**NASA DEVELOP National Program**

**Summer 2016 Project Proposal**

**NASA Marshall Space Flight Center**

**Chaco Canyon Cross-Cutting**

Utilizing NASA Earth Observations to Identify Chacoan Community Signature Profiles throughout the Chaco Canyon to Help with Preservation and Protection Strategies

**Project Overview**

***Objective:*** To identify Chacoan community signature profiles, such as roads and homesteads, throughout the Chaco Canyon to help with preservation and protection strategies by using NASA Earth observations.

***Community Concern:*** The Chacoan community flourished in northwest New Mexico between 850 and 1150 AD. Today, the monumental standing ruins draw over 40,000 visitors a year to experience natural grandeur and to learn about the Native history throughout the Chaco Canyon. Currently, the Chaco cultural landscape is under threat from horizontal drilling for oil and gas development making the landscape vulnerable to encroaching infrastructure associated with resource extraction, such as drill pads with requisite access roads and pipelines, throughout the San Juan Basin. Documenting identified Chacoan community signature profiles and determining which areas are at risk of being affected by resource extraction and encroaching infrastructures will help the project partners with preservation and protection strategies.

***National Application Area Addressed:*** Cross-Cutting

***Study Location:*** San Juan Basin, northwestern New Mexico

***Study Period:*** January 2000 to May 2016

***Advisors:*** Dr. Jeffrey Luvall (NASA at NSSTC), Dr. Robert Griffin (University of Alabama in Huntsville), Dr. Tom Sever (University of Alabama in Huntsville)

***Source of Project Idea:*** This project was requested from the National Park Service since there is a need to implement satellite remote sensing to identify Chacoan community signature profiles.

**Partner Overview**

***Partner Organizations:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| National Park Service (NPS) | Tom Lincoln, Intermountain Region Assistant Regional Director for Cultural Resources | End-User | No |
| Binghamton University | Dr. Ruth Van Dyke, Archaeologist | End-User | No |
| University of Nebraska-Lincoln | Dr. Carrie Heitman, Assistant Professor | End-User | No |
| University of Colorado Boulder | Dr. Steve Lekson, Curator of Anthropology | End-User | No |

***End-User Overview***

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

Currently, the NPS, Binghamton University, University of Nebraska-Lincoln, and University of Colorado Boulder uses Google Earth and Landsat series to find locations of Chacoan roads and houses. The project partners also find known Chacoan road and house locations by field work, which is both timely and costly. These known locations help the project partners better understand the Chacoan culture, as well as to better protect and preserve the ruins.

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

NPS – The NPS has little experience using NASA Earth observations. The results of this project will contribute to identifying unknown Chacoan roads and houses and provide more information on which areas are at risk of being affected by resource extraction and encroaching infrastructure. NPS will use these end-products to help with preservation efforts.

Binghamton University – Binghamton University has little experience using NASA Earth observations. The results of this project will contribute to identifying unknown Chacoan roads and houses and provide more information on which areas are at risk of being affected by resource extraction and encroaching infrastructure. NPS will use these end-products to help with preservation efforts.

University of Nebraska-Lincoln – University of Nebraska-Lincoln uses NASA Earth observations to find Chacoan road and house locations. The results of this project will contribute to identifying unknown Chacoan roads and houses and provide more information on which areas are at risk of being affected by resource extraction and encroaching infrastructure. NPS will use these end-products to help with preservation efforts.

University of Colorado Boulder – University of Colorado Boulder has little experience using NASA Earth observations. The results of this project will contribute to identifying unknown Chacoan roads and houses and provide more information on which areas are at risk of being affected by resource extraction and encroaching infrastructure. NPS will use these end-products to help with preservation efforts.

***Project Communication & Transition Overview***

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

The team lead will open communication during the first week of the term through email and set a time for a telecon. During this scheduled telecon, the team will introduce themselves and will discuss the proposed end-products to ensure there have not been any changes. In addition, the team will ask how the project partners would like to be updated with the progress of the project throughout the term.

***Transition Approach:***

During week 5 of the term, the team will ask the project partners if they will be able to attend the closeout session, as well as how they would like the end-products to be handed off.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameters** | **Use** |
| **Terra ASTER** | Global Emissivity Dataset, Digital Elevation Models | Terra ASTER data will provide emissivity data to show where there have been disturbances, which will then be used to find Chacoan roads and houses. Terra ASTER will also provide Digital Elevation models to better understand the topography of the study area. |
| **Landsat 8 OLI** | Surface Reflectance | Landsat 8 OLI data will provide surface reflectance data that will be used to visually pinpoint Chacoan roads and houses that are above the surface. |
| **SRTM-v2 C-band** | Digital Elevation Models | The SRTM-v2 C-band Digital Elevation Models data will be used to better understand the topography of the study area. |

***Ancillary Datasets:***

University of Nebraska-Lincoln – Chacoan Roads in-situ data – known locations of Chacoan roads

University of Nebraska-Lincoln – Chacoan Great House in-situ data – known locations of Chocoan houses

NASA Socioeconomic Data and Applications Center (SEDAC) – Global Roads Open Access Data Sets (gROADS) – global data set of roads

LANDFIRE – Existing Vegetation Type – Landcover data

Oak Ridge National Laboratory – LandScan data – population data

Google Earth – Worldview data – Locate Chocoan roads and houses

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

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Products** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| Chacoan Ruins Density Map | This map will show which areas throughout the San Juan Basin have the largest amount of Chacoan ruins. This will be used by the project partners to know where preservation efforts should be focused. | Datasets and sensors involved will be Terra ASTER, Landsat 8 OLI, and Worldview data from Google Earth. These sensors will be used to locate Chacoan roads and homesteads. | N/A |
| Chacoan Ruins Risk Map | This map will show which areas throughout the San Juan Basin are at risk of being affected by resource extraction and encroaching infrastructure. This will be used by the project partners to know where preservation efforts should be focused. | Datasets and sensors involved will be Terra ASTER, SRTM-v2 C-band, Landsat 8 OLI, in-situ data, and various ancillary datasets. These data will be used to understand which areas are at risk of being affected by resource extraction and encroaching infrastructure. | 1 |

***End-User Benefit:***

The results of this project will contribute to identifying previously unknown Chacoan road and house locations throughout the San Juan Basin in northwest New Mexico. This project will help the project partners with preservation efforts by showing which Chacoan ruins are at risk of being affected by resource extraction and encroaching infrastructure.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 1 Term: 2016 Summer

***Related DEVELOP Work:***

2015 Summer (MSFC/GSFC/WC) - Alto Orinoco Health and Air Quality: Utilizing NASA Earth Observations to Locate Yanomami Villages in the Alto Orinoco Municipality for Targeted Eradication of River Blindness Disease

**Project Needs/Requests**

***Participants Requested:*** 4

***Software & Scripting:***

ArcMap 10.3 – Raster manipulation/analysis, image enhancement, and map creation of Landsat OLI, Terra ASTER, and SRTM-v2 C-band

Python 2.7 – Raster manipulation/analysis and image enhancement of Landsat 8 OLI, Terra ASTER, and SRTM-v2 C-band

Dnppy Model – Landsat data pre-processing to TOA reflectance

**Notes & References:**

***Notes:*** MSFC Center Lead currently has the Chacoan roads in-situ data, the Chacoan house in-situ data, and LandScan data, and it will be provided to the team the first week of the term.

***References:***

<http://www.drillingedge.com/new-mexico>