

Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Testing whether bison grazing has altered vegetation phenology in Yellowstone National Park

Discipline: Natural

Type of Project: Research

Funding Agency: National Park Service

Other Partners/Cooperators: University of Montana

Student Involvement: No, post doc

Effective Dates: 5/2/2016 to 9/30/2018

Funding Amount: \$35,652

Investigators and Agency Representative:

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Project Abstract: The green wave hypothesis predicts that ungulates time spring migrations from lower to higher elevations in step with early-season vegetation growth. By tracking the wave of spring green-up, ungulates can prolong access to newly emerging vegetation that is high in protein and digestible organic matter, and low in fiber. It is often assumed that ungulates take a passive role in tracking phenology; climate and topography drive vegetation emergence and growth, and ungulates move in search of desired conditions. An alternative to this general assumption is that ungulates play an active role in influencing grassland conditions, including biomass and phenology. Grazing can increase plant production since plants are adapted to regrow after being consumed. Under sufficiently high grazing intensity, ungulates can alter vegetation phenology by slowing green-up rates and extending the period that new vegetation is available. Large numbers of ungulates exhibiting high grazing intensities across large spatial extents may have the potential to shape the green wave. Previous work on African buffalo have indeed confirmed that high densities of social ungulates do modify plant phenology and biomass in the phenomenon of 'grazing lawns'; here, we propose to test whether Bison in YNP exhibit the same patterns.

The northern Yellowstone bison subpopulation increased from fewer than 1,000 individuals during 2004 to more than 3,500 during 2015. Over the same time span, the central Yellowstone bison subpopulation experienced a similar magnitude of change in abundance, except in the opposite direction from high to low abundance. These changes provide us a unique opportunity to assess whether bison grazing intensity can alter vegetation phenology and test if ungulates can shape the green wave.

We aim to meet three objectives in our research:

- 1) Identify how the intensity of bison use during the growing season has changed with population size.
- 2) Use a field experiment to compare standing crop estimates, forage maturation rates, and forage nutrition indicators in naturally grazed and excluded paired plots across field sites representing different levels of grazing intensity.
- 3) Use time series analysis of remote sensing data to evaluate grazing intensity effects on vegetation phenology

Keywords: Bison, vegetation phenology, Yellowstone National Park, University of Montana