

Final Report Joint Fire Science Program

Project ID: 04-2-1-77

Project Title: Using cattle as fuel reduction agents in annual and perennial grass stands in northern Nevada

Project Investigators: Chris Call (PI), Nicole McCoy (Co-PI), and Nora Devoe (Federal Cooperator)

SUMMARY OF FINDINGS

The purpose of this project was to work with local ranchers and land managers in the Bureau of Land Management (BLM) Winnemucca District to determine the effectiveness of using cattle as fuel reduction agents in cheatgrass (*Bromus tectorum*) and crested wheatgrass (*Agropyron cristatum*, *A. desertorum*) stands. Findings are presented for the four objectives stated in the proposal.

Evaluate intensive cattle grazing as a method for reducing the fire hazard of cheatgrass and crested wheatgrass stands.

- Intensive grazing (80-90% utilization) in early-May and again in mid-May 2005 significantly reduced cheatgrass biomass and cover, and influenced fire behavior during prescribed burns (6% fuel moisture, winds $\leq 3 \text{ km h}^{-1}$) in mid-October 2005. Mean flame length in the grazed treatment was 0.25 m, compared to 2.3 m in the ungrazed treatment. Grazing, however, did not impact litter cover; thus, the rate of fire spread was similar ($\leq 7 \text{ m min}^{-1}$) for grazed and ungrazed treatments. When fuel parameters from the prescribed burns were substituted into dry climate grass fuel models in BehavePlus 3.0, simulated fire behavior under peak fire conditions in July/August (2% fuel moisture, 20 km h^{-1} winds) was significantly different for grazed and ungrazed treatments. Predicted flame length in the grazed treatment was 0.6 m, compared to 4.8 m in the ungrazed treatment; and predicted rate of spread was 13 m min^{-1} in the grazed treatment and 231 m min^{-1} in the ungrazed treatment. Grazing treatments were applied again in early- and mid-May 2006 on the same plots as part of another objective (seed bank reduction), and resulted in even greater reductions in cheatgrass biomass and cover. When prescribed burns were set in mid-October 2006, the flame front stopped completely within 5 m of entering the grazed treatment due lack of fuel biomass and continuity. Thus, one season (May) of intensive grazing can reduce the fire hazard of cheatgrass, particularly flame length. However, a combination of intensive grazing (May, first year), followed by prescribed burning (October, first year), followed by intensive grazing (May, second year) can reduce the fire hazard considerably more than one season of intensive grazing.
- Crested wheatgrass biomass was significantly reduced by moderate grazing (50-60% utilization) and intensive grazing (80-90% utilization) in mid-May and again in late-May 2005; however, due to fall green-up and prescribed burn conditions (6-8% fuel moisture, winds $\leq 3 \text{ km h}^{-1}$) in mid-October 2005, the flame fronts did not carry across the grazed and ungrazed treatments. Grazing treatments were applied again in mid- and late-May 2006 on the same plots. When prescribed burns were set in mid-October 2006, mean flame lengths were similar in the moderately grazed (0.25 m) and intensively grazed

(0.20 m) treatments, which were significantly lower than the mean flame length in the ungrazed treatment (1.8 m). Mean rate of spread was similar among the moderately grazed (10.5 m min⁻¹), intensively grazed (13.5 m min⁻¹), and ungrazed (15.0 m min⁻¹) treatments. When fuel parameters from the prescribed burns were substituted into dry climate grass fuel models in BehavePlus 3.0, simulated fire behavior under peak fire conditions in July/August (2% fuel moisture, 20 km h⁻¹ winds) was significantly different for grazed and ungrazed treatments. Predicted flame lengths in the moderately grazed (0.45 m) and intensively grazed (0.25 m) treatments were significantly lower than in the ungrazed treatment (3 m); and predicted rate of spread for the moderately and intensively grazed treatments (12 m min⁻¹) was significantly lower than that in the ungrazed treatment (90 m min⁻¹). Thus, moderate and intensive grazing can reduce the fire hazard of crested wheatgrass.

Evaluate intensive cattle grazing as a method for reducing the seed bank of cheatgrass.

- The grazing and burning scenarios described above allowed us to quantify the effects of grazing alone, burning alone, grazing plus burning, and no grazing and no burning on cheatgrass seedbank densities. After a cycle of intensive grazing (May, 2005), followed by prescribed burning (October, 2005), followed by intensive grazing (May, 2006), the lowest mean seed density was in the grazing plus burning treatment (485 seeds m⁻²), followed by the grazing treatment (1,205 seeds m⁻²), with the highest seed densities in the burning treatment (2743 seeds m⁻²) and the no grazing and no burning treatment (2367 seeds m⁻²). Findings from an associated seed rain study follow the seedbank density trends. The lowest mean seed input was in the grazing plus burning treatment (1,000 seeds m⁻²), followed by the grazing treatment (1,400 seeds m⁻²), with the highest seed inputs in the burning treatment (8,200 seeds m⁻²) and the no grazing and no burning treatment (7300 seeds m⁻²). Thus, intensive cattle grazing during the boot stage (May) significantly reduces the seedbank of cheatgrass.

Determine the cost effectiveness of cattle grazing as a fuel reduction treatment.

- Our findings, in terms of intensive cattle grazing reducing the biomass and cover of cheatgrass, are similar to those for the application of Plateau herbicide in the northern Great Basin (Jeffress and Vollmer 2000). Our BehavePlus simulations of peak season fire behavior, showing reductions in flame length and rate of spread with intensive grazing, are similar to those of Behave simulations for the application of Plateau herbicide (Jeffress and Vollmer 2000).
- Equipment, herbicide, cattle, labor costs, and fire suppression costs have been obtained, and are currently being incorporated into a model to compare the cost effectiveness of intensive cattle grazing and the application of Plateau herbicide. Units of effectiveness include fuel load, flame length, rate of fire spread, and fireline intensity in fuel reduction treatments for two scenarios: 1) a 100 m-wide strip as a fuel break adjacent to an existing road or a native plant community, and 2) a large block being prepared for a revegetation treatment.

Disseminate experimental results and management implications to land managers and other interested individuals.

- Project researchers met with members of the Wildfire Support Group, including the permittee providing cattle for the grazing treatments, to discuss experimental design and research results at least two times per year from 2004 to 2007. On May 30, 2007, about 30 BLM staff, ranchers, researchers, and consultants attended a field day held at the research site. Three articles are in different stages of preparation for peer-reviewed journals: *International Journal of Wildland Fire* (fire behavior), *Rangeland Ecology and Management* (economic analysis), and *Western North American Naturalist* (seedbank dynamics). A synopsis of the entire study is being prepared for *Nevada Sage*, BLM’s quarterly newsletter, for the popular journal *Rangelands*, and for the Nevada BLM website. Several presentations were given at professional meetings, including the 14th Wildland Shrub Symposium, the 3rd International Fire Ecology and Management Congress, and the 60th Annual Meeting of the Society for Range Management.

FIELD LOCATION FOR EXPERIMENTS

The study sites are located on the UC allotment within the Quinn River Management Area of the BLM Winnemucca Field Office, 20 km southeast of McDermitt, Nevada.

DELIVERABLES

Proposed	Delivered	Status
Annual progress reports	Each year from 2004-2006	done
Presentations	Diamond, J., C. Call, and N. Devoe. 2006. Effects of intensive grazing on fire behavior, seed dynamics, and composition of cheatgrass (<i>Bromus tectorum</i>) dominated landscapes. Poster presentation at 14 th Wildland Shrub Symposium (Shrublands Under Fire: Disturbance and Recovery in a Changing World), June 6-8, 2006, Cedar City, UT.	done
	Diamond, J., C. Call, and N. Devoe. 2006. Effects of intensive grazing on fire behavior, seed dynamics, and composition of cheatgrass (<i>Bromus tectorum</i>) dominated landscapes. Poster presentation at 3 rd International Fire Ecology and Management Congress, November 13-17, 2006, San Diego, CA.	done

Presentations (cont.)	<p>Diamond, J., C. Call, and N. Devoe. 2007. Effects of intensive grazing on fire behavior of cheatgrass (<i>Bromus tectorum</i>) dominated landscapes. Oral presentation at 60th Annual Meeting of the Society for Range Management, February 10-16, 2007, Reno, NV.</p> <p>Call, C., J. Diamond, and N. Devoe. 2008. Effects of grazing and fire on seed dynamics and species composition of cheatgrass dominated rangeland. Oral presentation for upcoming 61st Annual Meeting of the Society for Range Management, January 26-31, 2008, Lexington, KY.</p>	<p>done</p> <p>planned for January 26-31, 2008</p>
Field day at research site	Held on May 30, 2007. Thirty participants, including BLM staff, members of the Wildfire Support Group, researchers, and consultants. Presentations by BLM Winnemucca Field Office staff, permittee providing cattle and support, and project researchers, followed by tour of research site and discussion of feasibility of using cattle as fuel reduction agents on a landscape scale.	done
Journal articles	<p>Diamond, J., C. Call, and N. Devoe. 200X. Effects of intensive cattle grazing on fire behaviour of cheatgrass-dominated rangeland in the northern Great Basin, USA. To be submitted to <i>International Journal of Wildland Fire</i>.</p> <p>Diamond, J., N. McCoy, C. Call, and N. Devoe. 200X. Cost effectiveness of intensive cattle grazing and herbicide application for cheatgrass fuel reduction. To be submitted to <i>Rangeland Ecology and Management</i>.</p> <p>Diamond, J., C. Call, and N. Devoe. 200X. Effects of grazing and fire on seed dynamics and species composition of cheatgrass-dominated rangeland. To be submitted to <i>Western North American Naturalist</i>.</p>	<p>in progress; available 2008</p> <p>in progress; available 2009</p> <p>in progress; available 2009</p>

Technical report	8-page summary of research with management implications; to be distributed to BLM staff, the Wildfire Support Group, and the interested public.	in progress; available December 2007
Website	An adaptation of the 8-page technical report described above; to be placed on the Nevada BLM website.	in progress; available December 2007