

ASSESSMENT OF VEGETATIVE CHANGES FROM ELK EXCLOSURES

- assessing exclosures and reference areas, Bandelier National Monument, 1998-2000.

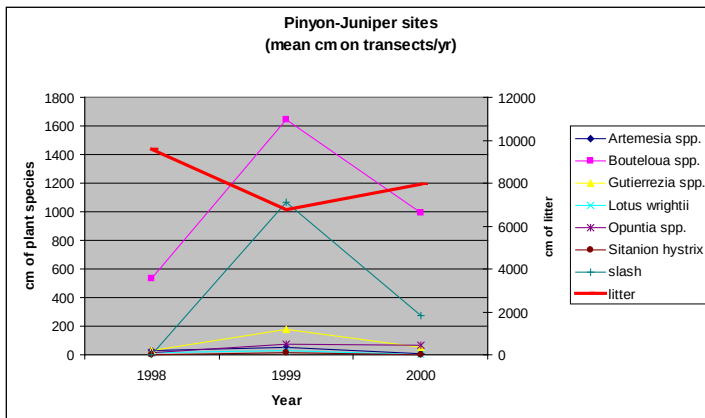
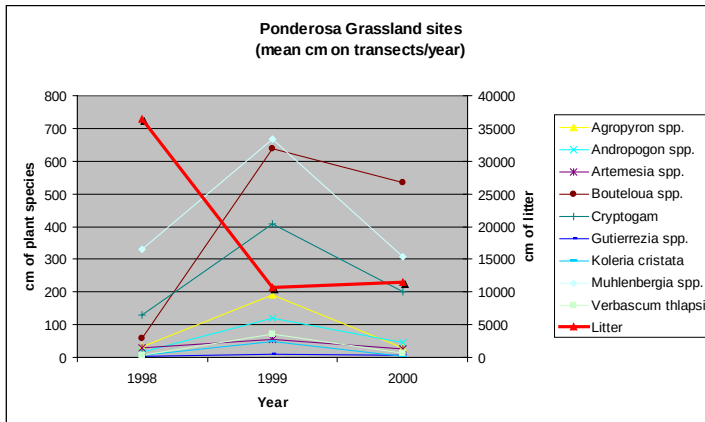
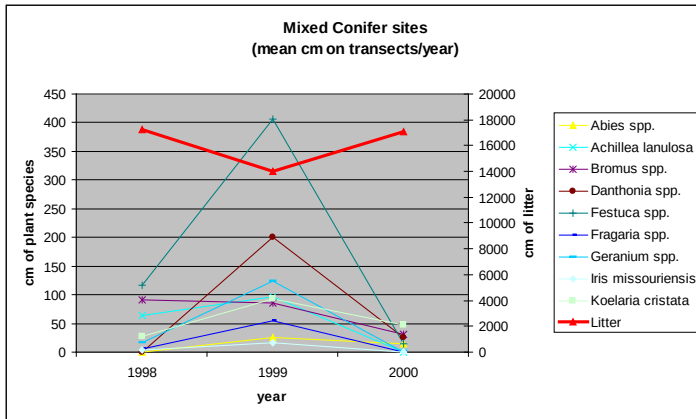
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In 1998, 60mx60m exclosures along with paired reference areas were established on 18 sites. Sites were chosen with 5 replicate pairs in each of 3 vegetative types: Mixed conifer (MC), Ponderosa Grassland (PG), and Pinyon-Juniper (PJ), additional pairs were established in meadow (MD) and 2 in Aspen (AS) sites. There were two 50-meter transect lines in each of the 18 exclosures and reference areas, with the exception of the meadow site where there were four 50-meter transect lines inside the exclosure and two 50-meter transect lines in each of the two adjoining reference areas. There were six stakes marking each 50-meter transect line and each transect line was parallel to one other transect line. Transects A and B were inside and Transect C and D were outside the exclosure. The transect lines begin at stake one and end at stake six for all MC, PG and PJ exclosures. Basal and aerial cover was identified for every centimeter along the transect. Any cover that intersected the vertical plane of the tape edge for ± 0.5 cm along the transect was recorded. Cover on ground was recorded as basal. Cover above the ground was recorded as aerial cover.

This is an assessment of changes detected after the first 2 years of elk exclusion. Plant species diversity was high on these Bandelier sites. Sampling detected 130, 144, and 106 different species on mixed conifer, ponderosa-grassland, and pinyon-juniper plots, respectively. Measures of plants between 1998 and 2000 comparing exclosure to reference areas did not show significant changes. Elk impacts during winters of 1998-1999 and 1999-2000 in reference areas outside the exclosures were not sufficient to cause measurable differences in either year. Communities may have already responded to impacts of this sort or it may take more time for community changes to be detectable. Vegetative trends suggested that total plant cover increased between 1998 and 1999. However, cover did not change significantly for individual plant species and differences were not significant between exclosures and paired reference areas (Wallace 2000). The vegetative trend was just the opposite between 1999 and 2000. Cover of common plant species tended to decrease to nearly 1998 values (Figs. 1-3). Exclosures and reference areas still did not differ (Barron 2000). Parametric t-tests of this vegetative data were inappropriate since it was not normally distributed and there were large numbers of values of 0. Non-parametric tests, appropriate and usually more conservative, did not support even the limited number of differences reported (Barron 2000).

Variation in plant cover between years, sometimes exceeding a 5 fold increase of a species abundance (Figs 1-3) over the 3 years measured, is masking any long-term trend that may be occurring. Between year variation was driven by climatic, primarily precipitation, differences between years and was fairly consistent across plots and treatments.



Vegetative community change is often slow. Change following the removal of a community shaping force like grazing that has had a long-term effect may take many years. Weather patterns that affect plant growth, amount of elk grazing, and observer differences are 3 major uncontrolled sources of variation in this exclosure experiment. Differences between amounts of precipitation and soil productivity at different exclosure/reference areas within each habitat type may result in different plant responses between plots each year. The intensity or duration of elk use of reference areas will also affect the type and magnitude of differences between reference and exclosure areas. Furthermore, elk grazing effects will differ over years and may be cumulative. Finally, there are differences between observers collecting data on transects each year. These sources of variation confound interpretation of the effects of elk exclusion over just 2 years. Data will be needed over a longer period to identify trends of change due to elk exclusion. If logistic constraints preclude measuring vegetative data annually, I recommend that this design be continued and data be collected at 5-year intervals. Further modifications that would detect plant changes sooner would include marking and monitoring specific individual plants and focusing on shrub components of the community that may show greater response than herbaceous plants.

Aerial plant cover will vary most with annual climatic conditions. Change in plant basal cover would be more meaningful. Given enough years data, analysis of variance for common species, present on most plots within a vegetative type, with year and treatment (exclosure or reference) should detect long-term community changes. Contingency table analysis should prove fruitful testing for significant changes in proportion of all species occurrences across plots within vegetative types between treatments and years.