii. Other costs (salary, fringe, travel, other) is needed
- iii. Either source of funds would be applicable to my project.

b. Proposed use of funds by category, not to exceed \$5,000 requested. Indirect costs are not allowed per the prime sponsor agreement.

Category	Request (USGS)	Request (Mills)	Justification
Salary	\$0	0	
Fringe Benefits	\$0	0	
Travel	\$	0	
Supplies	\$	0	
Tuition	\$	\$5000	Funds will be used to pay my tuition and fees. Cost savings from this will be used to acquire the sensors that are described below.
Other	\$ 5000	0	Funds will be used to purchase sensors (stem flow gauges for transpiration estimation and soil moisture sensors)
Total	\$5000	\$5000	<i>Not to exceed \$5,000</i>