SU biologist partners with National Park Service to study bison grazing in Yellowstone

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While Yellowstone's celebrated bison may be among the most popular tourist attractions in the park, their grazing habits and increasing numbers have raised questions about the long-term stability of the park's grasslands. To find answers, the National Park Service has partnered with Syracuse University biologist Douglas Frank, who has studied the effects of climate change and herbivores on the park's grasslands over the past 20 years.

"During the late 1980s, similar concerns were raised about the size of the park's elk herd and whether the herd was negatively impacting grasslands," says Frank, a professor in SU's College of Arts and Sciences. "Rather than having a negative impact on the grasslands, we found that increases in elk grazing actually stimulated plant growth."

The new study, which will take about three years to complete, will focus on grazing areas most frequented by bison and will incorporate ecological research techniques that were pioneered at SU. Frank will also work with National Park Service staff to develop a long-term grasslands monitoring system using these same research methods.

"Fossil records indicate that prior to the industrial revolution, the Earth's grasslands and large herds of migratory herbivores coexisted for millennia," Frank says. "These systems were stable, despite having sustained very intense levels of grazing. My work in Yellowstone explores why and how this happens."

Past studies have found that intensive grazing triggers several mechanisms that actually increase plant growth. For example, increases in the amount of elk feces and urine on heavily grazed areas provide an easily available source of nutrients for plants, as compared to ungrazed areas. In addition, grazing spurs plants to produce new shoots and grow new leaves. Younger, more numerous leaves and shoots are more photosynthetically active than older leaves on un-grazed areas. Consequently, grazing stimulates both shoot and root growth and increases grassland vitality.

"Heavy grazing also increases the amount of nitrogen in the leaf material, which increases the quality of material that falls to the ground," Frank says. "The high-quality litter is quickly broken down by soil bacteria, which in turn enriches the soil around grazed plants."

Scientists have found that intensive grazing also alters important interactions between roots and closely associated bacteria. While a working in a post-doctoral position in the Frank lab, Bill Hamilton—now an associate professor at Washington and Lee University—showed that grazing Yellowstone grasses stimulated the rate at which simple organic compounds are exuded from the tips of plant roots.

"These simple compounds, which are made of sugars and amino acids, are like cotton candy for soil microbes," says Frank. "The microbes thrive on the compounds."

In a series of cascading events, microbes use the food energy from the compounds to decompose organic material in the soil around the roots, which then results in a new source of nutrients for plants.

Next spring, Frank will travel to Yellowstone to fence areas of grassland that will become test plots for the study. Each fenced-in area will be about a 15-yard square and will be left untouched for a year. Over the

following two years, some areas will be clipped at various intensities to mimic natural grazing. Plant data obtained from the fenced areas will be compared with adjacent areas as well as with areas of the park where natural grazing varies in intensity depending on the time of the year.

"The study will be very similar to the one we did 20 years ago on elk grazing," Frank says. "It will be interesting to see if we reconfirm our original findings or whether we find something new. We also intend to use this opportunity to better understand the complex and fascinating ways in which the interactions among plants, herbivores and soil organisms foster the stability of grassland systems."

Provided by Syracuse University

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