**NASA DEVELOP National Program**

**Fall 2016 Project Proposal**

**NASA Langley Research Center**

**Glacier National Park Climate**

Utilizing NASA Earth Observations to Correlate Landscape Disturbances to Effects of a Changing Climate across Glacier National Park

**Project Overview**

***Objective:*** To map and quantify landscape disturbances, including fire, forest pathogens, avalanche, landslides, floods, and invasive species that are related to a changing climate, in order to benefit existing resource management programs and guide the direction of future research and educational outreach.

***Community Concern:*** Glacier National Park is interested in developing a spatial database that relates landscape-level disturbances to climate-related effects across the park. Many disturbances have affected park lands within the larger Crown of the Continent ecosystem including fire, forest pathogens, and avalanche; however, park managers have identified the period from 1999 to present as one of climate extremes, the effects of which are currently unknown. By synthesizing these known and unknown disturbances, the Park will be able to better address and focus management resources to respond to disturbances within the park.

***National Application Area(s) Addressed:*** Climate

***Study Location:*** Glacier National Park, MT

***Study Period:*** 1999 to 2016; Forecasting to 2020

***Advisor(s):*** Dr. Kenton Ross (NASA Langley Research Center)

***Source of Project Idea:*** The project idea was originally proposed by Richard Menicke, geographer at Glacier National Park to the DEVELOP National Program in spring of 2016 through DEVELOP’s call for NPS proposals. Richard identified the park’s need to develop map products that quantify landscape disturbances connected to climate change.

**Partner Overview**

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| National Park Service, Glacier National Park | Richard Menicke, Geographer | End-User | No |
| National Aeronautics and Space Administration, Biospheric Branch at Ames Research Center | Christopher Potter, Senior Research Scientist | Collaborator | No |

***End-User Overview***

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

The National Park Service currently uses some NASA Earth observations to study landscape-level disturbances within the park, specifically Landsat. The Earth observations are especially important for assessment and understanding of burn severity patterns and diversity resulting from large fires within the park boundaries. Additionally, they use aerial photography to characterize and map vegetation diversity and distribution.

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

NPS Glacier National Park – The end-user is familiar with NASA Earth observations and their applications, and is working to expand their usage in Glacier National Park through his work with Dr. Potter at NASA Ames. This project would enhance the park’s/ end-user’s usage of NASA Earth observations by furthering development of Dr. Potter’s methodologies relating to landscape-level disturbances in Glacier National Park.

***Collaborator & Boundary Organization Overview***

***Collaborator Support:***

NASA Biospheric Branch at Ames Research Center – Dr. Christopher Potter has been developing a methodology to use Landsat to monitor disturbances within national parks. The project team will be adapting Dr. Potter’s methodology, and will be utilizing Dr. Potter’s expertise and experience to further expand the methodology.

***Project Communication & Transition Overview***

***In-Term Communication Plan:***

The team will communicate with the project partners weekly to update the partners on project progress. Additionally, phone calls will be conducted once or twice each month to discuss methodology and progress more in depth. The main POC for this communication will be the team lead.

***Transition Approach:***

End products will be provided to the partners through an electronic handoff at the end of the term. The maps will be available for the park managers to use in their allocation of management resources.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| **Landsat 5,7, & 8 TM, ETM+, and OLI** | NDVI & NDMI | Vegetation indices |

***Ancillary Datasets:***

Montana high school science classes – ground truth datasets – validate model results

GAP Analysis Program - ecosystem land cover – vegetation indices

NED - DEM data – vegetation indices

PRISM or DayMet - climatology data – vegetation indices

NPS disturbance data - fire and pathogen mapping – vegetation indices

***Modeling:***

TerrSet Land Change Modeler (Clark Labs)

***Software & Scripting:***

Exelis ENVI 5.0 – vegetation indices, image processing

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

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product(s)** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| Vegetation Change Maps | Indicates changes in vegetation of study period | Landsat 5, 7, & 8 |  |
| Current Vegetation Distribution Map | Maps distribution of vegetation in the present | Landsat 8 |  |

***End-User Benefit:***

The end user will gain updated distribution maps of current forest health, as well as a map of changes in vegetation from 1999 to 2016. This mapping will help enhance the decision making process by providing land managers a more holistic understanding of the changes in and current distribution of vegetation within the park. Further, these analyses will allow for better distribution of management resources and future planning.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 2 Terms: Fall 2016 (Start) to Spring 2017 (Completion)

***Multi-Term Objectives:***

* **Term 1 (Proposed Term):** Fall 2016 (LaRC) – Glacier National Park Climate
  + Determine methodology for rule-based classification to create vegetation maps.
* **Term 2** Spring 2017 (LaRC) – Glacier National Park Climate II
  + Expand methodology to larger study area and update rule-based classification.

***Related DEVELOP Work:***

Spring and Summer 2007 (Ames) – California Ecological Forecasting

Summer 2016 (WC) – Northern Great Plain Water Resources

**Notes & References:**

***References:***

Potter, C. 2016. Vegetation cover change in Glacier National Park detected using 25 years of Landsat satellite image analysis. Journal of Biodiversity Management & Forestry, 5(1), *doi: http://dx.doi.org/10.4172/2327-4417.1000156.*