**NASA DEVELOP National Program**



BLM at Idaho State University GIS TReC & Wise County Clerk of Circuit Court’s Office

*Spring 2017*

**Short Title: Southeast Idaho Water Resources II**

**Subtitle:** Utilizing NASA Earth Observations to Identify Existing Surface Water Features and Improve Water Management and Resource Allocation in Southeast Idaho

**VPS Title:** Where's the Water? Locating Surface Water in the Idaho Desert

**Project Team & Partners**

**Project Team:**

Cody O’Dale (Project Lead), odalcody@isu.edu

Austin Counts

Brooke Colley

Claire Haupt

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**Advisors & Mentors:**

Keith Weber, Lead Science Advisor (GIS Training and Research Center at Idaho State University)

Charles Peterson (Biology Department, Idaho State University)

Mark Carroll (NASA Goddard Space Flight Center)

**Past or Other Contributors:**

Traci Olson

Dylan Thomas

Caitlyn Toner

**Partner Organizations:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| Bureau of Land Management, Pocatello Field Office | Karen Kraus, Natural Resource Specialist | End-User | No |
| Idaho Department of Water Resources, State Office | Linda Davis, Senior GIS Analyst | End-User | No |
| NASA RECOVER Science Team | Keith Weber, GIS Director | Collaborator | Yes |

**Project Details**

**Applied Sciences National Application Addressed:** Water Resources

**Study Area:** Southeastern ID

**Study Period:** May 2016 – July 2016

**Earth Observations & Parameters:**

Landsat 8, Operational Land Imager (OLI) – spectral classification

Shuttle Radar Topography Mission (SRTM) version 2 – elevation, slope, and aspect

Sentinel-2 MultiSpectral Imager (MSI) – spectral classification

**Ancillary Datasets Utilized:**

* USGS Dynamic Surface Water Extent (DSWE) – water classification
* USGS National Hydrography Dataset (NHD) – surface water

**Software Utilized:**

* Google Earth Engine API – Image processing, classification, and analysis
* ESRI ArcGIS – Image processing and analysis

**Project Overview**

**80-100 Word Objectives Overview:**

Personnel at the Bureau of Land Management (BLM) and Idaho Department of Water Resources (IDWR) in southeastern Idaho need current and dynamic data when managing sensitive aquatic habitats and anthropic water supplies. Currently, partners rely on local knowledge and dated information for identifying water bodies. This project utilized NASA Earth observations and Google Earth Engine to produce a model that finds surface water more accurately than currently available information. This model is as a user-friendly tool that allows partners to identify surface water from the latest imagery and monitor temporal changes of surface water in their management area.

**Abstract:**

Understanding water dynamics in southeast Idaho is critical to planning and improving water management practices. Partner organizations that focus on water resource management, such as the Bureau of Land Management (BLM) and Idaho Department of Water Resources (IDWR), currently use the National Hydrography Dataset and legacy knowledge to identify water bodies. However, this approach has been insufficient to meet all their needs because these datasets may not always reflect the current ground conditions. This poses a risk for officials at the BLM and IDWR that could lead to ineffective use of their resources and inefficient management practices. Therefore, this study used NASA Earth observations and Google Earth Engine (GEE) to create a tool that would allow end-users to better identify and track water bodies within their management area. Known as the Surface Water Indicator Model (SWIM), this tool incorporated Landsat 8 imagery, Sentinel-2 imagery, multiple water indices, and topographic data into a Support Vector Machine (SVM) classifier. This study combined multiple water indices into a single tool to create a more accurate surface water indicator. The resulting SWIM tool was created in both GEE and ESRI ArcGIS to allow the end-users their choice of platform. The SWIM tool will help natural resource managers with current and seasonal surface water indication and provide more accurate data for land managers.

**Keywords:**

Surface water, Landsat, SVM, water index, water resources, SWIM, Google Earth Engine, seasonality

**Community Concerns:**

* Existing maps are out-of-date and in some areas inaccurate which leads to land managers committing resources towards protecting nonexistent water or finding unexpected water during invasive removal field work.
* Water rights are a controversial topic in southeastern Idaho and land managers often find themselves making difficult decisions to balance anthropogenic demand with ecological protections.
* Knowledge about both the spatial extent and flow dynamics of water sources are required to improve management decisions.

**Current Management Practices & Policies**:

The Bureau of Land Management and the Idaho Department of Water Resources are responsible for the management of surface water bodies and habitats with threatened or protected species in southeastern Idaho. Neither organization currently uses satellite data to identify surface water features. Instead, they rely on the National Hydrological Dataset and legacy knowledge to determine areas which require special management practices. The NHD, although considered a standard resource, includes features identified as far back as the 1950’s that originally included any feature with the potential to store water. The BLM is required to place a buffer around each river or stream in the NHD before they can spray for weeds. This can then include areas that no longer contain water, which results in a continued inhabitation of invasive species. The Idaho Department of Water Resources is the state steward for the NHD and rely on local knowledge and maps to keep the NHD current.

**Decision Support Tools & Benefits:**

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| --- | --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** | **Software Release** |
| Surface Water Map | Landsat 8 OLI, Shuttle Radar Topography Mission (SRTM) Version 2, Sentinel 2, MultiSpectral Imager (MSI) | The initial results will help our project partners focus resources in areas known to hold water, eliminating outdated data provided by the NHD. | N/A |
| Surface Water Indication Model (SWIM) | Landsat 8 OLI, Shuttle Radar Topography Mission (SRTM) Version 2, Sentinel 2, Multispectral Imager (MSI) | This model will give our partners the ability to compile their own water indication map from the latest Landsat data and compare current and historical water extents. | III |
| Surface Water Identification Model Tutorial |  | This will give partners the ability to apply project methodologies to other study areas or time frames. | N/A |