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### Spatio-temporal Analysis of Ungulate Herbivory within Willow (Salix spp.) Communities on the Northern Range of Yellowstone National Park, USA

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Spatio-temporal Analysis of Ungulate Herbivory within Willow (*Salix spp.*) Communities on the Northern Range of Yellowstone National Park, USA

Donald Lee Belile Jr. and Dr. Robert Crabtree, University of Montana

Across Yellowstone National Park's northern range the intensity of ungulate herbivory on willow (*Salix spp.*) communities has changed over time in response to abiotic and biotic factors. However, since wolf reintroduction no studies have been conducted that simultaneously examine multiple factors with multiple working hypotheses. Studies were either short-term or used auxiliary information to estimate changes in, and causes of, riparian shrub herbivory.

Alternatively we applied a long-term in-situ, nondestructive browsing history method by way of outer growth ring record and Boolean logic. Both fixed and continuous explanatory variables were statistically analyzed within a spatially implicit and explicit, multi-model framework using generalized linear models. Our binary response was modeled using a binomial distribution and logistic regression. Preliminary results specify that the most significant factor for the period of winter 1999-2009 was growing season precipitation, followed by SWE (snow water equivalent) and elk numbers. Post winter 2009 bison, which don't typically consume willow, are the most significant predictor followed by elk and SWE. Bison browsing increased from 10% of total browsing in winter 2010 to 22% winter 2014. Whereas elk browsing increased from 30% of total browsing in winter 2010 to 41% winter 2014. During the same time frame the bison population increased by 21%, however elk numbers declined by 22%. In conclusion, preliminary results indicate that a high bison population is both directly and indirectly driving increases in ungulate browsing of willow.