Spring Burning for Removal of Sagebrush Competition in Nevada

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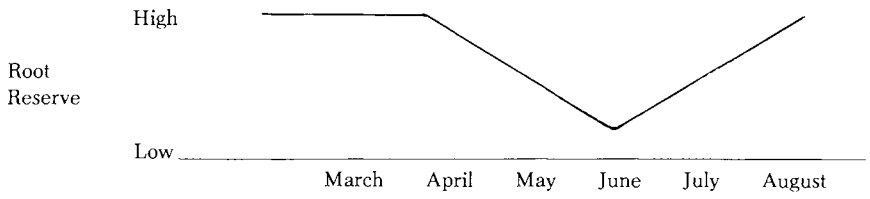
On the Humboldt National Forest prescribed burning looked like a good substitute for the 2,4D herbicide we had previously used quite extensively in our range improvement projects. A substitute was needed because research indicated that herbicides have led to increased deaths and abnormalities in some game birds.

Nevada Fish and Game personnel opposed our 2,4D programs because of the loss of forb understory. Fire, on the other hand, looked good. Since most of our lands have evolved under fire, we believed fire would be a safe tool for our use.

Prescribed fires, in general, greatly increase the diversity of wildlife species as well as population densities on all vegetative types

(Komarek, 1963; Marshall, 1963). Our goal was increased variety in the predominantly sagebrush landscape of the Humboldt National Forest. Research by Miller (1963) and Komarek (1963) showed that deer, doves, and many song birds favor a varied habitat created by fire. They stated a patchy burn, retaining about 20 percent unburned area, is most desirable for wildlife. This left adequate cover and a winter food supply for upland and big game. The use of fire to remove big sagebrush *(Artemesia tridentata)* was made a reality because of the vegetative response in and around a wet meadow following a wildfire on August 20, 1971. The wildfire consumed the woody plants, such as big sagebrush, and all of the forbs and grass that resprouted were available for grazing by livestock or game. This summer burn had its detrimental effects. The soil was left bare for the remainder of the growing season and was subject to wind erosion. The second drawback was the lack of diversity. We had changed from a monotype of sagebrush to a monotype of grass and forbs.

This experience showed us that to use fire, we would have to burn in the spring or late fall. We concentrated on developing an early spring burning prescription. A search of the literature on prescribed burning during the winter of 1971-72 showed that very little work dealt with the time period from snow melt to early stages of green up. This period we believed would put the least amount of stress on the plants because regrowth would take place and prevent bare soil being exposed to wind scouring for that entire growing season. The fact that root reserves are generally believed to follow the hypothetical pattern shown below (Kozlowski and Keller, 1966), further convinced us of the desirability of spring burning.



With a good fire behavior background, and some information from the research publications, we decided it was necessary to have moderate winds to drive the fire across the ground fast enough to prevent

deep penetration of heat into the plant's root crowns. Observation of the August 20, 1971 fire pattern indicated that even during a hot day with winds up to 25 mi/hr, low sagebrush *(Artemesia arbuscula)* communities did not have enough fine fuels to carry a fire. If a fire could not run through that fuel type in August, we would not have to construct miles of control line to contain the fire within the vegetative types we wanted to burn. Natural barriers, snowbanks, and shallow fuels were all that was needed to restrict the fire to the designated burn areas.

The first year, we burned 400 acres in Willow Creek on April 24 and 25, 1972, and 600 acres on Table Mountain (Figs. 1 and 2) on May 8

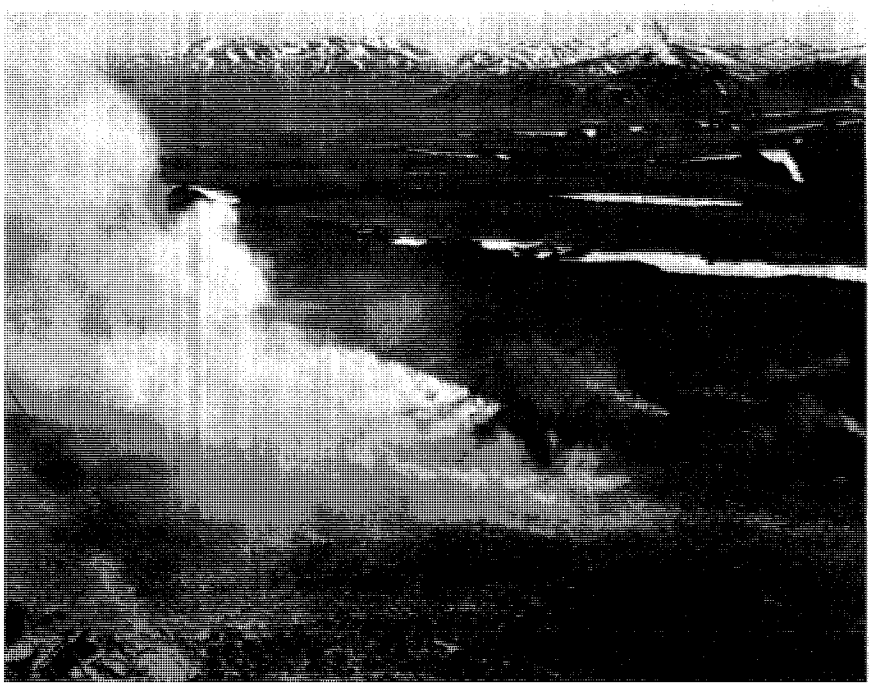


Fig. 1. Table Mountain Burn, Santa Rosa R.D., Humboldt NF, Nevada. This prescribed fire burned during May 8-9, 1972. Notice the small fires out in front of the main fire. This results in a mosaic of burned and unburned areas and is favorable to native wildlife.

Fig. 2. Uneveness of the fire front is illustrated in this view of the Table Mountain Burn. Notice the almost complete cover of sagebrush.

and 9, 1972. Field observations were made on both burns and comparisons of vegetative responses were made (Figs. 3 and 4). Both burns took place at 6,000 to 6,500 elevation with the same exposure. The Willow Creek Burn had a greater response by all the grasses in the community, while the later burn on Table Mountain had less response by the grasses, except wild rye *(Elymus* spp.), and more response by the forbs and grass-like plants.

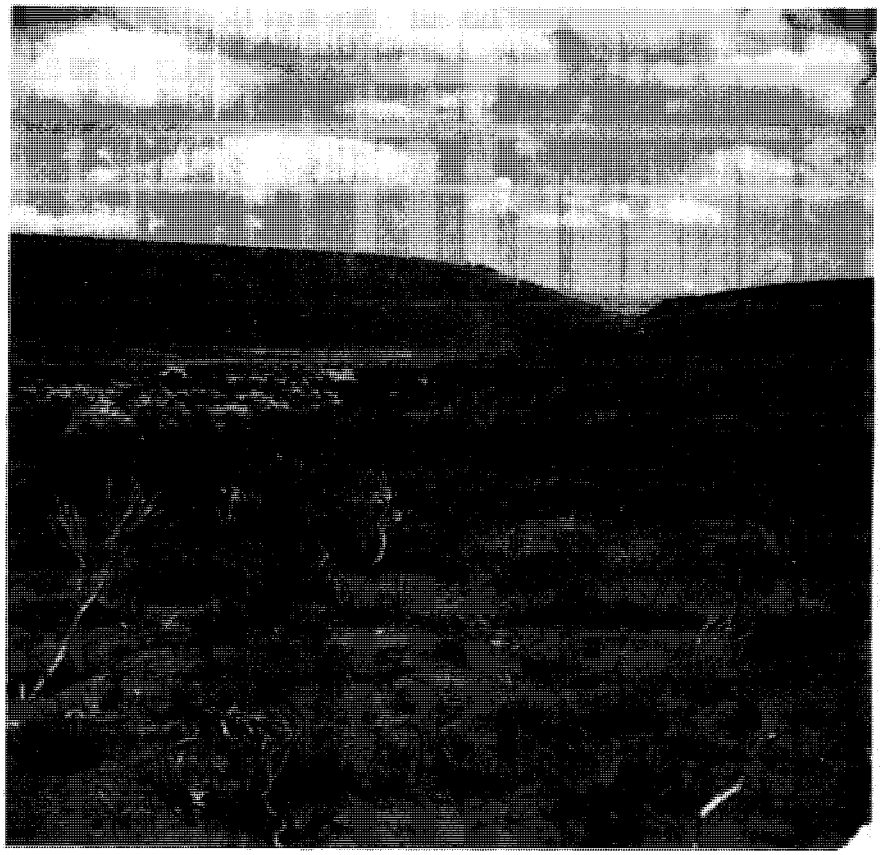


Fig. 3. Table Mountain fire area approximately 10 weeks after the burn. Notice the almost complete removal of sagebrush and response of grass and forbs. Also notice unburned patch of sagebrush in left background.

The conclusions from our observation of these two burns were that soil moisture and root reserves were a very important part of being able to obtain good survival of the herbaceous vegetation, particularly of the fire-susceptible grasses such as Idaho fescue *(Festuca idahoensis)*. In order to conduct a successful spring burn, we found we needed 600 to 700 pounds of fine fuel per acre. This was necessary to allow the fire

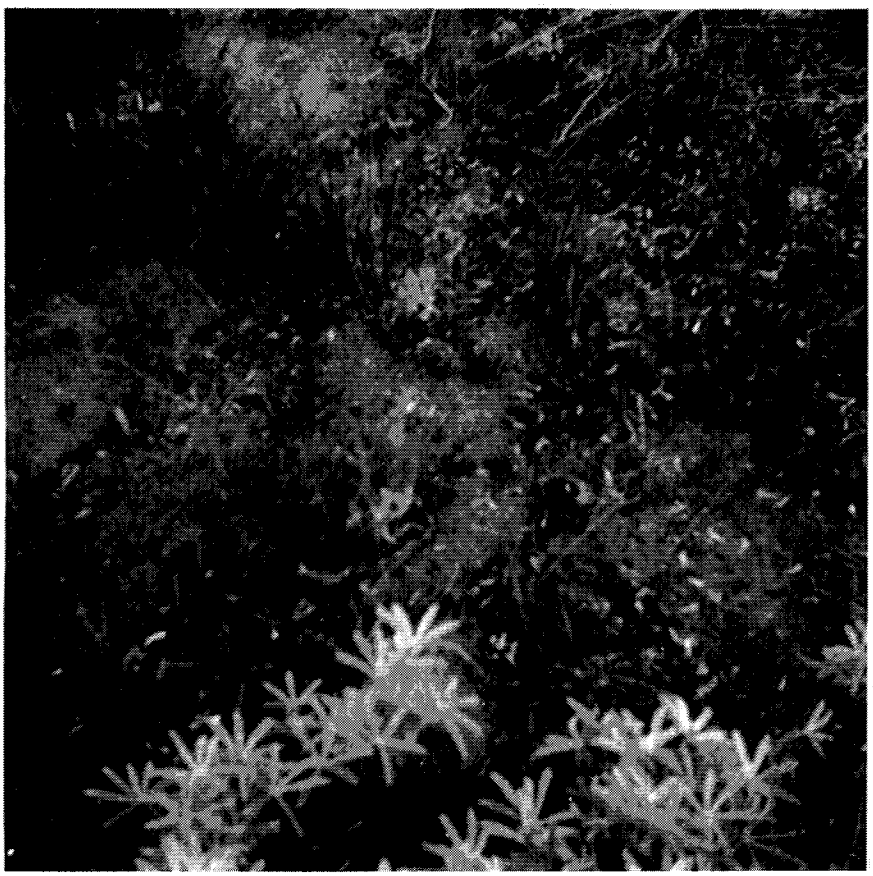


Fig. 4. Close up of grass and forb response 10 weeks after burning at Table Mountain.

to spread between sagebrush plants. Without the density of fine fuels, each individual plant must be ignited. This made the burning operation costly and prohibitive. Timing of the burn was extremely important. Ignition must take place when the relative humidity is 60 percent or less, and before or just after the plants had broken dormancy. The burning operation must stop when new plant growth reached 2 inches. The time to burn could last only a few days or up to 2 weeks in high

cooler climates. If burning operations continued when the root reserves are being used up rapidly by the plant, high mortality in the fire-susceptible plants would occur. These later burns favor forb production.

Of the four elements necessary to obtain a successful burn, no one element is any more important than the next. They are all necessary to come up with a completed product that complements the land:

(a) The soil must be wet.
(b) Windspeeds must be in excess of 8 mi/hr and gusty.
(c) The area of land to be burned must have 600 to 700 pounds of fine fuels per acre.
(d) Burning operations should stop when spring growth is 2 inches on grasses, unless burning is to increase the forb community.

Wright (1974) came to a similar conclusion. He stated that, "Ideally a prescribed burn should be conducted when the preferred plants are dormant." Research in Sweden has shown that as heat penetrates downward, soil moisture apparently migrates upward. A "sweat" zone is formed and the latent heat of vaporization serves as sort of a narrow shield that further impedes heat flow downward. Wright (1974) states, "Where prescribed burning is an applicable tool, many objectives can be achieved simultaneously. Increased herbage yields, increased utilization, increased availability of forage, improved wildlife habitat (more food with unburned patches for cover), control of undesirable shrubs, a mineral seedbed for establishment of commercial trees, and control of various diseases (e.g. liver fluke and brownspot) can all be achieved with one burn." We have also found burning to be a tool to rid a site of allelopathy effects of plants.

Management of a burned area is essential in obtaining desirable results. Grazing animals will frequently concentrate on a burn because the feed is more palatable, nutritious, and readily available. Samples of grasses from the burned areas have shown that they have 7 percent more crude protein than the same grasses outside the burned area. Natural fires during dry years have been found to be harmful because they magnify drought stress on plants (Wright 1974). This is the normal situation, which we have observed. Fires during wet years, however, are generally beneficial because moisture is not limiting and fires increase the soil temperature and stimulate nitrification. We have observed this in our controlled burns on the

late nitrification. We have observed this in our controlled burns on the Humboldt National Forest. Because of the black ash on the soil surface, soil temperature is usually 5 to 10 degrees above the soil surface in the unburned areas. The stimulation of the nitrogen is indicated by the green luxurious forage, which predominates on the burned areas.

PRESCRIBED BURNING PROCEDURE

Spring burning of sagebrush presents very few problems either in control or in burning the desired areas. The amount of fine fuels necessary to carry a fire are located only in the draws and areas of deep soil. Fire will confine itself to these areas, due to the availability of the fine fuels. Based on resource management, this is an ideal fire prescription. The sagebrush community that has invaded the more productive soils is *Artemesia tridentata,* subspecies *tridentata* and *vaseyana*. These two subspecies receive very little use from wildlife or livestock. The low sagebrush community necessary for antelope and sagegrouse is not burned due to the lack of fine fuels to carry the fire.

The use of fusees has been determined to be the best method of ignition in the burning operation. They are safe to handle, easy to carry, and provide no problem in storage.

When the selected areas are long distances from roads, or snowbanks prevent driving to the area, horses are used for transportation. Gentle horses are required for safety of personnel. In this way, many additional acres can be covered.

Burning procedure is very simple. You always burn with the wind to your back. Ignition is carried out where the fine fuels are sufficient to carry a fire between sagebrush plants. Firing out should take place all along the windward side. The small unburned islands and uneven borders are left unburned because of erratic winds. This gives a vegetative mosaic that is esthetically pleasing to the eye and complements wildlife with an increased amount of edge. Burning should be done when winds reach 8 mi/hr or higher and gusting. Burning should not have to stop because of high winds. The winds only allow the fire to move faster, and have less heat penetration into the soil.

Following these guidelines we have successfully burned over 10,000 acres of sagebrush in the past 3 years on the Humboldt. We believe

prescribed burning is one of our best tools in the management of our rangeland resources.

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