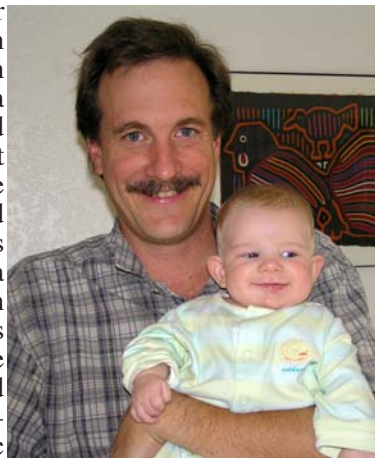


## Featured Investigator - Brandon Bestelmeyer

Brandon Bestelmeyer (seen here with his son Thomas) is an ecologist with the USDA-ARS Jornada Experimental Range and adjunct faculty in Biology at New Mexico State University. Brandon joined the Jornada five years ago as a post-doc and then became a research scientist and an LTER co-PI in 2003. His research interests have centered on community and landscape ecology, emphasizing moderately holistic approaches and applications to aridlands management. In spite of warnings during his undergraduate program that the field of community ecology was dead, Brandon pursued it anyway during an MS and then a PhD at Colorado State University. Inspired by the use of ants and their functional groups to indicate management effects in Australia, he studied ant community variation within land-use systems of northern Argentina, Guatemala, Mexico, and finally at the Shortgrass Steppe (CO), Sevilleta, and Jornada (NM) LTER sites. The successes and



failures of this approach, as well as interactions with Jornada colleagues, led to a deepening interest in the process of landscape change and how knowledge of it can be applied in the real world. This work has focused on the ecological underpinnings of Ecological Site Descriptions that are increasingly used by agencies and NGOs to classify landscapes according to vegetation potential and dynamics, and the associated state-and-transition models that describe the processes and management implications of ecosystem change. Current approaches emphasize 1) the significance of scale and thresholds in vegetation pattern-process relationships, 2) the significance of soil-geomorphic heterogeneity (soil scientists convinced him that holistic approaches actually require the digging of holes), 3) the interaction of animal communities with vegetation dynamics, and 4) the incorporation of these concepts in rangeland management and biodiversity conservation practices.

## Recent Publications Continued

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# JORNADA TRAILS



Jornada Basin Long-Term Ecological Research Program

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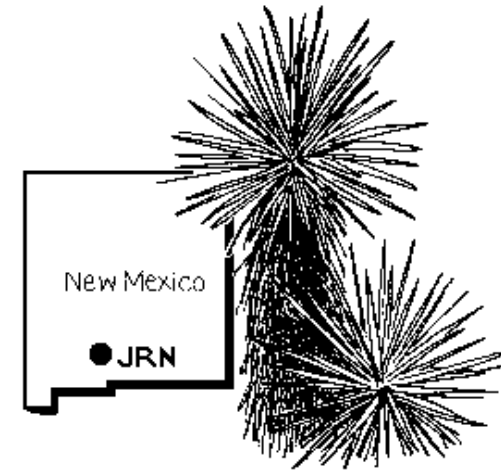
## Impacts of Small Mammals on Chihuahuan Desert Ecosystems by Dave Lightfoot

Native kangaroo rats and rabbits are prominent small mammals in Chihuahuan Desert ecosystems. We are experimentally determining how native small mammals may alter plant species diversity and vegetation structure as well as soils, cryptobiotic crusts, vascular plants, termites, and ants in Chihuahuan Desert grassland and shrubland ecosystems, and how small mammal influences are affected by short-term and long-term climate change both locally, and regionally across the Chihuahuan Desert. The Small Mammal Exclosure Study (SMES) is a cross-site LTER study at the Sevilleta and the Jornada Basin LTER sites (New Mexico, USA), and at the Mapimi Biosphere Reserve (Mexico). In 1995-96 we installed a standard, replicated, experimental design at all three study sites using screen fences to exclude rodents and rabbits from study plots. One type of fence excludes rabbits but allows entry by kangaroo rats and other smaller rodents; the other type of fence excludes both rabbits and other rodents. Non-

fenced control plots are used for comparison. Data were collected for one year prior to rodent removal and exclosure fence construction; data have been collected twice each year since that time.

To date, we have found that removing rodents and rabbits results in increased cover of perennial grasses at the Jornada. Soil surface disturbance on the control plots varies from one to ten times greater than on the exclosure plots, and varies with rodent population densities. The number of seed harvester ant nests has more than doubled on the kangaroo rat exclosure plots, but not on the rabbit only exclosure plots. Our findings demonstrate that kangaroo rats have a greater impact than rabbits, and that rodent impacts are more pronounced in creosotebush habitat than in black grama grassland.

A rodent and rabbit exclosure at the Jornada grassland site in Pasture 9.



The Jornada Basin LTER Program is an NSF funded and USDA Agricultural Research Service supported project.



## J • O • R • N • A • D • A T • R • A • I • L • S

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## Water in the Desert by Keirith Snyder

Globally, climate is changing due to increased concentrations of greenhouse gases. This change in global climate is likely to produce changes in regional weather patterns, such as greater winter rainfall or greater summer rainfall. Recent research indicates that changes in the distribution of precipitation as well as seasonal rainfall amounts can have important effects on ecosystem responses, in particular in water limited arid systems. At the Jornada Experimental Range, we are manipulating the frequency and magnitude of rainfall events to determine the effects on grass-shrub interactions. A 60 mm increase in summer precipitation (46% increase over mean summer rainfall) was applied with two different frequencies and magnitudes for twelve weeks during the summer growing season in 2003, 2004, and 2005. Plots containing mesquite (*Prosopis glandulosa*) and

black grama grass (*Bouteloua eriopoda*) received small (5mm) weekly rainfall, large (20mm) monthly rainfall, or

ambient conditions (no additional rainfall). We found that mesquite used rainfall from both small frequent rainfall and large infrequent rainfall events. Use of small rainfall events by mesquite was greatest in the dry summer of 2003. Large infrequent rainfall improved the ability of the ecosystem to take up carbon from the atmosphere and potentially act as a carbon sink. In addition, initial results suggest that small frequent events may have more biological impact in a dry year, while large infrequent events may have more impact in a wet year. This time- and labor-intensive project was made possible with the assistance of lead technician Connie Maxwell, a number of Jornada staff members, NMSU graduate and undergraduate students, a Las Cruces high school student, and visiting scientists from Hungary.



Monthly rainfall applied using a portable rainfall simulator.

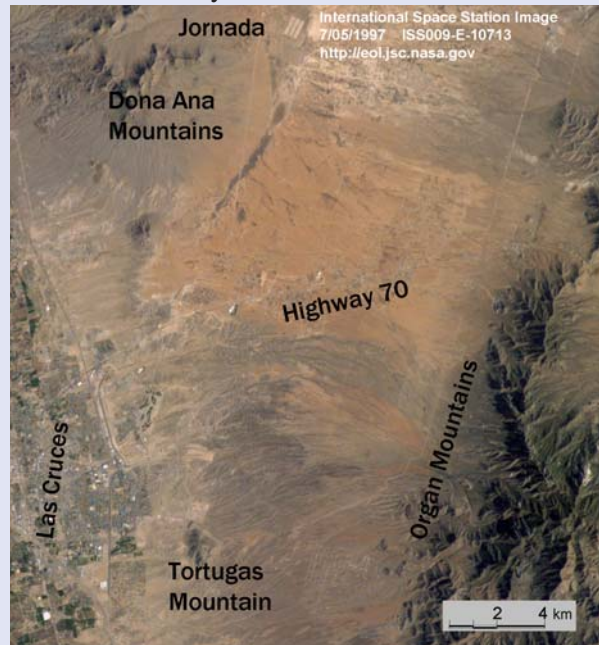
## Our Changing Socio-Economic Environment

The Jornada Basin in southern New Mexico, as part of the Jornada del Muerto, has had human influences and interactions for thousands of years. For example, we are aware of activities by the Jornada Mogollan, Native Americans living in the area over 600 years ago, and their long lasting impacts on vegetation dynamics and patterns in water erosion. More recently, Europeans had early effects on the Jornada through the transport of animals and goods between Mexico City and Santa Fe along the Camino Real starting in the 1500s. The cattle boom of the 1880s combined with periodic drought initiated a regional scale shift in vegetation from grasslands to shrublands that persists to the present. In addition to historic drivers, the region continues to change rapidly: the Southwest is one of the fastest growing areas in the U.S.; Dona Ana County, home to the Jornada Basin, had a population increase of 29% from 1990 to 2000 compared to 13% for the U.S. A large local Hispanic population (63%) combined with the influx of retirees and young professionals result in often conflicting demands for land and water resources, and increasing stress on the ecological integrity of the landscape. Although human activities have played an important role in generating current landscape patterns and it is recognized that increasing human numbers are having a large range of ancillary effects, the complex and changing socio-economic environment of the region is not well studied and scenarios for the future remain largely unanalyzed.

We recently incorporated three NMSU faculty members into our LTER project with a keen interest in integrating human dimensions perspectives with our ecological research. These faculty are Rhonda Skaggs, Department of Agricultural Economics/Agricultural Business, and Jack Wright and Janet Greenlee, Department of

Geography. They have expertise in agricultural economics, environmental planning, and human geography. A central objective of their collaboration with this LTER will be an analysis of socio-economic change from 1910 to the present with the goal of first understanding these changes, and then using this information to forecast future landscapes under alternative climatic and land use scenarios. Land tenure patterns – the varying types of private and public ownership – will form a significant component of this research. Land tenure is the expression of deeply rooted cultural values and ideologies, and decisions about land use have far reaching environmental impacts on an ecoregion that is becoming increasingly fragmented by development and uncoordinated land management. The 1997 photograph below from the Space Station is of the east mesa area near Las Cruces and within 8 km south of the Jornada along Highway 70 that will serve as a laboratory for this research.

Image below obtained from the International Space Station website, and edited by Isabella Mariotto.



## Livestock As Tools For Ecological Restoration: Using Goats To Control Salt Cedar by Sandy Tartowski

Salt cedar (*Tamarix spp.*) has invaded riparian areas throughout the Western United States and has been reported to increase evapotranspiration, increase fire frequency, reduce habitat values, and replace native plant species. Herbicides and mechanical clearing are the most common methods used to remove salt cedar. Recent studies by Jornada

researchers show that goats can be used as effective management tools for salt cedar. Goats readily browsed salt cedar, Russian olive, and undesirable weeds in experimental plots along the Rio Grande, while maintaining weight and health. Nearly every salt cedar plant was damaged by browsing, but goats had an especially severe impact on resprouts.

## J • O • R • N • A • D • A T • R • A • I • L • S

*Jornada Trails* is a biannual publication of the Jornada Basin Long-Term Ecological Research (LTER) Program, sponsored by the National Science Foundation. Stories and story ideas are welcome. Send them to:

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*Jornada Trails* also appears on the World Wide Web at <http://jornada.nmsu.edu>

Newsletter by Valerie K. LaPlante and Kris M. Havstad

## Water Availability in Calcic Soil Horizons by Mike Duniway

Mike Duniway, a Jornada Basin LTER graduate student, is investigating water availability in calcic soil horizons. Petrocalcic and calcic soil horizons develop extensively in arid ecosystems around the world, often within the rooting zone of many desert plant species. As part of his dissertation research, Mike has monitored soil water content across a chronosequence of calcareous soils on the JER. Soil profiles were instrumented with TDR soil moisture probes, both above and within the high carbonate horizons. All soil profiles, including calcic and petrocalcic horizons, received substantial increases in soil water from above average winter precipitation in 2004-2005. The petrocalcic horizon water content increased an astounding 0.12 to 0.14 m<sup>3</sup>/m<sup>3</sup> above late summer levels. Both the calcic and petrocalcic horizons retained significantly more winter precipitation into the spring than the non-carbonate sandy soil. However, all profile water contents were reduced to pre-winter levels by the late spring. Petrocalcic and partially indurated calcic horizons are often overlooked when assessing soil profile available water. This study indicates that petrocalcic and calcic horizons contain significant amounts of plant available water and can be recharged by winter rains.

Grass cover, especially native grama grasses, increased from less than 1% before goat browsing to about 20% after goat browsing.

## Recent Publications from the Jornada

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(Continued page 4)

## Jornada Schoolyard LTER Program Receives Additional Funding by Stephanie Bestelmeyer

The goal of the Jornada Schoolyard LTER is to increase the scientific literacy of preschoolers to adults. We are now moving closer to this goal, thanks to new program components made possible by additional funding this year.

NSF offered extra funding for Schoolyard LTER programs because these programs are excellent models of the integration of education and research. In addition to the \$15,000 annual supplements, there were also competitive funds available for expanding successful programs through the BIO Directorate as well as the Education and Human Resources Directorate (EdEn Fund). The Jornada LTER was fortunate to receive all three levels of funding.

The annual supplement will be used to continue our successful program of field trips and hands-on schoolyard activities. With the expansion funds, we will join forces with the Chihuahuan Desert Nature Park's Experience Science Program which offers monthly classroom programs and two field trips to third grade students at eight under served schools in Las Cruces. Finally, the EdEn grant will allow us to offer two summer teacher workshops and a series of public events run by teacher workshop participants.

All efforts are aimed at providing a seamless series of activities for students of all ages to participate in hands-on, inquiry-based science.



Third grade students at Central Elementary School in Las Cruces collect data on the weather conditions in their schoolyard.

## Interpreting Indicators of Rangeland Health, Version 4.0 by Jeff Herrick

Jornada researchers, working in collaboration with the USGS, NRCS, and BLM, released version 4.0 of "Interpreting Indicators of Rangeland Health". The protocol uses 17 qualitative indicators to evaluate three attributes: soil and site stability, hydrologic function, and biotic integrity. The latest version increases repeatability through the



development of semi-quantitative reference sheets which describe the range of variability expected for each indicator in an undegraded state. Unique reference sheets are developed for groups of similar soils and climates. Jornada research was used extensively in the initial development of the indicators (published in 2000 in

Version 3.0). Jornada researchers also led the development of the complementary quantitative measurements and co-lead a consistency test together with the USGS.

The protocol is being applied nationally by the NRCS, BLM, and other organizations. Draft versions are also available in Spanish, Mongolian, and Chinese.

Copies are available from the Jornada or may be downloaded from [http://usda-ars.nmsu.edu/JER/Monit\\_Assess/monitoring.php](http://usda-ars.nmsu.edu/JER/Monit_Assess/monitoring.php).

## Unmanned Aerial Vehicles (UAV) Suitable for Jornada Basin LTER Research by Al Rango and Andrea Laliberte

Starting in 2000, we have experimented with UAVs at the Jornada Experimental Range for use in rangeland applications. Experiments have included both fixed wing and helicopter platforms. Recently, complete and ready-to-operate UAV systems have become available. A demonstration of one of these, the MLB Bat 3, was impressive. The Bat 3 is cata-

pult launched, flies to a way point and orbits there waiting for further commands. Flight lines are entered into a software program on the computer before the flight or they can be uploaded to the Bat 3 in-flight. After completing data collection, the Bat 3 can land autonomously in very rough fields. The acquired imagery can be downloaded and

reviewed while in the field. It is our impression that the Bat 3 would easily operate at the Jornada and could acquire very high resolution imagery at any time over rangeland study areas. It appears to be the ideal platform for developing a capability for operational applications for use by agencies such as BLM.