CHAPARRAL SHRUB CONTROL
GRAZING, HERBICIDES

Best control of chaparral shrubs on rangeland at Hopland Field Station has been achieved with the use of herbicides. In both grazed and ungrazed areas, chemical control reduced the brush to less than 1% of the plant cover within four years and maintained a very low level for the 14-year period of the experiment. Grazing without other controls had little influence on the results, except for a re-occurrence of poison oak in ungrazed areas. Fire reduced the composition of brush for the first two years, but peaked out in the sixth year with a gradual decline thereafter.

ON MOST rangeland areas, shrub species play an important part in the total feed resources for livestock and wildlife. Since these woody shrubs are in many places the dominant cover, their management becomes critical for best use of this resource. At present, people concerned with shrub ecology include range livestock managers, homeowners, hydrologists, soil scientists, air pollution board members, and land planners. The basic objective is to make the shrub cover compatible with the use of the land, whether for livestock, recreation, or for human residence.

The area in California covered by shrubs varies from 10 to 25 million acres, depending on how the shrubs are classified. These areas range from sea level to more than 8,000 ft in elevation. The chaparral shrubs are generally considered to cover about 10 to 15 million acres, much of it on rocky soil and often on steep slopes. Production of food for animals is low on areas occupied by mature shrubs, but its potential is better if the shrub cover is reduced in density and the open space seeded to grasses and herbaceous plants.

Proper management of shrub lands is important because (1) wildfires in shrub areas cause more than one million dollars damage annually, but could be reduced by judicious use of fire, chemicals, and grazing; (2) dense shrub areas use water that could be put to better use; (3) wildlife thrives where shrub cover is reduced,

AS INFLUENCED BY AND FIRE

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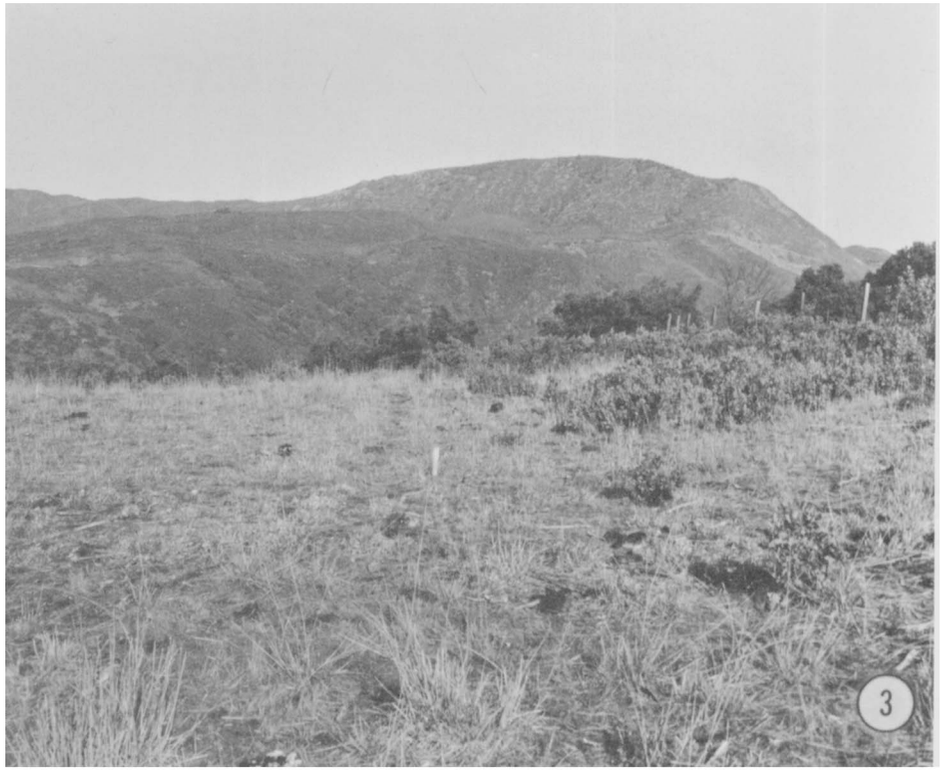
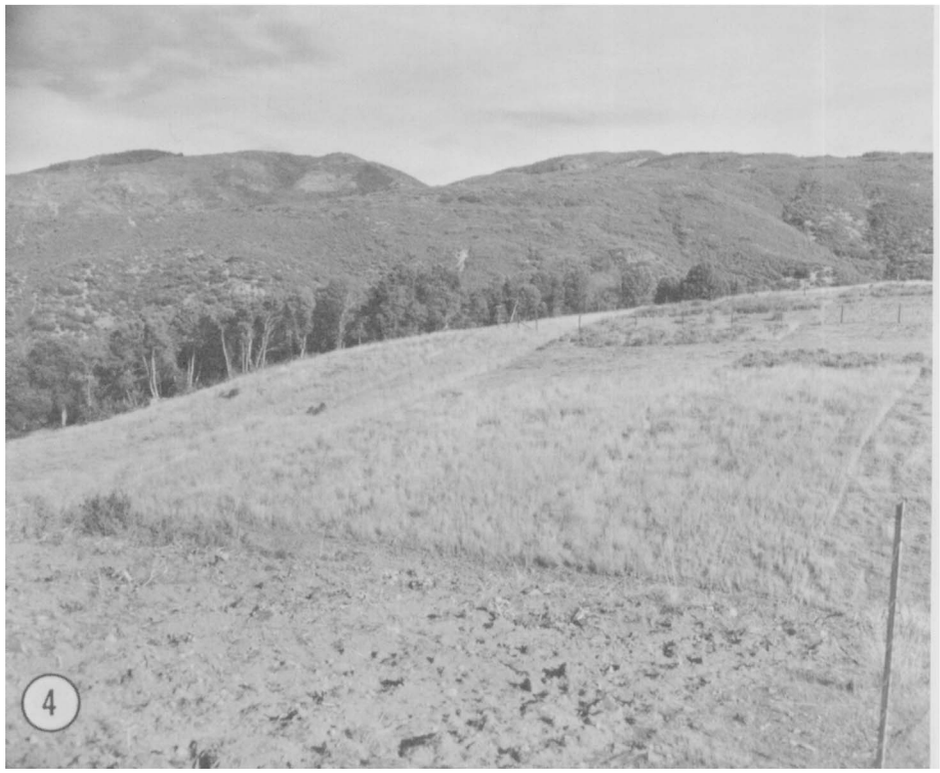
with open areas producing two to three times as many deer as dense areas; and (4) livestock production can be increased fourfold if shrub density is reduced and grass and clover are added. By 1954, up to 227,000 acres were being managed by controlled burning. By 1971, however, this amount had fallen to 50,000 acres annually, because of the increased number of regulations, such as air pollution controls and local restrictions, and because of the growing number of dwellings in rural areas, which increases fire damage risk. In addition, when land changes hands, the new owner is often not aware of the value of brush management.

To understand the part played by fire, chemicals and grazing in shrub management, a study area was established at Hopland Field Station in southeastern Mendocino County on an extensive brushfield area straddling the Lake-Mendocino county line. The shrubs were growing in a shallow Los Gatos soil containing coarse rock fragments, on a moderate slope with a westerly exposure at an elevation of 2,200 ft. The area has a history of periodic burns, the most recent in the late 1940s. At the start of the study the brush was over 6 ft high and dense enough to make traversing the area difficult.

Plants on the site included dwarf interior live oak (*Quercus wislizenii* var. *frutescens*), scrub oak (*Q. dumosa*), leather oak (*Q. durata*), common manzanita (*Arctostaphylos manzanita*), Eastwood manzanita (*A. glandulosa*), hoary manzanita (*A. canescens*), chamise (*Adenostoma fasciculatum*), wavyleaf ceanothus





1. Dense brush in study area before treatment (photo Feb. 1956).

2. Comparison of burning (right) and chemical treatment (left) without grazing in 1964 (photo Dec. 16, 1964).

3. Comparison of burning (right) and chemical treatment (left) with grazing in 1964 (photo Dec. 16, 1964).

4. Treatment study area after burning brush and seeding (right center) showing fenced area for evaluating effects of grazing (photo Jan. 13, 1961).

5. Manzanita was the dominant shrub (right) where grazing was the only treatment, while the burn treatment area (left) shows only low growing live oak shrubs (photo March 12, 1973).

6. Chemically treated shrubs (right) show no new plants developing after 14 years, whereas the shrubs (left) with only grazing have crowded out grass cover (photo March 12, 1973).

(*Ceanothus foliosus*), poison oak (*Rhus diversiloba*), chaparral pea (Pickeringia montana), and coyote bush (Baccharis pilularis). Of these eleven species, all but two sprout from the basal stumps. Manzanita, chamise, and ceanothus also develop dense stands of seedlings following burning, providing strong competition to herbaceous vegetation. Many brush seedlings die from water stress; only a few survive when a dense stand of grass is present.

The climate of the area is generally rainy from about October to May, with an average annual precipitation of about 40 inches. During the hot summer the plants are quite dry and are thus susceptible to the recurrent fires that characterize an area with this type of shrub formation. When treatment began in the fall of 1956, the first step was to crush the shrubs with a bulldozer, and then burn them. The following autumn, the area was seeded with a rangeland drill using Harding, Palestine orchard, smilo, blando brome, and annual rye for grasses. Rose, crimson and subclover made up the legume component. The clovers, however, did not become successfully established because of unfavorable environmental conditions. To aid the seeded species on this poor site, fertilizer in the form of 16-20-0 was applied at the rate of 370 lbs per acre.

Fencing was placed around one portion of the area, to restrict deer and livestock and thereby form a control section for measuring the impact of animals on brush. The fence was also designed to prevent rodents from using the fenced portion. Within both the fenced and the non-fenced areas, some of the resprouting brush plots were treated with chemicals and fire, while others received no treatment following the burn.

Chemicals

The chemical treatment was standard brush killer (2,4-D and 2,4,5-T) at 4 lbs active ingredient per 100 gallons of water with 1% diesel oil, using a hand-operated backpump with a boom-type sprayer. The first application of herbicide was in June 1958, the second year following the burning. In 1959 and 1963 the sprouts surviving were treated again. These three treatments were sufficient to control all the brush species in the chemically treated plots.

In the plots treated with fire only, it was necessary to repeat the burn in 1959, three years after the initial fire, because of regrowth of brush sprouts. Another repetition was needed in 1963. The next

fire treatments, in 1967 and 1970, were needed only in the area protected from grazing, since the livestock and wildlife in the grazed portion provided sufficient control of the brush sprouts.

Grazing effects

In the ungrazed plots and in the plots where grazing was the only control of brush, no difference in amount of brush was evident in the first two years of the study. Thereafter the ungrazed brush expanded at a more rapid rate than the grazed, consisting of 99% of the plants in 1964, while the grazed brush was 76%; the difference by 1972 was much smaller—99% and 97%, respectively (chart 3).

A comparison of effects of grazing on four brush species can be made by using height measurements. Manzanita attains the greatest height (5 ft) with grazing, followed by live oak (3 ft), poison oak (1 ft), and chamise (1 ft) reflecting the relative palatability of these species. Where not grazed, the growing vigor of live oaks was demonstrated by greatest height (7 ft), chamise and manzanita were equal (5 ft), and poison oak was lowest (3 ft).

Growth patterns

The contrast of growth patterns between live oak and manzanita is interesting. Live oak, a palatable species, shows a marked reduction in stand where grazing was the only control for 14 years. The percent of stand dropped 30%, from 52% to 22%. Where fire was used, the difference with grazing was 14%, from 19% to 5% (see chart 1).

Manzanita, a shrub with low palatability, shows growth patterns different from those above. In the area with grazing as the only shrub control, the difference after 14 years was 33%, with 69% manzanita where grazed and 36% where not grazed. The explanation is that the palatable species in the stand are grazed, allowing the little-used manzanita to dominate the area. But in ungrazed plots the more dominant live oak tends to crowd out the lower growing manzanita. Where fire is used, the grazing treatment has minor impact in percent cover (chart 2). For the other species, ceanothus generally increased in the nongrazed areas for about six years, but was then crowded out by the more vigorous species. Chamise, on the other hand, was more abundant where not grazed but only represented a low percent of cover.

The best brush control was achieved with the use of herbicide. In both the grazed and ungrazed areas chemical treatment reduced the brush to less than 1% of the plant composition by 1964 and maintained a very low level for the 14 years of the experiment (chart 3). However, at the end of this period poison oak was beginning to occur in the ungrazed treatment, while none was present in the grazed treatment. In contrast, fire reduced the amount of brush for the first two years, but its effectiveness peaked out in the sixth year, with a gradual decline thereafter. In 1960 the fire controlled grazed brush was 14% of the stand; in 1964, 29%; and in 1972, 7%, while the area without grazing for the same dates was 22%, 67% and 66%, respectively.

Total effects

When the effect of the treatments on the total brush cover is examined, it is evident that chemical control was by far the most efficient method and that grazing without other controls had little influence on the results. For tractor boom-type spray equipment the chemical cost will vary from $8 to $12 per acre for the initial spray, with about $4 for a follow-up spray.

When fire is the major control element, it opens up the brush considerably; when used in conjunction with grazing, its effectiveness is greatly improved—in this study about 60% less brush grew when the burned area was grazed. Burning costs between $8 and $10 per acre initially, with the follow-up burns costing about $5. These are needed about every three to four years if the burned area is not grazed, but less frequently if the area is used heavily by livestock.

Grazing only

Where grazing is the only control, the grazing merely lengthens the time it takes for the brush to occupy the area completely and does not achieve satisfactory control.

These studies point out some alternatives that can be used to keep brush within manageable limits, and costs within economic limits—especially in high risk ares where uncontrolled wildfires can result in losses to property and suppression costs that run into millions of dollars.

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CHART 1. LIVE OAK COVER

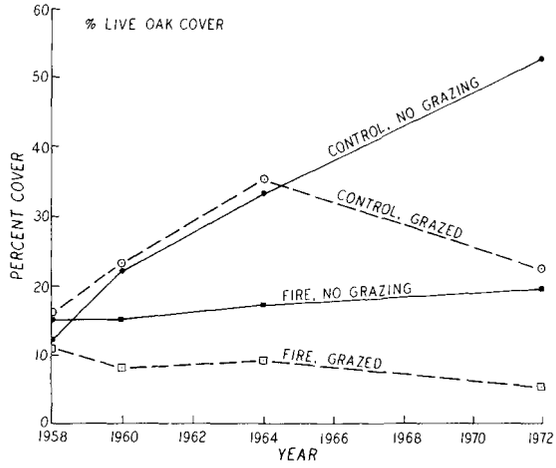

CHART 2. MANZANITA COVER

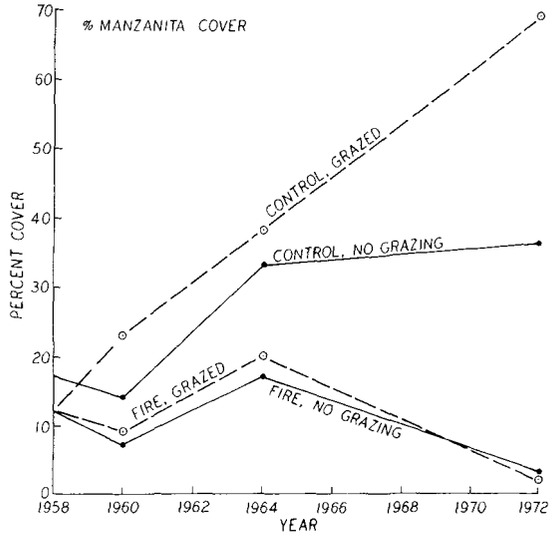

CHART 3. TOTAL BRUSH COVER