Prescribed Burning For Elk in Northern Idaho

THOMAS A. LEEGE, Research Biologist

Idaho Fish and Game Dept.
Kamiah, Idaho

The majestic wapiti, otherwise known as the Rocky Mountain Elk (*Cervus canadensis*), has been identified with northern Idaho for the last 4 decades. Every year thousands of hunters from all parts of the United States swarm into the wild country of the St. Joe Clearwater River drainages. Places like Coolwater Ridge, Magruder and Moose Creek are favorite hunting spots well known for their abundance of elk. However, it is now evident that elk numbers are slowly decreasing in many parts of the region. The reason for the decline is apparent when the history of the elk herds and the vegetation upon which they depend are closely examined. This paper will review some of these historical records and then report on prescribed burning studies now underway by Idaho Fish and Game personnel. The range rehabilitation program being developed by the Forest Service from these studies will hopefully halt the elk decline and maintain this valuable wildlife resource in northern Idaho.

DESCRIPTION OF THE REGION

The general area I will be referring to includes the territory to the north of the Salmon River and south of Coeur d'Alene Lake (Fig. 1).

It is sometimes called north-central Idaho and includes the St. Joe and Clearwater Rivers as the major drainages. This area is lightly populated, especially the eastern two-thirds which is almost entirely publicly owned and managed by the United States Forest Service; specifically, the St. Joe, Clearwater and Nezperce National Forests.

The topography is extremely mountainous and dissected by river systems. Elevations vary from 700 feet at Lewiston to over 10,000 feet along the Bitterroot Divide between Idaho and Montana. Pre-

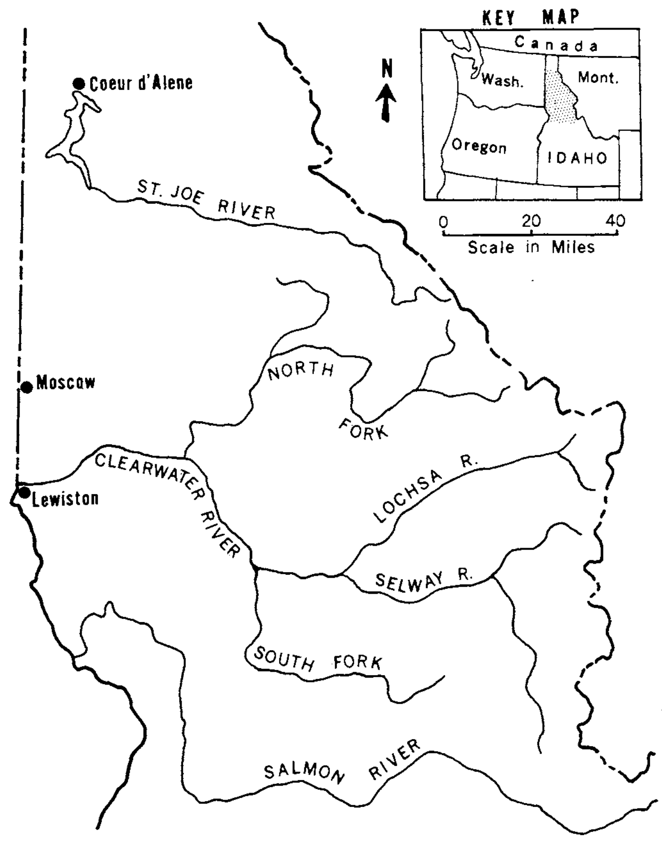

FIG. 1. Map of northern Idaho where prescribed burning of elk winter range is becoming an accepted practice.

cipitation ranges from 10 inches at Lewiston to more than 50 inches at the higher elevations, and falls primarily during the fall, winter and spring months. Much of the precipitation in the mountains comes in the form of snow. This drives the big game to the lower elevations along the major streams where they spend the winter months. Food is critical in these concentration areas and the population size is regulated by the quantity and quality of the forage which is available. The winter range is only about one-tenth the size of the summer range.

VEGETATION AND SUCCESSION

Abundant precipitation permits the growth of dense conifer forests over most of the region. The main tree species are western red cedar (*Thuja plicata*), grand fir (*Abies grandis*), Douglas fir (*Pseudotsuga menziesii*), western white pine (*Pinus monticola*), larch (*Larix occidentalis*), lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), spruce (*Picea engelmanni*) and ponderosa pine (*Pinus ponderosa*).

When these confer stands are destroyed by fire, grasses and forbs immediately take over the site. Soon, shrub seedlings grow in size and form dense brushfields. These shrubs are the life line for deer and elk as the buds and annual twig growth provide the winter food supply. The tallest brush species on winter ranges are willow (*Salix scouleriana*), birch (*Betula papyrifera* var. *commutata*), serviceberry (*Amelanchier alnifolia*), mountain maple (*Acer glabrum*) and bittercherry (*Prunus emarginata*). Medium height shrubs include redstem (*Ceanothus sanguineus*), oceanspray (*Holodiscus discolor*), syringa (*Philadelphus lewisii*), ninebark (*Physocarpus malvaceus*) and cascara (*Rhamnus purshiana*). The important low-growing shrubs are thimbleberry (*Rubus parviflorus*), spirae (*Spiraea betulifolia*), rose (*Rosa* spp.) and snowberry (*Symphoricarpos albus*).

Eventually, conifers become established and they outgrow the shrubs to once again dominate the site. Most shrubs are intolerant of shade and therefore are elminated from the vegetative community. The cycle, then, is from a burned conifer stand, to grasses and forbs, to shrubs, and back to conifer forest. The time span required for this

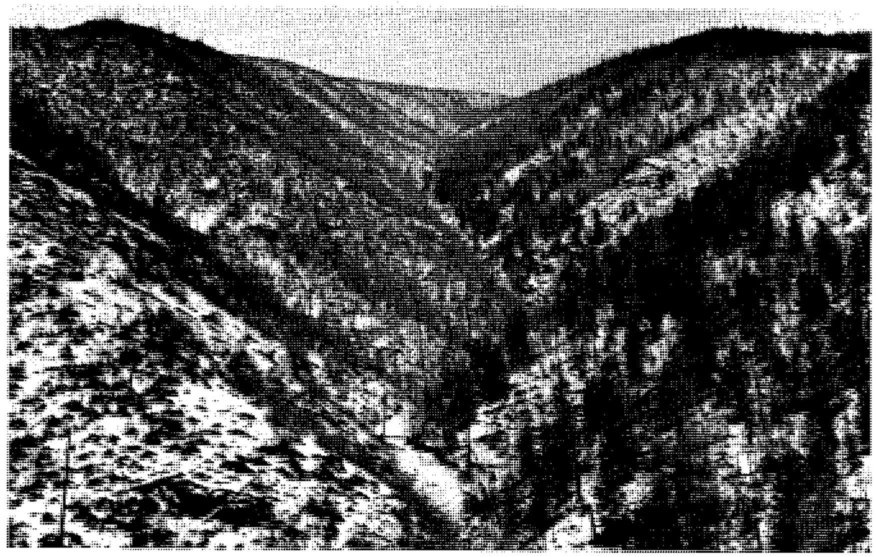

FIG. 2. This area on the Lochsa River was completely burned over in 1919 and again in 1934. Vegetation is advancing toward the conifer climax more rapidly on the northerly exposures. A decrease in elk browse is associated with advancing plant succession.

cycle depends upon the intensity of the fire, nearby seed sources, climatic conditions and the site characteristics. Generally, north and east aspects return to conifers more rapidly because they are wetter and therefore more capable of supporting young seedlings. (Fig. 2).

EARLY WILDFIRES

Wildfire has played a major role in determining vegetation patterns for many years. Leiberg (1900) made the first intensive survey of the Clearwater drainage in 1898 and found that most of the area showed evidence of past fires. He noted that the old burns had generally reforested well and that the recent burns (after 1862) were primarily at the higher elevations in alpine-fir type forest. A map he prepared showed that the majority of the low-elevation areas which are now

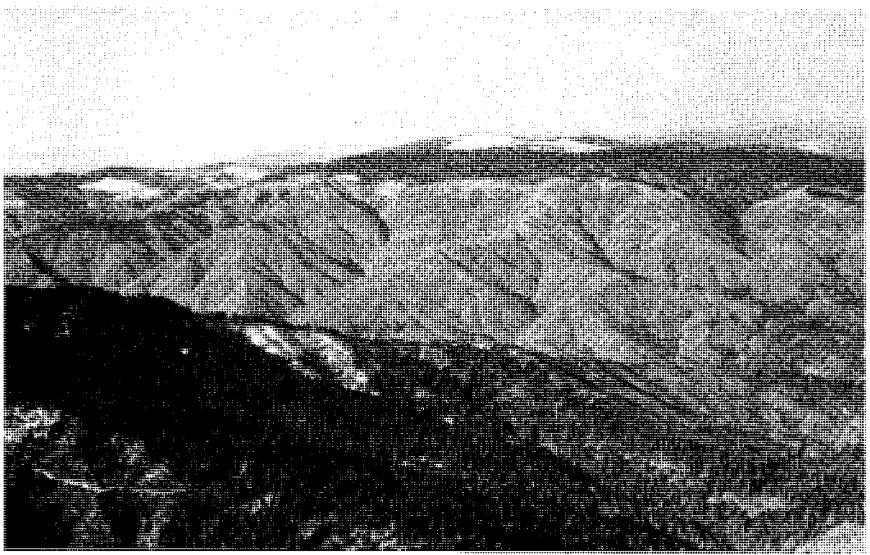

FIG. 3. Many of the wildfires in the early 1900's burned at low elevations and created numerous wintering areas for big game. Elk and deer herds increased after palatable shrubs invaded the burns.

important elk winter ranges, had dense stands of timber on them in 1898.

In the 20th century, wildfires have been especially severe. In 1910, 1919, and 1934 fires consumed millions of forested acres in northern Idaho, many of which were at winter range elevations (Fig. 3). Since that time, wildfires have decreased significantly because of technological advances in fire location and suppression techniques (Fig. 4).

Leiberg (1900) blames man for causing the fires which occurred before his survey. He stated that Indians burned large acreages to congregate game in certain localities as "it is a well known fact that deer and elk exhibit a special liking for tracts freshly burned, due to the profuse growth of various kinds of weeds springing up there, which constitute a favorite browse for them." Prospectors invaded the region in the 1860's and, according to Leiberg, deliberately set

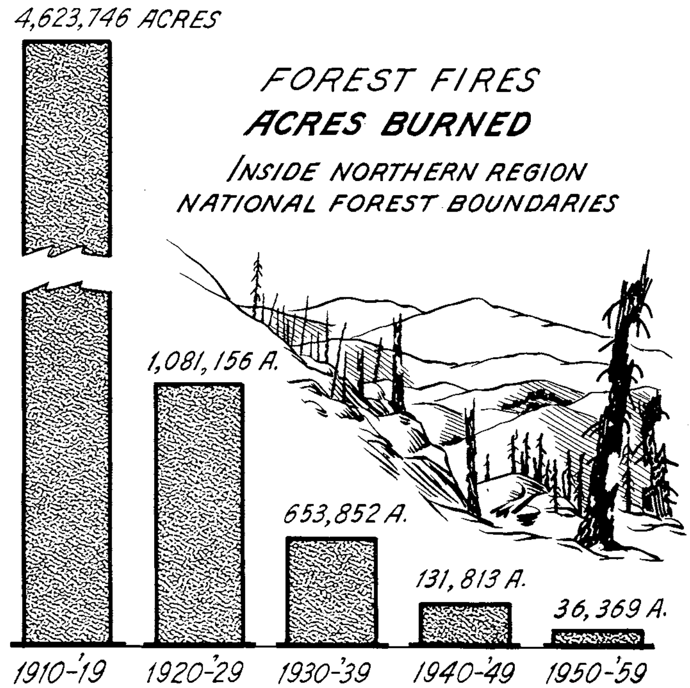

FIG. 4. Acres burned by wildfires in northern region of the U.S. Forest Service between 1910–1960. Northern region includes eastern Washington, northern Idaho and western Montana. Burned acreage is continually decreasing because of technological advances in fire location and suppression. Graph courtesy U.S. Forest Service.

numerous fires to clear the vegetation when searching for gold. For the period since 1900, Forest Service reports show that over 80 percent of the wildfires in the region have been started by lightning.

BIG GAME POPULATIONS

The earliest reports about big game in north-central Idaho were by the Lewis and Clark expedition in 1805–06. They noted that deer and elk were present, but not plentiful, along the Lochsa River and much of the time the men were without meat (Hosmer, 1917). A group of hunters killed deer and elk near Colgate Warm Springs on the Lochsa in 1893 (Elsensohn, 1951:245). However, these animals were apparently not abundant as another party traveled the Lochsa in February and March of 1894 and reported that game was very scarce (Bailey, 1935:315). Moose Creek on the Selway River was said to be the only place in the Clearwater River drainage where elk were plentiful enough to warrant taking a trip to seek them in 1906 (Case, 1938). Parsell (1938) reported that deer were numerous in the upper Selway drainage as early as 1900, but that elk were rare, being found only in the extreme eastern portion of the Selway. Elk sign was rarely found by hunters and guides in the Selway headwaters as late as 1913.

It was not until after the large 1910 fires that the elk herds started expanding (Young and Robinette, 1939). McCulloch (1955) stated that between 1927 and 1936, elk numbers surpassed deer in the upper Selway because elk were better competitors for forage. However, elk also started decreasing soon after they reached their maximum numbers in the mid-1930's.

In the lower Selway, which was not burned until 1934, elk numbers didn't reach their peak until 1954 (Beeman, 1957). The vegetation throughout the Clearwater and St. Joe drainages is comparable to the Selway, so it is likely that the elk numbers were maximum between 1936 and 1954, depending on the year each particular area was burned. Since then, elk herds have been slowly dwindling. The Lochsa River is one drainage that has been cenesused from helicopters during recent times and the decline is apparent. The elk count decreased 14 percent between 1957 and 1964, from 4307 animals to 3736 (Norberg and Trout, 1957; Norberg, 1965). However, there are a few areas where elk are holding their own or increasing. This is because of clear-cut logging operations that are opening up low-elevation timber stands which were missed by the early fires. Unfortunately there are few of these areas.

THE PROBLEM

Large numbers of deer and elk were not always common to northern Idaho. The literature indicates that big game, especially elk, were scarce prior to the 20th century. Large fires in the early 1900's burned hundreds of thousands of acres of low-elevation winter range and created a great food supply where it was needed most. Big game numbers increased with elk out-competing the mule deer. Now many of the shrubs have grown too tall to be utilized and conifers are crowding out some of the brushfields. Elk numbers are decreasing because of the reduction of food which is inherent with the advance of plant succession toward the conifer climax.

Realizing that brushfields needed to be rejuvenated on winter ranges, the Idaho Fish and Game Department initiated in 1965 a long-term study to evaluate prescribed burning for this purpose. The United States Forest Service is a major cooperator in this research.

PRESCRIBED BURNING STUDIES

The Lochsa River drainage (Fig. 5) was chosen as the study area because of its centralized location and accessiblity. The vegetation is

FIG. 5. The Lochsa River in north-central Idaho. Most of the prescribed burning research is being conducted in this drainage.

representative of the other burned-over drainages to the north and south. Pete King, Otterslide, Fish, Sherman and Holly Creeks are Lochsa tributaries where research is currently in progress. Individual studies will not be singled out, but rather, general findings and conclusions applicable to the entire program will be discussed.

Controlled burning appears to be feasible at only two seasons of the year, early spring after the snow has melted at the lower elevations, and in the fall, soon after the seasonal rains begin. Burning could be done during the hot summer months, but fire control would be difficult and expensive. It is also likely that results would not be satisfactory as Ferguson (1957) found that shrubs in Texas resprouted poorly when burned during the growing season.

Spring Burning Techniques

Spring burning can be conducted from about the end of March until mid-May. Weather varies considerably from year to year, but rarely will there be more than 10 or 12 days when fuel moistures and climatic conditions are such that a burn will be successful. Areas are ready for burning when the snowline recedes and dead, herbaceous fuels are adequately dried. Air temperatures of at least 65°F and relative humidities no higher than the mid-30's are desirable. The hotter and drier the day, the better are chances for a successful burn. Good quantities of light fuels are also very helpful, especially if air temperatures or humidities are not optimum. Burning operations are usually terminated by the middle of May because of vegetation "green-up." After plant growth has started, burning is more difficult and shrub response to fire does not appear to be as good.

Wind is not needed to spread the fires as they are started at the bottom of steep slopes and the flames naturally preheat the fuel ahead of the fire. As a head of fire builds, updrafts are created to further stimulate the burn.

A backfire fusee, placed on the end of a stout stick, is the usual device for starting fires. Diesel and propane torches have also worked successfully, but fusees are lightweight and do an adequate job when fuels are light and easy to ignite. Dried bracken fern (*Pteridium aquilinum*) and cured grasses are the best flash fuels and fire success is assured where these are abundant.

FIG. 6. A prescribed burn on Sherman Creek, April 6, 1966. Note the snow still present on the shadier aspects and at higher elevations. A fall-burn study area is on the right side of this fire (see Fig. 7).

There is usually no problem in controlling spring burns because snow is still present at higher elevations and on shadier aspects (Fig. 6). All manpower is used for igniting the fuels. Men usually work in two-man crews as a safety precaution.

FALL BURNING TECHNIQUES

Summers are very warm in this area, with temperatures in the 90's and 100's throughout July and August. Relative humidities are low and precipitation is almost non-existent. About mid-September the fall rains begin and thereafter lie the chances for prescribed burning until mid-October when conditions normally become too moist and cold. Hot, sunny days must precede any burning attempt during the fall, as well as in the spring. We've only conducted two fall burns during this study and both were fired in the middle of October

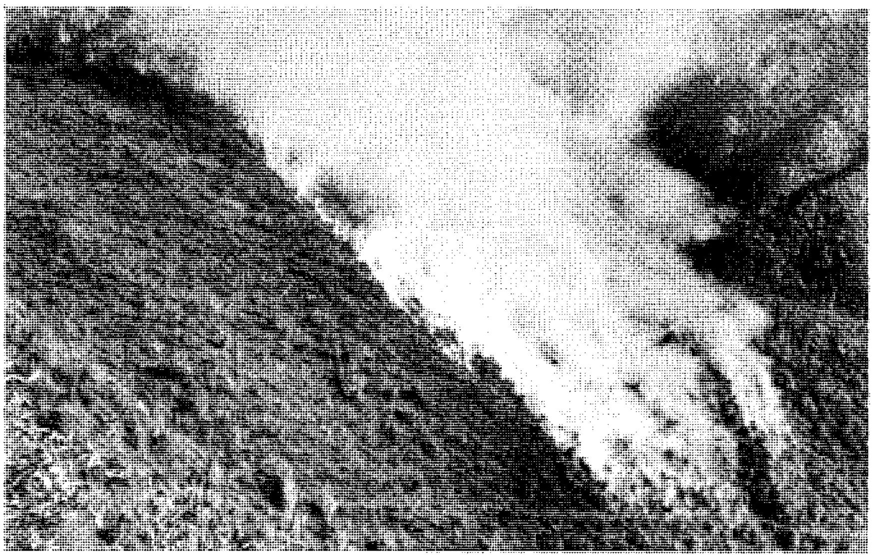

Fig. 7. A successful fall burn on Sherman Creek, October 10, 1966.

(Fig. 7). In each case temperatures were in the low 70's, but relative humidity varied from 30 percent on one burn to about 45 percent on the other. The latter situation produced an incomplete burn, presumably because of the higher humidity.

For the fall burns it was necessary to have fire control lines surrounding the areas. Fire lines were made by men using hand tools, and were usually kept on the crests of primary or secondary ridges to facilitate fire control. Ten to fifteen men patrolled the lines during the burns which were both about 5 acres in size.

When firing an area, a safety strip was first burned out adjacent to the uppermost fireline. The men doing the igniting then made passes on the contour across the hillside, starting from the safety strip and working downward at intervals until the area was totally burned. This was done to insure complete coverage of the area with the fire. Diesel torches were used instead of fusees as fuels didn't ignite as easily as in the spring.

FIG. 8. Forest Service personnel patrolling the fireline during the prescribed burn on Otterslide Creek, October 12, 1965. Fire control costs are much higher for fall burns than for spring burns.

VEGETATION RESPONSES TO FIRE

Over 500 shrubs, including all the main species on the study area, were measured before and after burning. The species most important to elk because of their palatability and abundance were willow, serviceberry, mountain maple and redstem.

Most species sprouted prolifically from the root crown following treatment with fall and spring fire. A few redstem and bittercherry plants failed to sprout, but others also died on the unburned control areas, so their death was not thought to be caused by the fires. Willow was the most vigorous sprouter with shoots averaging 4 to 5 feet after one growing season (Fig. 9).

Most of the other species had sprouts 2 or 3 feet high. Average sprout numbers ranged from 10.5 for cascara, the lowest, to 120.3 for mountain maple, the highest. All species together averaged 40 to

FIG. 9. A resprouting willow (*Salix scouleriana*) in July, one growing season after it was burned. The crown height was reduced from 25 feet to 7 feet by burning and browse availability (below 7 ft.) increased from 5 percent to 100 percent. This plant had 85 sprouts.

50 sprouts per plant. Fall burning stimulated slightly less sprouting for most species than spring burning, but as a rule, the sprouts were longer.

There was a substantial reduction in the height of shrub crowns because of burning. The increase in browse availability which resulted, especially for mountain maple, willow and serviceberry, is one of the main benefits from burning (Fig. 11). These shrub species

FIG. 10. This mountain maple (*Acer glabrum*) was 20 ft. high before burning and provided little browse. Now, one growing season after a fall burn, the shrub has 122 sprouts which are completely available as forage for big game.

grow rapidly after sprouting, however, and after only two growing seasons they averaged nearly 8 feet tall. In an exclosure where shrubs have been protected from browsing after burning, mountain maple, willow and serviceberry averaged about 1 foot higher than adjacent browsed plants. It does not appear that normal browsing pressure by elk will keep these shrubs from growing out of reach.

Shrub seedlings were found on the study plots after they were burned. On spring-burned areas, numerous seedlings appeared a year following the fire. Fall burns produced abundant seedlings the next May, only 7 months later. Redstem and bittercherry were the two main species of seedlings, redstem being far more numerous. Spring burning produced about 60,000 redstem and 10,000 bittercherry seedlings per acre. After fall burns, there were approximately 240,000 redstems and 5,000 bittercherries per acre (Fig. 12). Unfortunately,

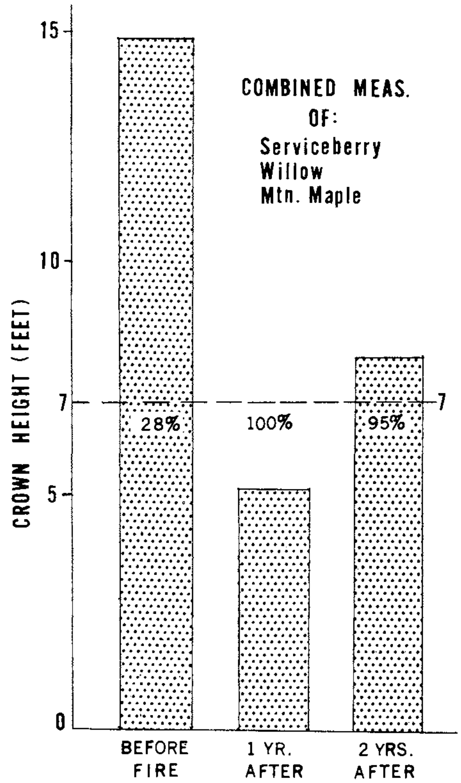

FIG. 11. The decrease in shrub height and increase in browse availability after burning. The number in each column under the 7 ft. line is the percent of the browse that can be reached by elk.

two abnormally hot, dry summers in succession, 1966 and 1967, killed most of the seedlings on these burns.

Browse production is mainly affected by prescribed burning in two ways: (1) the reduction in height of existing browse, and (2) the addition of new browse plants to the area by seed germination. Other factors also being investigated are the changes in browse palatability and nutrients after burning. We found that the palatability of all shrub species was definitely increased as plants were browsed heavier on burned areas (after one growing season) than on adjacent control areas (Fig. 12). The diameter to which elk browsed

FIG. 12. Redstem ceanothus (*Ceanothus sanguineus*) seedlings, one year after a fall burn. Prescribed burning stimulated the seeds from this prime forage shrub to germinate and grow.

the twigs was also greater on burned plants. Increased palatability due to burning has also been reported by Vogl (1965) and Lay (1967).

Studies of chemical changes have not yet been completed, but it is suspected that the browse will be higher in protein after burning as found by DeWitt and Derby (1955) and Lay (1957).

Fall vs. Spring Burning

Spring burning has some significant advantages over fall burning, probably the greatest being that it is much less expensive. The high cost of fall burning is mainly due to the additional manpower and firelines needed to insure against fire escape. This contrasts with spring burning where neither precaution is necessary. Burning costs have ranged from \$.10 to \$1.00 per acre in the spring compared to about \$40.00 per acre for the two fall burns. Fall burning expenses could be decreased considerably if larger areas were burned, and if the topography was such that dozers could be used to build firelines. Nevertheless, spring burning will normally be cheaper because of the difference in control expenditures.

Fall burns did not promote quite as much sprouting as the spring burns. However, fall burning was more successful in stimulating redstem seeds to germinate than the spring fires. This phenomenon has also been reported by Biswell (1961:132) for other species of ceanothus in California.

Soil erosion has not been noticeably accelerated by the prescribed burns. The only gulleys that occurred were in the firelines, epecially those with steep gradients. Fall burns have a greater potential for causing erosion because they destroy more of the organic matter than spring burns. Also, a fall-burned area remains without the protection of vegetation until the following spring, whereas spring burns revegetate very rapidly. This also means that fall burning eliminates the following winter's food supply whereas spring fires stimulate plant growth before the winter dormancy. This could be an important consideration when large areas are treated in the heart of a critical winter range.

Another factor that must be considered is the timing of burning activities in relation to the other projects that need to be accomplished by Forest Service personnel. Here again, spring burning is better suited for this region as the good-burning days in the fall are needed for firing the slash left from clear-cut logging operations.

BURNING AS A MANAGEMENT TOOL

Because of the advantages of spring burning, most prescribed burning on a management scale has been, and will continue to be, done in the spring. However, in special cases, such as where maximum redstem seed germination is desired, fall burning can be justified.

Because of the beneficial results obtained from this study and from an administrative study on the St. Joe National Forest (Brown 1966), the National Forest administrators in this region have started a program of rehabilitating winter ranges with prescribed burning. Caution is being exercised until experimentation and experience have given the program a firm foundation. In 1965, 220 acres were burned along the St. Joe and Clearwater Rivers. The acreage was increased to 2073 in 1966 as confidence in the technique increased. A larger program was planned for 1967, but poor spring weather limited the burning to 1600 acres. Over 5000 acres are scheduled for burning in 1968.

More than 300,000 acres of elk range in the St. Joe and Clearwater drainages are in need of rejuvenating. The job is a big one, and much work remains to be done. Criteria for determining potential, as well as actual, key winter range areas must be more clearly outlined. Wintering areas need to be surveyed so that burning priorities can be established. Research must determine long-term effects of burning and re-burning on vegetation, soil and on the elk themselves.

Eventually, those areas designated as key winter ranges will be burned on a rotation basis to keep them producing maximum quantities of browse. When this is accomplished, the future for elk in northern Idaho will be secure.

ACKNOWLEDGEMENTS

The material presented in this paper was gathered under Idaho Federal Aid Project W-85-R.

I am grateful to Mr. W. O. Hickey, Research Biologist, Idaho Fish and Game Department, for his assistance in gathering much of the data reported herein and for his criticisms of the manuscript.

The U.S. Forest Service has supported this research since its beginning. Personnel of the Clearwater National Forest were very cooperative in burning the areas requested and in constructing firelines and an exclosure. They also provided research materials and secretarial help when it was requested. I would especially like to thank Mr. D. R. Jenni, Forester, for his continuous assistance and for reviewing this manuscript.

LITERATURE CITED

Bailey, R. G. 1935. River of no return. Bailey and Blake Printing Co. Lewiston, Idaho. 515pp.

Beeman, R. D. 1957. Salt in the management of elk and other wildlife in the lower Selway River area. M.S. Thesis. Univ. Idaho, Moscow. 113pp.

Biswell, H. H. 1961. Manipulation of chamise brush for deer range improvement. Cal. Fish and Game 47(2):125–144.

Brown, R. L. 1966. Avery face browse rehabilitation study. Final Report (typewritten). St. Joe Nat. For., St. Maries, Idaho. 5pp.

Case, G. F. 1938. The influence of elk on deer populations. 1st and 2nd Game Mgt. Conf., Univ. Idaho Bull. 33:25–27.

DeWitt, J. B. and J. V. Derby, Jr. 1955. Changes in nutritive value of browse plants following forest fires. J. Wildl. Mgmt. 19(1):65–70.

Elsensohn, Sister M. A. 1951. Pioneer days in Idaho County. Vol. II. Caxton Printers, Ltd. Caldwell, Idaho. 618pp.

Ferguson, E. R. 1957. Stem-kill and sprouting following prescribed fires in a pine-hardwood stand in Texas. J. Foresty 55(6):426–429.

Hosmer, J. K. 1917. History of the expedition of captains Lewis and Clark. Vols. 1 and 2. A. C. McClurg and Co., Chicago. 1083pp.

Lay, D. W. 1957. Browse quality and the effects of prescribed burning in southern pine forests. J. Forestry 55(5):342–347.

———. 1967. Browse palatability and the effects of prescribed burning in southern pine forests. J. Forestry 65(11):826–828.

Leiberg, J. B. 1900. The Bitterroot forest reserve. Twentieth annual report of the U.S. Geological Survey, Vol. 5. U. S. Gov't printing office, Wash, D.C.

McCulloch, C. Y., Jr. 1955. Utilization of winter browse on wilderness big game range. J. Wildl. Mgmt. 19(2):206–215.

Norberg, E. R. and L. Trout. 1957. Clearwater game and range study. Final Report, Proj. W–112–R. Idaho Fish and Game Dept. Boise. 171pp.

———. 1965. Aerial Survey. Completion Report, Proj. W–85–R–15, Job No. 1. Idaho Fish and Game Dept. Boise. 23pp.

Parsell, J. 1938. Elk problem in the Selway. 1st and 2nd Game Mgmt. Conf., Univ. Idaho Bull. 33:23–25.

Vogl, R. G. 1965. Effects of spring burning on yields of brush prairie savanna. J. Range Mgmt. 18(4):202–205.

Young, V. A. and W. L. Robinette. 1939. A study of the range habits of elk on the Selway Game Preserve. Univ. Idaho Bull. No. 16, Moscow, Idaho, 47pp.