Thinning Dense Sagebrush Stands with Spike 20P

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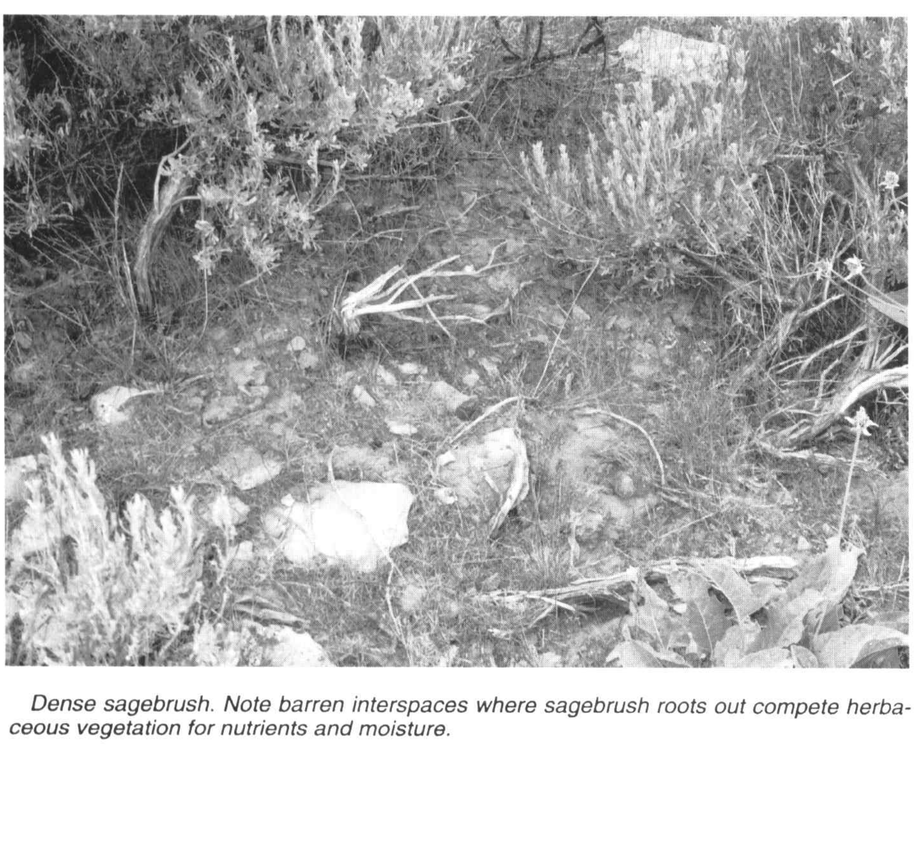
It is generally accepted that although big sagebrush (*Artemisia tridentata*) has always been present on much of the western rangeland, its density typically increased as a result of past grazing abuse. This abuse may date back to the turn of the century. (Cottam 1947, Hull and Hull 1974, Christensen 1963, Passey and Huge 1963, Blaisdale 1958). The control of wild fires has frequently further complicated the situation. Sagebrush increases at the expense of herbaceous grasses and forbs, affecting the health, diversity, and productivity of the range. Sagebrush is a large water user. As sagebrush cover increases, soil moisture is reduced, resulting in lowered water tables, reduced water flow in springs and seeps, and depletion of adjacent riparian areas.

Alma Winward, Regional Ecologist for the Intermountain Region of the Forest Service stated the opinion that, "There are more acres of sagebrush-grass lands in the western United States being held in low ecological status the past decade due to abnormally high sagebrush cover and density than currently is occurring due to livestock grazing." He further states many millions of acres of big sagebrush presently have canopies above 20% and have depleted understories. These are the acres that will require some kind of thinning or removal process in order to reestablish a balanced herbaceous component. There is essentially no way to reestablish a native or introduced herbaceous cover without first removing some of the dense sagebrush canopy. Only when sagebrush crowns are spaced far enough apart to allow "open" microsites, do we get successful recovery of the understory. Dr. WInward also recognizes that certain wildlife species, such as sage grouse and mule deer, have specific sagebrush density requirements. (Winward 1991).

Simply removing livestock from the range does not necessarily mean there will be an improvement in ecological condition in sagebrush communities. Many livestock exclosures have been established in sagebrush communities over the past 50 years or more. Frequently we see little or no detectable improvement in understory grasses and forbs after these extended periods of protection from grazing.



Dense sagebrush. Note barren interspaces where sagebrush roots out compete herbaceous vegetation for nutrients and moisture.

Traditional sagebrush control practices have been directed at trying to convert sagebrush to grass dominated ecosystems. This is not satisfactory to some wildlife interests as some sagebrush density is essential for the well being of particular wildlife species and biodiversity of the plant and animal community.

Chaining or plowing and seeding projects are costly, harsh on the environment, and may reduce forbs in preference to grasses. In many instances, these efforts have actually increased sagebrush density by providing a better seedbed for sagebrush.

The use of 2,4-D, although effective in controlling sagebrush, frequently impacts many brush and forb species which are desirable for wildlife. Also, there is a very narrow window when plant and soil conditions are right for good sagebrush control with 2,4-D.

Burning is an effective tool when used with skill; however, fire usually kills all sagebrush in its path, and may leave the soil bare and unprotected for a period of time. Burning is being scrutinized more closely due to concerns about particulate matter, gasses, and polynuclear aromatic hydrocarbons (potential carcinogens) in smoke (Dost 1986). Burning attempts are sometimes aggravated by insufficient understory to carry the fire and by uncooperative burning weather or problems with fire containment. Improper use of fire can damage soil, desirable plant species, or result in the proliferation of rabbitbrush, which is more difficult than sagebrush to control.

Range managers have always noticed the attraction of large herbivores such as cattle, elk, deer, and antelope to areas where sagebrush has been controlled. This attraction is due to increased palatability and nutrient content of herbaceous vegetation after the competition from brush has been reduced. With increased interest in Ecosystem Management and improving biodiversity, the concept of **thinning** sagebrush, rather than trying to **eradicate** the species is much more acceptable. The thinning concept regards sagebrush as an integral component of the plant community and recognizes that many plant and animal life forms depend on its presence. It also acknowledges the significance of a "land ethic" for western rangeland and the growing concept of "holistic resource management".

Studies by the University of Wyoming recently measured long term changes occurring in plant and animal communities when big sagebrush is **thinned** with tebuthiuron (Spike 20P) herbicide. They found that big sagebrush can, in fact, be thinned by using reduced rates of tebuthiuron. When big sagebrush canopy was reduced from levels of 36% or more to approximately 15%, greatest diversity in plant community was achieved and small mammal numbers and diversity were also the greatest. Small mammal species diversity and density was used as an indicator of the health of wildlife populations. The studies also show that the density of thinned sagebrush communities did not increase significantly during the 10 year study time following treatment (Johnson et al. 1995).

Spike 20P is a clay pelleted product containing 20% tebuthiuron. It is applied to the soil by aerial or ground application equipment. After the product has been dissolved by rain, it is absorbed by the roots of the sagebrush and translocated to the shoots. Photosynthesis is then inhibited and defoliation of the plant occurs over a 1–3 year period. Because Spike is pelleted, it is not subject to drift and volatization as is 2,4-D. It can be applied effectively anytime the soil is not frozen. At rates recommended for thinning sagebrush, tebuthiuron has little or no adverse effect on grasses, forbs, or desirable wildlife brush species such as bitterbrush, winterfat or serviceberry. The product is sensitive to the amount of clay and especially organic matter in the soil. Instructions on the regular Spike 20P label call for too much product for sagebrush thinning. The supplemental product label should be followed when applying reduced rates of Spike 20P.

Sagebrush at about 10% crown cover. Note ground cover and healthy understory.

Thinning dense stands of big sagebrush increases forage production, enhances wildlife habitat, promotes biodiversity and reduces runoff, erosion and sedimentation. (Olsen et al. 1996). Because forbs are insect pollinated, they may attract more insects than either sagebrush or grass, which are wind pollinated. Insects provide an important protein source to birds, especially chicks and nesting females. The skeletons of dead brush provide perches for song birds and tend to trap blowing snow which along with reduced transpiration from the brush, increases soil moisture and water flow in springs and seeps. Increases in small mammals benefit predatory birds and animals. In addition to on site benefits, it has been suggested that due to increased palatability of forage species in the treated areas, livestock and wildlife may be attracted to sagebrush thinned areas and away from riparian areas.

Recently the author visited a number of sites in the Intermountain area which had been treated 10 to 17 years previously with low rates of tebuthiuron. Basic measurements were made to determine the long term sustainable effect of treatment. All the areas were being grazed by livestock. The following data were gathered:

At Albion, Idaho 17 years after treatment with 0.4 lbs. ai/acre (2 lbs. of Spike 20P per acre) sagebrush overstory was decreased from 28% to 11%, ground cover increased from 65% to 77%, plant density increased from 24% to 35%, litter remained about the same, grass production increased from 160 to 495 lbs per acre dry weight and forb production increased from 22 to 42 lbs. per acre dry weight.

At Woodruff, Utah 10 years following treatment at about 0.36 lbs ai/acre (1.8 lbs of Spike 20P per acre), overstory sagebrush was reduced from 20% to 5%, and the ground cover increased from 51% to 79.4%. (Production data were not gathered).

At Riddle, Idaho 13 years following treatment at 0.5 lb. ai/acre (2.5 lbs. of Spike 20P per acre), ground cover increased from 33% to 80%, plant density increased from 13% to 50%, and litter remained the same.

At Mountain Home, Idaho 14 years following treatment at about 0.25 lbs. ai/acre (1.25 lbs of Spike 20P per acre) sagebrush overstory decreased from 20% to 10–12%, ground cover increased from 20% to 65%, plant density increased from 10% to 35%, and the litter increased from 10% to 30%.

Dense, untreated sagebrush. 30% + overstory.

During the summer of 1997, eleven other sagebrush sites in the Intermountain area, which had been thinned with Spike 20P two or three years earlier, were evaluated. The purpose of this evaluation was to determine proper application rates for thinning sagebrush to a 10 to 15% overstory. This density of sagebrush overstory generally meets wildlife and biodiversity requirements. The following conclusions were reached from these studies.

On sandy soils with less than 20% clay, and where organic matter was less than 2% in the top six inches, 0.1 ai/acre (0.5 lb. of Spike 20P) was sufficient. These were typically low elevation sites, around 4,000 ft. and supported *wyomingensis* subspecies of big sagebrush.

On soils with 20 to 30% clay and organic matter of 2 to 4%, 0.2 to 0.3 lbs. ai/acre (1 to 1.5 lbs of Spike 20P) produced best results. These sites were typically 4,000 to 5,000 feet in elevation and supported *wyomingensis* subspecies at lower elevation and *tridentata* or *vaseyana* subspecies at higher sites.

On sites where clay content was greater than 30% and/or the organic matter was between 4 and 5.5%, 0.4 to 0.5 lbs ai/acre (2 to 2.5 lbs of Spike 20P) were required. These sites were typically, 5,000 to 8,000 ft in elevation and support *tridentata* or *vaseyana* subspecies.

Where clay content is greater than 30% and organic matter exceeded 5.5% results were more erratic and 0.6 to 0.7 lbs ai/acre (3 to 3.5 lbs. of Spike 20P) were required to thin. These sites were typically 8,000 to 10,000 feet in elevation and supported *vaseyana* subspecies. On the cooler sites or north slopes of such areas, treatment with Spike is not recommended until further studies are made.

If management emphasis is to maximize herbaceous production, the higher application rates should be used, If emphasis is for more diversity and brush overstory, the lower rates should be used. These conclusions are based upon a limited number of studies. Recommendations may be adjusted as more data is gathered.

Summary

Technology now exists to thin dense stands of big sagebrush by applying reduced rates of tebuthiuron (Spike 20P) herbicide. Thinning dense stands of sagebrush can improve biological diversity, and restore damaged ecosystems to a healthier condition. This can benefit wildlife habitat, forage production, ground cover and soil stability over an extended time. Soil texture and especially organic matter are important factors in determining the proper application rate for thinning sagebrush with Spike. Subspecies and varieties of big sagebrush may provide an indication of soil types thus of proper application rates.

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