

# HIGHLIGHTS

*Rangeland Ecology & Management*, March 2006



## **Fluxes of CO<sub>2</sub> From Grazed and Ungrazed Tallgrass Prairie**

Clenton E. Owensby, Jay M. Ham, and Lisa M. Auen

To determine the impact of seasonal steer grazing on annual CO<sub>2</sub> fluxes of annually burned native tallgrass prairie, we used relaxed eddy accumulation on adjacent pastures of grazed and ungrazed tallgrass prairie. During the early growing season, grazing reduced net carbon exchange relative to the reduction in green leaf area, but as the growing season progressed on the grazed area, regrowth produced younger leaves that had an apparent higher photosynthetic efficiency. We conclude that with grazing the reduced ecosystem respiration, the open canopy architecture, and the presence of young, highly photosynthetic leaves are responsible for the increased net carbon exchange efficiency.

## **Elevated Atmospheric CO<sub>2</sub> Magnifies Intra-specific Variation in Seedling Growth of Honey Mesquite: An Assessment of Relative Growth Rates**

H. Wayne Polley, Charles R. Tischler, and Hyrum B. Johnson

Atmospheric carbon dioxide (CO<sub>2</sub>) enrichment could stimulate growth of the invasive shrub honey mesquite, but CO<sub>2</sub> effects may not be expressed uniformly among mesquite genotypes. We measured effects of doubling CO<sub>2</sub> concentration on seedling growth of 14 mesquite genotypes. Seedling biomass 1 month following emergence was 3%–75% greater at elevated than ambient CO<sub>2</sub> depending on genotype, but CO<sub>2</sub> enrichment did not favor the largest or fastest-growing genotypes at ambient CO<sub>2</sub>. CO<sub>2</sub> enrichment could accelerate mesquite encroachment by increasing seedling growth, but CO<sub>2</sub> effects on mesquite are not predictable from seedling size or growth rate at the current concentration.

## **Herbaceous Vegetation Responses (1992–2004) to Restoration Treatments in a Ponderosa Pine Forest**

Margaret M. Moore, Cheryl A. Casey, Jonathan D. Bakker, Judith D. Springer, Peter Z. Fulé, W. Wallace Covington, and Daniel C. Laughlin

Restoration treatments in southwestern ponderosa pine forests are intended to convert closed canopy stands to an open canopy structure. An experiment was initiated in northern Arizona in 1992 to evaluate long-term responses to 3 treatments: 1) thinning from below (thinning), 2) thinning from below with periodic prescribed burning (composite), and 3) an untreated control. Total herbaceous standing crop was significantly higher on the 2 treated areas than on the control over the entire post-treatment period (1994–2002). Plant functional groups responded differently to treatments and to drought. A restoration goal of optimizing standing crop must be weighed against the competing goals of increasing biodiversity and managing invasive species.

## **Stocking Rate and Weather Impacts on Sand Sagebrush and Grasses: A 20-Year Record**

Robert L. Gillen and Phillip L. Sims

Understanding the impact of stocking rate on the abundance of common plant species is fundamental to the sustainable management of rangelands. We had the unique opportunity to study the responses of grasses and sand sagebrush (*Artemisia filifolia* Torr.) to 3 stocking rates over a 20-year time span that included both wet and dry precipitation periods. Canopy cover of sand sagebrush was not affected by stocking rate, and no grass species responded to stocking rate as an increaser or decreaser over the entire length of the study. Under the conditions of this study, stocking rates that maximized economic returns did not have long-term detrimental effects on the grass community.

## **Woody Plant Community in the Cross Timbers Over Two Decades of Brush Treatments**

David M. Engle, Timothy N. Bodine, and J. F. Stritzke

The closed overstory of the cross timbers, like fire-adapted forests throughout the world, precludes surface fires of sufficient intensity to open the overstory. We assessed woody plant cover and plant community compositional trajectories resulting from brush treatments in the cross timbers. About 10 years after the initial herbicide treatment, the tebuthiuron + fire pastures contained almost 20% cover of sumac (*Rhus* spp.), and the tebuthiuron pastures contained >40% cover of

eastern redcedar (*Juniperus virginiana* L.). Application of tebuthiuron, which influenced composition of the overstory more than did triclopyr, appears to be a long-term unidirectional disturbance in the cross timbers.

### **Postfire Vegetation Dynamics in Three Rangelands of Northeastern Patagonia, Argentina**

César M. Rostagno, Guillermo E. Defossé, and Héctor F. del Valle

Shrub encroachment has been recognized as an important ecological and economic problem in semiarid rangelands of northeastern Patagonia. Land use practices such as heavy grazing and reduction in fire frequency seem to be implicated. In 3 areas affected by wildfires on different dates, we determined the structure of the vegetation and compared it with that of nearby unburned areas. Aerial biomass of perennial grasses was greater and total shrub cover lower for burned than for unburned areas. The postfire increase in perennial grass biomass represents a substantial improvement in the condition of these rangelands.

### **Herbaceous Restoration of Juniper Dominated Grasslands With Chaining and Fire**

R. J. Ansley, H. T. Wiedemann, M. J. Castellano, and J. E. Slosser

Juniper encroachment in grasslands usually progresses toward a stable woody state of mature trees that requires a significant disturbance to shift succession in another direction. On a degraded (40% bare ground) north Texas site dominated by redberry juniper (*J. pinchotii* Sudw), we quantify long-term herbaceous responses to mechanical chaining followed by fire. Total grass cover in treated plots did not increase over the untreated until the second year after the fire treatment. Results suggest increases in herbaceous production from chaining alone were due to increased growth of existing vegetation patches, while the fire treatment appeared to stimulate herbaceous recruitment into bare soil areas.

### **The Accuracy of Ground-Cover Measurements**

D. T. Booth, S. E. Cox, T. W. Meikle, and C. Fitzgerald

Ground cover is a key indicator of rangeland condition but, when measured by conventional methods, does not allow the acquisition of statistically adequate data sets across the extensive areas encompassed in most rangeland watersheds. We compared the less expensive ground-cover measurement by image analysis with conventional methods using a novel known-population model. Conventional methods were more accurate, but image-analysis accuracy might be improved by reducing the number of picture elements used in our method of manual image-point sampling for calibration of automated analysis. These findings provide an important measure of relative accuracy among methods and are particularly relevant for improving rangeland monitoring methods.

### **Do Pasture-Scale Nutritional Patterns Affect Cattle Distribution on Rangelands?**

David Ganskopp and Dave Bohnert

The effects of senescent herbage on cattle distribution have not been studied at pasture scales. By temporally halving crested wheatgrass pastures with electric fence and applying heavy cattle grazing to 1 side, we created pastures that in the subsequent year displayed current season's growth in 1 half and a mix of current and senescent herbage in the other half. Over a 7-day trial, GPS collared grazing cattle displayed a 68%–32% preference for sectors supporting only current season's herbage. Findings are important to land and livestock managers attempting to alter well-established and inefficient grazing distribution patterns.

### **Effect of Standing Litter on Rough Fescue Utilization by Cattle**

Darlene M. Moisey, Walter D. Willms, and Edward W. Bork

Rough fescue is well suited to dormant season grazing, but spring defoliation is detrimental to its productivity and survival. We investigated the relationship of residual stubble height on grazing height of new growth in spring as a means for managing defoliation on rough fescue plants. Stubble height of standing litter had no effect on plant selection but dramatically affected defoliation of new growth in spring. These results indicate that fall grazing has a direct effect on plant vulnerability to grazing in spring and that this relationship might be incorporated in a multiseason grazing strategy.

### **Cattle Consumption of Velvet Lupine (*Lupinus leucophyllus*) in the Channel Scablands of Eastern Washington**

Michael H. Ralphs, Kip E. Panter, Clive Gay, Ernie Motteram, and Stephen T. Lee

Certain lupines contain alkaloids that cause crooked calf syndrome if the pregnant cow consumes them during the 40th–70th day of gestation. We determined when cattle graze velvet lupine and whether this period overlaps the susceptible period of gestation. Cows consumed lupine during July and August after cheatgrass and other forbs matured, while the deep-rooted lupine remained green and succulent. This overlapped the critical period of gestation, but no crooked calves were produced because of the declining alkaloid levels in the plant. It is recommended to restrict access to lupine during July in years when lupine density is high.

### **Effects of Livestock Grazing on Duck Nesting Habitat in Utah**

Ben C. West and Terry A. Messmer

Grazing by livestock is a potentially useful but controversial habitat management tool on waterfowl nesting areas.

We evaluated the impact of a winter livestock grazing program on duck nesting habitat at the Bear River Migratory Bird Refuge in Utah. Our results suggest that winter grazing may negatively impact habitat for early nesting ducks but not for duck species that nest later in the spring when vegetation has recovered. Managers should consider grazing timing, site characteristics, and waterfowl species when making decisions about livestock grazing as a management tool.

### **Seasonal Variation in Resistance of Aspen Stems to Shearing Force**

Craig W. M. Dockrill, Arthur W. Bailey, Peter V. Blenis, and Jane R. King

Cattle utilization of aspen varies considerably throughout the growing season, with cattle using aspen more frequently during spring and early summer. Shearing resistance of current year, 1-year-old, and 2-year-old stem age classes was measured from late spring to early fall. Resistance to shearing force increased by 200%–2,000% between the first and last measurements of a given year, which may explain the tendency for cattle to reduce their selection of aspen in late summer. Range management plans that defer cattle grazing until late summer may reduce associated damage to aspen suckers and thereby reduce conflicts between foresters and livestock producers.

### **Successful Adaptive Management—The Integration of Research and Management**

Kimberly J. Reeve Morghan, Roger L. Sheley, and Tony J. Svejcar

Adaptive management is a way for managers to do their job in the face of uncertainty and learn by doing. Unfortunately, while the term “adaptive management” is often used, there is confusion about exactly what adaptive management is, and managers are hard-pressed to find any clear guidelines for implementing it. In this paper we briefly explain adaptive management and then offer a step-by-step process for developing and implementing adaptive management in small reserves or private lands. We believe increased understanding of adaptive management will lead to its widespread use and will ensure that more people benefit from its strengths.

### **Emerging Issues in Rangeland Ecohydrology: Vegetation Change and the Water Cycle**

Bradford P. Wilcox and Thomas L. Thurow

Water on rangelands is an important and timely issue. In this paper we outline an agenda for future research that examines how vegetation cover affects the quantity and quality of water. Emerging issues of importance are 1) how do woody plants affect recharge and stream flow? 2) how are invasive species affecting the water cycle? and 3) what are the implications of rangeland degradation to the water cycle?