Highlights

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Does Shrub Removal Increase Groundwater Recharge in Southwestern Texas Semiarid Rangelands?

Georgianne W. Moore, David A. Barre, and M. Keith Owens

Aquifers in semiarid regions are being depleted alarmingly fast, which raises the issue of whether brush management on rangelands may alter groundwater recharge if evapotranspiration is altered. This study, located above the Carrizo–Wilcox aquifer in southwest Texas, quantifies changes in groundwater recharge following vegetation cover change from native woodland to pasture using chloride mass balance. Annual recharge rates averaged only 0.72 mm per year (0.02 inches per year) in areas not cleared of woody vegetation; upon clearing, recharge was higher by an estimated 2.59 mm per year (0.10 inches per year). Although brush management increased recharge modestly, potential recharge from managed rangelands cannot offset the current rate of aquifer drawdown.

Density-Dependent Ecohydrological Effects of Piñon–Juniper Woody Canopy Cover on Soil Microclimate and Potential Soil Evaporation

Patrick D. Royer, David D. Breshears, Chris B. Zou, Juan Camilo Villegas, Neil S. Cobb, and Shirley A. Kurc

Tree and shrub cover shades the ground and reduces soil temperature, affecting important rangeland processes such as potential soil evaporation, but simple approximations for how microclimate changes with amount of woody plant cover are lacking. Patterns of shading, soil temperature, and associated potential soil evaporation were evaluated for a piñon–juniper woodland gradient spanning 5–65% woody plant cover. Locations between woody plant canopies at the highest density site were as cool as locations beneath woody canopies at the lowest density site. Resulting trends enable approximate estimation and consideration of how microclimate varies among sites with different amounts of woody plant cover.

Long-Term Effects of Fire, Livestock Herbivory Removal, and Weather Variability in Texas Semiarid Savanna

Charles A. Taylor, Jr., Dirac Twidwell, Nick E. Garza, Colin Rosser, James K. Hoffman, and Terry D. Brooks

Semiarid savannas are moving away from grass–tree codominant ecosystems to shrub-dominated woodlands. We compared the effects of summer fire, winter fire, and no fire on semiarid vegetation in the Edwards Plateau, Texas, over 12 years. Only high-intensity summer fires maintained the frequency of desirable woody plants in this savanna and reduced problematic plants in the under- and overstory. Grasses responded more to the removal of livestock herbivory and precipitation patterns than to fire treatments. These findings suggest that high-intensity fires can reduce or eliminate woody plants that threaten live oak savannas while having little long-term effect on grasses desired by managers.

Response of Grass Seedlings to Smoke-Water and Smoke-Derived Butenolide in the Absence of Macronutrients (NPK)

Manoj G. Kulkarni, Habteab M. Ghebrehiwot, Kevin P. Kirkman, and Johannes Van Staden

Fire, smoke, and changes in nutrient status may cause compositional changes in South African semiarid grasslands. To understand the mechanisms controlling species dynamics, seedling growth performance of three common grass species was tested along macronutrient (nitrogen [N], phosphorus [P], potassium [K]) gradients and smoke concentrations. Smoke-water and smoke-derived butenolide enhanced seedling growth of red grass (*Themeda triandra*) in absence of NPK, whereas exclusion of N reduced vigor of weeping love grass (*Eragrostis curvula*). In the presence of NPK, smoke-water and smoke-derived butenolide suppressed seedling growth of Guinea grass (*Panicum maximum*). Interaction of macronutrients and smoke may influence grassland species growth differently.

Grazing Intensity and Spatial Heterogeneity in Bare Soil in a Grazing-Resistant Grassland

David J. Augustine, D. Terrance Booth, Samuel E. Cox, and Justin D. Derner

Spatial patterns in vegetation cover can serve as indicators of rangeland condition. We outline an approach for using very-large-scale aerial photography to assess spatial patterns in bare soil in the northeastern Colorado shortgrass steppe. Under very heavy grazing, bare soil increased at the scale of individual plants, both through increased density of small (2–20-cm; 0.75–8-inch) bare patch intercepts and increased frequency of bare patch intercepts that were 20–60 cm (8–24 inches). Very-large-scale aerial photography can be used for monitoring rangelands across broad scales (pastures, landscapes) while testing for shifts in bare soil patchiness at the scale of plant interspaces.

Seasonal Patterns of Forage Availability in the Fescue Grasslands Under Contrasting Grazing Histories

Edward Bork, Walter Willms, Steven Tannas, and Mike Alexander

Grazing by large herbivores has been shown to condition vegetation in a manner that improves grassland quality for subsequent herbivory. We examined the effect of long-term summer grazing on seasonal forage production and quality of fescue grasslands with the use of long-term exclosures. Although moderate summer grazing reduced the proportion of rough fescue biomass in the community by about 30%, grazing had no effect on total forage productivity. Grazing also reduced litter mass, potentially altering selection by herbivores. Moderate stocking rates in summer appear sustainable in fescue grasslands, though the decline of fescue may reduce the quality of these grasslands for winter grazing.

Cattle Grazing and Yosemite Toad (*Bufo canorus* Camp) Breeding Habitat in Sierra Nevada Meadows

L. M. Roche, B. Allen-Diaz, D. J. Eastburn, and K. W. Tate

Across Sierra Nevada national forest lands, exclusion of cattle from public allotments has been proposed to reduce potential impacts of grazing on Yosemite toad (*Bufo canorus*), a sensitive species of concern. We studied the impact of cattle exclusion from mountain meadows on toad breeding-pool quality. Breeding-pool water quality was uniformly high regardless of grazing treatments (grazed control, grazing exclusions). We found no evidence of improved toad breeding-pool conditions following exclusion compared to standard US Forest Service grazing management, suggesting cattle grazing and toad habitat conservation can be compatible goals in this landscape.

Comparison of Herbicides for Reducing Annual Grass Emergence in Two Great Basin Soils

Merilynn C. Hirsch, Thomas A. Monaco, Christopher A. Call, and Corey V. Ransom

Seedbank composition of degraded rangelands often contains a high proportion of invasive annual grass seeds. Pre-emergence herbicides provide a practical means of reducing annual grass seedbanks and minimizing interference with emerging desirable species. Controlled seedbed studies revealed that pre-emergence herbicides consistently reduced seedling emergence, biomass production, and mortality of downy brome (*Bromus tectorum*), more so in sagebrush compared to salt desert soils. These results suggest that fundamental differences in soil chemical properties result in variable herbicide bioavailability, which helps predict herbicide effectiveness when applied in unison with rangeland seedings.

Genetic Improvement and Diversity in Snake River Wheatgrass (*Elymus wawawaiensis*) (Poaceae: *Triticeae*)

Kevin B. Jensen, Ivan Mott, Joseph G. Robins, Blair L. Waldron, and Mark Nelson

Vast areas of semiarid rangelands in the western United States are severely disturbed, frequently burned, and subsequently infested with weeds. Reseeding these rangelands with improved plant materials that are competitive enough to replace existing undesirable vegetation is often the most economically feasible way to reclaim such sites. This study describes the genetic structure and agronomic trait relationships of Snake River wheatgrass and its wildland collections. It seems possible to selectively increase traits in Snake River wheatgrasses that enhance their ability to establish and compete with invasive annuals such as cheatgrass without affecting the overall genetic makeup of the native populations.

Comparison of Ground-Measured and Image-Classified Mesquite (*Prosopis glandulosa* Torr.) Canopy Cover

Mustafa Mirik and R. James Ansley

The invasion of honey mesquite (*Prosopis glandulosa* Torr.) on rangelands has many management and ecological consequences. Mesquite canopy cover was classified using high-resolution aerial images and related to the ground-measured canopy cover. There were robust relationships between image-classified and ground-measured mesquite canopy cover. Aerial images can be used to monitor and map mesquite extent, invasion, and expansion in rangelands, especially over remote and large land areas.

Response of Biomass and Seedbanks of Rangeland Functional Groups to Mechanical Control of Yellow Starthistle

V. Matzek and S. Hill

Many ranchers use herbicides to control the invasive plant yellow starthistle *(Centaurea solstitialis)* on grazing lands, but this strategy raises the possibility of herbicide resistance in starthistle populations. Mowing the plant while in its flowering stage, when practiced over 3 years, provided excellent control of yellow starthistle and eliminated its soil seedbank, with no negative effects on annual or perennial forage species. Rangeland managers may wish to include late-season mowing as part of an integrated pest management strategy for yellow starthistle control.

Mineral Nitrogen in a Crested Wheatgrass Stand: Implications for Suppression of Cheatgrass

Robert R. Blank and Tye Morgan

The exotic annual grass cheatgrass (*Bromus tectorum*) has contributed to the conversion of some perennial grass–sagebrush communities to annual grass dominance. We studied soil nitrogen in a crested wheatgrass system to learn what mechanism (or mechanisms) are responsible for resistance to cheatgrass invasion. Throughout the year, mineral nitrogen in soil beneath crested wheatgrass (*Agropyron cristatum*, *Agropyron desertorum*) is dominantly in the ammonium form. We hypothesize that resistant plant communities may have reduced rates of nitrification, and thereby lower quantities of nitrate, which may reduce the competitiveness of cheatgrass.

Recovery and Germination of *Dichrostachys cinerea* Seeds Fed to Goats (*Capra hircus*)

Julius T. Tjelele, Luthando E. Dziba, and Hosea T. Pule

We determined the seed recovery rate and germination of sickle bush (*Dichrostachys cinerea*) seeds eaten by goats voluntarily, mixed in with feed pellets, or force-fed. Seed recovery was higher from force-fed goats (32.7%) than those eating the mixed pellets (9.9%). Seeds that passed through the digestive tract (pellets and force-fed treatments) had higher germination than untreated seeds. Goats have the potential to influence sickle bush encroachment through seed dispersal.