**NASA DEVELOP National Program**

**2018 Spring Project Proposal**

**Alabama – Marshall**

**New Jersey Urban Development**

*Identifying Optimal Regions within New Jersey’s Pine Barrens Forest for Urban Development Based off of Wildfire Risk and the Wildland-Urban Interface Theory*

**Project Overview**

***Project Synopsis*:**  Over recent years more people are relocating to areas near forests, often referred to as the wildland-urban interface (WUI). In New Jersey, citizens take advantage of the privacy, natural beauty, and recreational opportunities the WUI offers, requiring developers to build neighborhoods adjacent to natural areas. As a result, forests are becoming less healthy and prominent in the state, and more buildings and homes are being damaged by accidental forest fires. This project is partnering with the New Jersey Pinelands Commission (NJPC) to develop a tool that will identify areas most suitable for urban development, and other areas where less intense development may be permitted if in conjunction with Best Management Practices (BMPs). Using Landsat 8 OLI, SMAP, and GPM GMI, this tool will take into account distance to urban areas as well as environmental parameters to examine wildfire-risk within the WUI. Risk assessments such as this are important for decision makers because it enables them to target areas for fuel reduction treatments.

***Community Concern:*** The New Jersey Forest Fire Service responds to over 1,500 wildfires annually throughout the state of New Jersey, and with WUI on the rise, this number could increase. These wildfires not only damage local ecosystems, but are becoming an increasing threat to homeowners living in these areas. There are a number of variables that influence a community’s vulnerability to wildfire damage, some of which include land use decisions, building standards, and landscape choices. A better understanding of these variables, along with climatic variables, will help decision makers determine areas that have the lowest risk of wildfire and are most suitable for development, and where tools to lessen risks should be considered for protection.

***Source of Project Idea:*** This project originated from discussions between Dr. Rob Griffin, the Marshall’s Science Advisor, and Maggi Klug, the Center Lead of the Alabama – Marshall node. This discussion led to the node leadership reaching out to the partners to gain a better understanding of their needs in order to develop a more robust project.

***National Application Areas Addressed:*** Urban Development

***Study Location:*** NJ

***Study Period:*** January 2016 – December 2017

***Advisors:*** Dr. Jeffrey Luvall (NASA Marshall Space Flight Center), Dr. Robert Griffin (University of Alabama in Huntsville), Leigh Sinclair (University of Alabama in Huntsville, Information Technology and Systems Center), Maggi Klug (University of Alabama in Huntsville)

**Partner Overview**

***Partner Organization:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC** | **Partner Type** | **Boundary Org?** |
| **New Jersey Pinelands Commission** | Larry Liggett, Director | End User | No |

***End-User Overview***

***End User’s Current Decision-Making Process:***In response to an increase in WUI development, the end user organization has increased fire suppression and prevention research, and the use of BMPs for more rural development.Currently, the NJPC conducts risk mapping in forested areas using old maps and/or field surveys that consist of an assessor on the ground. This assessor uses a visual scoring system to examine the fire risk of an area, which is both subjective and time consuming.

***End User’s Capacity to Use NASA Earth Observations:***

*New Jersey Pinelands Commission* – Managers at the NJPC are familiar with GIS and NASA Earth observations and work closely with organizations that utilize NASA Earth observations. This project will build their capacity further by developing new tools to assess wildfire probability.

***Project Communication & Transition Overview***

***In-Term Communication Plan*:** During the first week of the project, the team lead will contact the partner organizations and schedule a conference call for participants and partners to introduce themselves and determine if there are any changes to the end-products. Weekly or bi-weekly meeting will be held via teleconferences during the term.

***Transition Plan*:** At the end of the term, end-products and results will be disseminated to the project partners via a web conference. During this meeting, the team will give a brief presentation of the results followed by a tutorial explaining how to use the end-products.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameters** | **Use** |
| **Landsat 8 OLI** | Surface Reflectance | Landsat 8 OLI is a 30 m dataset that will be used to analyze local vegetation and land cover in the study area. |
| **SMAP** | Soil Moisture | SMAP will be used to measure soil moisture at 9 km to aid in determining wildfire risk. |
| **GPM GMI** | Precipitation | GPM GMI precipitation estimates will be used as an environmental variable to analyze risk. |

***Ancillary Datasets:***

US Geological Survey (USGS) National Land Cover Database (NLCD) – To use for spectral vegetation indices and land cover classifications

Oak Ridge National Laboratory LandScan Data – For population data

NOAA National Centers for Environmental Information Climate Data Online Temperature, Precipitation, Snow Fall and Snow Depth – To analyze daily historic climatic data

FireWhat Inc. Current U.S. Wildland Fires – To monitor current active fire locations and current wildland fire potential

Landfire Reference, Disturbance, Vegetation, Fuel, and Fire Regime Data – To use as inputs in our tool to examine an areas vegetation and fuel data.

***Software & Scripting:***

Esri ArcGIS 10.4 – Raster manipulation and analysis, imagery processing, and map production

**Decision Support Tool & End Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Products** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| **Fire Risk Assessment Tool** | The Fire Risk Assessment Tool will be used to assist project partners in determining areas that have a minimal threat for fire destruction and identify other more risky areas that could be developed with appropriate measures. Partners will be able to use this tool in the future as the vegetative make-up of the area changes. | This tool will use an algorithm created in ArcGIS Model Builder. The algorithm will take into account multiple fire-risk variables derived from Landsat 8 OLI imagery, SMAP, and GPM GMI. | N/A |
| **Low Risk WUI Map** | This map will enhance project partner’s decision making process by identifying suitable and low risk areas for urban development. | The Low Risk WUI Map will be created using a combination of Landsat 8 OLI imagery and environmental variables such as soil moisture, precipitation, etc. | N/A |

***End-User Benefit*:** This project will identify areas of low fire risk, saving project partners time and money over conducting similar on the ground surveys for fire-risk assessment. End products will eliminate the potential of bias and subjective fire risk scoring, giving the project partners more confidence in the assessment. Additionally, project partners will have the capacity to use the tool in the future to continue conducting risk assessments on a seasonal basis and enhance land use planning.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 1 Term: Spring 2017

***Related DEVELOP Work:***

Fall 2015 (SSC) – Texas Disasters II: Utilizing NASA Earth Observations to Assist the Texas Forest Service in Mapping and Analyzing Fuel Loads and Phenology in Texas Grasslands

Summer 2013 (AL) – Southeast Agricultural and Disasters: Assisting State and Federal Post-Wildfire Assessments through the Application of EOS Data

Summer 2014 (GSFC) – Utilization of Ground-Based Annual Survey and Habitat Classification Data to Demonstrate and Predict Population Trends and their Implications for Bird Conservation

**Notes & References:**

***References:***

Price, O., & Bradstock, R. (2014). Countervailing effects of urbanization and vegetation extent on fire frequency on the Wildland Urban Interface: Disentangling fuel and ignition effects. *Landscape and Urban Planning, 130*, 81-88. https://doi.org/10.1016/j.landurbplan.2014.06.013

Skowronski, N. (2015). Assessing Fire Risk at the Wildland-urban Interface Using LiDAR. US Forest Service Research & Development. Retrieved from https://www.fs.fed.us/research/highlights/highlights\_display.php?in\_high\_id=874

Stein, S. M., Comas, S. J., Menakis, J. P., Carr, M. A., Stewart, S. I., Cleveland, H., . . . Radeloff, V.C. (2013). Wildfire, Wildland, and People: Understanding and Preparing for Wildfire in the Wildland-Urban Interface. Retrieved from https://www.fs.fed.us/openspace/fote/reports/GTR-299.pdf

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