# The Life History of Deerbrush–a Fire Type

**FRED P. CRONEMILLER**

*Forest Service, U. S. Department of Agriculture, San Francsico, California.*

Among the various ecological factors that control the composition of vegetation, fire has been a major one in many parts of the world. Grasslands that support game and livestock herds in central Africa have been kept free of the invading acacia by fire, both accidentally and intentionally. The chaparral of the Pacific Southwest is mostly a "fire type," maintaining itself either by sprouting immediately after fire or by producing hard-coated seeds that await treatment, such as the heat of a fire, and then abundantly reseed the devastated area.

The composition of the forests of the United States has been governed by fire to a major degree. In the West, herbaceous and shrubby species have been encouraged when fire thinned the forest canopy, and they have often gained competitive advantage over tree species, temporarily at least, by their ability to regenerate quickly.

Fires in the ponderosa pine type are often of such severity that a part of the forest is destroyed, and light reaching the forest floor is markedly increased. There follows rapid growth of various species of shrubs. Some originate from sprouts, but most come from a great volume of seed accumulated in the duff on the forest floor. Such species as bear clover *(Chamaebatia foliosa)*, numerous manzanitas *(Arctostaphylos* spp.), and several species of ceanothus, particularly deerbrush *(Ceanothus integerrimus)*, may form pure stands. Deerbrush is particularly desirable as forage for livestock and wildlife and is one of the most important shrubby forage species in the mountains of California.

Deerbrush is a member of the buckthorn family *(Rhamnaceae)*. It is most widely known as deerbrush or sweet birch. It is also called mountain lilac, wild lilac, blue brush, buckbrush, rough brush, birch brush, snow brush, and soap brush. It is a somewhat open, spreading, deciduous shrub from 4 to 18 feet in height at maturity and having slender, graceful, somewhat drooping branches. It is widely branched and often as great in breadth as in height. The growth of the current year is a light yellow-green, the branchlets are pliant, and frequently 12 to 18 inches long. The leaves, soft and thin, are ovate to oblong ovate, entire, and characteristically three-nerved from the base. They are 1 to 3 inches long, smooth, and lighter green on the underside. They are arranged alternately on the stem. The flowers are predominantly white, but blue and occasionally pink flowered plants occur.

### Distribution

Deerbrush is in greatest abundance along the west slope of the Sierra Nevada between Kings River and Feather River. Altitudinally, it is found between 5,000 and 7,000 feet in southern California, 3,000 to 5,500 in the central Sierras, and 2,000 to 4,000 in northern California. This is roughly the floristic belt occupied by ponderosa pine *(Pinus ponderosa)*. Deerbrush occurs sparingly in the inner North Coast Ranges and in the Sierra Madres of southern California.

The shrub is found on almost any well-drained soil, even though considerable amounts of loose and broken rock are present. Shallow soils support only light stands and small shrubs.

On the Stanislaus Forest in the central Sierras where intensive studies were conducted, three grazing allotments embracing a total of 76,000 acres were surveyed intensively. On nearly 35,000 acres, or 45 percent of the area, deerbrush was an important component of the vegetation, with a density from 5 percent to 100 percent. In net surface area this was equivalent to 10,555 acres, or about 14 percent of the total. This quantity of

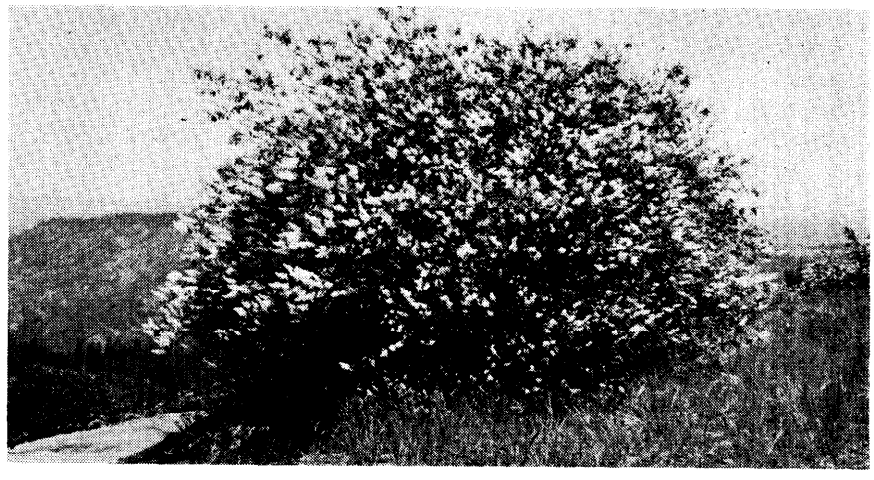

FIGURE 1. An 11 year old deerbrush plant in full bloom in the area of its optimum growth —Stanislaus National Forest.

FIGURE 2. One-year-old seedlings following a burn in ponderosa pine—Plumas National Forest. The seedlings not yet conspicuous, are but a few inches high, and may be eliminated by close grazing.

browse on a segment of the range is indicative of its importance.

### Reproduction

Reproduction of deerbrush is principally from seed, but stump- and root-sprouting are natural occurences. Being hard-coated, the seeds remain viable but dormant on the forest floor for many years. Just how many we do not know, but probably more than 20 years. Much seed accumulates during this time but requires some disturbance, such as forest fires and logging operations, for germination. Without disturbance, seed reproduction is extremely rare. Rodents, birds, or other animals show little interest in the seed. However, squirrels occasionally cache it, as evidenced by seedlings appearing in groups. The heavier stands of deerbrush which now exist are on areas that have been swept by fire within the last 30 years. Lighter stands are found on the disturbed soils of logging operations. The major part of the germination takes place the first year after the disturbance, a very small amount in the second and third. Rarely have any plants been found that germinated after the sixth year.

### Growth

Seedlings reach a height of 3 to 4 inches during the first growing season. The second year's growth usually, but not always, produces two branches besides the leader, the plant averaging 8 inches in height by the end of the season. During the third season it attains its typical branching form, begins to look bushy, and may reach 12 inches in height, more in years favorable to growth. In the third year, the grazing capacity steps up markedly, and in the next increases manyfold; the shrub grows vigorously in both height and breadth, often producing branches up to 14 inches long. On the better sites, rapid growth continues until the tenth to twelfth year, when the shrub reaches its maximum size for the site. On thin soils, mature plants may not reach a height of 4 feet. On better soils they reach 18 feet, with stems up to 4 inches in diameter. Full stands then produce a dense crown. The foliage below is shaded out, leaving a barren soil and a thick understory with little foliage available to livestock.

Where there is a residual stand of deerbrush at the time of a fire, there will be numerous basal sprouts. These grow rapidly, reaching a height of 30 inches or more the first year. Sprouts maintain their dominance over plants originating from seed through most of their life. However, they rarely make up more than 5 percent of the stand. On many areas no deerbrush is alive when a new burn occurs.

Very few plants reach 35 years of age. Stands in full sunshine are thrifty at 25 to 30 years, but then decadence sets in. Side limbs die back, no foliage is available to livestock, the shrubs lose their rounded form, and take on a sickly appearance. By the thirty-fifth year practically all plants fade from the scene. Reinvading conifer reproduction may compete with deerbrush for light and root space at the end of 10 years. After 20 years, where the trees form a full canopy, few deerbrush plants survive. Older plants occur only where they have considerable sun. A search for the oldest living specimen located one 47 years old.

A full stand of deerbrush contains about 300,000 seedlings per acre the year after a fire. These thin out naturally to 10,000 before the tenth year, to 2,500 or less by the twentieth, and to only a few hundred by the thirtieth.

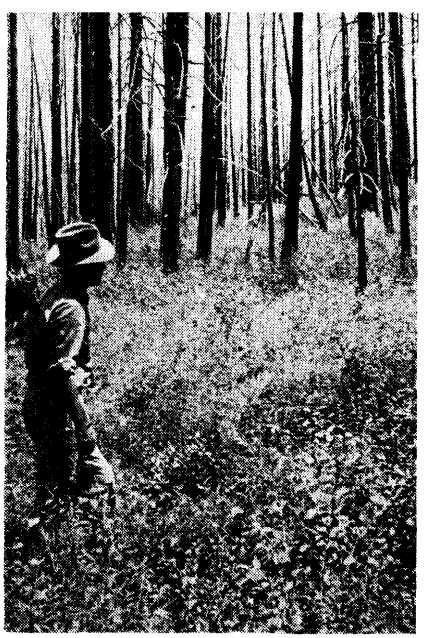

FIGURE 3. Three-year-old seedlings of deerbrush showing the beginning of vigorous growth and high forage production. The vegetation shown in this picture is over 95 percent deerbrush, all of which originated from seeds lying dormant in the duff on the forest floor—Stanislaus National Forest.

The density of full stands as measured by line interception is about 30 percent at 4 years. This jumps to 90 percent at 10 years; slowly thins out to 75 percent at 20 years; then drops more rapidly to 10 percent or less at 30 years.

### Ecological Relationships

#### To Ponderosa Pine

Deerbrush is but a temporary type in the ponderosa pine forests, growing almost exclusively where the forest has been partly or totally destroyed either by fire or by logging. Where seed trees remain, incense-cedar *(Libocedrus decurrens)* and ponderosa pine quickly reinvade. At first deerbrush predominates. If the trees produce seed after the burn or logging, tree reproduction may overtop the deerbrush within 8 to 10 years. If tree seed is a few years late, young trees are held back, and it may be 20 years before they are able to grow up through and above the vigorous deerbrush to attain dominance.

In practically all areas there is some reinvasion of the forest. If trees do not form a full stand at the time deerbrush reaches its life span, grasses and sclerophyllus shrubs, such as manzanitas and bear clover in thin stands provide an understory.

FIGURE 4. Deerbrush growth is slower and stands are thinner on shallow soils. A 15-year-old stand on a burn on the Stanislaus Forest.

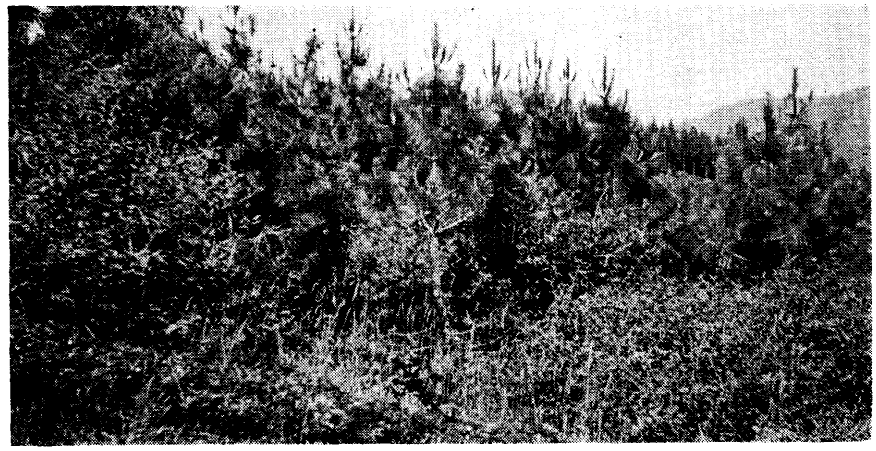

FIGURE 5. Ponderosa pine reproduction overtopping a 19-year-old stand of deerbrush Shade is eliminating this intolerant shrub.

#### To Other Shrubs

Deerbrush is often found growing in combination with manzanita, bear clover, whitehorn (*Ceanothus cordulatus*), gooseberries (*Ribes spp.*), and other plants. As long as these plants are the same size, or smaller, competition apparently does not retard the growth of ungrazed deerbrush. However, grazing at an early stage strongly favors the aggressive non-forage species. Otherwise bear clover and grass may grow beneath more open stands of deerbrush as a plant community. The regeneration of most associated shrubs is also encouraged by fire.

#### Effect of Grazing

Forest plantations are at times injured by livestock when deerbrush is closely grazed. Under judicious grazing, livestock should not be harmful and could be beneficial to the extent competition with tree reproduction is reduced. On benches and near watering places, cattle may damage trees up to 6 feet in height by trampling, rubbing, or hooking. Deerbrush plants may be killed by grazing during the first year or two or may be held back, allowing less valuable competitors to dominate. Once established, the plants are highly resistant to grazing. On salting grounds and around water holes, plants are often completely hedged and not a leaf remains available to cattle by early summer, yet they are thrifty. One 22 year old plant was kept down to a height of 8 inches by close grazing, yet showed no evidence of decadence. In fact, it appears that decadence does not set in earlier in such abused plants than in those ungrazed. When released from grazing, their growth is quite vigorous.

#### Reburning

Information on the effect of a reburn of deerbrush is somewhat confusing. A series of observations was made on the Tahoe National Forest over a 13-year period, ending in 1941, on an area burned in 1910. This area was partly reburned in 1924, and again in 1936. It was concluded that there was a moderate amount of sprouting following the first reburn and a greater amount with less intense fires. All resprouted plants died after the second fire. Seeding was partly successful after a reburn, but manzanitas and bear clover increased rapidly at the expense of deerbrush with subsequent burns. "Light burning"—that is, spring and fall fires for cleanup purposes—eliminated deerbrush.

FIGURE 6. At 32 years deerbrush is reaching the end of its life span. Most plants are dead, and the remainder will survive but a few years, regardless of the degree of grazing. This area is in the optimum range of the species and had a grazing capacity of four cow-months per acre per year during the years of peak forage production.

In July 1942, an area of dense deerbrush on the Eldorado National Forest was reburned. This stand had originated from a fire in 1924. The shrubs were tall, and no foliage had been in reach of livestock for some years. Fuel was added by slashing a thin stand of small pines and cedars that survived the previous fire. This, together with severe burning conditions, resulted in an intense fire that consumed most of the plant material on the area. There was a heavy germination of deerbrush seed the following year—approximately 300,000 seedlings per acre resulted. These were reduced to one-half the following year by natural thinning, and deerbrush numbered about 1,500 per acre 8 years later. At that time the foliage again made up a full canopy. These findings were interesting but somewhat academic, since it is most difficult to reburn stands of this species. The severe burning conditions required raise the cost of ensuring the protection of adjoining timbered areas and other values. In addition, any timber values on the area are eliminated. There is also the further possibility that the stand will give way to less valuable shrubs.

### Effect of Logging

Deerbrush seedlings and sprouts come in on logged-over areas where the soil has been violently disturbed, as on skidways, roads, and railroad grades. Where mature plants are broken off near the ground level in logging operations, vigorous stump sprouts result. Many seeds germinate in the disturbed soils. We have to assume that brush establishment results from scarification of the seeds rather than from reduced competition since natural reproduction is rare in other barren areas. Plant counts made on a series of transects on logged-over areas showed 2,000 to 3,000 plants per acre. The number correlated fairly well with the amount of soil disturbance. The light cutting and less destructive methods of present-day logging result in only light deerbrush stands.

Severe lopping or coppicing of mature deerbrush will result in the production of vigorous sprouts, making a stand once again a useful grazing type. There is one area that has been reburned once and cut back twice. Thirty-three years after the stand was established the plants still have full vigor, equivalent to the age of the sprout and not that of the rootstock. We would be glad to have someone explain that one away. We plan to continue to trim some of these plants periodically to determine the longevity of coppiced plants.

### Grazing Value

Deerbrush has many of the attributes of an ideal forage plant. It is nutritious, widespread, abundant, has high grazing capacity, and is highly resistant to livestock use. Like other forage plants, its palatability is governed considerably by weather conditions of the year, the geographic situation, and the period it is used.

Its seeds are eaten by livestock in late summer. In years of little seed production, livestock gains may be considerably reduced.

Because they cannot get to the foliage in heavy timber and brush, it may be difficult to handle sheep in deerbrush. Nevertheless, they relish it in mid-summer, and satisfactory lamb weights are obtained from browsing in younger stands of deerbrush.

Deerbrush is important as forage for deer in summer. Twigs are used in winter on ranges selected by deer for that period. However, heavy snows will force deer to elevations below which the species occurs.

Since grazing values and management of deerbrush have been discussed in detail[1], it will suffice here to say that in full stands, high grazing capacities develop in the third year and continue through the tenth. They can exceed three animal-unit months per acre. However, at this rate, soil disturbance is severe, and soil loss is appreciable on steeper slopes.

### Summary

Deerbrush is rather typical of many species that comprise fire

[1]*Cronemiller, Fred P. 1953. Deerbrush (sweet birch) in California. U. S. Forest Service. Mimeo. 16 pp.*

types. It occurs most commonly in dense stands in the ponderosa pine belt where fire has destroyed the forest. It regenerates almost solely after fire or some violent soil disturbance such as logging or road construction. Although not resistant to abuse during its first year or two, thereafter it rarely is killed by any mechanical treatment above the soil surface, and this includes grazing.

It produces a large volume of foliage from the third to the tenth year and sometimes later. Thereafter much of the foliage is beyond the reach of livestock. Any invading conifer reproduction may begin to overtop the plants at this time, and by the twentieth year the shrubs will be shaded out where a full canopy of conifers develops.

The life span of the plant is about 35 years, whether it is ungrazed or badly abused. It produces an abundance of seed, yet practically none germinates until fire opens the hard coat or mechanical disturbance scarifies it.

Because grazing capacity fluctuates during the life of the shrubs, the deerbrush type is not one upon which you can develop an economy. Much of the land it occupies is most valuable for timber production. Where deerbrush is in full sun, its useful life may be extended by 20 years at least by coppicing, and this practice appears economic because of the high grazing capacity of full stands. It is worth remembering, however, that fire types are dynamic vegetational complexes. They cannot be described by observations over a single year. Management and use must be in terms of their whole life history. We have hardly begun to study fire types as such complexes.

**ACKNOWLEDGEMENT**

*Except for the usual descriptions of the species contained in the manuals on the flora of the western states and the information on descriptions they contain, there is no known published material on the species. Several officers of the U. S. Forest Service in Region V have reported on the behavior and value of the species in memoranda, parts of reports, and formal reports. Among the latter, are those of Range Examiner L. S. Smith, of the Tahoe Forest; Rangers Milton Morris and W. H. Spargo of the Eldorado and Stanislaus forests; Ecologist Erwin Miller of the Stanislaus Forest, who conducted intensive ecological studies and Range Examiner John C. Heinan, who did important follow up work on that of Dr. Miller.*

*Although this paper does not cover in detail the value and behavior of the species as a forage plant, it should be recorded that several workers in the College of Agriculture, University of California, have conducted pasture tests, determined weight gains of cattle, and otherwise reported on its grazing value.*