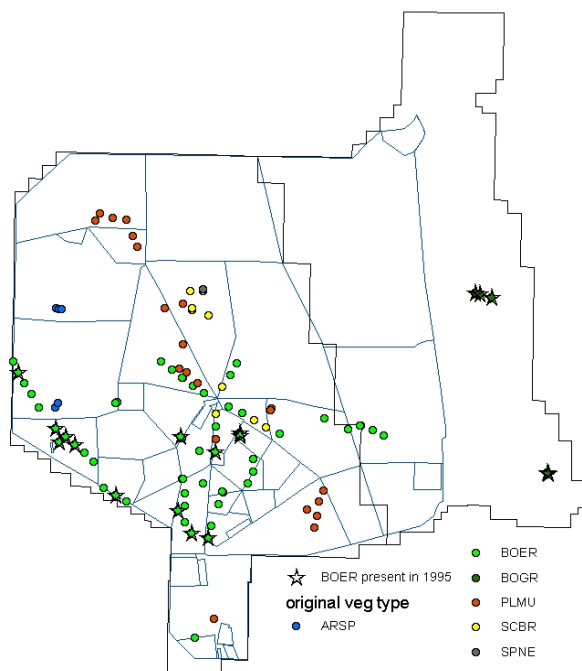


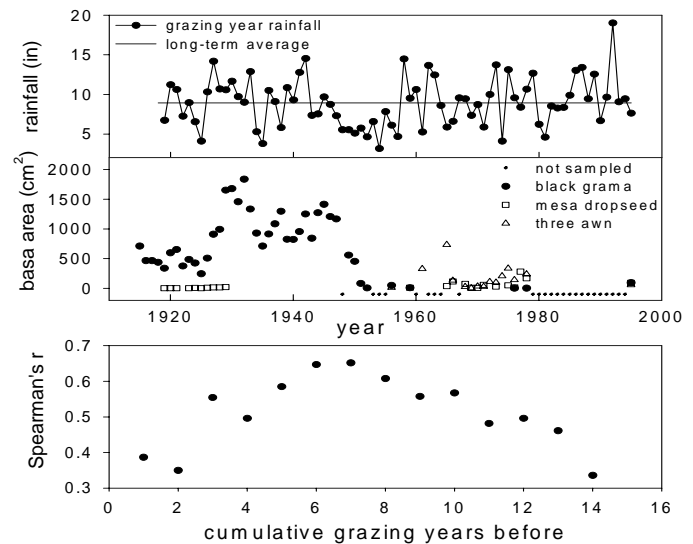
Long-term Permanent Quadrats

Permanent quadrats record vegetation changes since 1915 in a range of grassland and soil texture types. More than 100 1 x 1 m² quadrats were set up during 1915-32 to study the response of major forage species to cattle grazing and precipitation. Basal area of perennial grasses, locations of annual grasses, forbs and shrubs, and sometimes canopy cover of major shrubs were charted. Almost all quadrats were charted annually until 1947, and a portion of the quadrats was charted annually between 1947 and 1979. One hundred and six quadrats were relocated and charted in 1995 and again in 2001 and 2006.

Currently the data set, along with other long-term data collected at multiple spatial scales, is being used to identify the landscape, climatic, and anthropogenic factors that influence grass abundance, growth, and persistence. Recent analyses show that persistence of the dominant species, black grama, is positively related to processes at the quadrat (sand content, perennial grass production) and landscape scales (distance to nearest shrub-dominated community, variation in spring and winter rainfall), but the persistence of this species is negatively related to inter-annual variation in total grass production. Basal areas of black grama, mesa dropseed, and tobosa are correlated with long-term annual precipitation; the highest coefficients occurred with cumulative rainfall in the previous 6 to 8 years. Annual growth rates of these species were correlated with short-term rainfall occurring within the previous 15 months. Black grama response to precipitation was homogeneous among quadrats in persistent grasslands, but heterogeneous among quadrats where shrubs currently dominate.



Location of permanent quadrats at the Jornada LTER site. Initial vegetation type of each quadrat is shown (BOER: black grama; BOGR: blue grama; PLMU: tobosa; SCBR: burrowgrass; SPNE: dropseed)



Temporal variation in rainfall and vegetation, and correlation between rainfall and black grama basal area at quadrat B2.

Recent publications

Gibbens, R.P., and R. F. Beck. 1988. Changes in grass basal area and forb densities over a 64-year period on grassland types of the Jornada Experimental Range. *Journal of Range Management* 41:186-192.

Gibbens, R.P., and R. F. Beck. 1987. Increase in number of dominant plants and dominance-classes on a grassland in the northern Chihuahuan Desert. *Journal of Range Management* 40: 136-139.

Peters, D. C. and Gibbens, R. P. *Plant Communities in the Jornada Basin: The Dynamic Landscape*. 2006. IN: Havstad, K. M., Huenneke, L., and Schlesinger, W. H. *Structure and Function of a Chihuahuan Desert Ecosystem: The Jornada Basin Long-Term Ecological Research Site*. pages 211-231. New York, NY, Oxford University Press.

White, E.P., P. B. Adler, W. K. Lauenroth, R. A. Gill, D. Greenberg, D.M. Kaufman, A. Rassweiler, J. A. Rusak, M D. Smith, J. R. Steinbeck, R. B. Waide, and J. Yao. 2006. A comparison of the species-time relationship across ecosystems and taxonomic groups. *Oikos* 112 :185-195.

Yao, J., D. P. C. Peters, K. M. Havstad, R. P. Gibbens, and J. E. Herrick. 2006. Multi-scale factors and long-term responses of Chihuahuan Desert grasses to drought. *Landscape Ecology* 21:1217-1231.