

Grazing Sagebrush with Sheep to Enhance Greater Sage-grouse Brood-rearing Habitat

Principal Investigator: Roger Banner

List Names of Other Individuals on Project and Primary Responsibility: Frederick D. Provenza, CoPI

List Five Relevant Publications in Last Five Years

- Banner, R.E., J. Rogosic, E.A. Burritt and F.D. Provenza. 2000. Supplemental barley and charcoal increase intake of sagebrush by lambs. *J. Range Manage.* 53:415-420.
- Villalba, J.J., F.D. Provenza and R.E. Banner. 2002a. Influence of macronutrients and activated charcoal on intake of sagebrush by sheep and goats. *J. Anim. Sci.* 80:2099-2109.
- Villalba, J.J., F.D. Provenza and R.E. Banner. 2002b. Influence of macronutrients and polyethylene glycol on intake of a quebracho tannin diet by sheep and goats. *J. Anim. Sci.* 80:3154-3164.
- Provenza, F.D., J.J. Villalba, L.E. Dziba, S.B. Atwood, and R.E. Banner. 2003. Linking herbivore experience, varied diets, and plant biochemical diversity. *Small Rum. Res.* 49:257-274.
- Dziba L.E., Provenza F.D., J.J. Villalba and S.B. Atwood. 2006. Influence of terpenes and nutritional supplementation on intake of sagebrush by sheep. *Small Rum. Res.* In Press.
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PROPOSAL ABSTRACT

We propose to conduct research on properly timed and implemented sheep grazing to enhance sagebrush habitat for greater sage-grouse and other sagebrush obligate species while maintaining animal performance. If effective, this approach may provide a practical alternative to conventional methods which may be costly, fossil fuel intensive, risky and/or difficult to control. Habitat enhancement will arise through reduced mature sagebrush density and cover, increased herbaceous species diversity and production, higher rates of nutrient cycling, increased plant community structural diversity, greater diversity in sagebrush age class. Sheep grazing will take place in September after killing frost when herbaceous understory species are mature and dormant. Sheep will be stocked at high densities to achieve heavy use on sagebrush, and they will receive strategic protein and energy supplementation to reduce or ameliorate terpene toxicity from ingesting high amounts of sagebrush. Integrating sheep grazing into the system of land use and management will provide an alternative to traditional methods of sagebrush renovation – mechanical, fire, chemical - and create a mosaic of critical brood-rearing habitat within much larger areas of sagebrush steppe. If effective, it also will provide an alternative to broad scale application of costly conventional renovation methods that must be repeated periodically to maintain habitat values for sagebrush obligate species.

INTRODUCTION/BACKGROUND

Sagebrush steppe is an extensive and important ecosystem in the West. It is critical habitat for ranchers and their livestock, as well as wildlife including sage-grouse, pygmy rabbit, Brewer's sparrow, sage sparrow, sage thrasher, and mule deer among others. Unfortunately, changes in historical fire regimes, selective grazing by livestock, and the introduction of invasive plants have resulted in landscapes dominated by mature, decadent stands of sagebrush that lack plant diversity.

Research conducted by Utah State University researchers recently documented the positive effects of chemical and mechanical methods for enhancing sage-grouse brood-rearing habitat. Both methods effectively reduced shrub canopy and improved herbaceous cover to levels within brood-rearing habitat guidelines (Connelly et al. 2000). However, mechanical treatments were short lived and sage-grouse preferred to use the edge of treated areas where intact sagebrush cover was still available. These observations support management strategies that create a mosaic pattern and maximize edge as most

desirable in brood-rearing habitats. Rather than treating large blocks of sagebrush, the merits of managing smaller patches for brood-rearing activities should be considered. Sinuous treatments that create edge are particularly attractive to sage grouse and may be better for sage grouse with broods.

Strategic supplementation coupled with intensive grazing by livestock at high stock densities for short periods may be an economical and sustainable way to rejuvenate sagebrush steppe (Provenza et al. 2003). People typically have not viewed sagebrush as valuable forage and thus have not considered using livestock to enhance and maintain diversity in sagebrush steppe. However, recent findings suggest livestock can use sagebrush heavily (Gade and Provenza 1986), and they may be more effective at enhancing plant diversity than fire, chemical, or mechanical means in addition to being less fossil fuel intensive. Sheep and goats supplemented with energy and protein eat twice the sage as unsupplemented animals because they can better cope with sagebrush terpenes that limit its use (Villalba et al. 2002). Fall and winter grazing by livestock rejuvenates sagebrush steppe, and livestock at high stock densities provided appropriate supplement can use sage very effectively (Bork et al. 1998, Dziba et al. 2006). We propose to work with ranchers and other cooperators using grazing by sheep to apply research-based knowledge to increase biodiversity and habitat quality in sagebrush steppe. In doing so, livestock will offer an ongoing means of managing sagebrush steppe ecosystems, as an alternative to costly treatments imposed periodically as conditions dictate.

PURPOSE AND OBJECTIVES

Proposed projects must specifically address efficacy of integration of the effects of conservation provisions of the 2002 Farm Bill on sagebrush-steppe obligate species. See research priorities for specific guidance.

The purpose of the proposed study is to evaluate the landscape-level application of a management system that includes sheep grazing to increase plant species and structural diversity and to improve sagebrush habitat for greater sage-grouse and domestic livestock. It includes sheep grazing for manipulation of greater sage-grouse brood-rearing habitat on two sites.

The proposed study objectives are:

1. To evaluate the effect of sheep grazing mountain big sagebrush on greater sage-grouse brood-rearing habitat and subsequent habitat-use.
2. To compare the cost, benefits, advantages and disadvantages of a management system incorporating the use of sheep in management of greater sage-grouse brood-rearing habitat to mechanical and chemical methods.

STUDY SITE

The study will be conducted on Parker Mountain in Garfield, Sevier, Piute and Wayne counties of Utah. This area consists of ~107,478ha, of which 21,685ha are managed by the U.S. Forest Service (USFS), 36,398ha by Bureau of Land Management (BLM), 43,863ha by Utah School and Institutional Trust Lands Administration (SITLA), and 5,532ha by private landowners.

Parker Mountain is a sagebrush-dominated plateau at the southern edge of greater sage-grouse range. It is one of the few areas remaining in Utah with relatively stable numbers of greater sage-grouse and it includes some of the largest contiguous tracts of sagebrush in the state. The predominant land use on the mountain is grazing by domestic livestock at a stocking rate of 1.46haAUM-1. Sheep and cattle are moved seasonally through 10 grazing pastures beginning in lower elevation pastures in June. As vegetation in these pastures matures, livestock are sequentially herded into higher elevation pastures.

This study will be conducted at $\pm 2700\text{m}$ in the Pine Peaks Pasture which is dominated by mountain big sagebrush (*Artemisia tridentata vaseyana*), and used by sage-grouse during the late brood-rearing period. This area receives from 40-51cm of precipitation annually.

STUDY DESIGN METHODS

One of the proposed study areas was treated once-over in 2002 with the Dixie harrow to renovate greater sage-grouse brood-rearing habitat. Sagebrush on this area has quickly regained dominance and reduced the production of desired grasses and forbs important for sage-grouse brood-rearing, which raises questions about project life and appropriateness of once-over Dixie harrow treatments from both an economic and ecological perspective. The other proposed study area is adjacent to the first and ecologically similar except that it is dominated by sagebrush that has not undergone a rehabilitation practice.

Within each of the two study areas, we will establish four grazed (3.2ha and $\sim 64\text{m} \times 494\text{m}$) and four adjacent ungrazed areas. The ungrazed areas at each location will serve as controls to assess the effect of sheep grazing on the vegetation. Two herds of 500 mature ewes, one at each study site, will graze each of the four enclosures (replications) for approximately 5d in a randomly assigned sequence beginning in mid-September in the post-killing frost dormant season. Local ewes familiar with the vegetation and general area will be used. Ewes will be provided supplemental protein (12-13% CP) and energy (36.28 CP/DE ratio) at approximately 0.7kg/d to enhance terpene detoxification and elimination and increase use of sagebrush.

The sheep grazing will be carried out at high stock densities to achieve physical disturbance of the soils, heavy use of the vegetation, and increased cycling of nutrients sequestered in shrubs released through digestion and re-distributed via urine and feces. Understory vegetation (grasses and forbs) will be mature, dormant, and senescent and no detrimental effect is expected. Sagebrush is not tolerant of herbivory and heavy use is expected to reduce plant density and production, change age distribution, and reduce competition with grasses and forbs for water and other nutrients.

Vegetation parameter estimates will include cover and density by plant species and functional groups. Measurements will be taken prior to sheep grazing and at peak production around mid-July in the two subsequent years. Low-level aerial photographs will be taken of grazed and ungrazed areas immediately after sheep grazing and again in year three at peak production. Results will be used in conjunction with on-site vegetation measurements to assess low-level aerial photography as a more efficient vegetation monitoring technique.

To determine greater sage-grouse use, we will survey all the study plots for the presence of sage grouse pellets before and after treatments. Each plot will be divided into thirds and a stratified-random transect placed in each. We will slowly walk the transects and record pellet type (regular pellet or cecal), number of pellets or cecal droppings per cluster, distance of pellet cluster to centerline (meters), distance of cluster to edge of habitat type (meters), and habitat type where the pellet clusters were found. The edge of habitat will be determined by a change in species of dominant shrub, or abrupt change such as the edge of a treated area or road. Roost piles will equal 1 cluster occurrence. We will conduct bird-dog surveys, to assess sage-grouse use in general and brood use specifically, in mid-July to early-August prior to treatment and two years post-treatment. Each plot will be surveyed twice annually. The first surveys will be done by 12 dogs, each covering an entire plot during the same time period, from 0800-0930 hrs one morning. We will use this approach to reduce the risk of double sampling, especially where plots are located in such close proximity. Utah Chukar Foundation

members and their most experienced dogs will conduct the surveys. Grouse flushed during the surveys will be classified as chick, hen, male, or unknown. Broods will be counted as a hen with any number of chicks. If more than one hen flushes with multiple chicks, the number of broods will equal the number of hens.

The statistical model to be used to test hypotheses regarding vegetation and animal parameters is:

	<u>Degrees of Freedom</u>	
Location	$(l-1) = (2-1) =$	1 df
Replication/Location	$l(r-1) = 2(4-1) =$	6 df error A
Treatment	$(t-1) = (2-1) =$	1 df
Treatment x Location	$(t-1)(l-1) = (2-1)(2-1)$	1 df
Replication/Location x Treatment	$l(r-1)(t-1) = 2(4-1)(2-1)$	6 df error B

EXPECTED BENEFITS

1. Note the importance of the response of sage-grouse and/or sagebrush obligates to 2002 Farm Bill conservation practices.
2. Note the technology and tools to be developed by the project. Of special concern is the importance of the project to NRCS, SCD and state wildlife agency field staff from a planning perspective.
3. Note the importance of technology and tools to be developed to partners (NGOs, State wildlife agencies, etc.)

We will test an alternative management paradigm that properly timed and implemented sheep grazing can enhance sagebrush steppe habitat for sage-grouse and other sagebrush obligate species while maintaining animal performance. Using strategic livestock grazing to enhance habitat values provides advantages over traditional means of habitat restoration – mechanical, fire and herbicides – as grazing is no longer a treatment implemented periodically. Rather, livestock grazing is an ongoing part of management that strategically uses shrubs, such as sagebrush, not typically considered a forage source, and in the process, enhances and maintains sagebrush-steppe habitat for the benefit of livestock, wildlife and people. Using sagebrush as forage enlarges the resource base and may even support new custom grazing opportunities, directed toward vegetation management, for local ranchers. In addition to reducing soil erosion and improving water quality over conventional mechanical means and burning, systematic renovation of sagebrush steppe improves water balance and increases rates of nutrient cycling thereby creating a more vibrant and productive system. Livestock raised in the West many decades ago undoubtedly had much greater diet breadth, but through contemporary livestock and grazing management practices, they have been allowed to become increasingly selective grazers. This contributed to mature sagebrush dominance and stand decadence, reduced species diversity and the decline in sagebrush steppe habitat values for obligate species.

Integrating sheep grazing into the sagebrush steppe management system will provide project partners - NRCS and SCD technical assistance personnel, landowners and DWR managers - a sustainable means of planning and implementing habitat enrichment in sagebrush steppe. It also will reduce the need for periodic inputs of large amounts of funds and non-renewable resources for habitat renovation and benefit local ranchers, including sheep producers that are in the industry, as well as rural communities.

A number of deliverable products will be developed from this project. Research results will be presented in technical notes and/or fact sheets discussing the interaction of stock density and supplementation of animals to achieve manipulation of sagebrush by sheep. In addition, a PowerPoint presentation on the role of sheep in a sagebrush steppe management system will be developed for NRCS professional field staff and collaborating agencies - DWR, BLM, SITLA and FS.

LITERATURE CITED

- Bork, E.W., N.E. West, and J.W. Walker. 1998. Cover components on long-term seasonal sheep grazing treatments in three-tip sagebrush steppe. *J. Range Manage.* 51:293-300.
- Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. *Wildlife Society Bulletin* 28:967-985.
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- Villalba, J.J., F.D. Provenza and R.E. Banner. 2002. Influence of macronutrients and activated charcoal on utilization of sagebrush by sheep and goats. *J. Anim. Sci.* 80:2099-2109.

BUDGET

BUDGET (YEAR 1)

NOTE: All numbers should be entered without commas.

SALARIES: 26591 X 118.05 % 31391
(Fringe Percentage)

TRAVEL: 3450

COMMODITIES: 7200

CONTRACTUAL: 8500

TOTAL: 50541

BUDGET (YEAR 2)

NOTE: All numbers should be entered without commas.

SALARIES: 27920 * 118.18% 32997
(Fringe Percentage)

TRAVEL: 3450

COMMODITIES: 4000

CONTRACTUAL: 0

TOTAL: 40447

BUDGET (YEAR 3)

NOTE: All numbers should be entered without commas.

SALARIES: 29316 * 118.32% 34686
(Fringe Percentage)

TRAVEL: 3450

COMMODITIES: 2000

CONTRACTUAL: 10000

TOTAL: 50136

TOTAL BUDGET FOR THREE YEARS: 141124

Leveraged funds, in-kind support from Partners and other sources (list partner(s) and amount(s)).

Parker Mountain Adaptive Management Working Group \$unassigned value;

Parker Mountain Cattle Assoc. (forage) \$unassigned value;

Andy Taft – Rancher (1000 sheep @ \$.15/hd/d x 24d, WHIP) \$3600;

School & Institutional Trust Lands Admin. salary, travel, admin. \$3000;

Intermountain Joint Venture (Dixie harrow Treatment) \$12500;

Utah Chukar Foundation (Bird Dog Surveys) \$29200;

Water developments and transportation (WHIP) \$20000;

PI salary and benefits (3 months in-kind) \$32529;

CoPI salary and benefits (2 month in-kind) \$29883;

Natural Resources Conservation Service (enclosure fences) \$13900;

Total Support from Partners and Other Sources \$144612