

RH: Trophic Cascades Mediated by Rainfall • Harrower et al.

TROPHIC INTERACTIONS ARE MEDIATED BY THE AVAILABILITY OF WATER IN TEMPERATE GRASSLAND ECOSYSTEMS

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ABSTRACT

The addition or removal of predators from food webs by humans can have profound effects on the interactions between species. However, predators and primary producers are inextricably linked by the flow of energy through ecosystems. In temperate grasslands energy flow through ecosystems is often limited by water availability to plants. So, if the number and strength of interactions between species in grasslands depends on the amount of water available to plants, and we remove predators along a gradient in water availability, then we should see change in species interactions with predator removals along the gradient. After estimating trophic position and diet breadth of key predators, we excluded birds and small mammal predators from grasslands along a rainfall gradient in south central British Columbia for four years, and measured the response of plants and arthropods. Water availability significantly altered food web structure, and consequently the role of predators in structuring these ecosystems. When water was scarce, vertebrate predators impeded plant growth by feeding on spiders that would normally eat herbivorous insects. When water was more abundant, vertebrate predators facilitated plant growth by feeding on a broad range of arthropod prey. As water availability to plants increased they grew more. Herbivores were not able to consume all the new growth and thus dead plant material accumulated. Increasing detritus helped establish new links between predators and plants. Phenomena such as climate change can determine the availability of water entering ecosystems, which then alters trophic structure. If water availability can alter food webs there are no simple generalizations for community dynamics that are independent of climate.