

College of Agricultural, Consumer and Environmental Sciences

Chihuahuan Desert Rangeland Research Center

Annual Progress Report 2017



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2017 Annual Report

Chihuahuan Desert Rangeland Research Center

Gerald Thomas Hall, Room 220

Box 30003, MSC 3BF

Las Cruces, N.M. 88003

Phone: 575-646-3125

Fax: 575-646-2816

INTRODUCTION

Mission

New Mexico State University operates the Chihuahuan Desert Rangeland Research Center to protect and ensure availability of its resources for teaching, research, and extension endeavors that benefit the citizens of New Mexico as originally declared by Congress in 1927. The Chihuahuan Desert Rangeland Research Center conducts educational, demonstrative, and experimental development with livestock, grazing methods, and range forage, including investigation of the sustainability and management of natural resources and environmental ecosystems.

Activities

Teachers, researchers and students from across campus benefit from the center. The [Department of Animal and Range Sciences](#) oversees the facility with help from a steering committee of scientists from the College of Agriculture and Home Economics and the College of Arts and Sciences. The center is part of the Jornada Basin Long -Term Ecological Research project - a National Science Foundation Ecology Network. Current research efforts include:

- Evaluating continuous and seasonal grazing strategies at different intensities to determine effects on livestock performance as well as plant cover and composition.
- Evaluating performance of breeds of cattle in relation to quality and quantity of forage in a hot, arid environment.
- Determining the influence of range conditions on wildlife populations.
- Autecology of plant species.
- Assessing competition and other interactions between common plant species.
- Ascertaining the role of small herbivores in a desert environment.

In addition to research conducted by the Department of Animal and Range Sciences, faculty and graduate students from other NMSU departments are conducting research at the Center. Currently much of the research is in conjunction with the Long-Term Ecological Research program, which is part of a nationwide program funded by the National Science Foundation. The CDRRC is used for teaching, demonstration and research projects with livestock, grazing methods and range forage, including investigations into the sustainability and management of natural resources and environmental ecosystems.

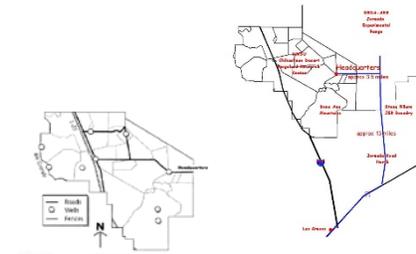
Due to its location and isolation, the CDRRC also is used by researchers from NMSU's Physical Science Laboratory (PSL), the U.S. Department of Defense, and private corporations for testing drones, telemetry, and radio interference.

History

Early hunting and gathering societies, part of the Jornada Mogollon culture, first roamed this area. Later, various Apache tribes made these lands their home. An eight-mile stretch of the Camino Real, the route established by the Spanish between Chihuahua, Mexico and Santa Fe, crossed the northern part of the Center. In 1887, the first Homestead was filed with the U.S. government for property now included in the Center. Several ranchers owned various portions of the land now constituting the Center, but in 1925 Max Vanderstucken, who then owned the land, was facing foreclosure and spoke to J.L. Lantow, head of the animal husbandry department at New Mexico A&M. He recommended the College buy his ranch, and in February 1926 the College acquired his land, with grazing rights on adjoining public lands. In 1927, Congress granted public lands to the College for research purposes. The last parcel was acquired in 1984 through a "land swap" between the federal government and the State of New Mexico.

Location and Description

The Center is located in Doña Ana County, New Mexico, at the southern end of the Jornada Plain. Now divided by Interstate 25, the Center encompasses almost 100 square miles, with one-fourth of the land west of the interstate.



Land on the Center varies widely, with elevations from 4,000 ft. on the Rio Grande flood plain on the west side to 5,840 ft. at the top of Summerford Mountain in the Doña Ana Mountains on the east side. The nearly level plains of the north and central parts of the Center are on the Jornada del Muerto basin, with several small playa areas where water collects after rainfall. Soils range from sandy loams to clays overlying caliche hardpan.

Several vegetation types occur on the center. Creosote bush dominates the upper slopes of the mountains and the hills along the river. At lower elevations, the creosote bush type grades into the mesquite type that grows on sandier soils, and into the tarbush type on heavier soils. The plains area, once dominated by black grama, today has been invaded by mesquite. These mesquite stands are interspersed with snakeweed and many species of grasses and forbs.

Wildlife populations on the Center are rich and varied. Among the larger mammals are mule deer, pronghorn antelope, gemsbok, bobcat, coyote, badger, and fox. Mountain lions have been sighted. There are also many rabbit and rodent species. Several bird species migrate throughout the area, but a large number also live and nest on the rangeland. Species such as roadrunners, hawks, and occasionally golden eagles are seen on the Center. Numerous lizard and snake species also inhabit these lands.

RESEARCH

Effect of two stocking levels on cattle production, forage production and financial returns on the Chihuahuan Desert

Jerry Holechek, Animal and Range Sciences

The purpose this study has been to determine the short and long-term impacts of light and conservative grazing on vegetation and cow-calf production in the Chihuahuan Desert. Earlier research has shown that conservative grazing was more effective than moderate grazing in terms of vegetation productivity, livestock productivity, financial returns and minimization of drought risk. Light grazing may be more effective than conservative grazing in terms of vegetation, livestock and financial outcomes because it reduces the need for destocking during drought years. After 20 years, the study we have conducted comparing light and conservative grazing on cow calf production in the Chihuahuan Desert has shown light grazing has benefits of more rapid vegetation recovery following drought and reducing the need to destock in drought years. However, it reduces financial returns in non-drought years compared to conservative grazing. Light grazing involving 25 to 30% use of forage appears to most advantageous to passive, low input ranchers who wish to minimize drought risk and want to improve ecological condition of their pastures. Conservative grazing appears advantageous to ranchers whose rangelands are in high ecological condition and are willing to actively manage their rangelands with intensive monitoring. The financial returns from light and conservative grazing have shown no definite difference as the higher returns from conservative grazing in non-drought years appears nullified by increased cattle trading costs in drought years and slower vegetation recovery from drought. Another five years of study as requested in this proposal would allow better resolution of both the biological and financial aspects of light compared to conservative grazing.

Results from this research project have been closely followed by ranchers and range managers in the southwestern USA and applied in stocking rate decisions. Concerns over global warming and the possible increased frequency of drought in the southwestern USA are additional strong justifications to continue this research.

We provided a major report of findings from this project in 2015 regarding long-term forage and cow-calf performance and economic consideration of two stocking levels on Chihuahuan Desert rangeland. We are now collecting additional data for the years 2016-2020. These data will include vegetation cover, forage production, shrub densities and cow-calf production on the four pastures as previously mentioned. We are also collecting vegetation data on seven exclosures.

Development of livestock behavior-based criteria to inform adaptive grazing management decisions on rangelands

Andres Cibils, Animal and Range Sciences

The basic premise of this proposal is that short-term temporal trends in spatial behaviors of livestock at the scale of pastures detected through animal movement analysis of real time GPS tracking data could provide original criteria to implement adaptive grazing management on rangelands. Use of GPS to monitor livestock for research purposes is now widespread in the United States and elsewhere. Ranchers and land managers will likely be relying on livestock GPS monitoring to inform grazing management decisions within the next decade or sooner. Nonetheless, as of today we are unprepared to meet upcoming demands for analytical tools to use livestock GPS monitoring data to inform grazing decisions in real time. Rangeland scientists have amassed extraordinary spatial data sets but only very recently have begun conducting the kinds of more sophisticated spatial analyses required to promote breakthroughs in the science of grazing management. Increasing access to GPS monitoring technology for use in commercial ranching operations opens new opportunities to develop animal behavior-based criteria to inform adaptive grazing management decisions on rangelands.

Continuing in the vein of analyses reported last year we further analyzed relationships between pasture greenness and GPS-derived cattle grazing behavior parameters. We specifically sought to evaluate the hypothesis that cattle foraging activity (i.e., spatial patterns) tracks landscape greenness and assess whether livestock movement patterns are linked with greenness change detected by remote sensors. Daily distance traveled by cows was greater and foraging area expanded during periods with higher precipitation. A regression model including minimum pasture NDVI, rainfall and their interaction explained 81% of the seasonal variation in distance traveled by cows ($P < 0.01$). Cows explored about 81 ha/d while foraging, but tended to explore smaller areas as the pasture became greener (green up and peak green stages). Cows foraged an average of 9.7 h daily and spent more time foraging with more concentrated search patterns as pastures became greener. These new findings suggest that measurement of vegetation greenness via remote sensing can facilitate meta-analyses of grazing studies conducted at different locations and times of year.

We continued to work on calibration of the JAVA software tools GRAZEACT and GRAZEPIX (see description below). Both these tools are intended to meet our overall objective # 3. Beta versions of these software tools have been used and reported in peer reviewed journal articles. Current efforts are focused on making the software more user-friendly.

Jornada Basin Long-Term Ecological Research (LTER)

In collaboration with the [Jornada Experimental Range](#) (USDA ARS), we have incorporated studies initiated in 1915 into the JRN LTER program. Previous research focused on desertification, a state change from perennial grasslands to woody plant dominance (i.e., desertified shrublands) that occurs globally. Based on findings from growing [long-term databases](#), the breadth of studies was expanded to include four additional state changes that occur in dryland systems:

- a reversal from desertified shrublands to grassland states,
- transitions among different states dominated by woody plants,
- invasion by non-native grasses leading to novel states, and
- transitions to human-dominated states.

Processes of interest include water mediated plant-soil feedbacks; patch-scale contagion by wind, water, and animals; landscape context; and time lags that are manifested as nonlinear dynamics and threshold behavior. These cross-scale interactions (the interactions between patterns and processes across scales) often lead to emergent behavior of broader scales that are not predicted from fine-scale patterns. Our study site is located in the northern Chihuahuan Desert, approximately 25 km northeast of Las Cruces, New Mexico, USA (+32.6 N, -106.7 W, elevation 1315 m). Annual precipitation is 24 cm and maximum temperatures average 13 C in January and 36 C in June. Our study site includes the 78,266 ha Jornada Experimental Range operated by the [USDA Agricultural Research Service](#), and the 25,900 ha [Chihuahuan Desert Rangeland Research Center \(CDRRC\)](#) operated by [New Mexico State University](#). The Jornada Basin LTER project was established in 1982, and is administered by New Mexico State University. This site is a member of the [LTER Network](#), one of 25 long-term sites funded by the [U.S. National Science Foundation](#). More information about the Jornada LTER and the research projects can be found at <https://jornada.nmsu.edu/lter>.