

Natural and experimental tests of trophic cascades: gray wolves and white-tailed deer in a Great Lakes forest

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Abstract Herbivores can be major drivers of environmental change, altering plant community structure and changing biodiversity through the amount and species of plants consumed. If natural predators can reduce herbivore numbers and/or alter herbivore foraging behavior, then predators may reduce herbivory on sensitive plants, and a trophic cascade will emerge. We have investigated whether gray wolves (*Canis lupus*) generate such trophic cascades by reducing white-tailed deer (*Odocoileus virginianus*) herbivory on saplings and rare forbs in a northern mesic forest (Land O' Lakes, WI). Our investigation used an experimental system of deer exclosures in areas of high and low wolf use that allowed us to examine the role that wolf predation may play in reducing deer herbivory

through direct reduction in deer numbers or indirectly through changing deer behavior. We found that in areas of high wolf use, deer were 62 % less dense, visit duration was reduced by 82 %, and percentage of time spent foraging was reduced by 43 %; in addition, the proportion of saplings browsed was nearly sevenfold less. Average maple (*Acer* spp.) sapling height and forb species richness increased 137 and 117 % in areas of high versus low wolf use, respectively. The results of the exclosure experiments revealed that the negative impacts of deer on sapling growth and forb species richness became negligible in high wolf use areas. We conclude that wolves are likely generating trophic cascades which benefit maples and rare forbs through trait-mediated effects on deer herbivory, not through direct predation kills.

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