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Aspen Recovery Since Wolf Reintroduction on the Northern Yellowstone Winter Range

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Abstract

Quaking aspen (*Populus tremuloides* Michx.) recruitment and overstory stem densities were sampled in 315 clones in 1991 and 2006 on 560 km² of the Northern Yellowstone Winter Range (NYWR). A primary objective was to observe if aspen status had improved from 1991 to 2006: evidence of a wolf (*Canis lupus*) caused trophic cascade. Recruitment stems (height > 2 m and diameter at breast height < 5 cm) represent recent growth of aspen sprouts above elk (*Cervus elaphus*) browsing height, whereas overstory stems (all stems > 2 m) represent the cohort of stems, which will insure the sustainability of the clone. Overstory stem densities declined by 12% ($P = 0.04$) on the landscape scale when compared with paired t-tests. Overstory stems declined in 58% of individual clones and in 63% of the 24 drainages of the study area. The second objective was to determine which factors influenced changes in aspen density. Winter ungulate browsing ($P = 0.0001$), conifer establishment ($P = 0.0001$), and cattle (*Bos* spp.) grazing ($P = 0.016$) contributed to the decline in overstory stem densities when analyzed using a mixed effects model of log transformed medians. Eighty percent of the clones were classified as having medium to high browsing levels in 1991, whereas 65% of the clones received a similar rating in 2006, possibly due to the reduced NYWR elk population. Aspen recruitment has increased in some 2–10 km² areas, but not consistently. Our study found that a trophic cascade of wolves, elk, and aspen, resulting in a landscape-level recovery of aspen, is not occurring at this time.

Resumen

Se muestreó el reclutamiento y la densidad de tallos aéreos de *Populus tremuloides* Michx. de 315 clones en 1991 y 2006 en un área de 560 km² en la Invernada Norte de Yellowstone (NYWR). Un objetivo primario de este estudio fue observar si el estatus de *P. tremuloides* mejoró entre 1991 y 2006 evidenciando una cascada trófica causada por el lobo (*Canis lupus*). El reclutamiento de tallos nuevos (altura > 2 m y diámetro a la altura del pecho < 5 cm) representa crecimiento de brotes recientes por encima de la línea de ramoneo de los ciervos (*Cervus elaphus*), mientras que los tallos aéreos (todos los tallos > 2 m) representan la cohorte de tallos que asegurarán la sustentabilidad del clon. Las densidades de tallos aéreos decreció en un 12% ($P = 0.04$) a la escala de paisaje según una comparación realizada con un prueba de “t” apareada. Los tallos aéreos decrecieron en un 58% de los clones individuales y en un 63% de las 24 micro-cuencas del área de estudio. El segundo objetivo de este estudio fue determinar cuáles factores influenciaron los cambios en la densidad de *P. tremuloides*. El ramoneo invernal de los ungulados ($P = 0.0001$), el establecimiento de coníferas ($P = 0.0001$), y el pastoreo bovino (*Bos* spp.; $P = 0.016$) contribuyeron a la disminución en la densidad de tallos aéreos según un análisis de efectos mixtos utilizando una transformación logarítmica de las medianas. El 80% de los clones fueron clasificados en la categoría de nivel de uso medio a elevado en 1991, mientras que el 65% de los clones recibieron una valoración similar en el 2006, posiblemente debido a la reducción en la población de ciervos en el NYWR. El reclutamiento de *P. tremuloides* ha aumentado en dos áreas de 10 km², pero no de modo consistente. Nuestro estudio demostró que una cascada trófica de lobos, ciervos, y *P. tremuloides*, que resulte en una recuperación de esta especie leñosa a escala de paisaje, no está ocurriendo en este momento.

Key Words: browse, *Cervus elaphus*, elk, *Populus tremuloides*, recruitment, trophic cascade

INTRODUCTION

Quaking aspen (*Populus tremuloides* Michx.) habitats make up a small percentage of vegetative cover in the Rocky Mountains but commonly support more species and greater numbers of wildlife than associated conifer habitats (Debyle 1985a). Aspen

are clonal and primarily rely on root sprouts to replace aging stems for the species to persist in the Rocky Mountains (McDonough 1985). Disturbances that remove aspen overstory stimulate root sprouting (Frey et al. 2003), although sprouting will frequently occur without disturbance in the Yellowstone area (Kay 1990). Wild ungulates such as moose (*Alces alces*), Rocky Mountain elk (*Cervus elaphus*), and deer (*Odocoileus* spp.) selectively browse aspen suckers in winter because they are a palatable protein source that is often available above the snow (Houston 1982). Where ungulate densities are high, browsing can suppress aspen sucker growth and prevent aspen clones from replacing older overstory stems with younger stems (Debyle 1985b), even after disturbances that stimulate dense suckering (Bartos et al. 1994).

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At the time of this research, Kimble was a MS candidate, Animal and Range Science Dept, Montana State University, Bozeman, MT 59717, USA.

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