**NASA DEVELOP National Program**

****Pocatello, Idaho

**Spring 2016**

**Short Title: Southeast Idaho Disasters II**

**Subtitle:** Using Earth Observing Systems to Characterize Juniper Invasion and Assess Changes in Soil Moisture within Cheatgrass Dominated Sites Relative to Wildfire Susceptibility in east Idaho

**VPS Title:** Where have all the Junipers come from?

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Keith Weber (GIS Training and Research Center at Idaho State University)

John Schnase (NASA Goddard Space Flight Center)

Mark Carroll (NASA Goddard Space Flight Center)

**Past or Other Contributors:**

Zachary Simpson

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**Partner Organizations:**

Bureau of Land Management, Idaho State Office and Cooperating District Offices (end-user), POC: Mike Kuyper, Natural Resource Specialist

USDA Forest Service, Caribou-Targhee National Forest (collaborator), POCs: Arik Jorgensen, Portneuf Zone AFMO-Fuels, and Chris Colt, Wildlife Biologist

Idaho Department of Fish and Game (collaborator) POC: Scott Bergen, Principle Wildlife Research Biologists

RECOVER Project at NASA Goddard, POCs: John Schnase, Senior Computer Scientist, and Mark Carroll, SR. Support Scientist; Boundary Organization

RECOVER Project at ISU, POC: Keith Weber, GIS Director; Boundary Organization;

**Project Details**

**Applied Sciences National Applications Addressed:** Disasters

**Study Area:** Southeast Idaho

**Study Period:** August 1985 to August 2015

**Earth Observations & Parameters:**

SMAP, Radiometer – soil moisture

Landsat 5, TM – land cover, NDVI, mSAVI2

Landsat 8, OLI – land cover, NDVI, mSAVI2

NAIP, Digital CIR – Aerial imagery

VLSA Bannock County, VLSA imagery – Aerial Imagery

**Ancillary Datasets Utilized:**

* North American Land Data Assimilation Systems – Soil Moisture, Soil Types
* Landscape Fire and Resource Management Planning Tools Program – Vegetation type, vegetation departure
* USGS National Land Cover Dataset (NLCD) - land cover
* Caribou-Targhee NF Existing vegetation map – RSAC – vegetation types
* Idaho Disasters III dataset
* USGS National GAP Analysis Program (GAP)- Land cover, land type
* Surface Management Agency (SMA) – land ownership classification
* AgriMet Weather Data – precipitation data

**Models Utilized:**

* TerrSet Geospatial Monitoring and Modeling System Land Change Modeler

**Software Utilized:**

IDRISI TerrSet – raster manipulation/analysis, land classification of Landsat imagery

ArcGIS – point classification, map creation, raster manipulation

**Project Overview**

**80-100 Word Objectives Overview:**

Past fire suppression efforts have led to juniper species (*Juniperus spp*.) expansion from their native habitats during the last century. This has led to an increase in fuel loads, altered fire regimes, and intensified the severity of wildfires. Cheatgrass (*Bromus tectorum*) is a species largely responsible for increased fire frequency since being introduced to the Western U.S. at the end of the nineteenth century. The objectives of this study were to characterize juniper invasion and expansion since 1985 to 2015 and to assess temporal changes in cheatgrass dominated sites and compare these changes in soil moisture to sagebrush-dominated sites.

**Abstract:**

The expansion of juniper from their original rocky terrain into herbaceous communities has altered fire regimes and increased fire severity not only in Idaho but throughout the Great Basin and Intermountain West. As the range of juniper is expanding they begin to co-dominate communities resulting in the die-off of shrubs, grasses, and forbs. Wildfires, coupled with the presence of invasive plant species like cheatgrass, are primary drivers of change in semi-arid savanna ecosystems. By comparing soil moisture changes in cheatgrass dominated sites with sagebrush dominated sites this project will provide maps and graphs that will aid project partners in understanding why vegetation is departing from its native habitat and help with vegetation conservation efforts. This project looked at the historical changes in juniper distribution from 1985 to 2015. Imagery from Landsat 5 and 8 was gathered in 5 year increments, during August, and combined different topographic and climatic data to characterize juniper expansion. The maps produced provide land managers with the most current information on juniper encroachment and support decision making regarding the management of junipers.

**Community Concerns:**

* Over the past 130 years the Great Basin and Intermountain West has seen pinyon-juniper stands increase 10-fold; as a result these large fuel loads there has been an increase in the size and severity of wildfires.
* Juniper encroachment has altered many ecosystems of the Idaho rangelands and decreases the evolutionary health of a multitude of species.
* Climate change and invasive species have created a positive feedback environment leading to increased frequency and duration of wildfire regimes in Idaho.
* Urban sprawl has increased the size of the Wildland Urban Interface (WUI), placing more human life and property at risk of wildfire devastation.
* 2015 was one of the longest fire seasons in Idaho. Tax payers spent around $60 million dollars combating fires that burned 750,000 acres resulting in the destruction of more than 100 structures

**Current Management Practices & Policies**:

Over the past few decades, the western US has witnessed a steady expansion of juniper and cheatgrass in semiarid savanna ecosystems. Recent efforts by the BLM to manage juniper have included thinning (removing a proportion or subset of trees within a dense stand) and limbing (removing the lower limbs on all trees within a stand to reduce the potential for a fire to enter the crown). This management is only partially effective as the ideal management process requires action when juniper plants are first entering an area. Currently, the BLM identifies areas of juniper using Google Earth, vegetation cover maps, and through the use of transects in field work that helps to build the BLM species database.

**Decision Support Tools & Benefits:**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Juniper Prediction Map | Landsat 5 TM  Landsat 8 OLI | This map will provide the best and most current information about the direction juniper is moving and support decision making regarding the management of junipers. |
| Vegetation Based Soil Moisture Map | SMAP - Radiometer | These maps and graphs will characterize how soil moisture changes in sites dominated by cheatgrass in contrast to areas dominated by sagebrush. |
| Management Handbook |  | This handbook will inform our end-users about what imagery should be used to best answer the management questions they have identified. This will be accomplished by describing the best sensor or platform as well as the technique to complete the analysis and answer their management question directly. |
| RECOVER Website Extension |  | The juniper encroachment/management map may be integrated into the RECOVER Decision Support System and made available to aid fire managers during subsequent wildfire seasons. In addition, these data will be readily available to enable managers to plan fuel load reduction prescriptions following the spring term. |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)

**Software Release Requirements**

This project has started the software release process for the object-based classification tool, created in ArcMap ModelBuilder, during the first term.