2009 Rangeland Vegetation Assessment at the O'Neal Ecological Reserve, Idaho

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ABSTRACT
Vegetation data were collected at 30 randomly located sample points during June 2009. Data were collected using both ocular estimation and line-point intercept transects each describing fuel load and percent cover of grasses, forbs, shrubs, litter, microbial crust, bare ground, and weeds respectively. In the SHPG (Simulated Holistic Planned Grazing) grazing treatment of the O'Neal, percent cover of grass (2009=24.66%, 2008=13.84%), forbs (7%, 5.82%), and shrubs (12.33%, 11.1%) increased from 2008. The Rest-Rotation grazing allotment also saw increased percentage cover in grasses (22.66%, 8.96%), forbs (9.16%, 6.34%) and shrubs (13.83%, 11.26%). In the Total Rest grazing allotment, percent cover increased in grasses (28.33%, 12.27%), forbs (10.33%, 4.1%), and weeds (13.6%, 12.33%). Much of the changes observed are likely attributable to the increase in precipitation in 2009 (106.8 mm) relative to 2008 (9.2 mm).

KEYWORDS: Vegetation, sampling, GIS, remote sensing, GPS, grazing treatment, land management

INTRODUCTION

There are many factors that influence land cover changes. Wildfire has been, and will always be, a primary source of broad scale land cover change. In addition, grazing management decisions and practices have also been linked to land cover change. With wildfire or grazing, a change in plant community composition, plant structure, or ecosystem function may result in increases in bare ground and decreases in land productivity. The introduction of non-native vegetation can lead to a degraded system due to the competition placed upon native plant life and the change in plant community composition. An increase in non-native vegetation may reduce the rangeland's ability to support livestock and wildlife, and may reduce its resiliency to larger, catastrophic events. Cheatgrass (*Bromus tectorum*) is an example of a non-native species that has greatly affected rangeland ecosystems throughout the Intermountain West.

This paper describes the vegetation/land cover sampling performed during the summer of 2009 which was performed to support on-going rangeland research at Idaho State University's GIS Training and Research Center (Anderson et al, 2008; Gregory et al., 2008; Russell and Weber, 2003; Sander and Weber, 2004; Tedrow, Davis, and Weber, 2008; Underwood et al, 2008; Weber and McMahan, 2005). In this study, land cover was estimated using line-point intercept transects and these data were used to foster a better understanding of the effect of grazing management practices at the O'Neal Ecological Reserve, with potential application to other semiarid rangelands around the world.

METHODS

Study Area

Research at the O'Neal Ecological Reserve is being conducted to A) determine if Simulated Holistic Planned Grazing can be used to effectively decrease bare ground exposure, B) determine if soil moisture changes relative to bare ground exposure and treatment, and C) examine the ecological effects of livestock grazing. The approximate location of the study area is shown below (Figure 1).

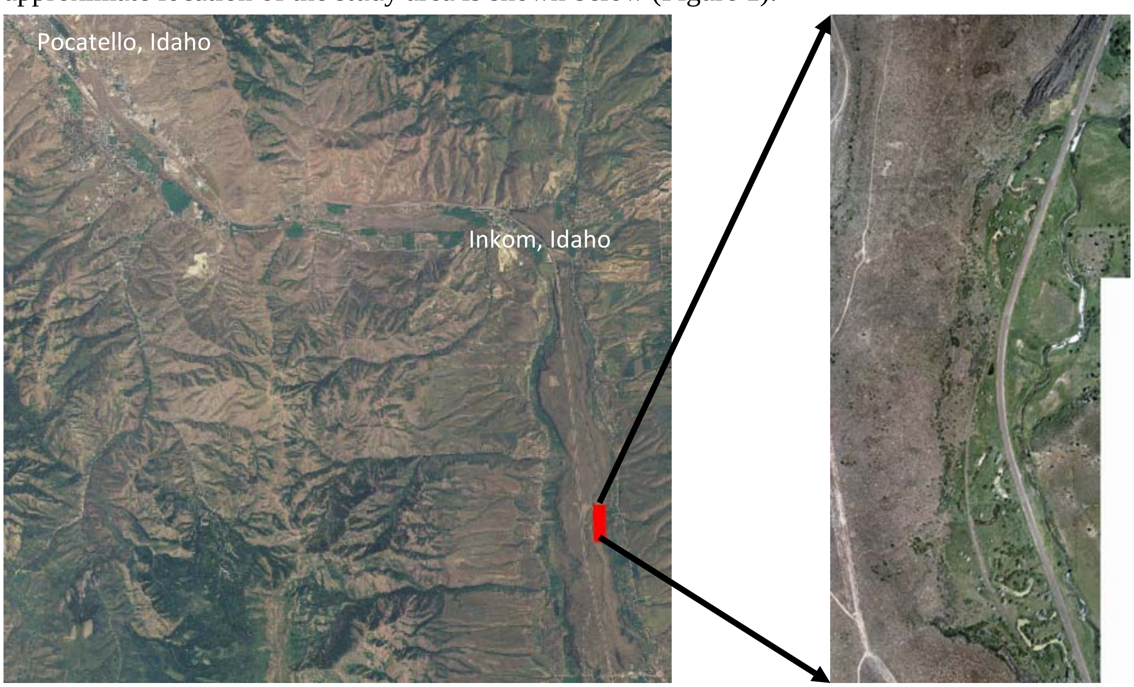

Figure 1. Research study area. The O'Neal Ecological Reserve, represented by red rectangle, is located near McCammon, Idaho.

Three different grazing treatments were sampled; Simulated Planned Holistic Grazing (SHPG), rest-rotation (RESTROT), and total rest (TREST). After comparing several metrics for each of these areas we infer various generalizations which may shed light on relationships between the measured variables and aid range managers in making decisions about prescribed and targeted grazing management.

Field data collection

Sample points for this study were randomly generated based on criteria determined prior to collecting the data. These criteria include: all points must be 1) >70 meters from an edge (road, trail, or fence line) and 2) <750 meters from a road. There were 30 points generated in total throughout the three O'Neal grazing pastures. The three grazing treatments were: 1) Simulated Holistic Planned Grazing (SHPG) 2) rest-rotation (RESTROT) and 3) total rest (TREST). A new criterion considered for the 2009 study included placing an east or west bearing on each sample point depending on its location in reference to the flight line of a concurrently acquired high-resolution (0.05mpp) aerial photography mission. If the random sample point was located to the west of the flight line path, then the point would be marked with an E to indicate the transect would be read to the east of the sample point (plot center), in contrast, if the random sample point was located to the east of the flight line path, then the transect would read directly to the west of plot center. This was done to ensure the entire transect would be acquired by the aerial photography mission.

Sample points were navigated to using a Trimble GeoXH GPS receiver. A 20 m flexible tape was laid out on the ground from the starting point (plot center) and in the designated direction (directly east or west) with the aid of a compass. Photographs were taken using a Sony digital camera in each cardinal direction, starting at north and proceeding to photographs viewing east, south, and west. Land cover type was determined by looking straight down at the transect tape and recording the land cover feature in the upper most canopy directly above the designated observation point. Observation points began at 10 cm from the sample point (observation point one) and continued every 20 cm thereafter (observation points 2-100). Land cover at each observation point was classified as either shrub, rock (if the rock was over 7.5 cm in surface diameter), bare soil, invasive weed, grass, forb, litter, standing dead herbaceous material, standing dead woody material (e.g., a dead tree or sagebrush shrub still intact at the ground), or microbiotic crust. A total of 100 point observations were made and recorded in the GPS-based field form.

The Trimble GeoXH GPS receiver (+/-0.20 m @ 95% CI after post processing) using latitude-longitude (WGS 84) was used to record the location of each sample point (Serr et al., 2006). Points were occupied until a minimum of 60 points were acquired and WAAS was used whenever available. All points were post-process differentially corrected using a constellation of GPS base stations each located <80km from the study area. This technique used Trimble's H-star technology to achieve improved horizontal positional accuracy. The sample points were projected into Idaho Transverse Mercator NAD 83 using ESRI's ArcGIS 9.3.1 for datum transformation and projection (Gneiting, et al., 2005).

Fuel load was determined by visually estimating the vegetation type and quantity in the immediate vicinity (approximately 20 meters) of the sample point. Anderson's (1982) fuel load classes were used (Table 1).

Table 1. Fuel load classes used in this study

Fuel Load Class	(Tons/Acre)	Description
1	0.74	Almost bare ground, very little vegetation
2	1.00	Grasses, some bare ground, few shrubs
3	2.00	Mixture of shrubs and grasses
4	4.00	Predominantly shrubs
5	>6.00	Shrubs to trees

RESULTS

Based upon land cover estimates, maximum bare ground was 26%, maximum weed cover was 25%, maximum grass cover was 46%, maximum shrub cover was 33%, and maximum forb cover was 24%.

Each grazing treatment was independently analyzed in order to better understand how land cover responded in relation to each grazing treatments. The mean cover of each cover type were separated by grazing treatment and summarized in Table 2.

Table 2. Mean cover of each land cover type by grazing treatment (2009).

	Mean cover (%)		
Land cover class	SHPG (*n*=3)	Rest-rotation (*n*=24)	Total rest (*n*=3)
Bare Ground	15.33	8.12	2.00
Shrub	12.33	13.83	13.00
Grass	24.66	22.66	28.33
Litter	9.33	9.04	7.60
Weed	3.00	8.25	13.60
Forb	7.00	9.16	10.33

Compared to a similar sampling campaign during the summer of 2008 (*n*= 150), 2009 showed a decrease in bare ground and litter across all treatment pastures as well as a decrease in weed cover in both the SHPG and rest-rotation pastures. In contrast, there was an increase in grass and forb cover found across all treatment pastures which is most probably the result of increased precipitation in 2009 relative to that in 2008. In June of 2008 the total rainfall was 9.2 mm with the monthly average at 0.025 mm. This differs greatly from June 2009 which had a total rainfall of 106.8 mm and a daily average of 0.296 mm. Similarly, there was an increase in shrub cover in both the SHPG and rest-rotation pastures as well as an increase in weed cover in the total rest pasture. The latter change may be due to the absence of grazing which in turn may favor the establishment of invasive annual weeds such as cheatgrass (Table 3). It is noted however, that these changes are observations based upon absolute values and not the result of a statistical comparison of inter-annual differences within each pasture. Statistical analyses were not performed as the number of samples was not sufficient.

Table 3. Mean cover of each land cover type by grazing treatment (2008).

	Mean cover (%)		
Land cover class	SHPG (*n*=50)	Rest-rotation (*n*=50)	Total rest (*n*=50)
Bare Ground	17.52	10.36	5.47
Shrub	11.1	11.26	13.86
Grass	13.84	8.96	12.27
Litter	18.68	12.14	8.47
Weed	4.5	12.04	12.33
Forb	5.82	6.34	4.10

In 2009, the SHPG was not grazed, which may be a factor explaining the increased grasses and forbs compared to the summer of 2008 when the allotment had been grazed. The RESTROT pasture was grazed in 2009 and 2008, and in this case an increase similar to that found in the SHPG treatment area was observed. This suggests the changes observed in the SHPG pasture is attributable more to the increase in precipitation (environmental effects) than grazing (anthropic effects). The small number of samples in both the SHPG (*n*=3) and TREST (*n*=3) pastures in 2009 compared with the number of samples taken from the RESTROT (*n*=24) pasture could also be a factor affecting the reported results.

CONCLUSIONS

The results from 2009 field season saw some dramatic changes when compared with the results from 2008. There was an increase in both grass and forb cover classes across all three grazing treatments (Tables 2 and 3). In addition, there was also a decrease in bare ground and litter in each pasture.

Higher percentages of grass cover are very important to provide a healthy environment for both livestock and wildlife and in 2009 there was a substantial increase in grass cover. Each allotment increased from 2008 by an average of 13.5%. The differences observed could be due to more effective grazing treatments, but observational bias as well as environmental factors should be noted as possible influences to changes reported from the previous year. During June of 2009, rain fell consistently at the O'Neal site, resulting in an increase in precipitation from 2008 by 97.6 mm. This is most probably the principle factor in the increased growth of grasses and forbs. However, further comparisons would help to better analyze whether there were any grazing treatments effects as well.

Bare ground decreased by an average of 2.63% while litter decreased by an average of 4.44%. Comparing the 2008 results with the summer of 2007 shows a similar trend of decreasing bare ground and litter. The RESTROT pasture and TREST pasture both exhibited a decrease in bare ground while the SHPG allotment maintained the same average percent bare ground from 2007 to 2008. It should be noted, however, that not as many sample points were taken within the SHPG pasture (*n*=3) and TREST pasture (*n*=3) as compared with the sample size from the RESTROT pasture (*n*=24). This could be a factor affecting the reported results, but the general trend towards a decrease in bare ground suggests an overall improvement. Further sampling and monitoring will more definitively indicate if these trends will continue towards a reduction in bare ground.

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