**NASA DEVELOP National Program**

****The University of Georgia

*Spring 2017*

**Short Title: Southern Appalachia Disasters**

**Subtitle:** Using NASA Earth Observations to Monitor Vulnerability, Wildfire Damage, and Recovery in the Appalachian Forests

**VPS Title:** Where the Wildfires Are: Monitoring Vulnerability, Damage, and Recovery

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Marguerite Madden (University of Georgia, Center for Geospatial Research)

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**Partner Organizations:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| US Forest Service, Southern Research Station | Dr. Cassandra Johnson Gaither, Research Social Scientist | End-User | No |
| US Forest Service, Eastern Forest Environmental Threat Assessment Center | Dr. Steve Norman, Research Ecologist, William Christie, Biological Scientist GIS/Remote Sensing Analyst, William W. Hargrove, Research Ecologist | Collaborator | No |

**Project Details**

**Applied Sciences National Applications Addressed:** Disasters, Health & Air Quality

**Study Area:** GA, TN, and NC

**Study Period:** October 2016 – December 2016

**Earth Observations & Parameters:**

Landsat 8 Operational Land Imager (OLI) – land cover

Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) – elevation

Terra Moderate Resolution Imaging Spectroradiometer (MODIS) – decadal change and phenoregions

**Ancillary Datasets Utilized:**

* State Departments of Assessments and Taxation Computer-Assisted Mass Appraisal (CAMA) Data – property ownership/management information
* Forest and Rangelands Community Wildfire Protection Plans (CWPP) – identification of communities with fire protection plans
* Firewise Communities Maps – spatial information about areas with fire protection plans
* USGS National Land Cover Dataset (NLCD) – land cover

**Software Utilized:**

* Google Earth Engine API – Landsat time series creation
* ESRI ArcGIS – image processing, NDVI calculations, & map creation

**Project Overview**

**80-100 Word Objectives Overview:**

The objective of this project was to explore ecological and social relationships to heightened fire susceptibility in the Southern Appalachians. Additionally, the team monitored vegetation changes as a result of the wildfires that occurred at the end of 2016 in this region. This project used Terra MODIS, Terra ASTER, and Landsat 8 OLI data to monitor changing vegetation conditions, such as greenness and phenology, throughout areas most affected or damaged by the wildfires. This project contributed to existing management programs and on-going work to aid in community preparedness, land management practices, and protection of fire-sensitive properties.

**Abstract:**

Wildfires in the southeastern US are less understood compared to other portions of the nation. In October and November of 2016, over 60 individual wildfires ignited among seven states in the Southern Appalachian region. These fires damaged hundreds of buildings, caused numerous power outages, and resulted in several fatalities. The devastating effects led to the evacuation of cities such as Gatlinburg and Pigeon Forge, TN and highlight the need to improve understanding of fire-susceptibility and risk in the southeastern US. The US Forest Service requires a thorough understanding of wildfire vulnerability, damage, and recovery to effectively help local communities respond to and prepare for these unfortunate events. The University of Georgia NASA DEVELOP team partnered with US Forest Service’s Southern Research Station to assess vegetation dynamics before and after the 2016 major wildfire events, focusing on GA, NC, and TN. This was accomplished by utilizing Landsat 8 OLI, Terra ASTER, and Terra MODIS data to evaluate land cover changes and air quality from October to December 2016 and assess the severity of these fires. In addition to physical environmental parameters associated with the fire, this project incorporated demographic data to examine the relationship between fire risk and fuel build-up associated with under-managed lands, such as heirs’ properties. The results of this project provided researchers at the US Forest Service with an increased understanding of how property ownership and community management practices can affect the risks for future wildfires.

**Keywords:**

Remote sensing, MODIS, Landsat 8, wildfire susceptibility, heirs’ property, NDVI, CWPP, Firewise communities

**Community Concerns:**

* In November of 2016, nearly 60 individual wildfires in the Southern Appalachian Mountains damaged hundreds of buildings, caused power outages, and led to the evacuation of several populated areas.
* Over 15,000 acres within Great Smoky Mountains National Park (a designated UNESCO World Heritage Site and one of the world’s most biologically diverse and intact forests) and the adjacent popular tourist areas of Gatlinburg and Pigeon Forge are estimated to have burned over a two-day period (28-29 November 2016) due to fires spread by 90 mph winds, low humidity, presence of fuel loads, and drought.
* There is a need for US Forest Service agencies to have a thorough understanding of vulnerability, damage, and recovery related to wildfires in remote and economically depressed areas such as Southern Appalachia.
* Under-managed or poorly maintained properties can pose a risk for build-up of fuel loads, especially in drought conditions.

**Current Management Practices & Policies**:

The US Forest Service is currently investigating methods to properly treat areas of concern through restoration, regeneration, and fuel reduction in the southern Appalachians. Additionally, the US Forest Service has performed thinning treatments and prescribed burns to areas in southeastern US where there have been multi-year droughts. Studies conducted by the US Forest Service Southern Research Station have focused on excessive fuel loading, management policies related to human alteration of local ecosystems, and both the use and effectiveness of prescribed burns. These studies are long-term and require additional field observations to determine forest sustainability. The US Forest Service Southern Research Station is currently investigating the role of properties lacking clear title of ownership (also known as heirs’ properties) in contributing to fuel loads and increased risk for wildfire ignition and spread in the southeast.

**Decision Support Tools & Benefits:**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** | **Software**  **Release** |
| Vegetation and Fuel Loads Change Maps | Landsat 8 OLI, Terra ASTER, and Terra MODIS | Will be used by the Forest Service to identify properties with unclear ownership and assess land management practices | N/A |
| Fire Event Time Series | Landsat 8 OLI | Will provide the Forest Service with Landsat-based time series animations of the 2016 wildfires in TN, GA, and NC in addition to Google Earth Engine scripts to create future animations | III |
| Fire Vulnerability Matrix | Landsat 8 OLI, Terra ASTER, and Terra MODIS | Will incorporate environmental and sociological factors aid the US Forest Service to identify at-risk and vulnerable locations | N/A |