SAGEBRUSH AGE ESTIMATION IN THE UPPER SNAKE RIVER PLAIN, IDAHO

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ABSTRACT
During the summer 2002, sagebrush plants (n = 611) growing in the sagebrush-steppe region of southeastern Idaho were sampled to estimate age. Techniques used follow those described by Perryman and Olsen (2002) and include measurement of maximum stem diameter. Stem diameter measurements are then applied to a linear regression equation fit for various sub-species of Big Sagebrush (*Artemesia tridentata*). Sagebrush age estimates were analyzed for overall trend and compared by treatment (grazing and past wildfire). No treatment effects were detected, however a positive correlation was observed between average sagebrush age and percent shrub cover.

Keywords: Field sampling, GIS, range.

INTRODUCTION

One of the focuses of ISU's Geographic Information Systems (GIS) Training and Research Center is on performing spatial analysis of rangeland ecosystems. While methodological and practical constraints have prevented our determination of the age of sagebrush individuals and stands in the past, the significance of such determinations is undeniable. Now, new methods developed by Perryman and Olson (2000) and adapted by ISU's GIS Training and Research Center make it possible to determine the age of sagebrush plants and to study how factors such as grazing, historic wildfires, and total shrub cover affects or correlates with the age of sagebrush plants. The data gathered here may shed light on relationships between these variables and may aid range managers in making decisions about prescribed fire and grazing management. This report focuses on a portion of Idaho's Eastern Snake River Plain (Figure 1) and is intended to study the relationships mentioned above, as well as assess the feasibility of the methods used.

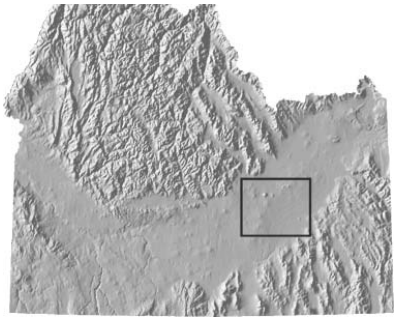

Figure 1: Hillshade image of southern Idaho showing this study's Area of Concern (AOC)

METHODS

Point data describing ground cover and sagebrush diameter (measured in mm) was estimated by GIS Center technicians during the summer of 2002 (n=370). Each point was randomly selected and represents the center of a circle with a 30-meter radius. This circle is bisected by two lines, one running east-west and the other running north-south. These lines effectively divide the circle into quadrants. The maximum diameter (in mm), within the lowest 25cm of stem, of the sagebrush plant closest to the center of the circle in each of the four quadrants (NW, NE, SE, and SW) was measured. Associated with each sample point were as many as four and as few as zero sagebrush stem diameters, depending on whether a sagebrush plant was available for sampling in each quadrant. Zeros were entered into the database to represent quadrants containing no sagebrush plants (McMahan and Sauder 2002).

To estimate sagebrush age, an equation developed by Perryman and Olson (2000) (modified for Eastern Idaho by ISU GIS Training and Research Center technicians) was employed (equation 1)

$$Age = 6.1003 + 0.5769(diameter)$$

Where; Diameter is the largest stem diameter (mm) within 25cm of the plant's base
Age is the age of the sagebrush plant in years.

Using spatial join operations in ArcMap 8.2, grazing treatment data (i.e., whether the point had been grazed by livestock or not) was incorporated into the database. Data describing the number of historic wildfires between the years of 1939 and 2001 was also added to the database using the Surface - point Z-value extractor Avenue script (spPntzval.ave) in ArcView 3.2.

With this information, I used Microsoft® Excel for basic processing. Descriptive statistics and graphs were generated illustrating the relationship between estimated sagebrush age and other factors such as treatment (grazing and/or wildfire), and total shrub cover (figures 2 and 3, respectively). Plants growing in areas where no fire or grazing had occurred were used as a control population for comparison with plants in areas known to have been grazed, burned, or both.

RESULTS

Descriptive statistics, generated in Excel, regarding treatment and percent shrub cover are presented in tables 1 and 2. These statistics are graphed in figures 2 and 3. Standard error was used to plot error bars, not standard deviation.

Table 1: Descriptive statistics regarding sage age versus grazing and fire treatment data.

Treatment	***Control***	***Grazing Only***	***Fire Only***	***Fire & Grazing***	***No Fire, Unknown Grazing***
Mean	27.86	28.24	27.78	30.76	29.44
Standard Error	0.80	1.57	1.90	3.00	0.60
Median	26.29	26.29	26.58	27.16	27.73
Mode	19.95	23.98	15.91	28.02	18.79
Standard Deviation	9.56	10.77	11.07	13.44	11.48
Range	55.96	47.88	46.73	58.27	65.77
Minimum	13.02	14.18	12.45	15.91	10.14
Maximum	68.98	62.06	59.18	74.17	75.91
Count	144	47	34	20	366

Table 2: Descriptive statistics regarding sage age versus shrub cover data.

Shrub cover	***1-5%***	***6-15%***	***16-25%***	***26-35%***	***36-50%***
Mean	25.94	27.75	29.00	31.47	36.52
Standard Error	1.27	0.91	0.57	1.61	3.46
Median	25.14	25.71	26.87	29.75	32.64
Mode	23.98	19.95	18.79	33.79	26.29
Standard Deviation	8.82	11.65	10.35	12.17	15.10
Range	39.81	62.31	62.88	62.31	58.27
Minimum	10.14	12.45	6.10	13.60	16.48
Maximum	49.94	74.75	68.98	75.91	74.75
Count	48	163	324	57	19

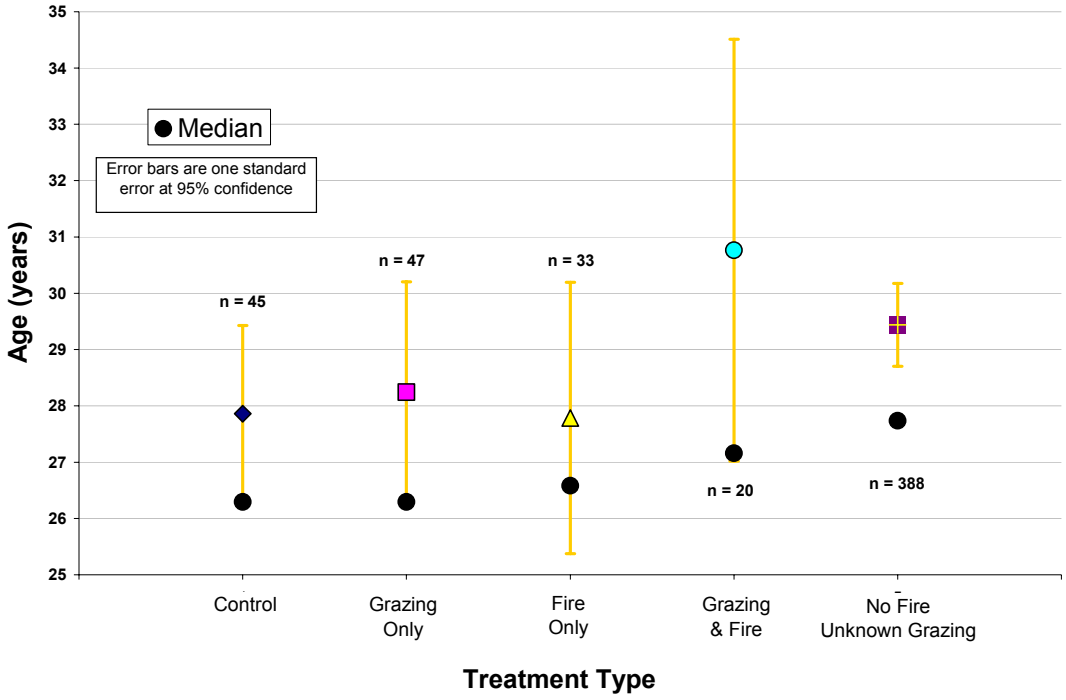

Figure 2: Average age of sagebrush plants versus grazing and fire treatments

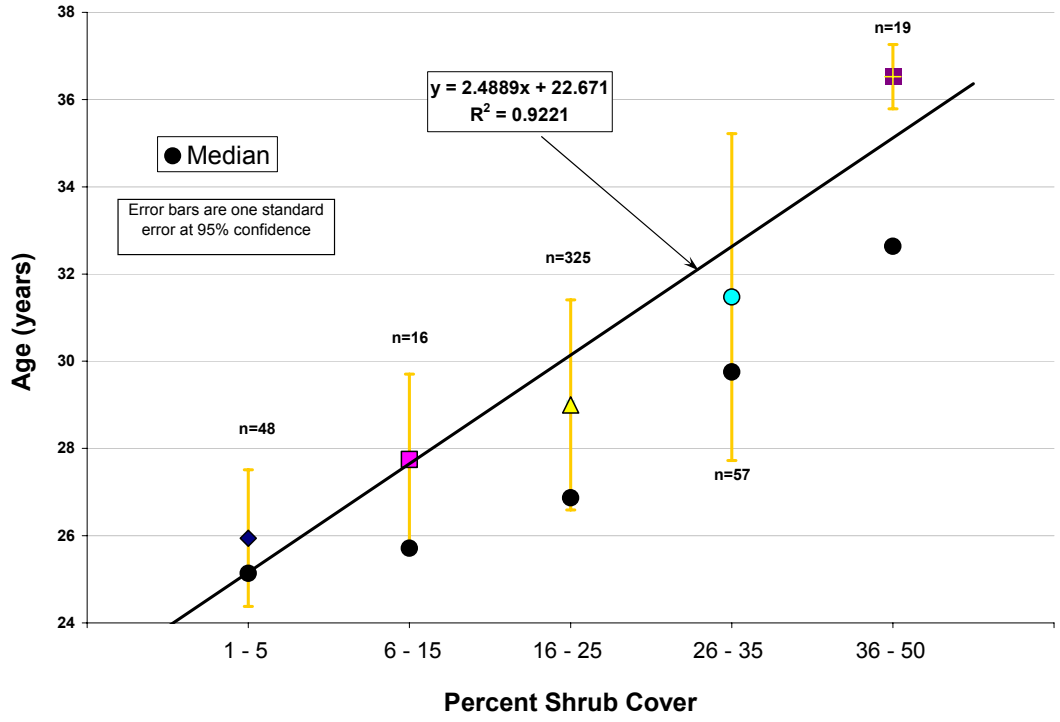

Figure 3: Average age of sagebrush versus percent shrub cover

DISCUSSION

It is clear in figures 2 and 3 that no difference exists in mean or median sagebrush age between burned versus unburned areas. Similarly, there is no difference in sagebrush age in grazed versus ungrazed areas. Figure 3 shows a gradual increase in average estimated age with increasing shrub cover. T-tests indicate this trend is not significant (95% confidence), however linear regression analysis reveals a trend line that describes the mean sagebrush ages with an R^2 value of 0.9221.

Little can be said from this exercise regarding how average age of sagebrush plants in a stand is affected by grazing and/or fire. Based upon our data, it appears that any treatment effect on the average age of sagebrush plants is insignificant compared to other factors not addressed by this study.

In many plant communities, one would expect large, dense stands to contain some old individual plants. The data in figure 3, while within statistical error bounds, illustrates trend which supports this presumption. However, Thomas Windholz (pers. comm.) indicated that, with large standard errors, the means themselves may have little significance.

ERROR ASSESSMENT

Perryman and Olson's (2000) methods for developing their technique and equation included collection of a section of sagebrush stem. Part of the stem was then cut and sanded so that annual growth rings could be counted. Diameter measurements took place after the samples were uprooted, cut, and sanded. At this point in the procedure, it is unclear how knowledge of the vertical position of the measurement on the stem, even simply whether or not the measurement was taken above the soil, could be assured. This is a source of error untouched by Perryman and Olson (2000), and we are unsure how to assess this in the report short of making the reader aware.

ACKNOWLEDGEMENTS

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