



Spring 2023 Project Summary

Southern Idaho Ecological Conservation

Investigating the Impact of Targeted Grazing to Improve Wetland Habitat in the Sterling Wildlife Management Area

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Project Overview

Project Synopsis:

The Idaho Department of Fish and Game (IDFG) established the Sterling Wildlife Management Area (SWMA) in 1968 to safeguard upland and wetland habitats, promote the well-being of diverse wildlife, and offer wildlife-based recreation, with a particular emphasis on hunting. SWMA land managers aim to improve the area's waterfowl and ring-necked pheasant (*Phasianus colchicus*) populations by managing and enhancing the wetland habitat. Standing, senesced vegetation is a significant issue at SWMA, resulting in decreased wildlife use and reduced public access. IDFG has partnered with local ranchers to introduce targeted grazing at a small scale to manage the landscape and decrease biomass. The grazing started in January 2021 and has been ongoing since then. Where does DEVELOP come in? Provide one or two sentences regarding your partnership

Abstract:

Wetland ecosystems are vital for biodiversity conservation and ecosystem services but are often threatened by invasive plant species. Targeted grazing has been proposed as a sustainable alternative to chemical herbicides or burning for controlling invasive plants. The Sterling Wildlife Management Area in Bingham County, Idaho, has an issue with decadent and accumulated vegetation growth encroaching on wetland habitat, which presents challenges for wildlife, decreases biodiversity, and limits public access. Land managers introduced targeted cattle grazing in January 2021 to reduce biomass. NASA DEVELOP partnered with the Idaho Department of Fish and Game to determine the impact of the grazing by using NASA Earth observations from Landsat 8 Operational Land Imager in Google Earth Engine. Images were processed with TerrSet's Land Change Modeler and ArcGIS Pro's Change Detection Wizard to further understand the land changes after grazing. A Normalized Difference Vegetation Index analysis was performed to assess the impacts on vegetation productivity and to compare variances in biomass before and after grazing. A Normalized Difference Water Index was used to compare changes in ground moisture content to evaluate the suitability of the area for migratory birds post-grazing. Results showed a decrease in the vegetation index and an increase in the water index post-grazing. The DEVELOP team's analysis suggests that the grazing helped break down the thick, senesced vegetation and increased the ground moisture. Providing a workflow model allows partners to continue monitoring in this area and other management areas around the state.

Key Terms: change detection, NDVI, NDWI, Landsat-8, Google Earth Engine, TerrSet2020, ArcGIS Pro, targeted grazing

National Application Area(s) Addressed: Ecological Conservation

Study Location: Sterling Wildlife Management Area, Bingham County, Idaho

Study Period: 2013-2022, Forecasting to 2022

Community Concerns:

- Excess biomass makes it difficult for visitors to move through the land, limiting public access
- Tall, emergent vegetation degrades the open water zone of the wetland habitat, negatively impacting the wildlife in both population numbers and biodiversity

Project Objectives:

- Generate quantitative results that show the effects of grazing
- Quantify change in vegetation productivity and surface water cover
- Compare vegetation productivity and surface water cover before and after cattle grazing treatment
- Develop a step-by-step tutorial to provide the Idaho Department of Fish and Game with tools for future monitoring and analysis

Partner Overview

Partner Organization(s):

Organization	Contact (Name, Position/Title)	Partner Type
Idaho Department of Fish and Game	Maria Pacioretty, Habitat Biologist Jeff May, IT Software Engineer	End User

Decision-Making Practices & Policies:

IDFG conserves, protects, perpetuates, and manages wildlife, fish, and plants in Idaho. SWMA managers previously utilized mowing and prescribed fires to manage wetland vegetation. However, due to limited resources, staff, and funding, IDFG implemented an alternative, more cost-effective approach by collaborating with local ranchers to introduce high-intensity, short-duration targeted grazing to decrease wetland vegetation.

IDFG has monitored the area using photographs and measuring yardsticks in the field. They would like to leverage Earth observation data in addition to the LiDAR and ground data already in use. The organization has a strong interest in increasing its remote sensing capacity to assist with management and monitoring practices.

Earth Observations & End Products Overview

Earth Observations:

Platform & Sensor	Parameter(s)	Use
Landsat 8 OLI	Green, Red, and NIR Band	NDVI (Normalized Difference Vegetation Indices) was generated using NIR and Red bands to compare vegetation density before and after grazing NDWI (Normalized Difference Water Indices) was generated using NIR and Green bands to identify water area changes during the study period
National Agriculture Imagery Program (NAIP)	Red, Green, and Blue band	NAIP was used to validate the georeferenced of the Landsat and PlanetScope dataset
PlanetScope SuperDove	Red, Green, Blue, and NIR band	PlanetScope data was processed to calculate NDVI change during the study period
Aerial LiDAR	Elevation	LiDAR dataset was used to run Land Change Modeler in TerrSet2020

Ancillary Datasets:

- Boundary index of Sterling Wildlife Management Area: Idaho Fish and Game: To Classify boundaries
- Idaho Wetlands data layer: US Fish and Wildlife Service: To identify wetlands
- AgriMet weather data: Bureau of Reclamation: To monitor rainfall for Pheno-Calc processing
- Drought conditions (percent area): US Drought Monitor: To monitor drought history
- Grazing information: Idaho Fish and game: To identify grazing area and period
- LANDFIRE (Vegetation type and height): USFS & US Dept. of Interior: To gather vegetation information
- National Land Cover Database: Multi-Resolution Land Characteristics Consortium: To identify landcover

Modeling:

- Land Change Modeler in TerrSet (POC: Clark labs, Clark University)

Software & Scripting:

- Google Earth Engine – Landsat Level 2 data acquisition and processing
- ArcGIS Pro – Clip Raster, Change Detection
- TerrSet – NDVICOMP, Land Change Model
- Python – Matplotlib, Pandas, Numpy, Seaborn
- Pheno-calc (POC: Keith Weber, Idaho State University)

End Product(s):

End Product	Earth Observations Used	Partner Benefit & Use	Software Release Category
Google Earth Engine Code (NDVI and NDWI download)	Landsat 8 OLI	Partners can reuse this code for their future projects to download and generate NDVI and NDWI products	V
Vegetation Area Change (Change detection maps from NDVI)	Landsat 8 OLI	Partners can identify which area has an increased vegetation growth pattern	N/A
Water Area Change (Change detection maps from NDWI)	Landsat 8 OLI	Partners may monitor water area changes using the NDWI dataset	N/A
Predicted NDVI images	Landsat 8 OLI	Partners use this data to investigate the changes in vegetation due to grazing and other environmental factors	N/A

Product Benefit to End User:

The available products are valuable resources for the Idaho Fish and Game partners for predicting future changes in the Sterling Wildlife Management Area. These resources enable a comparison of ecosystem changes in areas with and without grazing activities in the coming years. This study also shows how earth observation dataset may help local community concerns. Additionally, reproducible resources such as Google Earth Engine code may broaden end users' prospective for future study.

References

- Hamad, R., Balzter, H., & Kolo, K. (2018). Predicting Land Use/Land Cover Changes Using a CA-Markov Model under Two Different Scenarios. *Sustainability*, 10(10), Article 10.
- Henry, A., & Scaup & Willet LLC. (2022). Wetland Review Report for Sterling Wildlife Management Area (p. 98). Idaho Department of Fish and Game, Southeast Region.
- LANDFIRE, E. R. O. and S. C. (EROS). (2022). LANDFIRE 2020 Existing Vegetation Height (EVH) CONUS 2022 Capable [Data.raster digital data]. LANDFIRE, Earth Resources Observation and Science Center (EROS), U.S. Geological Survey.
- Larson, D. M., DeJong, D., Anteau, M. J., Fitzpatrick, M. J., Keith, B., Schilling, E. G., & Thoele, B. (2022). High abundance of a single taxon (amphipods) predicts aquatic macrophyte biodiversity in prairie wetlands. *Biodiversity and Conservation*, 31(3), 1073–1093.
- Rose, D. (2014). Sterling Wildlife Management Area Management Plan 2014-2023 (p. 82). Idaho Department of Fish and Game, Southeast Region.