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Source: Rangeland Ecology & Management, 61(1):55-62. 2008.
Published By: Society for Range Management
DOI: http://dx.doi.org/10.2111/06-149R2.1
URL: http://www.bioone.org/doi/full/10.2111/06-149R2.1

Invertebrate Community Response to a Shifting Mosaic of Habitat

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Abstract

Grazing management has focused largely on promoting vegetation homogeneity through uniform distribution of grazing to minimize area in a pasture that is either heavily disturbed or undisturbed. An alternative management model that couples grazing and fire (i.e., patch burning) to promote heterogeneity argues that grazing and fire interact through a series of positive and negative feedbacks to cause a shifting mosaic of vegetation composition and structure across the landscape. We compared patch burning with traditional homogeneity-based management in tallgrass prairie to determine the influence of the two treatments on the aboveground invertebrate community. Patch burning resulted in a temporal flush of invertebrate biomass in patches transitional between unburned and patches burned in the current year. Total invertebrate mass was about 50% greater in these transitional patches within patch-burned pastures as compared to pastures under traditional, homogeneity-based management. Moreover, the mosaic of patches in patch-burned pastures contained a wider range of invertebrate biomass and greater abundance of some invertebrate orders than did the traditionally managed pastures. Patch burning provides habitat that meets requirements for a broad range of invertebrate species, suggesting the potential for patch burning to benefit other native animal assemblages in the food chain.

Resumen

El manejo del apacentamiento se ha enfocado grandemente en promover la homogeneidad de la vegetación a través de la distribución uniforme del apacentamiento, para minimizar las áreas del potrero que son disturbadas severamente o no son utilizadas. Un modelo de manejo alternativo que conjuga el apacentamiento y fuego (por ejemplo, la quema de parches) para promover la heterogeneidad argumenta que el apacentamiento y el fuego interactúan a través de una serie de estímulos positivos y negativos para causar un mosaico de vegetación que cambia en composición y estructura a través del paisaje. Comparamos la quema de parches con el manejo tradicional, que promueve la homogeneidad, en una pradera de zacates altos para determinar la influencia de los dos tratamientos en la comunidad de invertebrados de la superficie del suelo. La quema de los parches resultó en un incremento abundante temporal de la biomasa de invertebrados en los parches en transición entre los parches no quemados y los quemados en el año en curso. La masa total de invertebrados fue aproximadamente 50% mayor en estos parches en transición, dentro de los potreros con quema de parches en comparación con los potreros con manejo tradicional basado en la homogeneidad. Más aun, el mosaico de parches en los poteros con quema de parches contenía un rango más amplio de biomasa de invertebrados y una mayor abundancia de algunos órdenes de invertebrados que los potreros manejados tradicionalmente. La quema de parches provee un hábitat que reúnen los requerimientos para un amplio rango de especies de invertebrados, sugiriendo el potencial de la quema de parches para beneficiar otros ensambles de animales nativos de la cadena alimenticia.

Key Words: ecosystem management, equilibrium, grasslands, grazing, heterogeneity, landscape ecology, patch dynamics, plant–animal interaction, rangeland

INTRODUCTION

Little remains of the North American Great Plains ecosystem once maintained by the interaction of fire and grazing herbivores. Grassland fragments and management practices that result in homogenous landscapes reduce the ecological value of remaining prairie (Coppedge et al. 2001; Fuhlendorf and Engle 2001). In contrast, heterogeneity, which links pattern in landscapes to ecological processes, should serve as the foundation for conservation and ecosystem management (Pickett et al. 2003).

Frequency and intensity of disturbance are important drivers of ecological processes, biological diversity, and heterogeneity across multiple spatial scales in grasslands that evolved with fire and ungulate grazing (Collins 1992; Fuhlendorf and Smeins 1999). Large herbivores preferentially select recently burned areas within a landscape (Forde et al. 1984; Coppock and Detling 1986; Moe et al. 1990; Wilsey 1996; Coppedge and Shaw 1998), which can be used to manage spatial patterns of cattle grazing over landscapes (Duvall and Whitaker 1964; Archibald and Bond 2004). However, because the spatial scale

This research was funded by the Oklahoma Agricultural Experiment Station through project S-1822 and USDA-NRI Managed Ecosystems Program (02-00777). This article is published with the approval of the Director, Oklahoma Agricultural Experiment Station.

At the time of the research, the senior author was Regents Professor, Dept of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK, USA.

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Manuscript received 8 November 2006; manuscript accepted 6 October 2007.