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G.E. Gruell

M.S. Boyce

L.D. Hayden Wing

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WILDLIFE HABITAT INVESTIGATIONS AND MANAGEMENT IMPLICATIONS ON THE BRIDGER-TETON NATIONAL FOREST[1]

GEORGE E. GRUELL[2]

Abstract: Grazing impact by elk and moose has been a point of concern in Jackson Hole for many years. Concern has been primarily directed toward sparsely vegetated south aspects, aspen stands, and willow bottoms. Numerous transects have quantified heavy forage utilization. Trend studies have been mostly inconclusive. Study of historical narratives, early photographs and consideration of plant physiology, soils data, and fire ecology have aided interpretations of vegetal trend and plant succession in recent years. Photographs show little change on sparsely vegetated sites. Soils information on these sites indicate that vegetal growth is limited by low site potential. Utilization of plants during the dormant winter period and early spring is not viewed as damaging. Early narratives suggest that forage species evolved under high levels of elk foraging.

Fire was formerly the predominant abiotic agent influencing vegetal succession on most sites. A reduction in acres burned has allowed vegetation to reach advanced succession at the expense of herbaceous plants and deciduous shrubs and trees. With advancing succession, the carrying capacity for elk and other wildlife has declined. Resulting low levels of aspen regeneration on winter ranges have been suppressed by foraging elk and moose.

It has been concluded that prescribed fire is a viable means of rejuvenating preferred vegetation on productive sites and improving the carrying capacity for elk and other wildlife. A prescribed burn of 1,000 acres was accomplished on Breakneck Flat and appropriate studies set up to monitor results. The use of prescribed natural fire and timber harvests also afford considerable opportunity to improve wildlife habitat.

The Jackson Hole region has long been recognized for its wildlife resource with much attention focused on the condition of elk (*Cervus canadensis nelsoni*) summer and winter ranges. Past emphasis has been on determining the effect of forage utilization by elk on vegetation and watersheds, with less consideration given to other biotic and abiotic influences, (Beetle 1952, Buechner 1960, Croft and Ellison 1960). Reliable information on long term habitat condition and trend was lacking. The current study was conceived to fill these information deficiencies and to perceive wildlife habitat changes from an historical perspective.

The condition of half-shrubs including Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), winterfat (*Eurotia lanata*), fringed sagebrush (*Artemisia frigida*), and herbaceous species growing on ridge tops and south and west facing slopes have historically concerned resource managers. Such sites are most prevalent in the Gros Ventre River drainage. Typical species besides the half-shrubs include several perennial grasses, Hoods phlox (*Phlox hoodii*), pussytoes (*Antennaria spp.*), eriogonum (*Eriogonum spp.*), and a mat locoweed. Interpretations of plant condition and trend on these sites have varied and have been complicated by yearly elk use.

The condition of aspen (*Populus tremuloides*) has also been of concern. With some exceptions, aspen stands today, particularly on big game winter ranges, are either mature or deteriorating (Krebill 1972). Regeneration during the twentieth century has been poor. Such deterioration is not unique to Jackson Hole (Schier 1975). Exceptions in Jackson Hole are young aspen stands on the 1934 Fall Creek-Munger mountain and Taylor Creek-Mosquito Creek burns; the 1919 Jack Creek burn; small 1930 and 1932 Spread Creek burns and localized areas where light ungulate browsing has allowed variable aspen regeneration without fire.

Prior to the 1930's, willows (*Salix* spp.) on flood plains were large and their growth form had not been materially altered by the browsing of large numbers of wintering elk. Only during severe weather when deep

[1]The data, interpretations, and conclusions discussed in this paper are presented in greater detail in an upcoming publication titled: Fires Influence on Wildlife Habitat on the Bridger-Teton Forest, Wyoming.

[2]Present address: Northern Forest Fire Laboratory, Drawer G, Missoula, Montana 59801.

crusted snow made preferred herbaceous forage unavailable did elk heavily browse willow and influence its growth form. Old timers refer to elk as being "willered up" during those severe periods. During intervening, less severe winters lighter browsing permitted willow to accumulate growth and maintain a large size. Utilization of willow by moose (*Alces alces shirasi*) was light during this era because moose numbers were extremely low. By the latter 1930's, willow on the Gros Ventre River flood plain showed the accumulative effects of browsing which Olson (1938) attributed to elk.

Several photos of the Gros Ventre winter range show a marked reduction in willow height during the past 50 years. The earlier, taller stature of willow is also currently evidenced by the greater height of dead branches protruding above living material.

Deciduous shrubs including bitterbrush, (*Purshia tridentata*) serviceberry (*Amelanchior* spp.) and chokecherry (*Prunus virginiana*) have been heavily browsed in many localities. Heavy utilization of forage by elk on Jackson Hole winter ranges has been documented over the years (Olson 1938, Baird 1958, Buechner 1960, Smith 1961).

Reliable quantative studies on range condition and trend are lacking. Various procedures have been used to measure the condition and trend of the more harsh sites on the Gros Ventre winter range, on sites east of the National Elk Refuge, and on the lower Hoback River. Several exclosures constructed in the late 1930's and early 1960's allow subjective interpretation but lack good quantitative studies.

Parker 3-Step transects established in the early 1950's are mostly unreliable for measuring condition and trend because of faulty establishment procedures and errors in recording. Photographs taken as part of these studies do allow subjective interpretations. Circular plots measuring .96 square feet, established in the early 1960's, have yielded inconclusive data on condition and trend.

Since 1967 emphasis has been placed on historical perspective as well as various biotic and abiotic factors which have influenced plant succession and vegetative condition and trend. A literature search revealed convincing evidence that elk and vegetation evolved together. Large numbers of elk wintered in Jackson Hole at the time of settlement. An estimate of 10,000 elk was made on the Gros Ventre drainage during the winter of 1896-97 (Price 1898) and 9,000 plus elk were counted there in the 1925 census (Anderson 1958). These early counts compare with a high in recent years of 3,600 on feedgrounds in 1969 which did not include small groups free-ranging over a wide area (Gruell and Loope 1974). Classification counts under ideal conditions in the winter of 1978 showed 1,700 elk on feedgrounds. An additional 700 free-ranging animals were counted from the air for a total of 2,400.

Work since 1960 by Forest Service soil scientists has demonstrated that soil productivity potential on the Gros Ventre winter range is generally very poor to poor on sites of low density plant cover (Olson 1961)(B. Glen 1977 personal communication). The evidence is strong that too much has been expected from these sites which were heavily utilized by elk prior to settlement as well as more recent times.

It is apparent that more consideration should be given to plant physiology—an understanding of which explains how plants can persist on winter ranges when heavily utilized. Ungulate use of forage species is during the dormant winter period or early in the spring before plants are susceptible to damage. Ungulate foraging usually removes only the current growth, thereby not appreciably affecting food reserves. This largely explains why plants persist after decades of intensive utilization. Shrubs, including winterfat, store carbohydrate food reserves in roots and larger branches (Garrison 1972). Grasses store food reserves in roots (McIlvanie 1942). Cured stems and leaves can be removed during dormancy without harm-

ing the plant appreciably because aerial portions have little influence on maintenance of life processes after grasses cure. Food reserves in grasses, forbs and shrubs are replenished during the growing season after ungulates leave the winter range.

Major emphasis has also been placed on evaluating the influences of wild ungulates, domestic livestock, insects and diseases, rodents, fire, and climatic fluctuations on plant succession and vegetative condition and trend. All these have played varying roles, but fire appears to have been the dominant force in plant succession except on sites with low plant density (Loope and Gruell 1973).

We have investigated fire's role in some depth by:

1. Review of publications on fire ecology.
2. Review of historical narratives mentioning fire.
3. Analysis of fire records on the Teton Forest since 1931.
4. Examination of the landscape for past evidence of fire.
5. Sampling of fire-scarred conifers for age of burns.
6. Aging of aspen.

An invaluable aid in reconstruction and interpreting early conditions has been the retaking of over 100 photographs spanning the period 1872-1942. Many of these photos predate significant use by settlers, thereby giving us a conception of pristine conditions.

These photo comparisons strongly suggest that southerly or westerly slopes on ungulate winter ranges that are sparsely vegetated today were in the same condition in pristine times (Figure 1). Growing conditions are harsh because of aspect, persistent winds and droughty soils. Erosion rates have been identified by soil scientists as geologic or natural. All photos show a close similarity in gully patterns. Only low growing plants adapted to these environments have persisted. Predominant species are often comprised of perennial wheatgrasses, Hoods phlox, pussytoes, eriogonum, and palitable half-shrubs including winterfat, fringed sagebrush and Douglas rabbitbrush. Sparsely vegetated slopes and adjoining terrain on the Gros Ventre winter range have been used for centuries by elk because of low snow accumulation. Supplemental feeding has reduced utilization on many sites by drawing elk away during the primary wintering period. Utilization levels on native forage have increased, however, near feedgrounds.

Photographic comparisons on the Hoback winter range where deciduous shrubs are more uniformly distributed, show that the condition and trend of chokecherry, serviceberry and bitterbrush is variable. In some localities, such as the Gilcrease site, and on the bench above the highway about one-half mile to the southeast, shrubs have grown considerably in recent years. In the latter area, former hedged crowns are still evidenced by dead branches within the shrub canopy. The change in growth form has largely resulted from reduced winter utilization by elk. Since about 1960, the elk in this area have shifted from foraging on traditional winter ranges to depending primarily on feedgrounds operated by the Wyoming Game and Fish Commission. Elk use still occurs during open winters and in spring, but at levels well below those of former years when large numbers of elk freeranged in this locality. Increased vehicle traffic over the years has also discouraged elk from frequenting some localities close to State Highway 187-189. This has resulted in reduced utilization and increased growth of shrubs. Snowmachine disturbance of elk has reduced utilization in other localities.

Utilization of palatable shrubs on the Hoback winter range has been heavier on wind blown ridges, south slopes and near elk feedgrounds where concentrated use over many years has suppressed growth and maintained a hedged growth form. Some observers believe that hedged shrubs resulted from increased elk utilization brought on by the feeding program, but early photographs

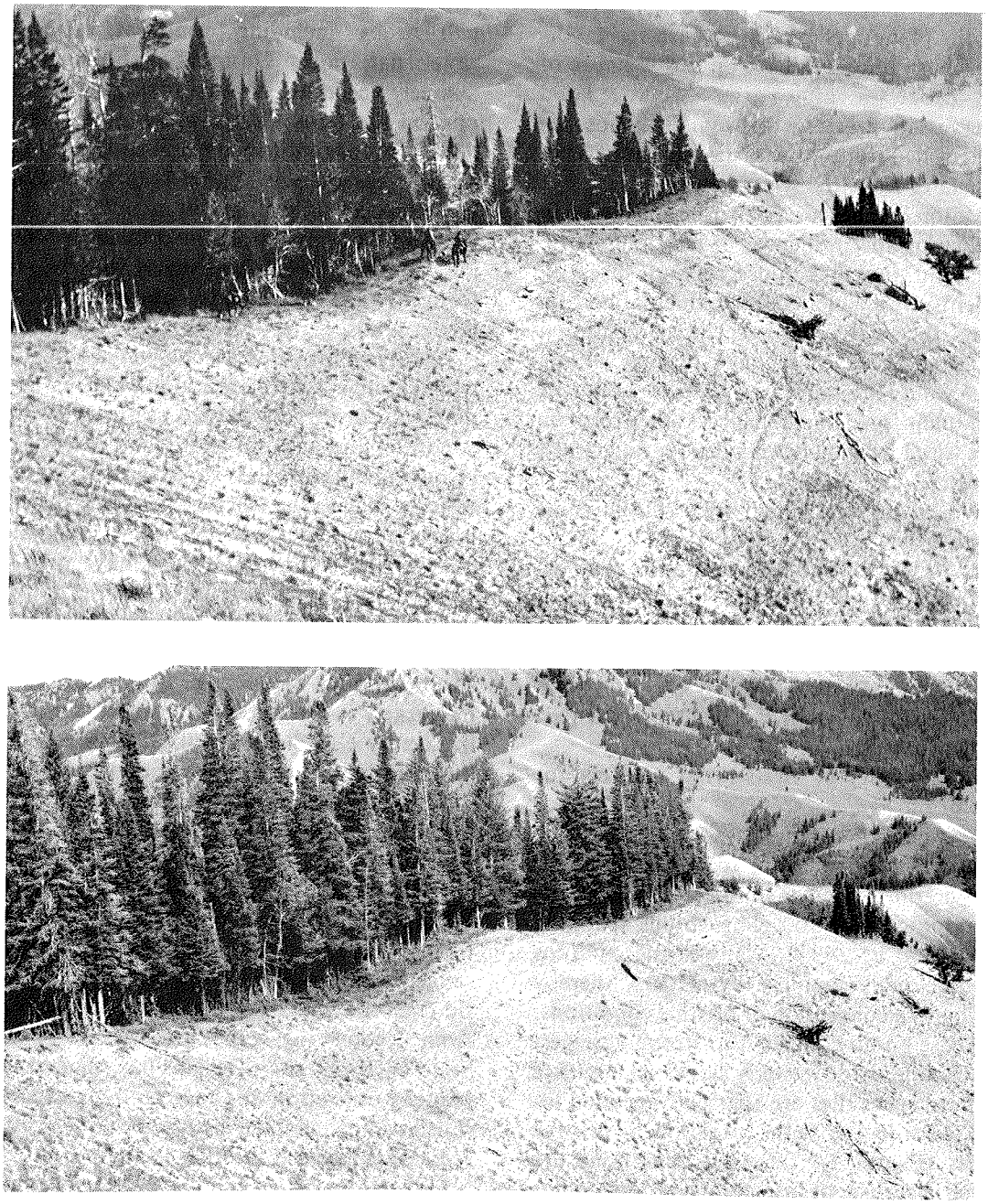

Fig. 1. (Upper) June 1918. Inspection party on ridge between Haystack Fork and Bear Paw Fork of Slate Creek. View is east-southeast across Haystack Fork. Southeast exposure in foreground was described as sparsely vegetated and covered by droppings from wintering elk. Note elk trail on slope and highlined conifers. Down timber in Haystack Fork beyond near ridge at right was killed by fire. Forest Service photograph 39588A by Smith Riley. (Lower) June 17, 1969. Site potential on near slope is severely limited by poorly developed sandy soils. Ground cover is comparable to early scene despite less precipitation than in 1918. Elk foraging in this locality has decreased significantly due to the winter feeding program in Gros Ventre valley. Conifers now predominate on old burn in Haystack Fork, while little change in the timber cover is evident on slopes above.

and reports clearly demonstrate that shrubs were uniformly hedged from the turn of the century through the 1950's. For example, at the Camp Creek exclosure, three-fourths of a mile from the Camp Creek elk feedground, serviceberry and bitterbrush were closely browsed in 1939 and 1942 prior to annual feeding that began about 1960 (Figure 2). Shrubs outside the exclosure continued to be closely browsed and hedged in 1968. Lacking historical perspective, some investigators have concluded that the robust shrubs inside the exclosure represent the natural appearance of the shrub community prior to the establishment of the feedground. However, the exclosure merely demonstrates the potential for shrub growth on similar sites if ungulate browsing is artifically excluded. A suppressed growth form from persistent browsing was the historical norm and will continue to be as long as elk and deer use the area.

Photo comparisons show convincing evidence of the dominant role of fires in the past. Prior to settlement of Jackson Hole, wildfires periodically set back plant succession and created a mosaic of variably aged vegetation (Figure 3). Early successional herbaceous plants, deciduous shrubs and deciduous trees were well represented. A marked reduction in acres burned has allowed vegetation to advance successionally, and fuels to build up greatly over wide areas. Much early successional vegetation has either died or become senescent, resulting in reductions in carrying capacity and heavy utilization of remaining palatable species by wild ungulates (Figure 4). Changes in vegetation have had far-reaching influences on wildlife and other fire dependent systems.

Krebill's 1972 study showed that 71 percent of the aspen on the Gros Ventre winter range regenerated between 1850 and 1899—a period of high fire occurrence. Most scenes retaken on the Forest show aspen in early succession during the late 1800's. For example, the slope near the outlet of Goosewing Creek burned about 1872. Photographic evidence in the latter 1800's shows this slope occupied by a young even-aged aspen stand (Figure 5). This stand was 89-98 years old when sampled in 1971 (Gruell and Loope 1974). Aspen stands on Turpin Hill in the lower Gros Ventre drainage regenerated following burning in 1879 (Figure 6).

Photographic comparisons also show a significant increase in the density of mountain big sagebrush since pristine times. Early fires removed and thinned sagebrush cover, increased herbaceous production, especially grasses, increased palatability and improved forage availability. The decrease in availability of grasses—a staple in the diet of free-ranging elk—has reduced carrying capacity on the Gros Ventre winter range.

My investigations have demonstrated that fire is a process vital to the creation and maintenance of wildlife habitat. But we needed to know how it could be re-introduced under prescribed conditions and its effects, particularly in initial stages of succession.

In cooperation with the Intermountain Forest and Range Experiment Station the Breakneck Ridge area of the Gros Ventre winter range was selected for prescribed burning and for monitoring vegetation responses during early succession. This locality was selected primarily because Forest personnel had not had prior experience with prescribed fire under extreme conditions and we believed the burn could be contained within the project boundary. Predominate vegetation included aspen and sagebrush in varying condition on a variety of slopes and exposures. Since it was only about two miles from feedgrounds, elk use was heavy.

The area was burned under extreme conditions on August 29, 1974 in an attempt to put fire through a variety of fuels and fuel moisture conditions. By 5:00 P.M. that day most of the burn was accomplished. In keeping with the burning plan, the fire was allowed to continue until extinguished by November storms. Flareups during intermit-

Fig. 2. (Upper) September, 1939. Camera is positioned at the southwest corner of Camp Creek exclosure No. 2 one year following construction. This exclosure was constructed to study vegetative potential and growth response following exclusion of elk foraging. The more prominent shrubs are serviceberry,while those of low growth form are principally bitterbrush. Elk foraging was intense prior to and during the early 1930's as indicated by the hedged growth form of these shrubs. At the time of this photograph, winter feeding of elk was sporadic, being practiced only during severe winters and for short duration. Elk free-ranged over the adjacent slopes as they had historically. Forest Service photograph by A. Buckingham. (Lower) September 26, 1968. Serviceberry and bitterbrush shrubs have robust growth forms after 29 years protection from elk foraging. The serviceberry shrub on far right has grown approximately seven feet. Bitterbrush at lower left has spread approximately seven feet. Other shrubs which have increased in growth and density include snowberry, rose and sagebrush spp.

Fig. 3. (Upper) 1878. Facing nearly due south up Cliff Creek, the camera is on the ridge separating Cliff and Little Cliff Creeks. The near slopes show the effect of fire in recent past with shrubs predominating. Note the irregular pattern of burning. Composites and grasses predominate in foreground. W. H. Jackson photograph 7518, courtesy of State Historical Society of Colorado. (Lower) July 16, 1968. Scouler willow is a conspicuous component of the vegetal cover on old burn. Various shrubs and subalpine fir growing in association with the willow make this locality ideal habitat for moose. The composite cover in foreground is less dense than formerly.

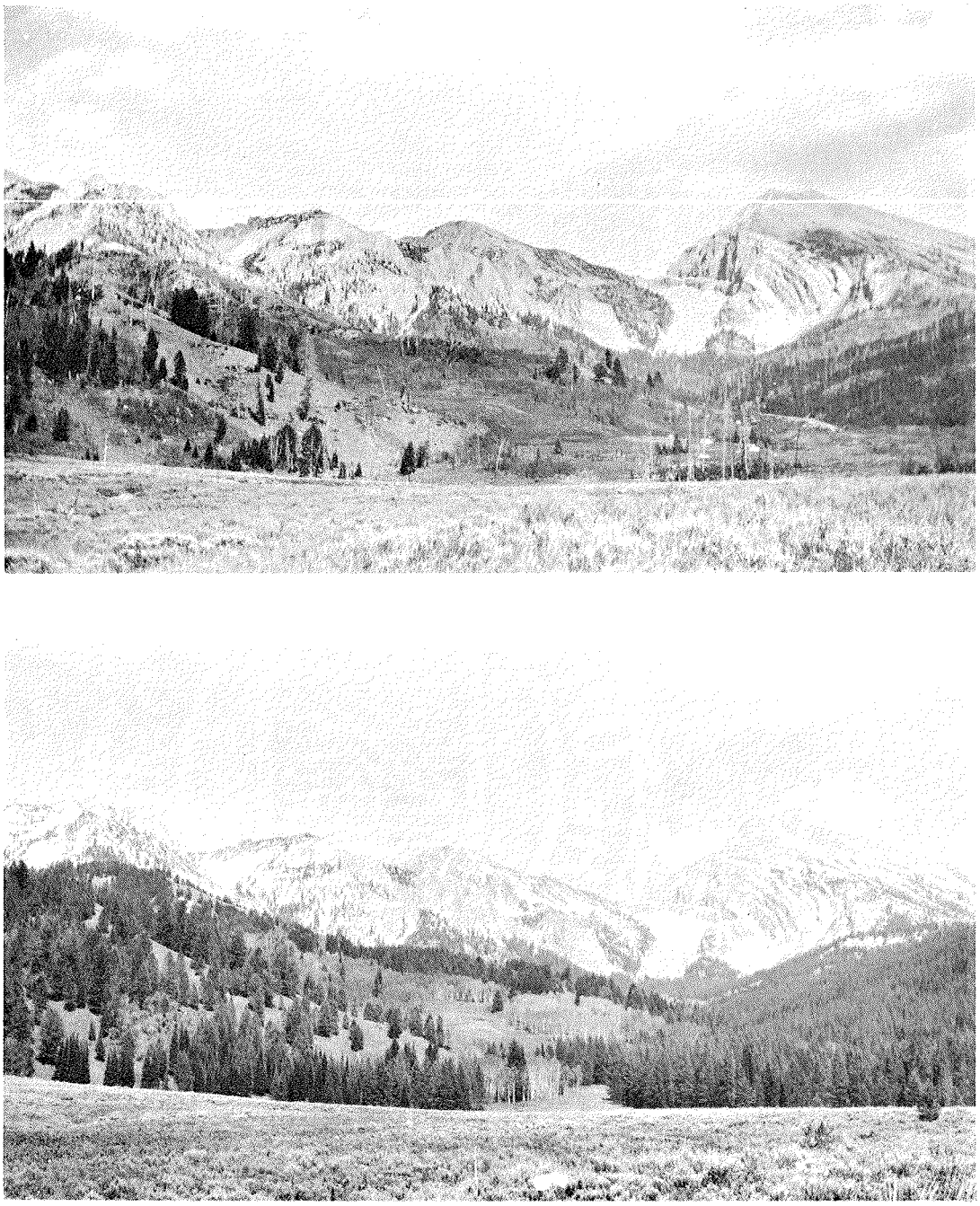

Fig. 4. (Upper) 1906. The camera faces up Swift Creek from trail adjacent to Girl Scout Camp. Foreground vegetation includes grasses and mountain big sagebrush. The prevalence of snags and size of even-aged aspen on distant slopes attest to a fire some 20-30 years earlier. Scattered large conifers indicate that this fire burned irregularly. USGS photograph 58 by A. R. Schultz. (Lower) June 27, 1968. Mountain big sagebrush in foreground has increased. Conifers are re-established on sites occupied prior to the burn, while aspen stands have matured. Deciduous shrubs including snowbrush ceanothus, russet buffaloberry, chokecherry, and serviceberry came in profusely following burn, but are now deteriorating.

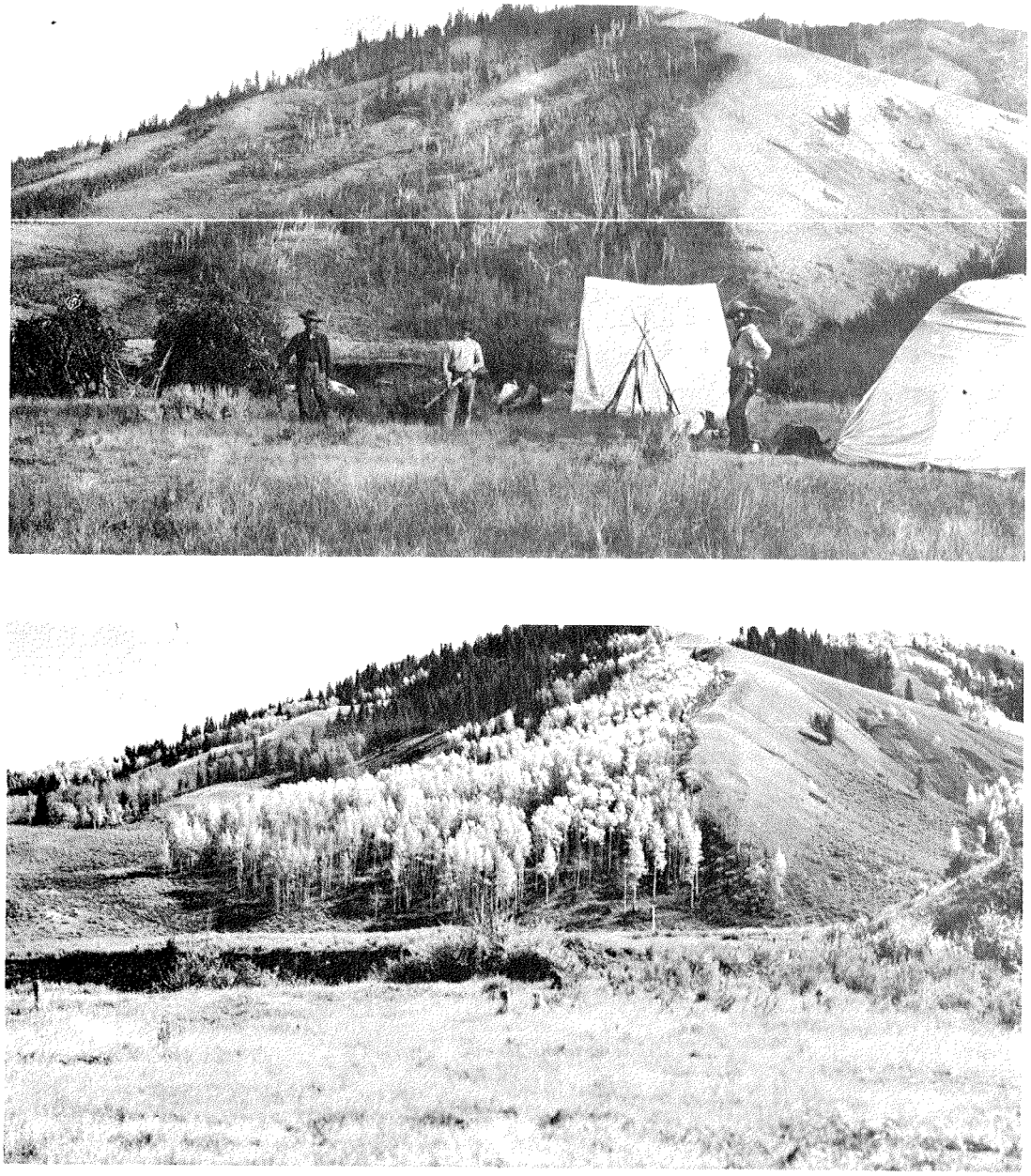

Fig. 5. (Upper) Between 1887 and 1896. The Owen Wister hunting party near the outlet of Goosewing Creek. The camera is facing southeast. Tree cover on the near slope is predominately aspen in early succession. Fire scars in the vicinity suggest an 1872 burn. The light-appearing trees are largely fire-killed spruce, which show that the stand was in advanced succession when burned. Note the network of well-worn elk trails on ridge above tent. Owen Wister Photograph, courtesy of Western History Department University of Wyoming. (Lower) September 12, 1969. Growth ring counts from aspens on near slope showed them to be 89-98 years old thus substantiating even age regeneration following the 1872 fire. Spruce are re-invading beneath the canopy. The elk trails have virtually disappeared, since winter feeding has drawn elk away from this locality. An increase in shrub cover is apparent on the deeper, more moist soils near the base of the southwesterly slope at right. Plant cover on the upper slopes continues to be sparse with available moisture limited by sandy, shallow soils. Heavy use by campers and bedding livestock has altered the plant cover in foreground.

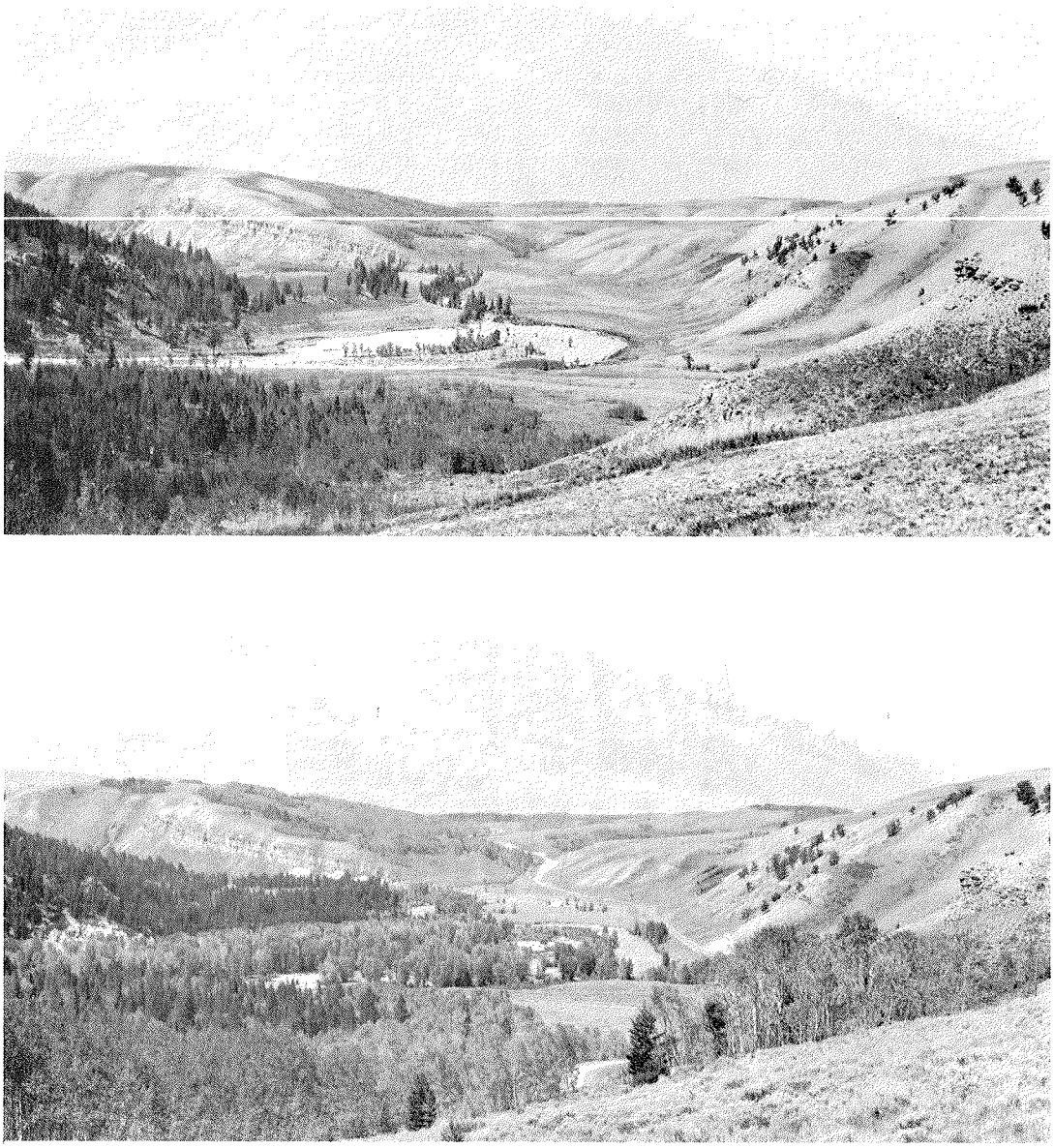

Fig. 6. (Upper) 1899. A westerly view of the Gros Ventre River from Turpin Hill. Location is north of a point on Gros Ventre Road, 1.4 miles from the Bridger-Teton Forest—Grand Teton Park boundary. Vegetation is largely in early succession some 20 years following the wildfire of 1879. Ground cover on near slope is an association of half-shrubs, herbaceous species and a scattering of mountain big sagebrush on a conglomerate formation. Based on present composition, a few widely dispersed serviceberry and snowberry shrubs of low growth form are also present. Aspens at left and right midground are in early succession. Note even-aged aspen on terrace across river. Bitterbrush and serviceberry shrubs prevail on deeper soils between sparsely vegetated areas on southeast exposure in distance at right. Haze obscures Teton Range in distance. Stimson photograph, courtesy of Wyoming State Archives and Historical Department. (Lower) July 28, 1971. Vegetation is in advanced succession following some 92 years of fire exclusion. The open half-shrub and herbaceous plant association in foreground is now dominated by mountain big sagebrush. Douglas-fir and limber pine are also invading the locality. Aspens in near stands have matured. Seral aspen on far terrace have largely been replaced by Douglas-fir. Bitterbrush and serviceberry shrubs on southeast exposure have increased in growth form, as have nearby limber pine. The associated ground cover appears to have improved.

tent dry weather burned additional aspen and sagebrush for a total of approximately 1,000 acres.

Aspen mortality was high in deteriorated stands with heavy fuel loading. Mortality in closed stands was sporadic because herbaceous vegetation was too moist to carry fire. Initial mortality was low, but drier conditions in September and October resulted in some additional aspen mortality in localized areas. Had the burn been executed later in the fall under more ideal burning conditions, aspen mortality would have been greater. Whether aspen will regenerate successfully on the Breakneck Ridge burn in the face of heavy utilization by ungulates will depend upon whether forage production and availability has been increased sufficiently over a large enough area to buffer the effects of browsing on aspen suckers. Considering the high level of utilization in this area, if aspen can be regenerated here it can probably be regenerated on other localities throughout the Gros Ventre winter range.

Much was learned from the Breakneck Ridge prescribed burn and some preliminary results are reported in this volume by Bartos and Mueggler. It is apparent that burning increases the production and availability of herbaceous species preferred by elk. Observations during initial succession indicate that the Breakneck Ridge burn has also benefited raptors, pronghorn antelope (*Antilocarpa americana*) and other terrestrial and avian species.

Coordinated planning with the Wyoming Game and Fish Department includes the use of prescribed fire on suitable areas of the Bridger-Teton National Forest. In addition, recent Forest Service fire management directives call for pre-planning and zoning areas where lightning caused fires will be allowed to burn under prescribed conditions. The purpose of this policy change is to reduce widespread fuel buildup, but future benefits to wildlife from this program could be tremendous. There is also considerable potential to improve habitat for elk and other wildlife by harvesting timber at lower elevations where there is high potential for rejuvenation of important early successional deciduous trees and shrubs and herbaceous plants. Broadcast burning of slash and closure of roads will be an important element of these projects.

It is clear that elk and other wildlife evolved in a diversified ecosystem. Therefore, future wildlife habitat management on the Bridger-Teton Forest should emphasize the manipulation of vegetation to achieve these former conditions.

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