

Vegetation Monitoring on Semi-Arid Grasslands Ungrazed by Domestic Livestock

Linda Kennedy

National Audubon Society, Appleton-Whittell Research Ranch, Elgin, Arizona

Dan Robinett

Robinett Rangeland Resources LLC, Elgin, Arizona

Abstract—The Research Ranch is an 8000-acre sanctuary and research facility in the semi-arid grasslands of southeastern Arizona, USA. Cattle were removed from the property in 1968 to provide a reference area by which various land uses, such as grazing and exurbanization, could be evaluated. Vegetation transects were established in 2000 and 2003 on several ecological sites in Major Land Resource Area 41. This monitoring program has tracked changes after wildfires and during drought. Trends associated with non-native, invasive species, particularly *Eragrostis lehmanniana* (Lehmann lovegrass) and *E. curvula* (Boer lovegrass) have been documented. For example, in an 8-year span, the frequency of Lehmann lovegrass on one loamy upland site grew from 1% to 60% at the expense of the native *Eragrostis intermedia* (Plains lovegrass) and *Bouteloua gracilis* (Blue grama). Results from monitoring provides feedback to Audubon personnel in the management of the property and are shared with other land managers to help tease apart the effects of grazing and other land use actions from the effects of climate.

Introduction

The Appleton-Whittell Research Ranch is an 8000-acre enclosure from which domestic livestock were removed in 1968. The facility is a cooperative effort among several landowners including the Bureau of Land Management, U.S. Forest Service, Resolution Copper Company, The Nature Conservancy, The Research Ranch Foundation, and National Audubon Society, and is managed by Audubon under contractual agreements with each. The Research Ranch is primarily Madrean mixed grass prairie. Its lands are tributary to the Babacomari River. Audubon staff work closely with the members of the cattle ranching community and ranchers are able to compare their management efforts with an ungrazed reference area. Many research projects have resulted from work conducted on the Research Ranch but vegetation monitoring has been a relatively recent addition to the scope of activities.

Methods

Eighteen vegetation transects were established in 2003 and 2004 based on the work by Breckenfeld and Robinett (2001). Transects were located in representative areas within Ecological Sites. The Plant Frequency method (Despain and others, 1997) is used to gather

vegetation data. Four parallel lines of 50 frames each yield 200 frames to determine frequency. Three points per frame are used to establish cover (data not shown). Simple rain gages are located at or near each transect and read twice per year.

Results

Data from a subset of four transects established in loamy uplands are summarized along with precipitation data (fig. 1) and some generalizations across all transects.

Transect 650

This transect is on the western side of the Research Ranch and exhibits a 15% SW slope. The Ryan Fire burned this area in April

In: Gottfried, Gerald J.; Ffolliott, Peter F.; Gebow, Brooke S.; Eskew, Lane G.; Collins, Loa C., comps. 2013. Merging science and management in a rapidly changing world: Biodiversity and management of the Madrean Archipelago III; 2012 May 1-5; Tucson, AZ. Proceedings. RMRS-P-67. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

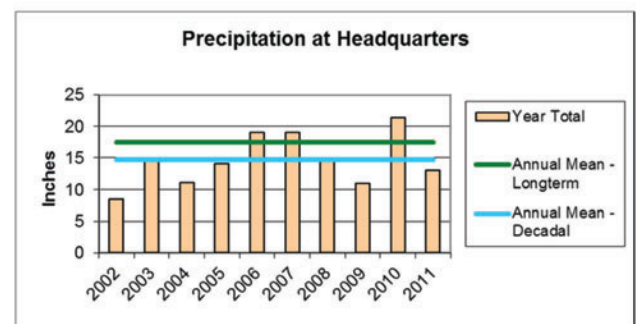


Figure 1—The cumulative shortfall (long-term mean—actual precipitation) during the 9 years represented by this report equals 24 inches.

2002 during severe drought. Recent precipitation: Monsoon 2010: 14.7 inches; Winter 10/11: 0.8 inches; Monsoon 2011: 6.7 inches. Frequency of sideoats grama (*Bouteloua curtipendula*) has been stable or increased (fig. 2), but blue grama (*B. gracilis*) crashed in 2006 and has not recovered. Wolftail (*Lycurus setosus*) is increasing and curly mesquite (*Hilaria belangeri*) is maintaining despite the dry winter of 2010/11.

Transect 651

This site is on the western side of the Research Ranch and has a 2% E slope. This transect also burned in the Ryan Fire of April 2002. Recent precipitation: Monsoon 2010: 12.5 inches; Winter 10/11: 1.5 inches; Monsoon 2011: 7.1 inches. Lehmann lovegrass (*Eragrostis lehmanniana*) is exhibiting its invasive potential on this transect (fig. 3), increasing from 1% frequency in 2003 to 55% in 2006, and is retaining dominance. Both blue grama and plains lovegrass (*E. intermedia*) show declines during this period. Wolftail is increasing on this transect.

Transect 706

This site is also on the eastern side of the research ranch. Slope is 12-15% E. This plot burned in the Ryan Fire of April 2002. Recent precipitation was: Monsoon 2010: 11.7 inches; Winter 10/11: 0.9 inches; Monsoon 2011: 10.6 inches. NRCS had established and read this transect in 1997 using the same protocol, so we were able to compare changes and trends for a longer time period. Curly mesquite was dominant in 1997 (96%), but found in only 2 frames (1%) in 2011 (fig. 4). Frequency of cane beard grass (*Bothriochloa barbinodis*) is trending upward, 18% to 52%. Lehmann lovegrass was found at low frequencies (2-3%) from 1997 through 2005 before peaking at 41% in 2009. Complete plant mortality for this species brought the frequency down to 10% in 2011. In 1997, plains lovegrass was noted in 26% of the frames. By 2011 none was recorded.

Transect 665

This transect has a slight (1-3%) northern exposure. This plot burned in the Ryan Fire of April 2002 and the Canelo Fire of May 2009 (also

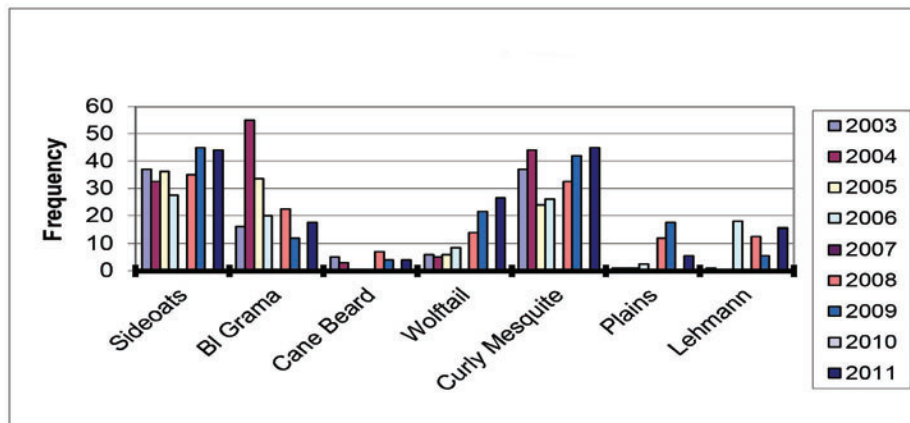


Figure 2—Loamy upland transect 650.

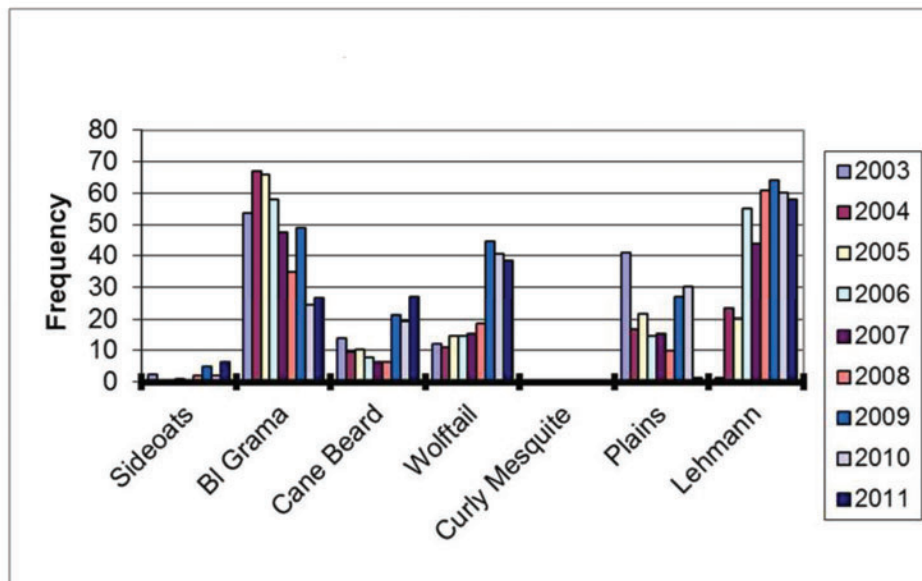


Figure 3—Loamy upland transect 651.

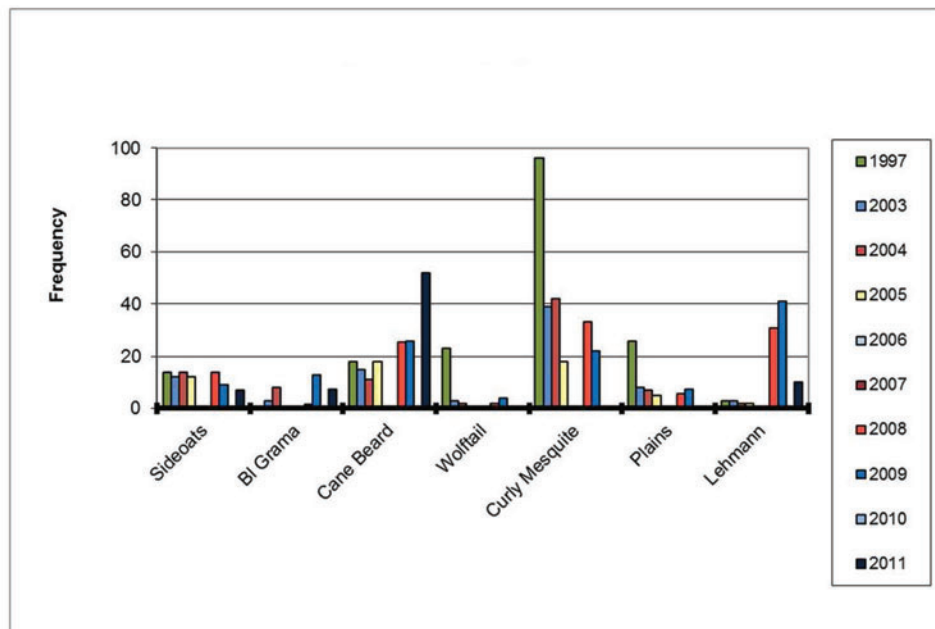


Figure 4—Loamy upland transect 706.

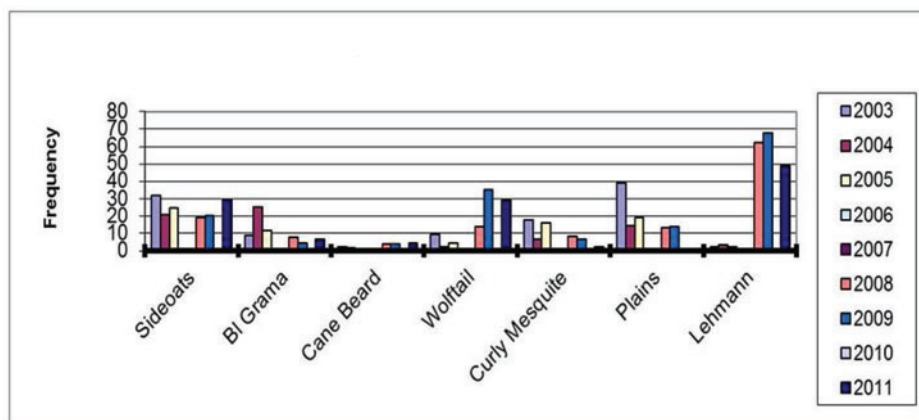


Figure 5—Loamy upland transect 665.

a drought year). Recent precipitation: Monsoon 2010: 13.0 inches; Winter 10/11: 1.0 inches; Monsoon 2011: 7.7 inches. Plains lovegrass has exhibited a steady decline during this period, from 39% frequency in 2003 to 0% in 2011 (fig. 5). Lehmann lovegrass was found at low levels until 2006 (62%). Curly mesquite declined from 16% to 2%.

Conclusions

We established/re-established sixteen transects in 2003 and added two more in 2004. The transects experienced a range of fire activity and all have been influenced by drought conditions. This is a monitoring project rather than a research project, so care must be taken to assign causality, but two iconic native grasses, plains lovegrass and blue grama have exhibited a steady decline in frequency and the trend for the non-native, Lehmann lovegrass is upward. It was hoped that

grassland protected from grazing by livestock would be resistant to invasion by non-native grasses, but this hope has proved groundless. Other methods must be used if the objective is to protect and maintain native plant species diversity.

References

- Breckenfeld, D.; Robinett, D. 2001. Soil and range resource inventory of the National Audubon Society Appleton-Whittell Research Ranch Santa Cruz County, Arizona. Online: <http://researchranch.audubon.org/PDFs/SoilRangeResourceInventory2001.pdf>.
- Despain, D.W.; Ogden, P.R.; Smith, E.L. 1997. Plant frequency sampling for monitoring rangelands. In: Some methods for monitoring rangelands. G.B. Ruyle, ed. Arizona Cooperative Extension Publication 190043.