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Upland Bare Ground and Riparian Vegetative Cover Under Strategic Grazing Management, Continuous Stocking, and Multiyear Rest in New Mexico Mid-grass Prairie

By Rick Danvir, Gregg Simonds, Eric Sant, Eric Thacker, Randy Larsen, Tony Svejcar, Douglas Ramsey, Fred Provenza, and Chad Boyd

On the Ground

- We compared land cover attributes on rangeland pastures with strategically managed ranches (SGM), continuously stocked (CS), and rested pastures.
- SGM pastures had less upland bare ground and more riparian vegetative cover than adjoining CS pastures, and SGM pastures had bare ground cover comparable to pastures rested from grazing for three or more years.
- Differences in riparian cover between management types were greatest in years of near-average precipitation and lower in years of high precipitation or drought.
- Remote sensing technology provided a means of quantifying range condition and comparing management effectiveness on large landscapes in a constantly changing environment.

Keywords: complex systems, strategic grazing management, remote sensing, upland bare ground, riparian vegetation.

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Ranchers' livelihoods depend on maintaining animal productivity, ranch profitability, and healthy soils and plants in highly variable environments. Having the knowledge and flexibility to adaptively manage in the face of change can determine whether managers meet these goals. While many ranchers continue to manage with moderate continuous stocking, others have adopted more management-intensive approaches to achieve their ecological and economic goals.[1–3]

We used remote sensing technology in this case study to quantitatively assess whether ranches using strategic grazing management (SGM)[1,3] and rotational grazing had less upland bare ground and more riparian vegetation than neighboring ranches that did not use SGM. SGM ranchers managed with long plant recovery periods, short grazing periods, few herds, and multiple pastures.

Published reviews of the scientific literature have concluded that existing experimental evidence does not support the hypothesis that rotational grazing outperforms moderate continuous stocking in plant or animal productivity.[4] Other reviews suggest that experimental grazing research often fails to consider the influence of external factors on management effectiveness. These factors include spatial scale, the adaptability of managers to changing conditions, and their desire to achieve conservation goals.[4–7]

The need to understand the impacts of management practices on working landscapes has never been greater. Land, water, and wildlife conservation organizations increasingly prescribe more intensive management practices, including rotational grazing, with the goal of increasing resilience.[6] Studying working ranches can help document management effectiveness. "Monitoring outcomes of various practices in a management context can contribute to more rapid development of local knowledge than more traditional forms of experimental research."[2]

Few studies have quantitatively compared management strategies on large working landscapes, as applied by managers adapting and making decisions in a constantly changing environment. Ranch managers continually learn and adapt. Practitioner knowledge, the practices applied, and environmental factors interactively affect economic and ecological

outcomes.[1,5,6] It can be difficult to assign cause and effect to specific treatments and outcomes on working lands with certainty.[1,2,7] However, resource managers and researchers working collaboratively may increase their understanding of creative systems, leading to principles-based management practices.[1,7]

To understand the behavior of organisms and environments, scientists attempt to develop principles about processes.[1] Principles of plant and animal behavior help guide our expectations about possible outcomes, but they do not guarantee certainty of those outcomes. An unexpected outcome does not necessarily mean the principles are wrong, but rather reflects the dynamism of biophysical processes and our incomplete knowledge as systems continually change. Through such experiences, we learn about the behavior of organisms and landscapes that we did not previously understand.

Despite the complex nature of biophysical systems, ranchers need ways to assess ecological progress, and grazing management practices must be science-based if they are to be broadly accepted. There is also a need to compare and quantify management effectiveness at large spatial scales.[1,2,5] Comparing differences in land-health metrics between adjacent lands under differing management strategies can provide useful feedback to ranchers as they assess landscape-scale management effectiveness. In this study, the four subject ranch managers wished to know how their ranches responded ecologically to SGM compared with their prior management style of continuous stocking (CS) (pastures grazed growing season-long or year-long). Because most grazed lands adjoining the subject ranches were continuously stocked pastures, we saw an opportunity to compare range cover characteristics on sites of similar ecological potential, but under different management.

The Ranches

The ranches were situated on broad valleys and mesas in eastern New Mexico. Ranches 1 and 2 were large ranches (10,765 and 26,809 ha) at 1,760 to 2,340 m in elevation. Ranches 3 and 4 were smaller (3,029 and 5,161 ha) at 1,330 to 1,540 m elevation. Dominant vegetation was representative of short- or mid-grass prairie, and typical upland species included blue grama (*Bouteloua gracilis*), buffalo grass (*Bouteloua dactyloides*), sideoats grama (*Bouteloua curtipendula*), and western wheatgrass (*Pascopyrum smithii*) with occasional stands of juniper (*Juniperus* spp.) and mesquite (*Prosopis glandulosa*).[8] Riparian vegetation included sedges (*Carex* spp.), rushes (*Juncus* spp.), and willows (*Salix* spp.). Invasive annual brome grasses (*Bromus* spp.) were not found on the subject ranches. Ranches 1 and 2 had <5% juniper or mesquite cover and have done little shrub/tree control. Ranches 3 and 4 had 10% to 15% shrub/tree cover and have practiced chemical or mechanical control.

Annual precipitation occurred primarily in May to September. Mean annual precipitation for the ranches ranged from 38 to 44 cm (15-18 inches, Fig. 1). In 2015, precipitation in Cimarron, New Mexico, (Ranches 1 and 2) was 148% of normal, and in Tucumcari, New Mexico, (Ranches 3 and 4) precipitation was 164% of normal, resulting in above-average growth of cool and warm season grasses (Fig. 1). However, all ranches experienced below-average precipitation between 2001 and 2014. Drought limited forage and stock water availability in the study area until 2015. As a result, several subject ranches were bordered by one or more pastures destocked (rested) for multiple years.

Information regarding ranch management practices was gained from interviews with ranchers, range consultants, and ranch management records. Subject ranch managers all received training in SGM and have practiced it for >10 years. All four ranches were managed with CS prior to adopting SGM. Infrastructure upgrades on subject ranches included development of higher-capacity stock-watering systems and additional interior fences and pastures to allow herd consolidation and higher stocking densities. Small, SGM ranches generally had the greatest pasture and water site densities. Subject ranch managers adjusted their annual stocking rates as needed to maintain livestock condition, based on fall forage inventories. Subject ranch managers

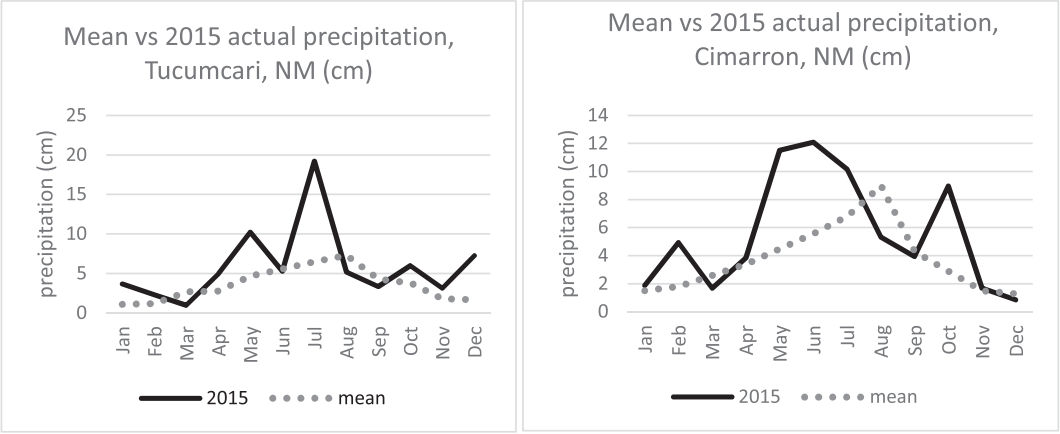

Figure 1. Mean and 2015 precipitation by month for Tucumcari and Cimarron, New Mexico, USA.