

Vegetation Management in Great Basin NP

By Raymond Jaindl, Lee Eddleman, William Brock and Boyd Byelich

The Great Basin province is a mixture of high desert basins alternating with a series of nearly 200 isolated, long, narrow, north-south oriented mountain ranges created by major block faulting. Great Basin NP (GRBA), in the South Snake Range of east-central Nevada, rises nearly 8 000 feet from the valley floor to the top of 13 063 foot Wheeler Peak. It contains a diverse flora, ranging from desert to arctic alpine above tree line.

Many of the potential natural communities found in the Great Basin Province were a complex of plant community types, the result of disturbances such as fire and drought. These events were cyclical, with natural successions occurring during interims that varied from 40 to more than 100 years, depending on the community. By the early 1880s, livestock grazing was being introduced to the Province on a first-come, first-served basis, with no restrictions to prevent overgrazing. Fire, believed to be a natural component of many of the potential natural communities in the Great Basin Province, was greatly reduced during this period because the fine fuels (grass) needed to carry fire were removed by grazing. Consequently, plants susceptible to fire but not used as livestock forage established and expanded their ranges.

Livestock numbers in Nevada have declined from a high of 1.2 million sheep and 500,000 cattle in 1918 to 93,000 sheep and 383,000 cattle today. The fire-carrying fuels have increased with the decline in livestock numbers and with improved rangeland management. However, a continuing policy of fire suppression has essentially eliminated fire.

GRBA was established to illustrate and preserve a portion of the Great Basin physiographic province. GRBA also is charged to provide for continued livestock grazing. Integrating livestock grazing into a preservation management strategy demanded a research study to evaluate the rangeland resources of the South Snake Range, from which a comprehensive range management program will be developed.

In 1988, in cooperation with the Department of Rangeland Resources at Oregon State University, GRBA began a 2-year range resource analysis. This study is also being used to verify, refine, and improve the vegetation classification and mapping effort of the NPS from LANDSAT imagery. Evaluation of rangeland resources includes a survey and description of the present plant communities in the park, analysis of the past status of these communities, and a prediction of future development under various management strategies. Following is a preliminary look at the resource evaluation after the first summer's field season.

Methods

The study area, in the South Snake Range, covers roughly 250,000 acres. Of this, approximately 4,000 acres is private land, 70,000 acres is managed by BLM, 99,000 acres by USFS, and 77,000 acres by NPS.

Reflectance values in four bands from a June 1986 LANDSAT image were used to generate spectrally unique landcover categories for each 30m x 30m area of land (pixel). These landcover categories were the result of an unsupervised classification within the GRASS GIS program. Based on preliminary surveys and observed cover types, a classification by the NPS GIS Division in Denver identified 20 cover types.

From this initial stratification, polygons were identified as potential sampling sites to describe the associated plant communities. A minimum polygon area of 2 ha was the initial criterion established. This was done to minimize the influence of errors either inherent in imagery, induced operationally through data manipulation, or associated with accurately locating uniform areas in the field (Warren et al. 1989). Sampling sites were concentrated on NPS and USFS lands. Within these lands the sites were so distributed that cover types were sampled in each of the major drainages and were proportional to the area occupied by each cover type.

Vegetation descriptions were determined from a 50m x 20m macroplot located within a representative portion of the identified polygon. Each site description included environmental characteristics, species lists and cover, ground cover characteristics, grass and forb production, relative deer and livestock use based on feces occurrences, and tree density, size and age. A total of 104 cores taken from dominant tree species established stand age distribution. Trees were divided into size classes similar to those defined by Blackburn and Tueller (1970) for pinyon and juniper, and by the USFS Ecosystem Classification Handbook (Jensen and Keane, 1987) for conifers and aspen.

Results and Discussion

During the 1989 field season, 50 macroplot sites were visited. Of these, 8 were mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*) with no tree species present, 15 were various densities of pinyon (*Pinus monophylla*) and juniper (*Juniperus osteosperma*), 10 were aspen (*Populus tremuloides*), 6 were other coniferous forest types, and the remainder were meadow and low sage (*Artemisia arbuscula*).

The pinyon juniper cover type occupies 86,540 acres of the project area. Prior to arrival of European man, pinyon and juniper are believed to have been confined to rock outcrops and other areas protected from fire. There, trees were relatively long-lived, but in low densities. Of the 15 pinyon juniper sites evaluated to date, only one was found to be an old mature stand. This was on a steep, south facing limestone slope. Total tree cover was 19 percent. Cores taken from an old mature pinyon and a juniper were estimated at 400 and 470 years, respectively.

The remaining sites are in areas with less adverse conditions. Of the pinyons aged in these sites, no tree was older than 160 years and most averaged less than 100. Thus, pinyon is a relatively recent arrival. The effect of pinyon on site dynamics can be estimated by comparing site conditions among various densities of pinyon cover in these stands. (Table 1). As the density of trees increases toward a closed canopy condition, the species diversity and the percent cover of shrubs, forbs, and grasses declines. By the time pinyon cover reaches 60 percent, total forb, grass and shrub cover has shrunk from 60 percent to less than 3 percent.

Continued on page 18

Table 1. Mean tree cover, cover and number of species of shrubs, forbs, and grasses, and deer pellet groups per macroplot for several plant cover types at Great Basin NP (T = trace).

Cover Type	Percent cover			Number species				deer pellet groups 100 m ²
	tree	shrub	forb	grass	shrub	forb	grass	
Sagebrush	0	33	13	17	6	19	7	69
Pinyon (old stand)	19	18	T	0	3	1	0	0
Sagebrush with scattered pinyon	4	21	9	21	6	20	9	15
Pinyon (young stands)								
Low density	20	23	5	7	6	13	6	48
Moderate density	41	6	2	2	4	10	4	6
High density	60	1	T	1	5	8	5	7
Aspen	81	5	10	3	3	11	4	25
Conifer								
Engelmann spruce	46	2	T	T	1	3	1	1
Limber pine	25	23	7	2	4	1	3	5
Douglas-fir	58	7	T	T	3	3	3	8

Great Basin NP Vegetation Management (Continued from page 17)

Deer use based on the presence of pellets also declines substantially as the density of pinyon approaches 40 percent.

Examination of size class distributions (Figure 1) within the low (10 to 25% cover), moderate (26 to 50% cover), and high (>50% cover) pinyon density groups

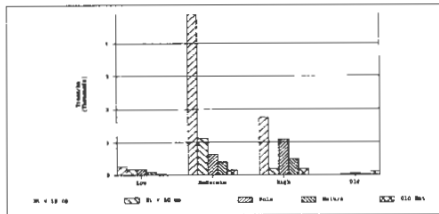


Figure 1. Pinyon size classes within the four pinyon density classes.

shows a large number of small plants in the moderate density class. These are the source of future mature trees, which eventually will dominate the sites and outcompete present vegetation. Since the survival rate of pinyons less than 0.5 m tall is relatively high unless killed by fire, this suggests continued increase in density and cover of pinyon on the 37,000 acres of moderate density pinyon sites. Any increase in pinyon can be expected to be accompanied by further loss of diversity and cover of associated forbs and grasses. The area most heavily used by deer would be further reduced.

The aspen cover type occupies 10,150 acres. Aspen are frequently a temporary, dominant, seral species in a variety of climax conifer associations following severe disturbance such as fire (Mueggler and Campbell 1986). Examination of the size class distributions (Figure 2) shows a large number of saplings (<1.5 m tall), pole (<12.5 cm dbh and >1.5 m tall), and mature (12.5 to 35 cm dbh) trees but no large mature trees (>35 cm dbh). Average age of trees in the pole size class was 74 years and in the mature size class, 107 years. Seedling and sapling white fir (*Abies concolor*), and limber pine (*Pinus flexilis*) are found in these stands. These small conifers averaged 50 years old. The presence of small conifers in the aspen commu-

nities suggests that aspen in most of this area is a seral species having become established 90 to 120 years ago following a disturbance of some sort. Fire scars on standing trees and charcoal found on these sites indicate fire occurrences. Fire suppression has been shown to contribute to a reduction of regeneration in aspen communities. Thus, under present management policies, these stands are expected to become dominated by conifers with a loss of aspen.

Conifer communities occupy 25,880 acres. They appear to be long-lived communities. Recruitment in the limber pine stands appears to be small, but survivability is high, so there are a number of large specimens (Figure 3). Douglas-fir (*Pseudotsuga menziesii*) and Engelmann spruce (*Picea engelmannii*) appear to have a greater rate of establishment but a lower sur-

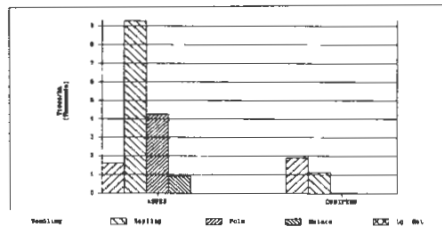


Figure 2. Size class distribution of aspen and conifers in the aspen cover type.

vival percentage, resulting in a similar number of large trees compared to limber pine. Maximum ages of the large trees were at least 381, 372, and 237 years for the Engelmann spruce, limber pine, and Douglas-fir, respectively. (Larger trees were present but equipment limitations prevented sampling of trees larger than 60 cm dbh). It appears these communities have changed relatively little since arrival of European man. With no disturbance, these stands probably will change little in the future except for an increased build-up of dead and down wood.

Summary

Examination of the rangeland management program at GRBA has developed awareness that live-

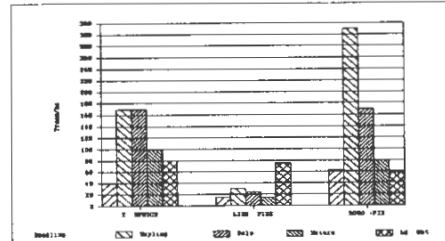


Figure 3. Size class distribution of the dominant conifer in the Engelmann spruce, limber pine, and Douglas-fir cover types.

stock management alone will not overcome the major vegetational changes occurring in the park. These changes were set in motion by humans decades ago, through overgrazing and the fuel reduction it causes. People continue to affect the dynamics of plant communities through suppression of naturally occurring fires. Fire management at GRBA is currently being reviewed. Refinement of this program is dependent on understanding today's plant communities and the historic role of fire.

Preliminary evaluation of GRBA's plant communities suggests that alternative management options will become drastically diminished if present successional trends continue. Associated with the on-going change is a reduction of vegetation diversity and a corresponding decrease in wildlife abundance.

Jaindl and Eddleman are Research Associate and Associate Professor at OSU; Brock and Byelich are the Resource Management Specialist and Range Technician at GRBA.

References

- Blackburn, W.H., and P.T. Tueller. 1970. Pinyon and juniper invasion in black sagebrush communities in east-central Nevada.
- Jensen, M.E., and R.E. Keane, in preparation 1987 draft. Ecosystem classification handbook. USFS.
- Mueggler, W.F. and R.B. Campbell, Jr. 1986. Aspen community types of Utah. USDA FS Intermountain Research Station. Ogden, Utah. Research Paper INT-362. 69 p.
- Warren, S.D., M.O. Johnson, V.E. Diersing and W.D. Goran. 1989. Rangeland inventory site selection using satellite imagery and a geographic information system. Abstract of paper presented at the 42nd Annual Meeting of the Society for Range Management. Billings, MT.