Jornada Experimental Range (JRN)

The goal of the Jornada Basin LTER (JRN) program is to quantify the key factors and processes controlling ecosystem dynamics and patterns in Chihuahuan Desert landscapes. This understanding is being used to develop effective strategies for managing arid and semi-arid landscapes in the U.S., and beyond. The Chihuahuan Desert has experienced dramatic changes in vegetation structure and ecosystem processes over the past 150 years. This "desertification" is manifested by the broad-scale expansion of unpalatable, xerophytic woody plants into perennial grasslands accompanied by soil degradation. Although desertification has occurred globally over a similar time period, the explanations for this change are numerous and controversial. Assigning primacy to a given factor is complicated by the occurrence of stochastic trigger events, and strong interactions including positive feedbacks that create threshold behavior and nonlinear ecosystem responses. Human activities have long been regarded as important determinants of desertification. However, the role of humans relative to other factors is poorly understood, but will likely assume greater importance as environmental conditions change and human population densities continue to increase.

Site characteristics. The JRN LTER is located 37 km north of Las Cruces, New Mexico, U.S.A. (32.5 N, 106.8 W, 1188 m a.s.l.) in the northern Chihuahuan Desert. The research site includes the 78,266-ha USDA ARS, Jornada Experimental Range and the contiguous 25,900-ha Chihuahuan Desert Rangeland Research Center (NMSU). The climate of the area is characterized by an abundance of sunshine, a wide range between day and night temperatures, low relative humidity. Annual precipitation is low (mean=23 cm/y) with 52% occurring in the summer. Average temperatures range from 13^{o}C in January to 36^{o}C in June. Extreme droughts are a recurrent climatic phenomenon: the 1951-57 drought was the most severe over the past 350 years. The Jornada Basin consists of repeated geomorphic units defined by landforms, soils, and associated vegetation properties characteristic of the Basin and Range Physiographic Province of the western U.S. and northern Mexico. Most of the basin is closed with no exterior drainage; water occasionally collects in scattered playas. Typically, the soils are sandy loams to clay loams with a calcium carbonate layer at depth, but the degree of "caliche" formation and depth varies with site position and soil age.

Black grama-dominated grasslands historically dominated uplands at the JRN LTER site. Remnant sites covered < 7% of theareain1998.

In the Jornada Basin, > 500 plant species, 140 bird species, 30 mammal species, and 20 snake species have been documented. The vegetation is representative of that found throughout

the Chihuahuan Desert. Five major plant communities can be found that differ in their degree of desertification: (1) upland grasslands dominated by black grama (*Bouteloua eriopoda*), (2) lowland grasslands dominated by tobosa (*Pleuraphis mutica*) and burrograss (*Schleropogon brevifolius*), and a series of desertified shrublands, including (3) tarbush (*Flourensia cernua*) on lower piedmont slopes, (4) creosotebush (*Larrea tridentata*) on upper piedmont slopes and bajadas, and (5) honey mesquite (*Prosopis glandulosa*) on the sandy basin floor. In general, the amount of area dominated by grasslands has decreased considerably from 1858 (80%) to 1998 (<7%) whereas the area dominated by shrubs has increased, primarily for creosotebush (<1 to 32%) and honey mesquite (17 to 54%) over the same time period. High spatial variation in the rate and pattern of conversion of grasslands to shrublands across a range of scales is a key characteristic of these systems.

Research focus. The JRN LTER through New Mexico State University has been investigating desertification processes since 1982. As part of our collaboration with the Jornada Experimental Range USDA-Agricultural Research Service (JER ARS), we have benefited from and contributed to a legacy of long-term research dating to 1915 with some historical records dating to the mid-1800s. We have a close collaboration with the Chihuahuan Desert Nature Park, our schoolyard LTER program that brings environmental education to thousands of K-12 students, teachers, and the public annually.

Honey mesquite-dominated shrublands have replaced most upland grasslands at the JRN LTER site. Similar conversion of grasslands to shrublands has occurred in arid and semiarid systems globally over the past 150 years.

Significant advances in understanding the causes and consequences of desertification have been made at specific spatial scales and for certain environmental conditions. More recently, the JRN LTER has been investigating the role of spatial and temporal variation in ecosystem properties and processes to desertification dynamics and the potential for grass recovery. We are particularly interested in evaluating how processes interact across a range of scales and under different conditions to drive desertification dynamics and to regulate the conservation of biological resources. We are using a suite of short- and long-term experiments, spatial databases, and remotely sensed imagery integrated in spatially-explicit, multi-scale simulation models to determine the conditions when fine-scale processes cascade to affect larger spatial scales, and the conditions when broad-scale drivers constrain or overwhelm fine-scale processes to influence system dynamics.