**NASA DEVELOP National Program**

**Fall 2016 Project Proposal**

**Wise County and City of Norton Clerk of Court’s Office, Wise, VA**

**Northern Great Plains Water II**

Utilizing NASA Earth Observations to Detect Changes in Annual Snowpack Coverage in Intermountain National Parks

**Project Overview**

***Objective:*** To further document retreating ice, snow cover and glaciers, along with associated changes in vegetation in the Intermountain National Parks.

***Community Concern:*** National Parks in the Intermountain region of the northern United States Great Plains region are experiencing snow and ice melt due to changes in climate. As the ice recedes, new ground is exposed, potentially revealing previously undiscovered archeological sites, as well as altering the vegetation and fire regime of the area. By mapping the change in snow and ice cover, the search for archeological sites can be focused on previously icebound areas.

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

***Study Location:*** Glacier National Park, Yellowstone National Park, Grand Teton National Park

***Study Period:*** January 1998 to October 2016

***Advisor(s):*** Kenton Ross (NASA DEVELOP National Program), DeWayne Cecil (NOAA NCEI, Global Science and Technology), Bob VanGundy (The University of Virginia’s College at Wise)

***Source of Project Idea:*** This project originated from Tom Lincoln, Assistant Regional Director of Cultural Resources for the Intermountain Region of the National Park Service. This is a continuation of the Summer 2016 Northern Great Plains Water project.

**Partner Overview**

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| National Park Service, Intermountain Region, Cultural Resources | Tom Lincoln, Archaeologist/ Assistant Regional Director of Cultural Resources for the Intermountain Region of the National Park Service | End-User | Yes\* |

***End-User Overview***

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

The National Park Service is responsible for protecting and documenting cultural resources across all parks. As annual snow and ice coverage decreases, previously buried archeological sites are exposed and need to be documented and preserved. Currently the National Park Service Intermountain Region relies on aerial photography and ground surveys to map the extent of snowpack and ice. While accurate, these methods require considerable time and monetary resources.

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

National Park Service Intermountain Region – NPS is familiar with NASA Earth Observations, however they have not used them to quantify changes in snow and ice coverage in the Intermountain National Parks.

***Project Communication & Transition Overview***

***In-Term Communication Plan:*** The team will communicate with Tom Lincoln, POC National Park Service and/or other NPS personnel via bi-weekly teleconference.

***Transition Approach:*** Hand off will be conducted via either Google hangout or teleconference with a shared screen for slides. It is hoped that the updated snow and ice cover and vegetation maps will be implemented immediately into the NPS decision-making process. Software release is not anticipated with this project.

**Letters of Support:** Tom Lincoln, Assistant Regional Director of Cultural Resources for the Intermountain Region of the National Park Service

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| **Landsat 5 TM** | Surface reflectance | Historical imagery will be compared to the “max melt” year of 1998 to locate areas with the greatest risk of reduced persistent ice and snow cover (PISC) |
| **Landsat 8 OLI** | Surface reflectance | Imagery from Landsat 8 will be used to monitor persistent ice and snow cover. |
| **Aqua/Terra MODIS** | Vegetation type | MODIS data will be used for assessing changes in ice and snow frequency and vegetation types in alpine landscapes. |
| **Sentinel-2A** | Surface reflectance | Sentinel-2A data will contribute to higher resolution imagery of PISC. |

***Ancillary Datasets:***

National Park Service – GIS database of Persistent Ice and Snow Cover – Used to verify NASA EO data products.

***Software & Scripting:***

ArcGIS 10.4 – data manipulation and map creation

ERDAS IMAGINE 2015 – Image processing of Landsat and MODIS data

ENVI 5.3 – Image processing of Landsat and MODIS data

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

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product(s)** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| Max Snow Melt Area Map | This product will be used to identify areas that have been historically been covered by snow and ice in order to identify previously covered archeological sites. | A change detection will be conducted using Landsat 5 TM and Landsat 8 OLI imagery. The resulting image will highlight areas previously covered by snow and ice. | N/A |
| Land Cover Map of Exposed Areas | This product will be used to help construct a land cover map which will assist researchers in assessing the paleo-environment of archaeological sites. | A land cover map will be derived from MODIS imagery acquired during the 2014 “max melt” year. | N/A |

***End-User Benefit:*** These end-products will be useful in “testing hypotheses about the drivers of human behavioral variability.” The NPS will use the end-products to weigh the effects of paleo-climate change combined with human population density on behavioral choices. Furthermore, these products will aid the NPS in its mission to “protect and mitigate for impacts of climate change to mountain cultural heritage resources.”

**Project Timeline & Previous Related Work**

***Project Timeline:*** 2 Terms: 2016 Summer (Start)- 2016 Fall (Completion)

***Related DEVELOP Work:***

2016 Summer (WC) – Northern Great Plains Water: Discovering Archaeological Sites by Utilizing NASA Earth Observations to Detect Changes in Snowpack Coverage in Intermountain National Parks