

tion of the sites. Except in the short grass prairie where grama-buffalograss and dropseeds make up a high percent of the composition, a diverse mixture of good grasses (annual or perennial-cool and warm season), forbs (annual and perennial), and several palatable shrubs with persistent leaves is my choice. Many experienced cowmen in the

Southwest claim to have better condition animals coming off range with a variety of these plants. Consequently, I do not believe that good range and good forages are equatable. Soil-site potential, livestock performance, and managerial skills are the master keys to successful ranch management.

'Lassen' Antelope Bitterbrush: a Browse Plant for Game and Livestock Ranges

Nancy Shaw and Stephen B. Monsen

A unique selection of antelope bitterbrush (*Purshia tridentata* [Pursh] DC) recently became the first accession of this valuable western shrub species to be released for commercial seed collection and production. Chosen for its productivity, palatability, winter leafiness, cover value, and seedling vigor, 'Lassen' antelope bitterbrush is a useful shrub for wildlife and livestock ranges, conservation plantings, and reclamation projects on adapted sites in the Intermountain and Pacific Northwest regions.



'Lassen' antelope bitterbrush growing near Johnstonville, Lassen County, California.

The release of 'Lassen' resulted from cooperative efforts of the USDA Forest Service, Intermountain Forest and Range Experiment Station; USDA Soil Conservation Service; Utah Division of Wildlife Resources; Nevada Division of Forestry; California Department of Fish and Game; California Department of Forestry; California Agricultural Experiment Station; Idaho Agricultural Experiment Station; Nevada Agricultural Experiment Station; and Oregon Agricultural Experiment Station.

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Description

'Lassen' antelope bitterbrush is unusual in its large size, uniform growth habit, and morphology of mature plants. Shrubs are upright with a spreading, leafy crown. Depending on site conditions, plants vary from 5 to 9 feet tall with crown diameters often exceeding the height. In early spring and summer, numerous solitary flowers and large achenes develop over the periphery of the crown on stems produced the previous years. Seeds ripen in early July and are quickly disseminated. In fall, fascicles of small, pubescent overwintering leaves replace the more abundant summer foliage. 'Lassen' tends to be leafier in fall and winter than many sources of antelope bitterbrush, which may account for its relatively high nutrient value during this season. On a dry weight basis, Welch et al. (1983) obtained in vitro protein content and digestibility value of 7.9 and 30.6 percent, respectively, for leaders collected in February. These were higher than values obtained for other sources of antelope bitterbrush and lower than Stansbury cliffrose or desert bitterbrush. Leaves constituted 15.1 percent of the new growth.

Origin and Development

In the 1940's, concern over deterioration of big-game and livestock ranges in northeastern California spurred researchers from the Pacific Southwest Forest and Range Experiment Station and the California Department of Fish and Game to begin investigations of antelope bitterbrush ecology and use of the shrub in range revegetation programs. In 1952, E.C. Nord made initial collections of 'Lassen' for inclusion in selection trials and seeding studies from stands near Janesville, Lassen County, California. The elevation at Janesville is approximately 4,200 feet with a mean annual precipitation of 14 inches. The temperature averages 49° F with summer highs of 100° F and winter lows of 15° F, although extremes of 106 and -17° F are on record. Associated species are basin big sagebrush, rubber rabbitbrush, and on moister sites, ponderosa pine (Nord 1965, Alderfer 1977).

In 1953, A.P. Plummer and A.T. Bleak obtained seed from the Janesville area for testing in Utah and Nevada. Plantings were extended to Idaho in 1956 by R.C. Holmgren. Interest in the characteristics and adaptability of this source led to

further studies by the Utah Division of Wildlife Resources and the Intermountain and Pacific Northwest Forest and Range Experiment Stations in Utah, Idaho, Oregon, and Nevada (Edgerton et al. 1983, Welch et al. 1983). The California Department of Fish and Game and commercial seed dealers annually collect large quantities of seed from the Janesville area for seedings in California and other western states. The site produces a considerable quantity of seed most years, and extensive plantings have been established using this source.

Uses and Adaptation

'Lassen' performs best on deep, coarse, well-drained, neutral to slightly acidic soils on sites from 3,000 to 6,000 feet in elevation. Pumice sites and coarse, granitic soils in northern California, central Idaho, and eastern Oregon are good sites for stand establishment. Areas of greatest adaptability are antelope bitterbrush-bunchgrass, ponderosa pine-antelope bitterbrush, mountain brush, and basin big sagebrush communities receiving from 12 to 24 inches of annual precipitation.

Vigorous seedlings and rapid growth make 'Lassen' a useful selection for seeding projects. Established stands provide valuable fall and winter forage for big-game animals and are heavily used by livestock. Under moderate to heavy grazing, 'Lassen' is highly persistent. It provides more available forage than low, spreading forms of antelope bitterbrush, particularly when a snow cover is present. Excessive browsing results in severe hedging and production of forage beyond the reach of browsing animals. The selection does not tolerate burning; root sprouting is rarely observed.

Because of its growth habit and unusual size, 'Lassen' can provide critical summer or winter cover for wildlife and livestock. It adds diversity to conservation and reclamation plantings and is an attractive, low maintenance shrub for roadways, campgrounds, and recreation areas.

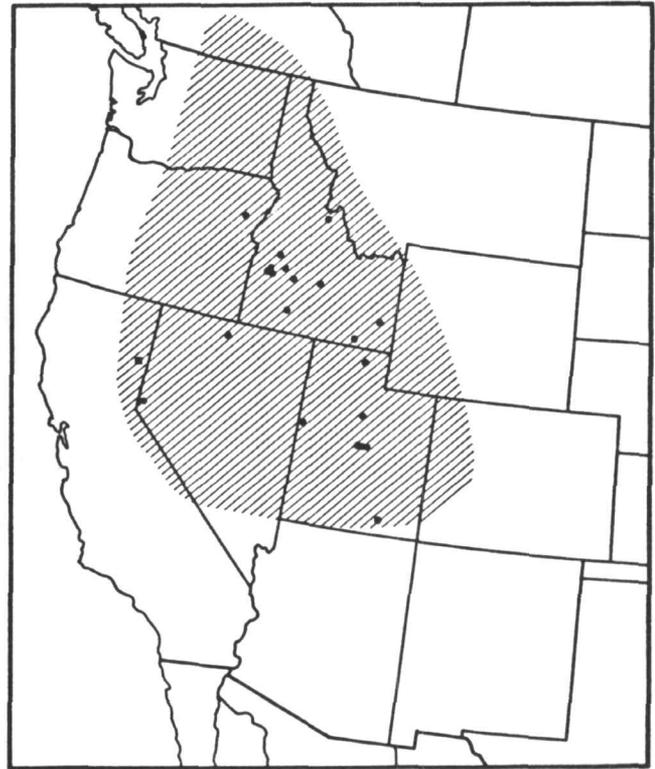
'Lassen' is especially well suited to planting with understory grasses and broadleaf herbs. Mixed plantings are extremely productive and can be grazed by livestock or wildlife. Mature stands of antelope bitterbrush do not reduce grass-herb production, but tend to increase forage yields, particularly of species such as intermediate wheatgrass and smooth brome.

Establishment

Small seedlings are sensitive to competition from grasses and weeds. However, 'Lassen' can be interseeded into established stands of grass or planted in conjunction with grasses and herbs if the seeds are planted in separate rows, strips, or spots at least 15 inches from adjacent grass rows. Seed should be planted about 0.5 to 1 inch deep in a firm seedbed.

Seeds are readily gathered and eaten by rodents. Consequently, seeding in the late fall or early winter reduces rodent predation and provides an adequate stratification period to break dormancy. Spring seeding requires pretreatment with hydrogen peroxide or gibberellic acid. Planting barefoot or container seedlings provides rapid establishment on sites that are difficult to seed.

Control of vegetative competition, rodent populations, and browsing during the first two growing seasons improves stand survival and accelerates development. On favorable sites, seeded plants begin to provide an adequate amount of forage in 3 to 5 years. Although young plants can withstand heavy browsing by big-game and livestock, growth is seriously depressed by excessive use.



Sites where 'Lassen' has been successfully established (●). Native stand (■). The variety is recommended for planting on adapted sites within the shaded area.

Maintenance and Availability

Seed harvested from wildland stands in an area between Doyle and Susanville, Lassen County, California, may be certified for commercial sales. Seed collectors should contact the California Crop Improvement Association, 231 Hunt Hall, University of California, Davis, California 95616 for information regarding certification procedures and costs.

Recognized classes of plant materials are foundation and certified seedlings. The California Department of Fish and Game maintains a population of parent plants on a site near Janesville. An orchard of foundation plants will be maintained by the Nevada Division of Forestry at the Washoe Valley Nursery, Carson City, Nevada.

Certified container seedlings for the establishment of certified seed orchards will be available from the Nevada Division of Forestry, 201 S. Fall Street, Carson City, Nevada 98701 in the fall of 1985. They should be planted on 10 foot centers with a minimum of 200 plants per orchard. With adequate care, plants begin to produce seed in about 3 to 4 years. Cultural information and recommended seeding prac-

tices may be obtained from the Nevada Division of Forestry or the Shrub Sciences Lab.

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Oak Consumption by Cattle in Arizona

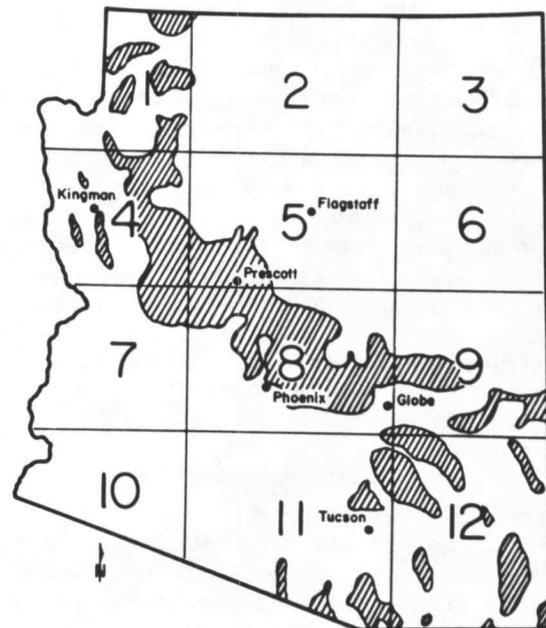
G.B. Ruyle, R.L. Grumbles, M.J. Murphy, and R.C. Cline

Cattle poisoning from consumption of oak leaves, buds, and acorns is widespread throughout the United States. The outbreak of oak bud poisonings that killed thousands of cattle in California during 1985 exemplifies the potential hazards that exist when livestock graze oak rangelands. Oak poisoning in cattle is generally a seasonal problem, occurring in the spring when new buds offer early green forage, and in the fall after acorns drop. The most likely toxic principles are tannic acids, or tannins. The level of toxicity is variable but poisoning problems can occur regardless of the plant part consumed (Kingsbury 1964, Panciera 1978).

Cattle can consume up to 50 percent oak buds and leaves in their diet without signs of poisoning but greater amounts lead to clinical toxicosis and death (Kingsbury 1964, Dollahite 1966). Tannin levels in oak may range from 2 to 6 percent (Dollahite et al. 1966). After ingestion, oak tannins are broken down into gallic acid and pyrogallol, chemicals toxic to cattle (Sandusky et al. 1977). Tannic acid toxicosis causes renal disease and subsequent kidney failure (Panciera 1978).

The initial clinical signs of oak poisoning in cattle include gauntness, listlessness, and constipation, followed by diarrhea, excessive thirst, and frequent urination (Kingsbury 1964). Rumen and renal function are reduced (Sandusky et al. 1977, Panciera 1978). Necropsy and histological findings are well-described (Sandusky et al. 1977, Panciera 1978), and should be easily recognized by a veterinarian. Histopathologic lesions are marked, and with the history of ingestion of oak leaves and necropsy lesions, a firm diagnosis can be made.

Oak consumption by cattle may also contribute to general unthriftiness of the cow herd long before the induction of



Shrub live oak distribution in Arizona. The twelve designated areas correspond to Table 1, and indicate general locations where cattle fecal samples containing oak were collected.

classical signs of toxicosis since tannins have negative effects on forage digestibility (McLeod 1974, Provenza and Malechek 1984). High levels of condensed tannins in livestock diets may depress protein and fiber digestion (McLeod 1974). It seems likely, therefore, that moderate levels of oak consumption by cattle, while not inducing the classical signs

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