

New study shows Yellowstone's ecosystem dynamics more complex than previously understood

April 3 2014, by Jennifer Dimas

Since their reintroduction in Yellowstone National Park, wolves have been heralded as the controversial savior of Yellowstone's ecosystem. However, new research by ecologists at Colorado State University's Warner College of Natural Resources proves that many diverse variables must be taken into account to fully understand how ecosystems respond to changes in food web structures.

The research is the first to show that reductions in [elk](#) numbers following the reintroduction of wolves are proportionate to increases in [willow](#) height along streams in Yellowstone. While that could lead to the simple conclusion that wolves improved the ecosystem, their central finding was that the relationship between elk populations and willow health was also dependent on geography, climate, and water supply for the willows.

"The effects of modifying a [food web](#) can't be predicted by only studying one thing in isolation. No single force explains the patterns of plant establishment and growth in Yellowstone over the past three decades," said CSU Professor Thompson Hobbs, co-author on the paper who is also a research scientist at CSU's Natural Resource Ecology Laboratory. "It has been popular and convenient to tell the romantic tale that wolves have restored Yellowstone. But our findings prove that it is not that simple."

The removal of wolves is commonly associated with an increase in

populations of herbivores, such as elk, who then over-browse plants, such as willows. Conversely, willow growth and abundance is often credited as an indicator that wolf reintroduction has directly resulted in ecosystem improvements.

Focusing on this premise, the researchers studied 30 years of riparian willow growth and establishment using growth-ring data. They compared that information with a complex set of variables to predict willow growth over time before and after the return of wolves. They studied factors like annual precipitation, stream flow, growing season length, herbivore abundance, and landscape elevation and soil moisture.

Among their findings, the team reported that the negative correlation between elk abundance and willow establishment diminished during wet periods. They also found that impacts on plant growth due to changes in climate were less evident than the effects of changing elk abundance overall.

The research findings were published in the *Journal of Ecology* in a paper titled "Interactions among herbivory, climate, topography, and plant age shape riparian willow dynamics in northern Yellowstone National Park, USA." The paper is authored by Hobbs, Kristin Marshall and David Cooper. Marshall conducted her research with advisors Hobbs and Cooper while she was a doctoral student in ecology at CSU's Warner College. Cooper is a senior research scientist in the Department of Forestry and Rangeland Stewardship.

"Our results contribute to a growing body of evidence showing that changes in growth of woody deciduous plants following the reintroduction of wolves cannot be explained by the trophic cascade model alone," said Marshall.

This research, funded by the National Science Foundation, was a large-

scale study that extended across the entire northern range of Yellowstone. The study was a follow-up to more than a decade of research by CSU scientists in Yellowstone, including a 2013 paper that concluded beaver dams' impact on water levels were equally responsible for vegetation health as herbivore browsing increases caused by the removal of [wolves](#).

The new research reconfirms the CSU team's previous conclusions that interactions among trophic forces, interannual climate variability and landscape topography must all be taken into account to fully understand how ecosystems will respond to changes.

Provided by Colorado State University

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