**NASA DEVELOP National Program**

NASA Langley Research Center

**Spring 2016**

**Short Title: Texas Water Resources II**

**Subtitle:** Utilizing NASA Earth Observations to Assess Soil Moisture in Texas for Wildfire Mitigation

**VPS Title:** Fire Distinguisher: Using SMAP Data to Improve Wildfire Predictions

**Project Team & Partners**

**Project Team:**

Greg Hoobchaak(Project Lead), gregory.hoobchaak.11@cnu.edu

Jessica Jozwik

Alyx Reibling

**Advisors & Mentors:**

Dr. Kenton Ross (NASA DEVELOP National Program)

**Past or Other Contributors:**

Megan Buzanowicz

Laura Lykens

Zacary Richards

Jeff Close

**Partner Organizations:**

Texas Forest Service (End-User), POC: Curt Stripling and Tom Spencer

**Project Details**

**Applied Sciences National Applications Addressed:** Water Resources, Disasters

**Study Area:** TX

**Study Period:** 2014-2015

**Earth Observations & Parameters:**

Soil Moisture Active Passive (SMAP) - soil moisture

**Ancillary Datasets Utilized:**

* Soil Climate Analysis Network (SCAN) - precipitation, air temperature, soil moisture
* Texas A&M University Soil Moisture Database - soil moisture

**Models Utilized:**

* NOAA National Centers for Environmental Information Standard Precipitation Index (SPI)

**Software Utilized:**

ArcGIS- Raster manipulation/analysis, image enhancement, and map creation

Python- Programming language, land classifications, image manipulation

**Project Overview**

**80-100 Word Objectives Overview:**

Accurate and real-time soil moisture data can play a crucial role when identifying areas susceptible to wildfires. This project will correlate NASA’s SMAP Satellite data with *in situ* data from the SCAN and TAMU Soil Moisture Database to provide the Texas Forest Service with a normalized single correction soil moisture model for the state of Texas to assist with their efforts in predicting and preventing wildfires.

**Abstract:**

Each year, Texas experiences severe droughts, making large areas of the state vulnerable to wildfires that damage agriculture, infrastructure, and habitats across Texas. The Texas Forest Service utilizes precipitation, temperature, vegetation, and soil moisture data to identify particular areas in danger of wildfires. Several methods exist to monitor soil moisture, but these methods rely on estimates from precipitation and temperature data or from testing specific locations with sensors. By incorporating satellite data into their monitoring practices, the Texas Forest Service can monitor and compare changing soil moisture levels throughout the year. Soil Moisture data obtained from NASA’s SMAP satellite was correlated with *in situ* data from the SCAN and TAMU Soil Moisture Database. A single correction model for Texas was created from trends identified in the data.

**Community Concerns:**

* In 2011, Texas experienced a record-breaking drought, resulting in $5.2 billion lost in agricultural resources, damaged roads, and infrastructure.
* As a result of the drought, wildfire severity and frequency increased. From November 15, 2010 through September 29, 2011, 23,835 fires burned more than 3.8 million acres and destroyed 2,763 homes.
* 80% of fires occur within two miles of a community, thus threatening life, property, and infrastructure.
* Wildfires also result in soil degradation, soil erosion, loss of biodiversity, and agricultural losses.

**Current Management Practices & Policies**:

The Texas Forest Service utilizes weather patterns, drought severity indices, and assessments of available vegetative fuels to identify areas susceptible to wildfires. Popular drought indices, like the Standard Precipitation Index and the Keetch-Byram Drought Index estimate evapotranspiration, fuel potential, and soil moisture from precipitation and temperature data to quantify severity of drought across varied spatial and temporal scales. The Forest Service then uses these data to justify budget requests, coordinate between agencies across jurisdictions, educate and communicate alerts to the public, and craft response and suppression plans. By incorporating soil moisture obtained from SMAP, researchers and planners can more accurately identify areas at risk for wildfires and better prepare prevention and response plans.

**Decision Support Tools & Benefits:**

|  |  |  |
| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Soil Moisture Maps | SMAP | Provide an additional tool to TFS to identify areas susceptible to wildfires |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)

**Software Release Requirements**

What category do the tools your project is creating fall within?

I, possibly III depending on the success of our methods.

**Software Title:** Insert here (ex. DEVELOP National Program Python Package)

**Software Abbreviation:** Insert here (ex. dnppy)

**Technical Point of Contact:** Insert full name, permanent email, and node here. Also include whether employed through SSAI or Wise County. (Team member who knows the most about the software.)

**Brief Description of the Software:** Insert here (ex. The dnppy package will be used to functionalize common programming tasks in the geospatial community, specifically for working with NASA data products. It will include functions for processing satellite data and assist in structuring analysis to reduce the startup time for DEVELOP teams to learn programming and create tools for end users.)

**Type of Code:***Executable Code* and/or *Source Code* (Select one or both)

**Will the software include any embedded computer databases?***Yes* or *No* (Select one)

**Does the software use or call any open software or libraries?***Open Source* and/or *Proprietary/Commercial* (Select one or both)

**List the software or libraries used, under what license they were obtained, and the URL for the license in the table below:**

|  |  |  |
| --- | --- | --- |
| **Name** | **License** | **License URL** |
| Ex. Arcpy module | Ex. group license through ArcGIS | http://www.esri.com/software/arcgis |
| Ex. Python | Ex. Open source license | http://opensource.org/licenses/Python-2.0 |
|  |  |  |

**Full Software Description and Plan**

**Introduction/Objective:**

What motivated the creation of this software, what problem does it address?

**Applicatio*ns and Scope:***

*Where and how will this software be used to influence decisions?*

**Capabilities:**

What can it do better than what was previously available?

**Interfaces:**

How is one expected to use the software? For example, command line, GUI, script execution, etc.

**Assumptions, limitations, & Errors:**

What areas that the software could be improved upon in the future? This is where limitations of the theory, model, science, etc should be briefly documented. If the tools only work for a specific scenario, say so.

**Testing:**

What validation techniques and testing strategy will be used to build confidence in the software?