**NASA DEVELOP National Program**

**Spring 2016 Project Proposal**

**NASA Langley Research Center**

**Texas Water Resources II**

Utilizing NASA Earth Observations to Monitor Drought Severity in Texas for Wildfire Mitigation

**Project Overview**

***Objective:*** This project will use SMAP data to help monitor drought severity in Texas and support the Texas Forest Service to use the previously developed Drought Severity Index. This project will be conducted in parallel with the Stennis DEVELOP Texas Disasters project which will focus on fuel type and loading monitoring.

***Community Concern:*** The Texas Forest Service (TFS) is the incident management agency for state emergencies in Texas, including wildfires. Wildfires pose a constant risk for many regions across Texas, burning several thousand acres each year. For example, in 2013, there were 7,598 fires reported, which burned 45,963 acres. The ability to accurately monitor drought conditions is vital to forecasting wildfire risk, especially in the grassland regions where fires often spread rapidly. Using meteorological drought severity indices like the Keetch-Byram Drought Index (KBDI) and remote sensing indices like the Drought Severity Index with inputs from NASA Earth observations can offer a continuous spatial coverage of drought conditions. With more information about the spatial coverage of drought conditions, decision makers at the Texas Forest Service can better allocate resources to mitigate the spread of wildfires when they occur.

***National Application Area(s) Addressed:*** Water Resources, Disasters

***Study Location:*** Texas

***Study Period:*** 2014-2015

***Advisor(s):*** Dr. Kenton Ross (NASA DEVELOP National Program)

***Source of Project Idea:*** This project idea came from the Texas Forest Service through communication with the DEVELOP National Program Office

**Partner Overview**

***Partner Organization(s):***

Texas Forest Service (End-User, POC: Curt Stripling, GIS Systems Coordinator; Tom Spencer, Department Head – Predictive Services)

***End-User Current Decision Making Process:***

Currently, the partners use products from the LANDFIRE Program and the National Predictive Services Unit which uses the Palmer Drought Severity Index, Climate Prediction Center Soil Moisture Model, USGS Weekly Streamflow, Standardized Precipitation Indicator, and objective indicator blends to classify the drought severity. The partners also use KBDI (Keetch-Byram Drought Index), which have inputs from NOAA NEXRAD. Another effort at Texas A&M is using AVHRR with NEXRAD to determine drought locations and severity. The LANDFIRE Program is designed to help the Texas Forest Service support fire planning, analysis, and budgeting to evaluate fire management alternatives. The Texas Forest Service also using LANDFIRE to supplement strategic and tactical planning for fire operations.

***NASA Earth Observations Capacity:***

Texas Forest Service – The Texas Forest Service currently uses Landsat and MODIS as well as other non NASA Earth observations, however, not for monitoring drought severity.

***Communication Plan & Transition Approach:***

The team will communicate with the partners on a bi-weekly telecon. This schedule can be adjusted to suit the needs of the team and the Texas Forest Service. It could also include a screen share as needed. A similar schedule was used very effectively during the first term of the project. The hand off will include a screen share and telecon explaining the results which will be used to help plan for the 2016 fire season.

***End-User Benefit:***

“These proposals represent a tremendous opportunity to significantly enhance real-time monitoring of wildland fuel conditions for Texas, particularly fuel loading and moisture. Continuous monitoring of these variables is extremely important in determining wildfire potential and risk.”

**Letters of Support:** Texas Forest Service, Tom Spencer, Predictive Services Department Head and Curt Stripling, Geospatial Coordinator. Submitted with the summer 2015 proposal.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform** | **Sensor** | **Geophysical Parameter** |
| **GPM** | Dual-Frequency Precipitation Radar (DPI) | Precipitation  |
| **Aqua & Terra** | MODIS | LST, NDVI |
| **GRACE** |  | Ground Water |
| **SMAP** |  | Soil Moisture |

***NASA Earth Observations Use:***

GPM DPI – used to calculate the drought indices over a large spatial area, filling in the gaps between ground-based stations

Aqua & Terra MODIS – used to determine land surface temperature and an estimation of vegetative health Normalized Difference Vegetation Index (NDVI)

GRACE - incorporated to identify fluctuations in ground water recharge

SMAP - used to highlight soil moisture available to the grasslands, where wildfires spread most rapidly

***Ancillary Datasets:***

NOAA Multisensory Precipitation Estimate (MPE) – Precipitation data prior to GPM launch

**Decision Support Tool & End-Product Overview**

|  |  |  |
| --- | --- | --- |
| **Proposed End Products** | **Decision to be Impacted** | **Current Partner Tool/Method** |
| Soil Moisture Maps | Where the Texas Forest Service and Texas Department will allocate resources in preparation for wildfires  | In situ measurements  |

*Soil Moisture Maps – Created using data form the newly launched SMAP, maps that show available soil moisture in the upper-most portion of the soil will give a good indication of the water available for grasslands.*

**Project Timeline & Previous Related Work**

***Project Timeline:*** 2 terms: Summer 2015 and Spring 2016

***Multi-Term Objectives:***

* **Term 1** – The first term will focused on adapting the Drought Severity Index to Texas using GPM and MODIS data. SMAP was explored for future inclusion.
* **Term 2 (Proposed Term)** – The second term of the project will focus on using SMAP along with the Drought Severity Index from the first term to highlight drought areas and drought severity in the region. This term will also include hand-off of results and methodologies to the project partners.

***Previous Related DEVELOP Work:***

Spring 2015 (JPL) – California Disasters: A New Method for Providing Near-Real-Time Active-Fire and Post-Burn Support to Fire Responders Using Data Products Derived from NASA’s UAVSAR

Summer 2013, Spring 2014 and Summer 2014 (LaRC) – Great Plains Agriculture I, II, III: Utilizing NASA Earth Observations to Monitor Drought Conditions for Enhancement of Rangeland Management

**Project Needs/Requests**

***Participants Requested:*** 4

***Software & Scripting:***

ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation of GPM DPI, GRACE, SMAP, and Aqua/Terra MODIS

Python – Drought Severity Index

**Notes & References:**

***Notes:*** Anything else you deem relevant and that supports the proposal.

***References:***

List out any relevant content or websites, however please note that citations should not be included in the text in the body of the proposal.