



Vegetation changes produce benefits

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An area once covered with chaparral (above) now contains demonstration plots showing the effects of different management techniques following burning and seeding (below).



The Hopland range area has more than 500 plant species, some of which were introduced from other parts of the world, and an understanding of the ecology of these plants is important for intelligent management of the vegetation.

The vegetation can be divided into herbaceous and woody plants. Herbaceous vegetation consists of grasses, clovers, and almost all of the nonwoody plants collectively referred to as the California annual type of plants. Woody vegetation refers to trees, such as oaks, madrones, California bay, and some coniferous species, and to shrubs, such as chamise, manzanita, ceanothus, and California holly. Many of the plants, whether herbaceous or woody, are copious seed producers.

The herbaceous vegetation has been used for a number of studies--management by cutting or grazing; applying fertilizers to encourage growth; introduction of other plant species for improved production; using chemicals and fire to change growth patterns; determining effects of frequency and timing of grazing; and determining the influences of climate, soil, and exposure.

In one study, it was found that as many as 13,104 plants occupied a square foot of grassland. The average density of plants, however, varied from 475 to 5,040 plants per square foot. Most of the germination took place after the first 1/2 to 1 inch of rain in the fall, and all species decreased in numbers per unit of area from December to June.

Forage production

Samples taken for 23 years show that forage production varies from 900 pounds to 3,500 pounds of dry weight per acre. Plant germination can be as early as September or as late as December. If rains start growth in the warm, early fall months, the plants generally develop faster and have a longer growing season. Usually, if 8 inches or more of rain have fallen by the third week in November, forage production for the remainder of the season will be above average.

The grassland areas support mostly annual plants, because their growth cycle matches the rainfall and temperature patterns in the Mediterranean-type climate. The grasses that make up the bulk of the population are bromes, fescues,

wild barley, and wild oats. The forbs include filaree, clovers, and numerous other broadleaved plants. Some are very palatable; others have little or no use. Their feed value varies according to season. They are almost all well used when young but, as some types mature, they form barbed seedheads, thorns, or awns which become objectionable to animals and are avoided. The seedheads on other plants lacking sharp stickers are often sought out by animals because of their palatability.

Studies show that the amount of plant residue left on the ground after grazing influences plant composition the next growing season. Broadleaf plants such as filaree and the short-growing grasses are more plentiful when little plant residue is left, and soft ches and wild oat do better when residue is abundant.

Grazing animals obviously influence vegetation. If the animals crop the vegetation closely, clovers and broadleaf plants are generally favored. If they do not graze closely, grasses are generally encouraged.

The attractiveness of plants as food to livestock varies as the plants mature. If the plants are not managed properly, livestock tend to eat the more palatable plants as they mature and reject those with objectionable characteristics. A plant population can be grazed so that the poorer forage plants survive and the better plants perish. A study with medusahead, a weedy grass, indicated that sheep would eat the plant when green but not when headed; however, when heavily grazed in the spring, a thinner stand resulted at maturity than if it was lightly grazed.

Studies also have shown that the composition of plant populations can be altered with chemicals to suit management needs for either an abundance of grasses or some other plant category. Using selective herbicides is one way to do this. Some materials kill only grasses; others kill only broadleaf plants.

The plant species vary greatly among years. If germination is early, plants are better developed to withstand the stress of uprooting from soil heaving caused by winter frost. Late development means the root structure is more easily pushed up in the soil. Usually, in wet years, grass dominates and, in dry years, broadleaf plants, such as filaree, dominate. A "good" clover season usually

develops with early germination. The extent of these variations is illustrated from vegetation composition studies showing a high of 74 percent grass in 1958 and a low of 36 percent in 1963. Annual clover averaged about 10 percent and filaree about 17 percent, while the perennial grasses were rarely more than 2 percent.

Exotic forage plants have been introduced to improve the quality and quantity of feed. Blando brome, a strain of soft ches; certain rye grasses; and two



perennial grasses, hardinggrass and Palestine orchard grass, have been introduced over the years and found suitable. Several clovers found widespread use once their nutrient and inoculation problems were solved. These included several strains of rose clover, 12 strains of subterranean clover, and, occasionally, Salina clover for damp locations.

These plants are capable of higher production than the resident annuals and either are green longer or make better quality dry feed. Once the introduced

A good stand of grass replaces brush, making this area once again valuable to livestock and wildlife.

plants are established, their nutrient needs must be met with proper fertilization, and grazing must be managed so other plants do not crowd them out. Clover-improved pastures, particularly, need to be grazed so taller grasses will not crowd them out.

Trees and shrubs

Woody plants also have to be managed for best production. They are usually divided into two categories--trees and shrubs. Trees generally grow on deeper soils and favor a more moist, north exposure, but they are scattered widely throughout the grassland community. Shrubs generally grow on the rocky, thin soils at higher elevations and form dense canopies that usually exclude herbaceous plants.

The principal tree species are oaks. The station has 10 species, representing both evergreen and deciduous types. Other common trees are madrones and California bays. Most all of the tree species will sprout if the tree is cut or the foliage is removed by fire. Some of the trees can be found in typical brush areas, usually growing in a more diminutive form.

The shade of the trees modifies the type and reduces the density and production of plants growing under the canopy. Under a moderate tree density, forage total is reduced by 500 pounds per acre compared with production in open grasslands. A very dense tree canopy will nearly eliminate ground cover vegetation. Dense stands of brush also do this. To increase forage production, these woody plants should be removed or thinned.

In several watershed projects, tree canopies have been opened up and the effects on soil erosion, water yield, and grazing productivity studied. In one case, trees were felled by cutting with a chain saw and then removed by burning. Almost all of the trees sprouted after this treatment. To prevent regrowth, the sprouts had to be sprayed with a combination of 2,4-D and 2,4,5-T herbicides. The result was good conversion to herbaceous vegetation, but the cost of labor for chain sawing and sprout spraying was high.

By putting various types and amounts of herbicides into cuts around the trunks, it was found that a low-cost amine formulation of 2,4-D does an

excellent job of killing trees at a much lower cost than using a chain saw and spraying. A cut is made into the cambium layer around the tree base, and about 1/4 teaspoon of herbicide per inch of diameter is placed in the cut. The equipment is inexpensive--axe and oil can for herbicide--and the sprouting problem is eliminated because the chemical kills the tree. The tree can be treated almost anytime during the year, but results are best when the ground is moist. Usually, the trees die in 3 to 6 months, and most of the trees will rot and fall 2 to 4 years after treatment. As the canopy opens under treated trees, herbaceous growth has increased as much as four or five times above its previous level.

Brush-covered areas offer more of a management challenge because more plant species are involved, the soils are less productive, and the terrain is rough and steep. When mature, brush stands inhibit the passage of animals and create a fire hazard. Brushlands can be managed intelligently by the judicious use of grazing, fire, and chemicals. If left unmanaged, brush that has been burned will regenerate by sprouting and thicken into a dense cover in 10 to 15 years. This regrowth can be slowed if used by animals for feed. If the area is suitable, herbaceous plants can be seeded and the brush sprouts held down by burning every 3 to 6 years or by spraying with brush-killing materials. Proper brush management can lead to complete conversion to herbaceous cover or any degree of brush density required for the land use needs.

Economics

With the various land management techniques available, it was necessary to determine whether the economics of production would sustain the improvement. On some of the treated pasture areas, animal production was measured and then compared to improvement costs to determine the time period required to recover the investment. Generally, the more productive land resulted in quicker returns and the poor sites in slower returns. Usually, areas with good tree cover would return the cost of improvement in 2 to 4 years, but this time could be as great as 8 to 10 years on the thin-soiled brushy areas. This means that site selection is an important consideration if

improving woody areas is to be profitable.

Plants are versatile, and the studies at the Hopland Field Station and other locations have shown that they need to be intelligently managed to make best use of our land resource.

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Selected bibliography

CHANGES IN A CALIFORNIA ANNUAL PLANT COMMUNITY INDUCED BY MANIPULATION OF NATURAL MULCH

Heady, H.F. 1956. *Ecology* 37(4):780-812.

VEGETATIONAL CHANGES IN THE CALIFORNIA ANNUAL TYPE

Heady, H.F. 1958. *Ecology* 39(3):402-416.

STUMP SPROUT CONTROL

Leonard, O.A., and A.H. Murphy. 1964. *Calif. Agric.* 18(4):7

QUALITY AND YIELD OF FORAGE AS AFFECTED BY CHEMICAL REMOVAL OF BLUE OAK (QUERCUS DOUGLASII)

Murphy, A.H., and B. Crampton. 1964. *J. Range Manage.* 17(3):142-144.

COST OF TREE REMOVAL THROUGH CHEMICALS

McCorkle, C.O., Jr., A.H. Murphy, L. Rader, and D.D. Caton. 1964. *J. Range Manage.* 17(5):242-244.

PREDICTED FORAGE YIELD BASED ON FALL PRECIPITATION IN CALIFORNIA ANNUAL GRASSLANDS

Murphy, A.H. 1970. *J. Range Manage.* 23(5):363-365.

BRUSHLAND RANGE IMPROVEMENT...ECONOMIC VALUES

Murphy, A.H., and D.T. Torell. 1972. *Calif. Agric.* 26(6):5-6.

EVALUATION AND MEASUREMENT OF CALIFORNIA ANNUAL TYPE

Heady, H.F. 1956. *J. Range Manage.* 9(1):25-27.

CHAPARRAL SHRUB CONTROL AS INFLUENCED BY GRAZING, HERBICIDES, AND FIRE

Murphy, A.H., and O.A. Leonard. 1974. *Calif. Agric.* 28(1):10-13.

MANAGEMENT OF CLOVERS ON CALIFORNIA ANNUAL GRASSLANDS

Murphy, A.H., M.B. Jones, J.W. Clawson, and J.E. Street. 1973. *Calif. Agric. Exp. Stn. Circ.* 564.