Range Vegetation Assessment in the Big Desert, Upper Snake River Plain, Idaho

Luke Sander, Idaho State University GIS Training and Research Center. Campus Box 8130, Pocatello, Idaho 83209-8130

Keith T. Weber, GIS Director, Idaho State University GIS Training and Research Center. Campus Box 8130, Pocatello, Idaho 83209-8130 (webekeit@isu.edu)

ABSTRACT
Vegetation data was collected at 575 randomly located sample points during the summers of 2003 and 2004 (424 in the USDI BLM Big Desert Region (253 in 2003 and 171 in 2004) and 151 in the USDA-ARS Sheep Experiment Station in 2004). We collected data describing percent cover of grasses and shrubs, dominant weed and shrub species, fuel load, sagebrush age, GAP vegetation classification, presence of microbial crust, litter type, forage availability, and photo points. Sample points were stratified by fire, grazing, and rest treatments. A high amount of cheatgrass was found throughout both years as well as a high amount of bare ground. However, in 2004 forage availability increased from 2003 probably due to increased rainfall.

Keywords: vegetation, sampling, GIS, remote sensing, GPS.

INTRODUCTION

Many factors influence landscape changes. Wildfire has been, and will always be, a primary source of broad scale landscape change. After a wildfire occurs a change in both plant community composition and plant structure results. In a completely unaltered system, there are plants and shrubs that establish themselves very quickly. In some systems, native plants are in competition with non-native vegetation that is more aggressive. The increase of non-native vegetation can directly result in the reduction of livestock and wildlife carrying capacities. Fire frequency may also increase. An example of non-native vegetation that out competes native vegetation and increases fire frequency is cheatgrass (*Bromus tectorum*). The Big Desert study area is approximately 71 km northwest of Pocatello and the center of the study area is approximately 113º 4' 18.68" W and 43º 14' 27.88" N. (Figure 1)

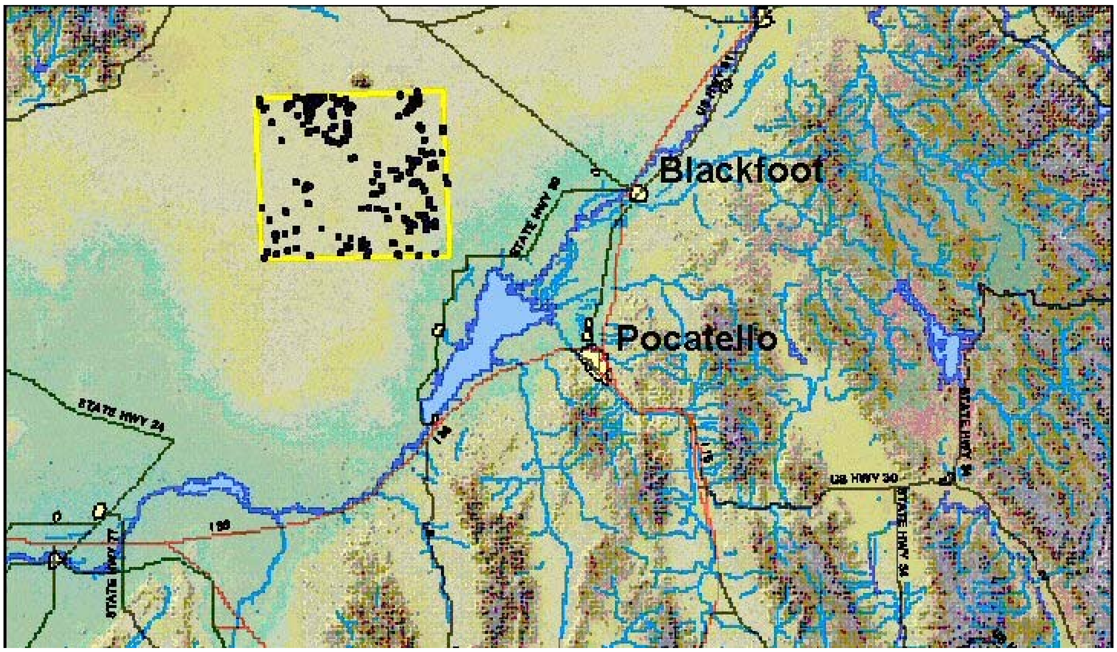

Figure 1. Southeastern Idaho and this study's Area of Concern (bounded in yellow rectangle) .

We assessed research in all possible areas; fire, no fire, grazing and no grazing. After comparing various traits in each of these areas we can create generalizations and these generalizations can then shed light on relationships between these variables and may aid range managers in making decisions about prescribed fire and grazing management.

METHODS

Five hundred and seventy five sample points were randomly generated across the study area. Each point met the following criteria;

1) >70 meters from an edge (road, trail, or fence line)
2) <750 meters from a road.

The sample points were stratified by treatment: 1) fire (within the past 10 years) 2) grazing and 3) rest. In 2004 50 points were created in each of these strata, and 70 in each in 2003. The location of each point was recorded using a Trimble GeoXT GPS receiver (+/-1m with a 95% CI) using native latitude-longitude (WGS 84). Points were occupied until a minimum of 120 positions were acquired and WAAS was used whenever available. All points were post-process differentially corrected using Idaho State

University's GPS community base station. The sample points were then projected into Idaho Transverse Mercator NAD 83 using Trimble's Pathfinder office for datum transformation and ESRI's ArcGIS for projection.

Ground Cover Estimation
Visual estimates were made of percent cover for the following; bare ground, litter and duff, grass, shrub, and dominant weed. Cover was classified into one of 9 classes (1. None, 2. 1-5%, 3. 6-15%, 4. 16-25%, 5. 26-35%, 6. 36-50%, 7. 51-75%, 8. 76-95%, and 9. >95%).

Observations were assessed by viewing the vegetation while looking straight down as we walked the sample site. This was done to emulate what a "satellite sees". In other words we were viewing the vegetation from nadir (90 degree angle).

Fuel Load Estimation
Based upon field vegetation training techniques provided by the BLM office in Shoshone Idaho, we estimated fuel load at each sample point. Visual observations of an area equivalent to a Quickbird pixel, (2.4mpp or approximately 5.76 m^2), centered over the sample point were used to estimate fuel load (table 1).

Table 1. Fuel Load Classes (Tons/Acre)

1.	0.74
2.	1
3.	2
4.	4
5.	>6

These categories were derived from Anderson (1982).

Forage Measurement
Available forage was measured using a plastic coated cable hoop 93 inches in circumference, or 0.44 m^2. The hoop was randomly tossed into each of four quadrants (NW, NE, SE, and SW) centered over the sample point. All vegetation within the hoop that was considered adequate forage for cattle, sheep, and wild ungulates was clipped and weighed (+/-1g) using a Pesola scale tared to the weight of an ordinary paper bag. All grass species (except cheatgrass (*Bromus tectorum*)) were considered forage. The measurements were then used to estimate forage amount in AUM's, pounds per acre, and kilograms per hectare (Sheley, Saunders, Henry 1995)

Microbiotic Crust Presence
Microbiotic crusts (Johnston 1997) are formed by living organisms and their by-products, creating a surface crust of soil particles bound together by organic materials. The presence of microbiotic crust was evaluated at each sample point and recorded as either present or absent. Any trace of a microbiotic crust was defined as "presence".

GAP Analysis
Vegetation cover was described using a list of vegetation cover types from the GAP project (Jennings 1997). The GAP vegetation description that most closely described the sample point was selected and recorded.

Litter Type
Litter was defined as any biotic material that is no longer living. Litter decomposes and creates nutrients for new growth. For the litter to decompose it needs to be in contact with the soil in order for the microbes in the soil to break down the dead substance. If the litter is suspended in the air it turns a gray color and takes an immense amount of time to decompose through chemical oxidation. If it is on

the ground it is a brownish color and decomposes biologically at a much faster rate. The type of litter present was recorded by color: either gray (oxidizing) or brown litter (decaying).

Big Sagebrush (Artemisia tridentata spp.) Age Estimation
Maximum stem diameter of Big sagebrush plants was measured using calipers (+/-1cm) to approximate the age of each plant (Perryman, Olson 2000) A maximum of four samples were taken at each sample point, one within each quadrant (NW, NE, SE, and SW). The sagebrush plant nearest the plot center within each quadrant was measured using calipers (+/-1cm) and converted to millimeters. The age of each big sagebrush plant was then estimated using the following equation (AGE = 6.1003 + 0.5769 [diameter in mm]).

Photo Points
Digital photos were taken in each of 4 cardinal directions (N, E, S, and W) from the sample point.

RESULTS
Percent Cover Bare Ground, Grass, and Microbiotic Crust
<u>2003</u>
Sixty-five percent of all 2003 field samples (*n* = 254) had >50% exposed bare ground. Eighty percent of the samples had <15% grass cover. Microbial crust presence was not recorded for this year. Seventy-two percent of the samples had >5% Cheatgrass.
<u>2004</u>
The dominant weed was nearly always cheatgrass (*n* = 195). Forty-five percent of the sample points had <5% cheatgrass cover. Ninety-three percent of all sample points had grass that covered <15% of the ground. Ninety-six of the sample points had >50% exposed bare ground. Only 4 of the 322 sample points had microbiotic crust present.

Big Sagebrush Age Estimation
<u>2003</u>
The mean age of sagebrush plants was 22.8 yrs (*n* = 514). The minimum age was 8 yrs and the maximum age was 106 yrs (Figure 2).

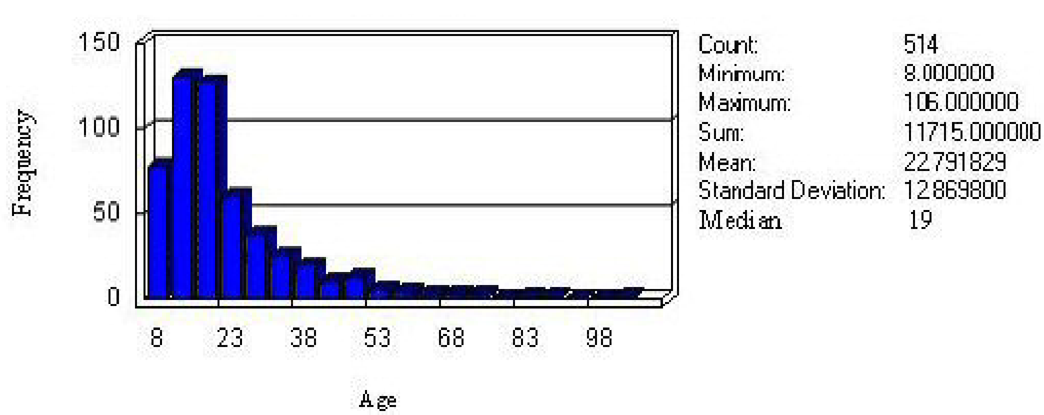

Figure 2. Age distribution of sampled Big Sagebrush plants in the study area (2003).

<u>2004</u>
The mean age of the sagebrush plants was 26.24 yrs (*n* = 227). The minimum age was 6 yrs and maximum age was 111 yrs. (Figure 3).

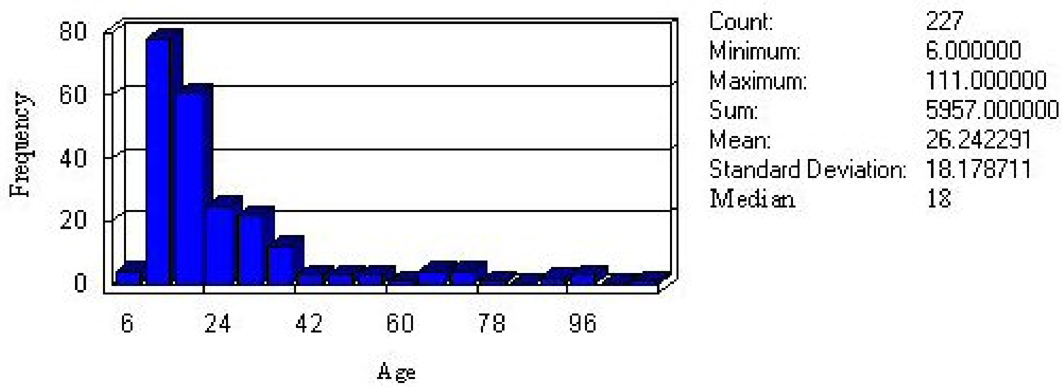

Figure 3. Age distribution of sampled Big Sagebrush plants in the study area (2004).

Forage Measurements

2003

Using AUM Analyzer software (Sheley, Saunders, Henry 1995), forage amount and available Animal Units were calculated for all sample points. Mean forage available was 191.3 kg/ha. The minimum forage available was 11 kg/ha and the maximum forage available was 1724 kg/ha.

2004

Using AUM Analyzer software, forage amount and available Animal Units were calculated for all sample points. Mean forage available was 289.7 kg/ha. The minimum forage available was 6 kg/ha and the maximum forage available was 3961 kg/ha.

CONCLUSIONS

The available forage present on the range in 2004 is higher than what was found in 2003. This is primarily due to greater amount in 2004 (table 2). This also serves to illustrate the potential of Idaho's rangelands.

Table 2. Recent annual precipitation (inches)

Month	2003	2004
May	0.53	1.91
June	0.14	0.56
July	0.00	1.09

The range appeared healthier and greener in 2004 for a longer period of time compared to 2003. There were multiple rainy days during the desert field season in 2004 while there was not one day of rain during the 2003 field season. The increased rainfall did not necessarily increase the amount of vegetation; it merely sustained the greenness of the vegetation for a longer period of time. Bare ground measurements were higher in 2004 than they were in 2003, yet AUM measurements were higher in 2004 than in 2003. These could be factors of the different areas sampled, but with such a difference in bare ground values over the 2 years I think that the vegetation that was already established used the moisture to sustain greenness for a longer period of time.

In 2004 there was a small decrease in cheatgrass from 2003. It was only a 10% difference which is not significant. Sampling in 2005 will be interesting to see the difference a high precipitation year makes in cheatgrass measurements.

In 2004 there was a higher occurrence of Green Rabbitbrush (*Chrysothamnus viscidiflorus*) than was seen in 2003. This occurred primarily in fire disturbed areas. Green Rabbitbrush is typically the first shrub to populate an area after a fire.

Big Sagebrush (*Artemisia tridentata* spp.) age was approximately the same between 2003 and 2004, although this year (2004) there was more points that had no sagebrush. This was most likely simply a function of the random points generated.

Only 4 of 322 sample points had a microbial crust present. "Microbial crust is formed by living organisms and their by-products, creating a surface crust of soil particles bound together by organic materials" (Johnston 1997). These are common in very poor rangelands and they are sometimes one of the last things left alive. They can retain water very well even against an osmotic pull. After seeing only 4 out of 322 sampled points with a positive presence during a high moisture year, continuing to record its presence would be beneficial to see how this crust changes from year to year.

ACKNOWLEDGEMENTS

This study was made possible by a grant from the National Aeronautics and Space Administration Goddard Space Flight Center. ISU would also like to acknowledge the Idaho Delegation for their assistance in obtaining this grant.

LITERATURE CITED

Anderson, Hal E. 1982. Aids to Determining Fuel Models For Estimating Fire Behavior. USDA For. Serv. Gen. Tech. Rep. INT-122. Ogden, Utah

Jennings, Michael. 1997. "Gap Analysis Program". USGS < http://www.gap.uidaho.edu>

Johnston, Roxanna. 1997. Introduction to Microbiotic Crusts. USDA NRCS Gen. Tech. Rep.

Montana State University. "AUM Analyzer" Sheley, Roger. Saunders Steve. Henry, Charles. Reprinted May 2003 < http://www.montana.edu/wwwpb/pubs/mteb133.pdf >

Perryman, B. L., and R. A. Olson, 2000. Age-stem diameter relationships of big sagebrush and their management implications. J Range Management. 53: 342-346.