type conversions. When coupled with a program of deferment and fertilization, the increased fuel developed by perennial and annual grasses, will assure a higher level of control on brush when burned.

Fertilization of rangeland has prompted some debate over the cost effectiveness of the practice. Based on current prices, the application of 300 lb/acre of ammonium phosphate would cost approximately $12.00/acre. With the predicted 3-year effectiveness of the practice, it would amount to a $4.00 acre per year investment. The range manager's decision to fertilize must be tempered with the multiplicity of benefits expected.

Fertilization merely for the sake of increasing production is a valuable but limited goal. However, the investment in fertilizer is often justified when coupled with the ulterior benefits of reestablishing or supplementing soil nutrients, providing an increase in the quantity/quality of forage in key wildlife areas, and stimulating a concentrated build-up of fuel for underburning.

The burning and fertilizer trials on the Big Stony type conversion were evaluated as an alternative to spraying for brush encroachment along with post-burning responses and accelerated recovery techniques for perennial grasses. Several notable conclusions were drawn:

1. Seasonal burning of annual or perennial grasses is a viable tool for controlling brush reinvasion in key range areas.
2. Perennial plants respond to burning with accelerated growth, lateral plant development, increased forage production and improving the availability of forage to livestock or wildlife.
3. The early removal of annual plant litter eliminates some competition to the proliferation of perennials.
4. When used in conjunction with burning, fertilization can speed-up recovery, improve forage conditions and provide fuel for late season burning.
5. Scattered buck brush plants *(Ceanothus cuneatus)* fertilized along with the pasture showed definite signs of heavy deer browsing and hedging.
6. The burning/fertilizing/brush control management of Big Stony redeveloped the type conversion as a key grazing area. Grazing use tripled, not only increasing the number of livestock, but extending the season of use (30 days beyond usual use). This is *significant* in so much as it reduced the early grazing pressure on native meadows and glades. Total deferment of pasture was *not* needed to assure recovery to the type conversion.

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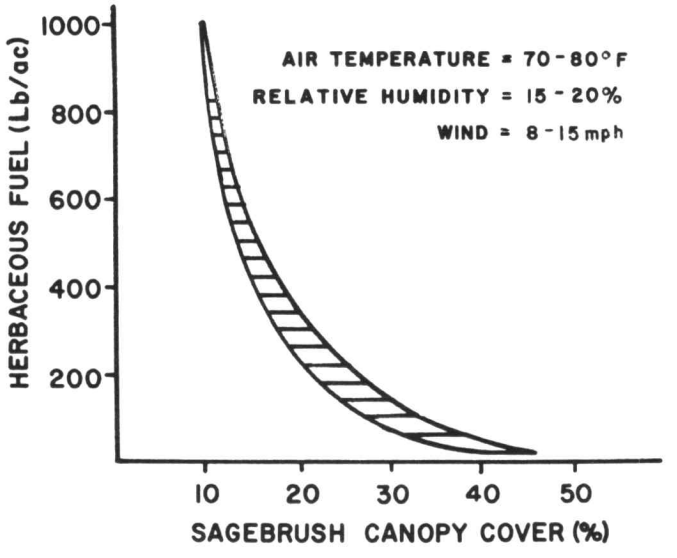
Will Your Sagebrush Range Burn?

Carlton M. Britton, Robert G. Clark, and Forrest A. Sneva

Currently, many sagebrush-bunchgrass communities of the Great Basin are virtual monocultures of big sagebrush *(Artemisia tridentata)*. This condition results in reduced herbaceous production and minimal habitat diversity. When management objectives include reduction of sagebrush density, prescribed fire provides an ecologically sound vegetation manipulation tool. Unfortunately, prescribed fire cannot be used to treat all sagebrush-bunchgrass communities. This paper presents a simple technique which will allow range managers to determine if a particular area can be burned under prescribed conditions. This technique is based on the relative amounts of herbaceous fuel (grasses and forbs) and the canopy cover of big sagebrush necessary to ensure fire spread.

The Relationship

The curve presented represents the relationship between sagebrush canopy cover and herbaceous fuel at which safe and successful prescribed burns can be expected. This relationship will hold when wind is 8 to 15 mph, relative humidity is 15 to 20%, and air temperature is 70 to 80° F. If burns are



Relationship of sagebrush canopy cover and herbaceous fuel load. Curve represents proportions of the two parameters where successful burns can be expected for the given conditions.

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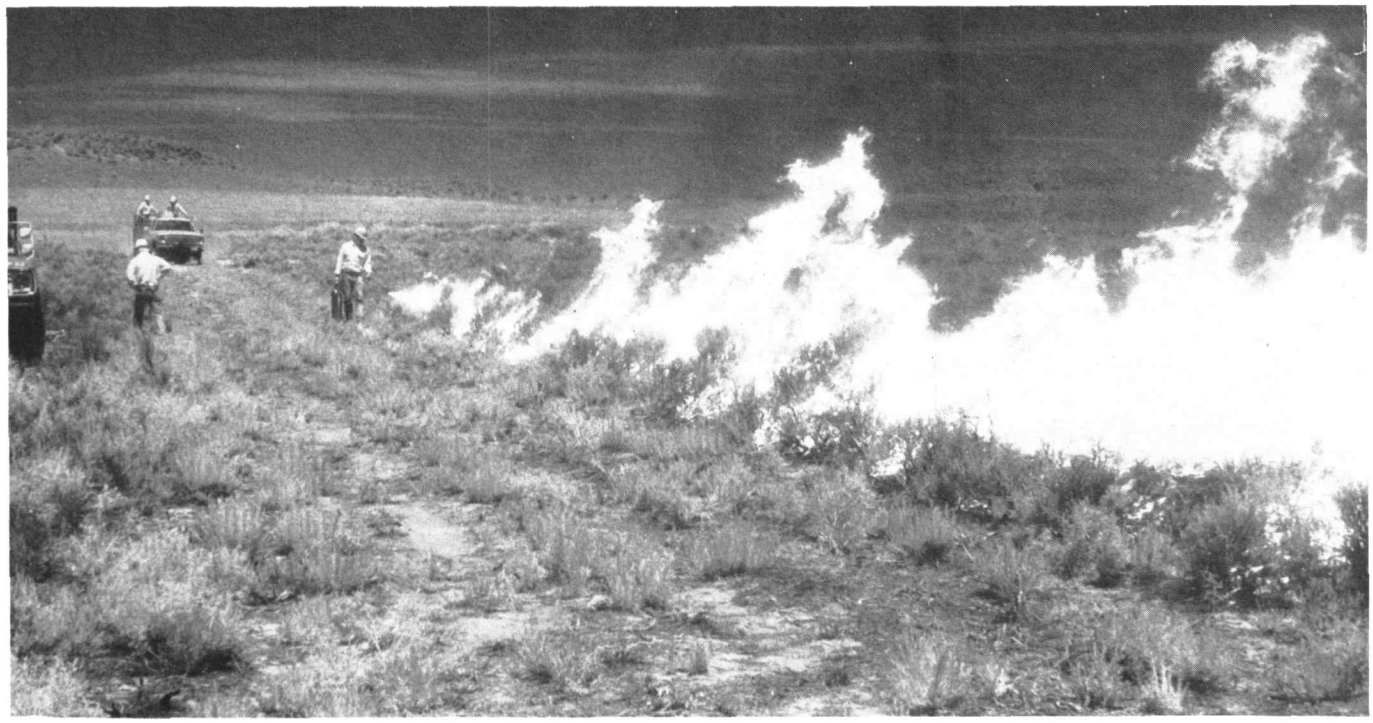

Burning to reduce sagebrush canopy cover in eastern Oregon.

conducted with higher winds and air temperatures at lower humidities, the curve will shift to the left. This implies that areas with lower fuel quantities could be burned, but control of the fire might be difficult. The curve will shift to the right when burns are conducted with lower winds and air temperatures in conjunction with higher humidities. Therefore, higher fuel quantities are required to ensure fire spread. As a general rule, at least 20% canopy cover of big sagebrush and 200 to 300 pounds per acre of herbaceous fuel is needed to ensure a successful prescribed burn.

The more productive the site, the greater the canopy cover of big sagebrush and herbaceous fuel. Therefore, subspecies of big sagebrush can be used as an initial evaluation of whether or not an area can be successfully burned. Mountain big sagebrush *(A.t.* subsp. *vaseyana)* is most easily burned. Basin big sagebrush *(A.t.* subsp. *tridentata)* is intermediate and Wyoming big sagebrush *(A.t.* subsp. *wyomingensis)* is most difficult to burn. These differences are not related to any specific attribute of individual plants but rather to sites where the subspecies occur. Mountain big sagebrush and basin big sagebrush typically occupy deeper soils that generally receive more precipitation compared to Wyoming big sagebrush. Thus, the better sites are capable of supporting greater plant densities. This results in more sagebrush canopy cover and herbaceous fuel. In sagebrush-bunchgrass communities, the more fuel that is available, the easier it is to conduct safe and effective burns.

To verify the relationship a test burn was conducted on an area with five levels of sagebrush canopy cover and herbaceous fuel. Results substantiated the limit of 20% sagebrush canopy cover when the herbaceous fuel is primarily bunchgrasses. However, with 800 to 1,000 pounds per acre of cheatgrass, no sagebrush canopy cover is necessary to ensure fire spread. This area was burned without firelines. The fire front moved from the area with herbaceous fuel to an adjacent area that had been closely grazed the prior week. The fire front would not move into the grazed area even though the canopy cover of big sagebrush was 15 to 20% at the boundary. One growing season after this October test fire, herbaceous yield was compared for the burned and adjacent grazed areas. The burned area produced 696 pounds per acre compared to the grazed area at 490 pounds per acre. Both areas had a history of light, late season use for the past 30 years.

An August test burn was attempted on an area with 500 pounds per acre of herbaceous fuel and 7 to 11% canopy cover of Wyoming big sagebrush. Wind was steady at 26 mph, relative humdity was 13%, and air temperature was 86° F. Under these conditions, the fire would not spread more than 30 feet when ignited with a drip torch. Another test burn was conducted on an area with about 100 pounds per acre of herbaceous fuel and 38% canopy cover of sagebrush. Wind was 4 to 6 mph, relative humidity was 18%, and air temperature was 79° F. This fire spread very well (about 18 feet per minute) until the front hit a transition where the sagebrush canopy cover dropped to 11%. At this point the fire front broke up and did not penetrate this reduced canopy cover more than 20 feet.

Benefits

Critical examination of canopy cover and herbaceous fuel on a sagebrush-bunchgrass range can prevent wasted effort in planning and conducting a prescribed burn. Areas where the fuel is not adequate for prescribed fire can be deleted from consideration. Areas with various levels of sagebrush canopy cover can be evaluated with respect to what areas will burn and those which likely will not. Those parcels that will not burn will leave a mosaic of vegetation that provides habitat diversity.

In planning firelines for a prescribed burn, areas with low fuel amounts can be left or minimal efforts devoted to line construction. This will save time and money and provide discontinuities in the appearance of other more intensely prepared firelines. ●