Comparison of Vegetation Structure and Composition in Modified and Natural Chaparral

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Highlight: *Six years following type conversion of a chaparral plot in southern California, density per acre and number of shrub species were reduced by 79.7% and 40%, respectively. Replanting following brush removal resulted in establishment of a perennial bunchgrass community with a basal area of 7% as compared to essentially no grass on the control plot.*

Type conversion of chaparral to grassland has been practiced by the San Bernardino National Forest, California, for the purpose of wildlife habitat improvement, fire control, increased water yield, and improved grassland, as outlined by the United States Forest Service (1972). The purpose of this paper is to report the results of a comparison of vegetation structure and compsoition of a 12-acre plots converted from chaparral to grass 6 years after conversion, with an adjacent natural (control) chaparral plot of equal area.

The Study Area

Type conversion of the 12-acre plot of chaparral to grassland (Fig. 1) in the Mud Flat region of the San Bernardino National Forest, San Gorgonio District, was completed in 1967. The chaparral site was the chamise (*Adenostoma fasciculatum* H. & A.) chaparral association as described by Cooper (1922), Burcham (1957), and Horton (1960). It is a south-facing slope of approximately 5 to 10% at an average elevation of 3300 ft. The soil is rocky and gravelly over a granitic base material, including granodiorite and gneiss with stratification parallel to the land surface.[1] No complete recent rainfall records are available for this specific area, but isohyetal records[1] indicate an average of 25 inches of rainfall per year for the Mud Flats region.

The conversion was accomplished following standard chaparral conversion techniques for California as outlined by Bentley (1967) and included the retention of a mosaic pattern of chaparral island for the purpose of creating scenic quality and maximum edge effect, as discussed by the U. S. Forest Service (1972). Brush was removed with a brush rake attached to a D-7 caterpillar. Brush pile burning and discing of the soil surface followed to aid residual brush decomposition. Herbicide treatments of the area, the first in 1967 and a second in 1969, consisted of a mixture of 2 lb/acre of 2, 4-dichlorophenoxy-acetic acid (2, 4-D) and 2 lb/acre of 2, 4, 5-trichlorophenoxyacetic acid (2, 4, 5-T), applied by hand spray. The modified plot was replanted using a rangeland drill seeding a mixture of intermediate wheatgrass (*Agropyron intermedium* (Host) Beauv.) and pubescent wheatgrass (*Agropyron trichophorum* (Link) Richt.) at the rate of 6 lb/acre.

Chaparral islands retained in the grassland (modified) plot constituted approximately 9% of the total 12 acres and averaged 3800 ft^2/island with an average measurement of 96 ft between islands.

Measurement Procedures

Field studies were conducted during the winter and spring months of 1973. A natural chamise chaparral plot of approximately 12 acres was selected for comparison with the modified plot. The site was selected adjacent to the modified plot but at a distance sufficient to be out of the influence of the conversion. Other criteria for selection of the control plot included lack of disturbance in a relatively homogeneous area of mature reproducing plants in an established site at approximately the same elevation and exposure as the modified plot. Specimens of all species were collected and identified according to Munz (1965).

Vegetation of the natural chaparral plot was sampled quantitatively with a 100-ft line transect at 11 randomly spaced sites along a compass line. The number of feet of shrub crown intercepting the line was recorded for each species, including overlapping species. From this, relative dominance and absolute percent crown cover were calculated.

A one-fortieth-acre quadrat (100 X 10.9 ft) was placed adjacent to 10 of the line transects. This quadrat was divided into four contiguous sections, each 25 X 10.9 ft. Individuals were counted in each quadrat. An individual plant was any plant possessing a trunk or burl distinct from other trunks and burls. Relative density, relative frequency, and density of individuals per acre were calculated from the quadrat data. Values of relative density, relative dominance, and relative

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[1] From the files (1967) of the forest supervisor, San Bernardino National Forest, San Bernardino, Calif.

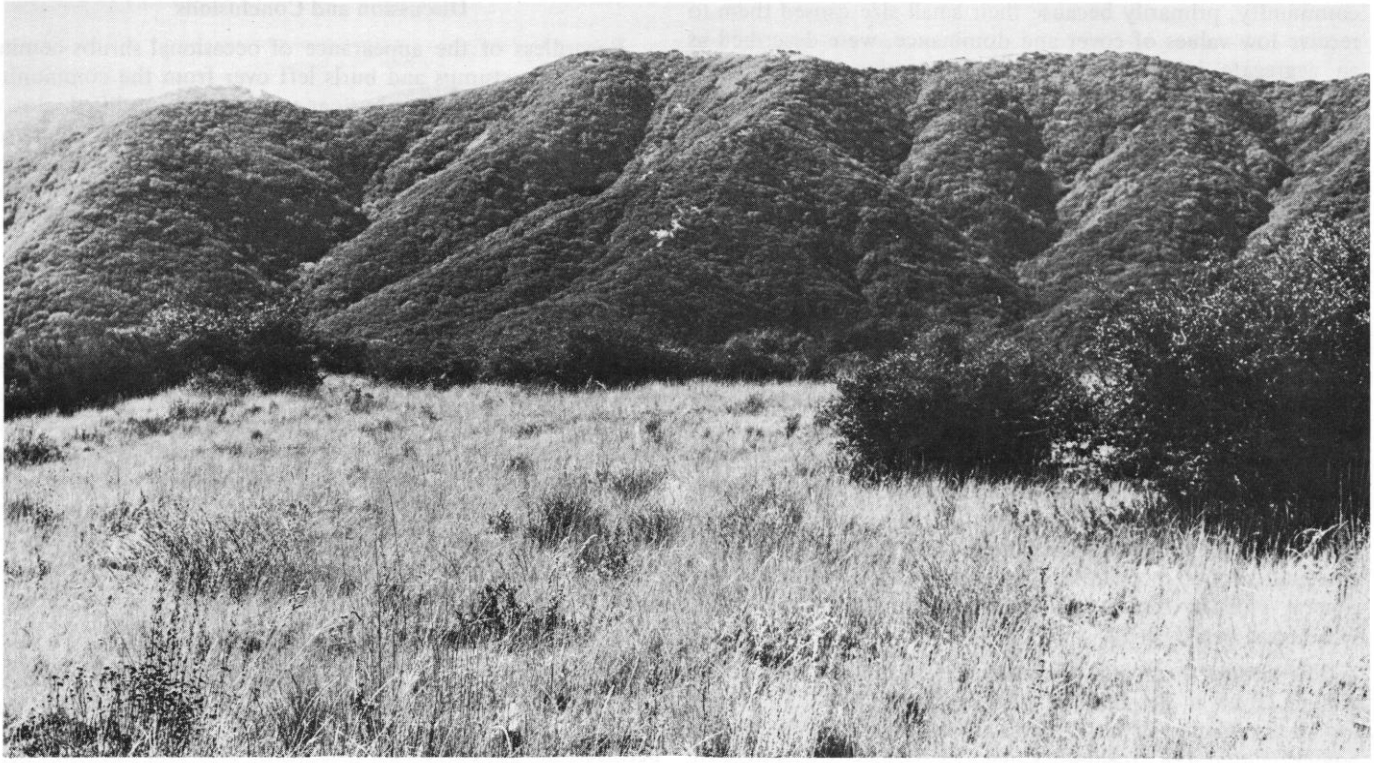

Fig. 1. *Modified plot showing conversion from chaparral to grassland in the Mud Flat region of the San Bernardino National Forest, San Gorgonio District, California.*

frequency were totaled to obtain importance values (I. V.) (Wilson and Vogl, 1965; Curtis and McIntosh, 1951).

Additional measurements included elevation, exposure, percent of slope, and lists of ground cover species in the quadrats.

Vegetation characteristics of the modified plot were studied at 10 sites located 100 ft apart along each of 10 transect lines. Each site was sampled by an integrated plot consisting of a 20-ft diameter circular plot superimposed over a 1 X 20-foot belt transect (Nord, 1965). Within the circular plot, which represented 1/138 acre, all shrubs were counted to obtain density per acre.

The basal cover (area) by plant species inside the belt transect was measured by a pocket tape to ascertain the area taken up by the plant at ground level. The basal area of the bunchgrasses was computed from the average diameters of clumps. The average diameter of stems was used to determine basal area of shrub and forb species (Hutchings and Pase, 1963).

The belt transect was broken into twenty contiguous sections, each 1 ft square. Clumps of the two bunchgrass species present were counted as an aggregate in each quadrat to determine percent frequency and density per plot. Likewise, individuals of the remaining species were counted in each quadrat but were found too insignificant in number to be considered further.

Table 1. Density per acre of the shrub species in modified and natural chamise chaparral plots in the San Bernardino National Forest, Calif. (Measurements in modified plot exclude chaparral islands.)

Species	Natural plot	Modified plot
Chamise	2800	28
Deerweed	–	721
Eastwood Manzanita	484	55
Hollyleaf cherry	112	70
Quixote plant	348	111
Scrub oak	1152	55
Chaparral whitethorn	104	–
Aggregate[1]	112	–
Total	5112	1040

[1] Includes: white sage, black sage, honeysuckle, redberry.

Results

Tabulation of the important shrub species in the natural chaparral plot (Tables 1 and 2) indicates the structure and composition of the modified plot before conversion to grassland in 1967. Density per acre of the important species in the natural chaparral plot is shown in Table 1; Table 2 lists the relative importance of each species in the community and serves as a species presence list for the control plot. Chamise receives the highest values for percent cover, relative dominance, and importance value. Scrub oak (*Quercus dumosa* Nutt.) is next in importance in the chamise chaparral of the study area. Eastwood manzanita (*Arctostaphylos glandulosa* Eastw.), quixote plant (*Yucca whipplei* Torr.) and chaparral whitethorn (*Ceanothus leucodermis* Greene) follow scrub oak in importance. Species that were relatively unimportant in the

Table 2. Average absolute cover (%), relative dominance, and importance value for shrub species in a chamise chaparral community in the San Bernardino National Forest, Calif.

Species	Cover	Relative dominance	Importance value
Chamise	39.4	57.2	126.1
Eastwood manzanita	4.8	6.9	26.1
Quixote plant	2.6	3.8	23.3
Scrub oak	20.9	30.3	65.6
Chaparral whitethorn	.8	1.2	8.6
Aggregate[1]	.4	.6	18.7

[1] Includes: white sage, black sage, honeysuckle, redberry.

community, primarily because their small size caused them to receive low values of cover and dominance, were described as an aggregate in Tables 1 and 2. The major species in the aggregate were white sage (*Salvia apiana* Jeps.), black sage (*Salvia mellifera* Greene), honeysuckle (*Lonicera subspicata* H. & A. var. *johnstonii* Keck), and redberry (*Rhamnus crocea* Nutt.).

Hollyleaf cherry (*Prunus ilicifolia* (Nutt.) Walp.) was absent from the line intercepts taken in the natural chaparral plots, but was present in the 1/40-acre quadrats and is listed in Table 1 as having a density about equal to that of chaparral whitethorn. Few other woody species were present in the natural chaparral of the study site, except occasional individuals located outside the sample plots. Among these species were knobcone pine (*Pinus attenuata* Lemmon), California wild lilac (*Ceanothus tomentosus* Parry), birchleaf mountain-mahogany (*Cercocarpus betuloides* Nutt.), and bigberry manzanita (*Arctostaphylos glauca* Lindl.). These occasional individuals found outside the sample plots tended to be more characteristic of manzanita chaparral, which is found in the general vicinity but at a higher elevation (Horton, 1960; Wilson and Vogl, 1965).

The natural chapparal plot contained very little herbaceous ground cover at the time of sampling (March, 1973), except for an abundance of basal leaves of soap plant (*Chlorogalum pomeridianum* (DC.) Kunth.) and occasional early leaves of annual grasses and forbs.

The original conversion treatments in the modified chaparral plot in 1967 reduced shrub density to near zero, but in the ensuing 6 years the shrub stand recovered to a density of 1040 plants/acre. Table 1 indicates 79.7% fewer shrubs per acre on the modified plot than on the natural plot in 1973. Likewise, there was a reduction in number of species (40%), with chaparral whitethorn, white sage, black sage, and other species of the aggregate listed in Table 1 missing from the modified plot. The modified plot, however, tended to favor deerweed (*Lotus scoparius* (Nutt.) Ottley), a shrub not present in the control plot (Table 1). Species which appeared least affected by the conversion were the quixote plant, which showed a reduction in density of 68.1%, and the hollyleaf cherry, which was reduced by only 37.5% (Table 1).

Replanting with grass in the modified plot following conversion resulted in a grass cover which measured 7% basal area. The intermediate and pubescent wheatgrass, considered as an aggregate, had a frequency of 87.5%, a density per plot of 2.7 bunches and an average area per plant of 4.2 inch^2.

Discussion and Conclusions

Regardless of the appearance of occasional shrubs coming up from the stumps and burls left over from the community before conversion, the physiognomy of the modified plot is decidedly that of a bunchgrass community. The chaparral islands retained in the modified plot were for the purposes of improving scenic quality in this brushland region and increasing the maximum edge, thus providing more cover for wildlife, particularly deer and quail (U. S. Forest Service, 1972).

Although not native to California, intermediate and pubescent wheatgrasses, which were planted following conversion in 1967, are apparently thriving and helping to form an established grassland community in the converted chamise chaparral plot in the San Bernardino National Forest. The 7% grass cover of the modified plot compares favorably with the 11% basal area reported by White (1967) for a natural bunchgrass community in California. This information indicates the success of chaparral modification procedures in southern California and is part of a larger project, currently in progress, which is evaluating the effect of chaparral type conversion on wildlife populations.

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