**NASA DEVELOP National Program**

****Langley Research Center

**Summer 2015**

**Short Title: Texas Water Resources**

**Subtitle:** Utilizing NASA Earth Observations to Monitor Drought Severity in Texas for Wildfire Mitigation Support

**VPS Title:** Breaking the Ring of Fire: Preparing for Drought Disasters in Texas

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Kenton Ross (NASA DEVELOP National Program)

**Past or Other Contributors:**

Stennis Space Center DEVELOP Texas Disasters project

**Partner Organizations**

Texas Forest Service, Boundary Organization and End-User, POC: Curt Stripling, GIS Systems Coordinator and Tom Spencer, Department Head – Predictive Services

**Project Details**

**Applied Sciences National Applications Addressed:**

Water Resources

**Study Area:** Texas, United States

**Study Period:** 2010 – 2011, 2014-2015

**Earth Observations & Parameters**

GPM, Dual - Frequency Precipitation Radar (DPI) - Precipitation

Aqua and Terra, MODIS – Land Surface Temperature (LST), NDVI

GRACE – Ground Water

SMAP – Soil Moisture

AMSR-E – Soil Moisture

**Ancillary Datasets Utilized**

* NOAA Multisensory Precipitation Estimate (MPE) – Precipitation data prior to GPM launch
* North American Land Data Assimilation System (NLDAS) – Soil Moisture

**Software Utilized**

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

Python – Drought Severity Index

**Project Overview**

**80-100 Word Objectives Overview**

In a cooperative effort with the John C. Stennis Space Center (SSC), our team at NASA DEVELOP Langley will assist the Texas Forest Service (TFS) in preparing for future wildfires by expanding upon a drought severity index (DSI) created during the summer 2013 Great Plains Agriculture project, which will allow the TFS to identify what geographical locations within the state of Texas are the most prone to wildfire disasters, and where water resources may be concentrated in order to fight them efficiently. Our team will also be comparing and contrasting our DSI with other drought severity indexes, such as the Palmer Drought Severity Index (PDSI) currently used by the Texas Water Resources Institute (TWRI).

**Abstract**

The 2011 wildfire season was one of the most destructive wildfire seasons in Texas history. The combination of a wet 2010 growing season, which allowed vegetation to prosper, and an extremely dry 2011 provided the worst case scenario for wildfires. The purpose of this project was to compare and contrast the Drought Severity Index (DSI) against other drought severity indices as a valid form of methodology for determining drought conditions throughout the state of Texas. A risk map of potential wildfire areas that contain dry fuels was also created; specifically, how dry the fuels are. To accomplish this, data that measure specific factors contributing to drought conditions and dry vegetation was acquired from the Moderate Resolution Imaging Spectrometer (MODIS) instrument onboard the Aqua and Terra satellites, Multi-Sensor Precipitation Estimate (MPE), and the Soil Moisture and Ocean Salinity (SMOS) satellite. The DSI was calculated using precipitation data measured by MPE, soil moisture from SMOS, land surface temperature from MODIS, and the Normalized Difference Vegetation Index (NDVI) derived from satellite near-infrared radiation and visible radiation. Layers of data were compiled through ArcGIS in order to assemble a risk map. The methods and results produced were presented to the Texas Forest Service (TFS) for future use throughout the state; the benefit of which was a high resolution drought index that can be easily constructed with little cost to the end user.

**Community Concerns**

* Wildfires pose a constant risk for many regions across the state; for example, in 2013 there were 7,598 fires reported which burned 45,963 acres
* Ability to accurately monitor drought conditions is vital to forecasting wildfire risk, in particular in grassland regions, where fires often spread rapidly
* More information about the spatial coverage of drought conditions will allow decision makers at TFS to better allocate resources to mitigate the spread of wildfires

**Current Management Practices & Policies**

The TFS currently uses products from the Landscape Fire and Resource Management Planning Tools, LANDFIRE program, and the National Predictive Services Unit. The National Predictive Services Unit uses the Palmer Drought Severity Index, Climate Prediction Center Soil Moisture Model, USGS Weekly Streamflow, Standardized Precipitation Indicator, and object indicator blends to classify the drought severity. KBDI, Keetch-Byram Drought Index, which has inputs from NOAA NEXRAD is also used. Texas A&M is leading another effort using AVHRR with NEXRAD to determine drought locations and severity. The LANDFIRE program is designed to help the TFS support fire planning, analysis, and budgeting to evaluate fire management alternatives and is used to supplement strategic and tactical planning for fire operations.

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Drought Severity Index Maps | GPM and MODIS | Provides estimation of water stress to vegetation; Impacts where TFS will allocate resources in preparation for wildfires |
| Soil Moisture Maps | Sample SMAP data; SMOS; AMSR-E | Show available soil moisture in the upper-most portion of the soil, will give a good indication of the water available for grasslands; Impacts where the TFS will allocate resources in preparation for wildfires |
| Ground Water Anomalies | GRACE | Show where ground water is depleted during droughts or where ground water storage is being recharged; Impacts where TFS will allocate resources in preparation for 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)