

NASA DEVELOP National Program

2024 Spring Project Proposal

Colorado - Fort Collins Idaho and Oregon Agriculture

Monitoring Vegetation Impacts of Livestock Management Practices Used to Reduce Predator Conflicts on Idaho and Oregon Grazing Allotments

Project Overview

Project Synopsis:

Ranchers in the western United States are reducing conflicts with predators through a range of intensive grazing management practices and new technologies. One of these practices successful in reducing predation on livestock involves enclosing and concentrating animals at night. Yet, the impacts on vegetation in these night pen sites are poorly understood and are a source of concern for federal agencies administering these grazing leases. This project partners with Alderspring Ranch of central Idaho, Krebs' Livestock Inc. of eastern Oregon, and the U.S. Department of Agriculture Animal & Plant Health Inspection Service National Wildlife Research Center to address this knowledge gap. The DEVELOP team will characterize the impact of night penning on net primary production and cover of annual forbs and grasses, perennial forbs and grasses, and bare ground. These rangeland attributes are modeled using Landsat 5-8 and will be accessed from the Rangeland Analysis Platform. We will also analyze how the response of vegetation to night penning varies across different site types (i.e., wet vs. dry sites, vegetation types, etc.). The findings from this project will be used by our partner ranches to inform their night penning practices moving forward and to communicate night penning impacts to their partners.

Study Location: Eastern Oregon and Central Idaho

Study Period: May 2000 – October 2023

Advisor(s): Dr. Paul Evangelista (Colorado State University, Natural Resource Ecology Laboratory), Dr. Catherine Jarnevich (USGS, Fort Collins Science Center), Dr. Anthony Vorster (Colorado State University, Natural Resource Ecology Laboratory), Nicholas Young (Colorado State University, Natural Resource Ecology Laboratory), Christopher Tsz Hin Choi (Colorado State University, Natural Resource Ecology Laboratory)

Partner Overview

Partner Organization(s):

Organization	Contact (Name, Position/Title)	Partner Type	Sector
Alderspring Ranch	Glenn Elzinga, Rancher	End User	Private
Krebs' Livestock Inc.	Cameron Krebs, Rancher	End User	Private
U.S. Department of Agriculture, Animal & Plant Health Inspection Service, National Wildlife Research Center	Stewart Breck, Research Wildlife Biologist	End User	Federal Government

End User Overview

End User's Current Decision-Making Process & Capacity to use Earth Observations:

Alderspring Ranch and Krebs' Livestock ranching operations both aim to maintain a successful business producing food and fiber while stewarding the natural environment. They are leaders in testing, refining, and implementing grazing management practices that reduce conflicts with predators and improve rangeland and riparian ecosystems. They are confident in their ability to reduce predation through practices like range riding and night penning (concentrating livestock each night), but have questions about how these intensive

management practices influence the vegetation. They are excited to tap into the capabilities of remote sensing to systematically identify the impact of night penning on vegetation to inform their practices (e.g., selecting night penning sites) and to communicate with stakeholders, such as the US Forest Service, who would like to see data to quantify the effects of these practices.

Earth Observations Overview

Earth Observations:

Platform & Sensor	Parameters	Use
Landsat 5 TM	Spectral bands and indices	This dataset will provide the temporal (16 days) and spatial (30 m ²) resolution needed to track range conditions.
Landsat 7 ETM+	Spectral bands and indices	This dataset will provide the temporal (16 days) and spatial (30 m ²) resolution needed to track range conditions.
Landsat 8 OLI	Spectral bands and indices	This dataset will provide the temporal (16 days) and spatial (30 m ²) resolution needed to track range conditions.

Ancillary Datasets:

- Krebs' Livestock Night Pen Data – location and date of use for night penning sites from 2017 to 2022.
- Alderspring Ranch Night Pen Data – location, date of use, and photo monitoring for night penning sites, years TBD.
- Rangeland Analysis Platform – fractional cover and net primary production derived from Landsat imagery from 1984 - present.

Modeling:

- Multiple linear regression (POC: Anthony Vorster, Colorado State University) – Model used to understand the relationship between night pen site characteristics and vegetation response.

Decision Support Tool & End Product Overview

End Products:

End Product	Partner Use	Datasets & Analyses
Impact of Night Penning on Vegetation Analysis	Partners will use this understanding of how night penning practices influence vegetation to inform their practices and to communicate with stakeholders.	Statistical tests (e.g., <i>t</i> tests) and visuals (e.g., box plots and plots of spectral values over time) to characterize the impact of night penning on vegetation. We will compare net primary production and fractional cover metrics from the Rangeland Analysis Platform between night pen vs. control sites and night pen sites before and after use.
Identification of Site Factors Influencing Vegetation Response to Night Penning	Partners will use knowledge of the role of site factors in the vegetation response to night penning to inform location of future night penning sites.	Multiple linear regression analysis to model the site factors (e.g., vegetation type, topography, topographic wetness, etc.) driving remotely sensed vegetation response to night penning, as quantified by changes to net primary production and fractional

		cover (from Rangeland Analysis Platform) between night pen vs. control sites and night pen sites before and after animal impact.
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Project Timeline & Previous Related Work

Project Timeline: 1 Term: 2024 Spring

Similar Past DEVELOP Projects:

- 2023 Spring (CO) – Southern Rockies Western Slope Agriculture: [Identifying Drivers of Rangeland Production for Drought Planning on the Western Slope of the Southern Rockies](#)

References:

References:

Jones, M. O., Allred, B. W., Naugle, D. E., Maestas, J. D., Donnelly, P., Metz, L. J., ... & McIver, J. D. (2018). Innovation in rangeland monitoring: annual, 30 m, plant functional type percent cover maps for US rangelands, 1984–2017. *Ecosphere*, 9(9), e02430.