

20 Years of Natural Recovery After Wildfire on Northern Nevada Rangelands

Ann P. Bollinger and Barry L. Perryman

Abstract: In recent decades Northern Nevada has experienced a dramatic increase in cheatgrass (*Bromus tectorum*). As a result, wildfire frequency and size has increased. The objective of this project was to examine natural vegetation recovery and trend following 1985 wildfires. Density and cover measurements determined a high but fluctuating occurrence of cheatgrass and minimal change of perennial grass and shrubs. Loamy 8-10 ecological sites have a greater potential for consistently producing more cheatgrass plants and cover than loamy 5-8 and droughty loam sites.

Introduction

The Great Basin is experiencing accelerated rates of ecological change. Across large expanses of sagebrush-grass rangelands, the introduction and proliferation of cheatgrass (*Bromus tectorum*) has changed vegetative composition and plant community dynamics. Since the discovery of cheatgrass in the Intermountain region early in the 1900s, estimates of cheatgrass dominance on 19 million acres of big sagebrush communities in Nevada have increased from 1 percent in the 1960s to 25 percent in the 1970s and even higher today (Young and Blank 1995). In addition, cheatgrass has expanded and adapted to drier conditions found in salt desert shrub plant communities.

Though drought and poor livestock management have influenced vegetative composition, cheatgrass has possibly caused the most dramatic changes on Great Basin landscapes in recent decades. With cheatgrass comes a change in the fire cycle (D'Antonio and Vitousek 1992). Once established, biomass production and high seed viability provide a fuel

load with greater continuity than native plant communities. Wildfires occur more often and burn more acres at any one time.

Several studies throughout the Great Basin describe vegetation history and dynamics. Robertson (1971) examined vegetation cover within and outside an enclosure on sagebrush-grass range in Humboldt County, Nevada. The Singas Creek enclosure was established as a site for range improvement studies in 1939, and eliminated further livestock grazing. Robertson, comparing vegetation data from 1940 and 1970, observed an increase in total vegetation cover including a 38 percent increase in cheatgrass. Wright and Klemmedson (1965) conducted an experiment to examine the effect of fire on four species of bunchgrasses: Sandberg bluegrass (*Poa secunda*), squirreltail (*Elymus elymoides*), needle-and-thread (*Hesperostipa comata*), and Thurber needlegrass (*Stipa thurberiana*). Sandberg bluegrass was least affected by burning, followed by squirreltail, and then both *Stipa* species. The season of burn, predicated by air temperature and humidity, was the greatest factor in determining damage or death to these grass species.

Today, rangeland science recognizes and is attempting to further define the concept of state and transition models (Westoby and others 1989) and thresholds (Laycock 1991). In the state and transition model, vegetation dynamics in sagebrush-grass communities recognizes that a site is first dominated by (perennial) grasses and later by shrubs. Harniss and Murray (1973) found that after a prescribed fire near Dubois, Idaho, total shrub cover, and particularly sagebrush, did not begin to increase until 12 years postfire. Young and Evans (1978) found that succession in sagebrush grasslands is now determined by cheatgrass. Given sufficient litter (Young and others 1976), cheatgrass seeds germinate in the first year following wildfire, outcompeting native annual and perennial species. Sagebrush is unable to compete with other native shrub species such as green rabbitbrush (*Chrysothamnus viscidiflorus*) and horsebrush (*Tetradymia canescens*) that resprout from the roots and crown. Due to the new, frequent wildfire cycle created by cheatgrass, formally abundant big sagebrush/Thurber needlegrass communities of northern Nevada have declined.

In 1985, wildfires burned approximately 600,000 acres around Winnemucca, Nevada (Corliss 1992). Wildfires occurred in subsequent years, but Nevada experienced a dramatic fire year in 1999 with 1.8 million acres burned across the state. The BLM Winnemucca Field Office experienced 640,000 acres alone (Western Great Basin Coordination Center 1999), with fires occurring on some of the same areas burned in 1985.

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Ann P. Bollinger is a Graduate Assistant, Department of Animal Biotechnology, College of Agriculture, Biotechnology, and Natural Resources, Mailstop 202, University of Nevada, Reno, NV 89557; email: annboll@yahoo.com.

Barry L. Perryman is an Assistant Professor, Department of Animal Biotechnology, College of Agriculture, Biotechnology, and Natural Resources, Mailstop 202, University of Nevada, Reno, NV 89557; email: bperryman@cabnr.unr.edu.

In this semi-arid region, vegetation often requires long periods of time to recover. We expect that frequent fires have changed vegetation composition to cheatgrass dominance and a threshold has been crossed. The overall goal of this study was to determine ecological trend based on perennial grass and shrub composition after wildfire on public rangelands of north-central Nevada. Specifically, the project analyzed vegetation response within and among ecological sites as well as change through time on areas of natural recovery. This report summarizes post-burn central tendencies for density and cover of functional plant groups from 1986 to 2005. Sites included in this report burned in 1985 and did not re-burn during the period of record.

Materials and Methods

All monitoring sites were located on land managed by the Bureau of Land Management (BLM) in Humboldt County, Nevada. They were within a 30-mile radius of Oroville, Nevada, but all were located west of the Santa Rosa Range of the Humboldt-Toiyabe National Forest. The area has a semi-arid climate characterized by long, cold winters and warm summers. Annual average minimum and maximum temperatures are 34 °F (1 °C) and 64 °F (18 °C), respectively. Annual average precipitation for the three ecological sites is: loamy 5-8, 8.3 inches (211 mm); and 10.6 inches (269 mm) for both the loamy 8-10 and droughty loam, with the majority falling in winter and spring (Western Regional Climate Center, 2005). Historically, vegetation types were shadscale and big sagebrush-grass, but many areas are now dominated with annual forbs and cheatgrass. Elevation on these ecological sites varies from 4,000 ft to 6,500 ft (1,220 m to 1,980 m). Aspect was varying directions. Slope was generally less than 5 percent; however, two transects were greater than 15 percent.

Permanent transects were established in 1986, the first year following the 1985 wildfire, by the BLM in an area representative of fire impact and vegetation composition. Each transect was monitored for the first 2 years, occasionally thereafter, and during the summers of 2004 and 2005. Following the 1999 wildfires, monitoring continued at the permanent transects established in 1986. A long-time BLM employee assisted with monitoring seven of the nine transects in the past and all transects in 2004 and 2005. This fortunate opportunity added consistency to data collection and reduced error in observer bias.

For this study, data from sites with natural recovery were examined. Three ecological sites were identified based on information in NRCS technical guides and included: loamy 5-8, loamy 8-10, and droughty loam 8-10. Sampling methods utilized in 2004 and 2005 remained consistent with those of previous years. Density was measured with a 9.6 ft² round quadrat (0.89 m²) for herbaceous plants and 96 ft² round quadrat (8.9 m²) for shrubs. Transects were 200 ft (60 m) in length and measurements taken at 20 ft (6 m) intervals. Canopy cover for both herbaceous and shrub species was estimated with Daubenmire quadrats (Daubenmire 1959). Transects were 1,000 ft (300 m) in length and measurement taken at 100 ft (30 m) intervals. Central tendencies of density and cover were determined for each sample period and

plotted by ecological site. Functional groups included annual grass, perennial grass, and shrubs. We also include a brief discussion of annual precipitation and potential effects on density and cover.

Results and Discussion

Annual Grass

Cheatgrass density and cover on loamy 5-8 and droughty loam sites fluctuated throughout the period of record; whereas on loamy 8-10 sites, cheatgrass density and cover exhibited an increasing trend (fig. 1). Cheatgrass cover on loamy 5-8 and droughty loam sites closely followed annual precipitation patterns (fig. 2); whereas on loamy 8-10 sites, cheatgrass cover increased to nearly 20 percent despite a precipitation decrease in 1992. This suggests that the loamy 5-8 and droughty loam sites are more dynamic with respect to these response variables, while loamy 8-10 sites provided conditions that allowed cheatgrass density and cover to steadily increase.

Perennial Grass and Shrubs

Perennial grass and shrubs exhibited few changes throughout the period of record. Density and cover trends are displayed in figure 3. On loamy 5-8 sites, perennial grass never exceeded two plants m⁻² or 1 percent cover. Shrub density fluctuated, whereas cover was low for the first 3 years followed by a substantial increase (0 to 7 percent) by 1995, perhaps related to an above average precipitation year in 1994/1995 of 10.7 inches (272 mm). The dominant shrub was shadscale (*Atriplex confertifolia*). As Sharp (1990) demonstrates, shadscale communities fluctuate with time (for example, precipitation and insect outbreaks).

Loamy 8-10 sites experienced minimal change in perennial grass and shrub density and cover throughout the period of record. The decrease in precipitation from 11.9 inches (302 mm) in 1985/1986 to 7.5 inches (190 mm) in 1986/1987 but slight increase in cover of both perennial grasses and shrubs suggest that short-term change in precipitation did not immediately affect vegetative cover. Between 1987 and 1992, precipitation was variable; however, 5.8 inches (147 mm) in 1991/1992 was considerably below-average year and the lowest during the 20 years of this study. Between 1992 and 2005, precipitation was also variable with 4 years of above-average precipitation including the year of data collection in 2004/2005. However, the previous 6 years from 1998/1999 to 2003/2004 were below-average. The increase in shrub cover from 0 percent in 1992 to 6.0 percent in 2005 may reflect a steady but undocumented increase throughout the 14 years as well as the sudden increase in annual precipitation.

On droughty loam sites, a long-term trend of perennial grass and shrub composition was static. Perennial grass density ranged from less than one plant m⁻² to 6.9 and cover ranged from less than 1 percent to 7.4 percent, with high density and cover percentages correlating to above-average precipitation years. Shrub density remained below 3.2 plants 10 m⁻² throughout the period of record. Cover did not exceed 3 percent until 2005.

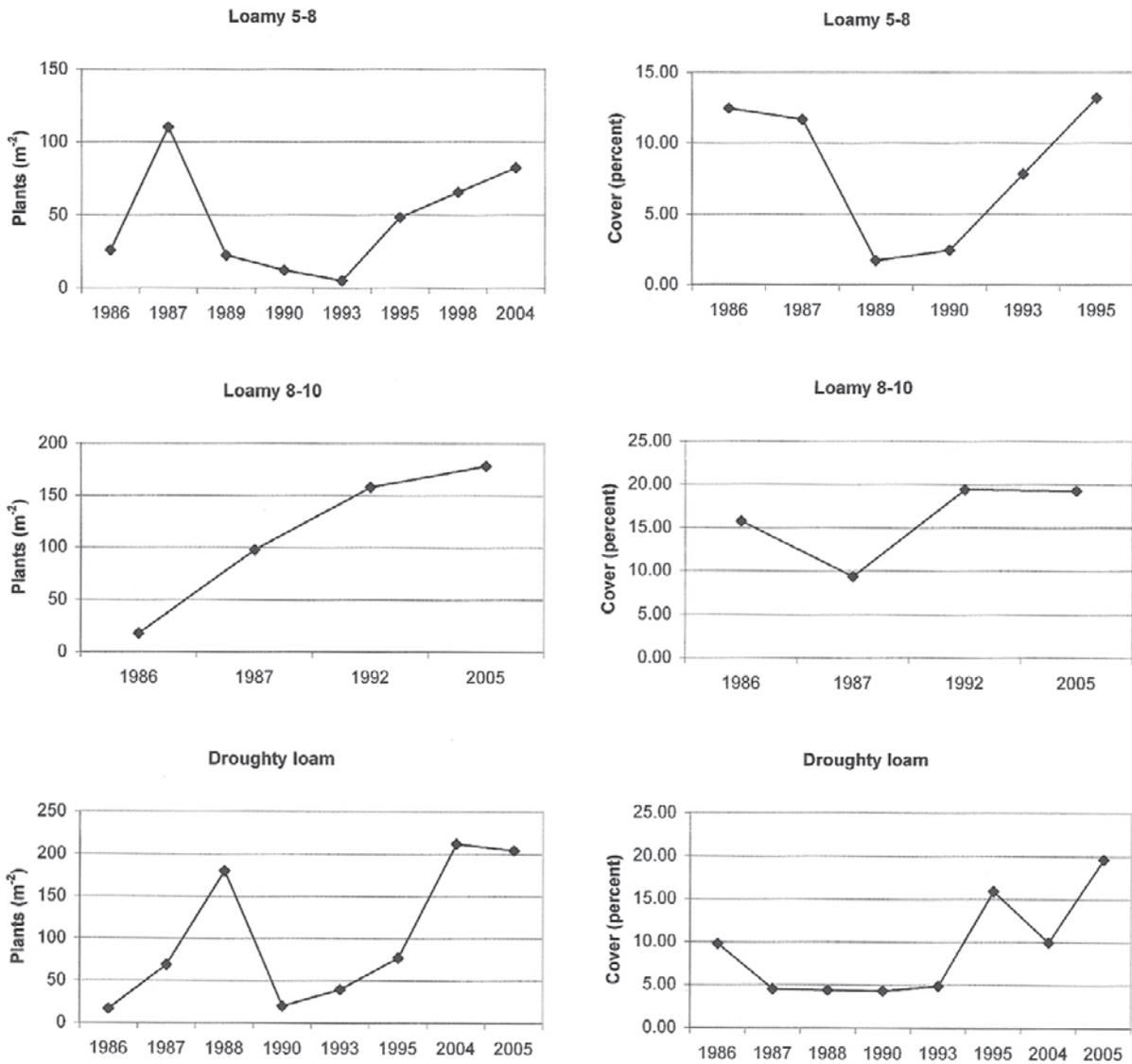


Figure 1—Cheatgrass density and cover by ecological site across the period of record, 1986 to 2005, in northern Nevada.

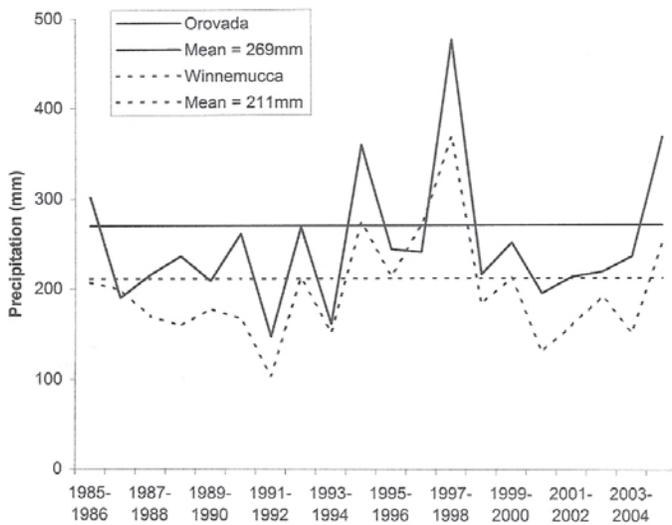


Figure 2—Precipitation data from the Western Regional Climate Center for the Orovada 4 WSW (solid line) and Winnemucca WSO Airport (dotted line) weather stations. Horizontal lines show water year precipitation (October to September) and long-term mean. The Orovada mean includes data from July 1948 through December 2005, and the Winnemucca mean includes data from January 1897 through December 2005. Orovada weather data represents precipitation for loamy 8-10 and droughty loam 8-10 sites. Winnemucca weather data represents precipitation for loamy 5-8 sites.

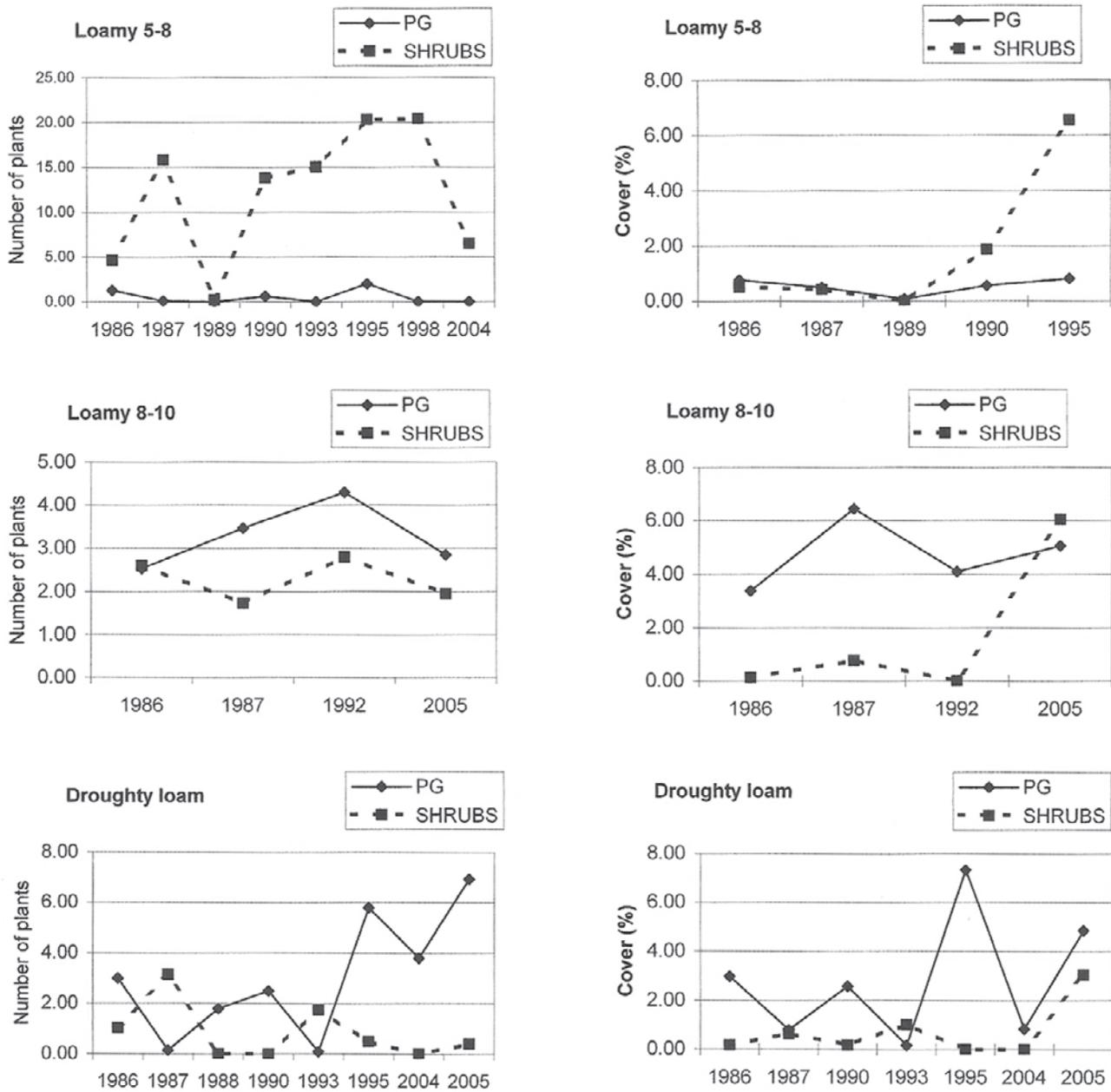


Figure 3—Perennial grass and shrub density and cover by ecological site across the period of record, 1986 to 2005, in northern Nevada. Number of plants equals per m⁻² for perennial grass and per 10 m⁻² for shrubs.

Conclusions

Vegetation communities are dynamic and changes are caused by any number and combination of biotic and abiotic factors. However, the introduction of cheatgrass has changed fire cycles and vegetative communities. By documenting long-term trend, we can evaluate changes on the landscape, and the new frequent fire cycle may provide us with pre- and post-burn data. In examining 20 years of postfire data, our results indicate that there is greater potential for high cheatgrass density and cover on loamy 8-10 sites whereas cheatgrass density and cover is more variable on loamy 5-8 and droughty loam sites. While this study is most relevant to areas with similar soil and precipitation characteristics, results provide documented insight to natural recovery on the semi-arid rangelands of northern Nevada.

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