**NASA DEVELOP National Program**

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Wise County Clerk of Circuit Court’s Office

*Spring 2017*

**Short Title: Wyoming Cross-Cutting**

**Subtitle:** Utilizing NASA Earth Observations to Detect Changes in Nighttime Sky Brightness in Grand Teton National Park

**VPS Title:** Illuminating a Lost Treasure: Remote Monitoring of Night Sky Light Pollution

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Dewayne Cecil (Global Science & Technology Inc., NOAA National Centers for Environmental Information)

Dr. Kenton Ross (NASA Langley Research Center)

Bob VanGundy (The University of Virginia’s College at Wise)

**Partner Organizations:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| National Park Service, Intermountain Region | Randy Stanley, Natural Sounds & Night Skies Coordinator | End-User | No |
| National Park Service, Grand Teton National Park | Dan Greenblatt, Colter Bay District Interpreter | End-User | No |
| International Dark-Sky Association | John Barentine, Program Manager | Collaborator | Yes |
| Wyoming Stargazing | Samuel Singer, PhD, Executive Director | End-User | Yes |

**Project Details**

**Applied Sciences National Application Addressed:** Cross-Cutting

**Study Area:** Grand Teton National Park and 300 km boundary buffer (CO, ID, MT, NV, UT, & WY)

**Study Period:** January 2014 – December 2016

**Earth Observations & Parameters:**

Suomi NPP Visible Infrared Imaging Radiometer Suite (VIIRS) – Day/Night Band (DNB)

**Ancillary Datasets Utilized:**

* Partner *In situ* Data – Wyoming Stargazing night-time sky brightness measurements
* Center for the Advancement of Science in Space (CASIS) – International Space Station (ISS) nighttime photography of study area

**Software Utilized:**

* ESRI ArcGIS – raster manipulation, statistical interpretation, map creation
* Google Earth Engine API – raster manipulation, statistical interpretation, map creation

**Project Overview**

**80-100 Word Objectives Overview:**

Urban expansion and improper use of artificial lighting increases the amount of light pollution radiating into the environment. Similar to other sources of pollution, light pollution threatens human health and the health of natural ecosystems, as well as decreases human enjoyment of the wilderness. Since the launch of the first Earth observing satellites, city lights have been visible from space; the amount of artificial light has only increased over time. NASA DEVELOP partnered with the National Park Service to use NASA’s Earth observations to improve current monitoring and research practices of artificial light sources.

**Abstract:**

Light pollution causes measurable damage to natural wildlife behaviors and human health, as well as decreases the ability for humans to view the night sky. The artificial brightening of the night sky, or sky glow, created by light pollution subjects nearly 100% of Americans to light-polluted skies with only three percent able to see the Milky Way from their homes. Historically, Grand Teton National Park has been a refuge for those seeking dark night skies; however, the quality of these skies is threatened by the spread of light pollution from nearby towns. The NASA DEVELOP Wyoming Cross-Cutting team partnered with Grand Teton National Park, the International Dark-Sky Association, and Wyoming Stargazing to utilize NASA Earth observations to identify sources of light pollution within the park, and the surrounding states up to a 300 km buffer. Utilizing Suomi NPP VIIRS Day/Night Band data and equations derived from Falchi et al.’s (2016) model of light emission, the team developed a convolution matrix to be used in the summer term to calculate sky glow levels and estimate light pollution within the park. The products will allow partners to assess areas where changes in lighting practices were effective, and suggest where mitigation is needed to reduce light pollution.

**Keywords:**

Remote sensing, VIIRS, Day/Night Band, light pollution, National Park Service

**Community Concerns:**

* Nearly 100% of the United States’ residents live under light-polluted skies, and only three percent are able to see the Milky Way at night due to improper lighting practices in urban landscapes.
* Grand Teton National Park enjoys some of the clearest night skies in the country due to its isolation and low humidity. However, light pollution produced by development in nearby urban areas threatens the natural night time sky.
* Increased artificial light can alter wildlife migratory patterns, breeding, and feeding habits. Park managers are concerned with protecting wildlife populations within the park from these effects.

**Current Management Practices & Policies**:

Currently, Grand Teton National Park records light measurements inside the park using the Unihedron Sky Quality Meter (SQM) to collect information about sky brightness conditions at scattered locations. Grand Teton National Park uses SQM measurements to assess light pollution in the park and to address lighting management practices. In addition, local jurisdictions outside Grand Teton National Park have created ordinances that limit the power, color, and duration of nighttime lighting to help control light pollution around the Park.

**Decision Support Tools & Benefits:**

|  |  |  |  |
| --- | --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** | **Software Release** |
| Sky Glow Convolution Matrix | Suomi NPP VIIRS DNB | Will be applied in Summer term to calculate sky glow and identify sources of light pollution in order to inform partners’ light mitigation practices | N/A |