FIRE'S INFLUENCE ON WILDLIFE HABITAT ON THE BRIDGER-TETON NATIONAL FOREST, WYOMING

VOLUME I -- PHOTOGRAPHIC RECORD AND ANALYSIS

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USDA Forest Service Research Paper INT-235
Intermountain Forest and Range Experiment Station
and Intermountain Region
Forest Service, U.S. Department of Agriculture

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Cover Photos

Town of Jackson and slopes of Snow King Mountain 39 years following the fire of 1879.	February 1918
Town of Jackson and Snow King Mountain 60 years later. The camera points for Plates 65a and 65b are on distant slopes at upper extreme right.	February 22, 1978

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PREFACE

The Bridger-Teton National Forest in the Jackson Hole Region of Wyoming has long been recognized for its wildlife resource. Management efforts have emphasized the measurement of forage utilization by elk *(Cervus canadensis nelsoni)* and their effect on summer and winter ranges. Less consideration has been given to other biotic and abiotic influences. Reliable information on long-term habitat condition and trend has also been lacking. In 1968, this study was conceived to fill these information voids and to consider wildlife habitat changes from a historical perspective.

Contents provide visual evidence of vegetative succession, range condition, and trend. Many old photographs are included. Because old photographs are difficult to obtain and photo points difficult to relocate, we decided to include them in one compendium. By pulling the photographs together, others can examine them, apply their field experience, and make their own interpretations. The interpretations offered are mostly related to wildlife habitat. This presentation is an invitation to biologists, geologists, botanists, archeologists, and others to "read" these landscapes and learn from the past. It is also intended for use by nonprofessionals interested in the landscape. For those less familiar with ecological terminology, appendix I defines some important terms.

Photographs and supporting data have been gleaned from Forest Service files, universities, libraries, archives, historical societies, and other Federal agencies. This historical and ecological information helped identify the important influences that shaped the habitats of Jackson Hole.

The report also includes information pertinent to fisheries, forestry, range, geology, soils, hydrology, fire management, and management of scenic quality. Insights are provided into stream channel changes, timber growth, site potentials, plant succession, erosion rates, fire occurrence, and fuel loading.

This publication comprises two volumes--volume I acquaints the reader with important historical and ecological relationships and presents the photo record. The photos include 85 matched pairs spanning the period 1872-1975. These are separated into three geographical sections with interpretations and conclusions for each. Volume II, intended for land managers, resource specialists, and the academic community, discusses and summarizes the causes of vegetal and watershed changes. Management implications, including limitations, potentials, and future opportunities, are also explored.

ACKNOWLEDGMENTS

The author extends grateful appreciation to Bridger-Teton National Forest Supervisor H. R. Jackson and former Supervisor C. T. Coston for their support and encouragement to publish this study. Members of the Forest Supervisor's staff and interdisciplinary team, including E. C. Hirsch, E. F. Layser, J. J. Conner, H. L. Edwards, W. G. Glenn, T. E. Sullivan, A. F. Galbraith, W. W. Collotzi, G. D. Allen, D. E. Eggers, J. F. Chapman, R. L. Dunblazier, and F. C. Pence provided valuable input in the fields of range management, soil management, hydrology, fish habitat management, timber management, fire management, and scenic management.

Critical review and suggestions to improve the manuscript were provided by W. J. Barmore, Grand Teton National Park; D. B. Houston, Yellowstone National Park; W. F. Mueggler, J. V. Basile, W. C. Fischer, R. C. Holmgren, J. P. Blaisdell, J. E. Lotan, and L. J. Lyon, Intermountain Forest and Range Experiment Station; R. W. Mutch, Lolo National Forest; G. W. Gullion, University of Minnesota; R. J. Vogl, California State University, Los Angeles; and H. A. Wright, Texas Tech University.

I also thank P. W. Shields, A. K. Dahlgren, G. W. Benedict, and D. W. Lloyd, Region 4 Forest Service; I. R. Thornton, Sawtooth National Forest; G. E. Roby, Wyoming Game and Fish Department; and R. L. Robbins, USDI Fish and Wildlife Service for constructive reviews and comments.

T. A. Phillips, Sawtooth National Forest, provided the plant list in appendix III. M. E. Lewis, Forest Service--retired, reviewed this material and that in appendix II. The excellent drafting was done by M. A. Kiner, Bridger-Teton National Forest. My sincere appreciation is extended to these people for their contributions.

RESEARCH SUMMARY

This paper is volume I of two volumes. It documents vegetative succession and wildlife habitat condition and trend on the Bridger-Teton National Forest in the Jackson Hole region of Wyoming by means of comparison photos taken between 1872 and 1968-1972.

An introductory section describes the study area - - geology, topography, soils, climate, vegetation - - early exploration and settlement, and biotic and abiotic influences.

The body of the report comprises 85 matched photos arranged in three geographic sections: the Teton Wilderness and vicinity, the Gros Ventre drainage, the Jackson locale, and the Hoback drainage. Because of elevational differences from 5,800 feet to 12,165 feet (1 768 m to 3 709 m), plant species vary widely - - from cold desert species to alpine species.

Photo captions describe vegetational changes and their significance for each scene, with emphasis on wildlife habitat. Also discussed are the implications of vegetative change for fisheries, forestry, range, soils, hydrology, fire management, and scenic values. The role of fire - - primary influence on vegetative development - - receives special emphasis.

Vegetational changes are summed up at the end of each photographic section. Discussion is limited to identifying the changes that have taken place; why the changes occurred will be discussed in volume II.

Because of differences in physical setting, vegetational changes differ among the three geographic sections. In all three sections, however, conifers and mountain big sagebrush have increased. Other trends are as follows:

Establishment of aspen following fire; a general decline in old stands.

Decline in aspen and deciduous shrubs such as chokecherry and bitterbrush where these plants are seral to conifers.

An increase in density of herb and alpine vegetation.

General reduction in size and distribution of willow.

No appreciable change in ground cover on sparsely vegetated sites at low elevations.

No observable change in rate of geologic erosion.

Channel changes on flood plains.

Lack of stream channel change where flow has been confined by topographic features.

CONTENTS

FIGURES AND PLATES

COMPILING THE PHOTO RECORD

Comparing photographs made many years apart provides an effective means for investigating changes in wildland ecology. This technique has been used by Phillips (1963), Hastings and Turner (1965), Progulski (1974), and Houston (1976). The author learned the merits of this method in earlier experiences on the Humboldt National Forest, Nevada (Gruell, unpublished 1966).

Photographs shown here, largely unavailable to the scientific community before this investigation, were obtained from a variety of sources. A few examples of places where early photographs were located demonstrates the opportunities that remain. Plates by Owen Wister were obtained from his daughter, Mrs. Walter Stokes, who found them in an attic trunk. Several of the W. H. Jackson photographs taken in 1878 were in a well-worn album at the Colorado Historical Society archives. These scenes, which do not appear in any of the prominent Jackson collections, are rare. U.S. Biological Survey photographs thought to have been lost during a World War II move were retrieved from the National Archives and Record Center.

The original photographs were taken for varied purposes from 1872 to 1942 by people on summer excursions, hunting trips, and government surveys. Most were taken by foresters, biologists, or geologists, some by hunters, and three by professional photographers. Many of these photographs predate significant use of the area by European man. All recent photographs were taken by the author.

[1]The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture of any product or service to the exclusion of others which may be suitable.

A 4x5 Kodak Crown Graphic[1] camera fitted with a 135 mm lens was used to rephotograph most scenes. In a few instances, a 190 mm or 300 mm lens was used where the original exposure was made with a lens of longer focal length. Plus X Pan Professional film in 16 exposure packs proved satisfactory, except that rendition of dark tones (willow, sedge) was not always comparable to the wet plate process or the slow speed ortho film used to take the original photos.

Photographs in this report provide a representative cross-section of habitats on the Teton Division of the Bridger-Teton National Forest. Twenty additional matched sets showing comparable conditions are on file at the Forest Supervisor's office. Eighty-two originals were not rephotographed because of poor quality, duplication of scenes, unknown location, or views obstructed by human development.

The original photographers traveled through many different habitats, ranging from alpine vegetation (plate 26) to cold desert shrub (plate 38). Scenes include streams and rivers; meadows and mountain herblands; spruce-fir, whitebark pine, lodgepole pine, and Douglas-fir forests; aspen and sagebrush-grass communities; and perennial grass-low shrub vegetation.

Most photos were taken along primary drainages, which often were historic travel routes. Excepting the Teton Wilderness, many of the original trails have been replaced by roads, sometimes visible in the retake. Readily accessible photo points were located and conditions under which the original photo was exposed were noted before retaking the scene. This insured replication at the right season and time of day.

At some remote sites, prior reconnaissance was not possible, so some scenes were rephotographed at the improper season, wrong time of day, or in adverse weather.

Relocating photo points proved difficult where the original photo lacked distinctive land features as points of reference. With some exceptions, precise relocation of photo points was not critical, because the area of interest was usually distant from the camera. In most instances, the new photo point is within a few feet of the original.

THE STUDY AREA

Location

This study was mostly confined to the Teton Division of the Bridger-Teton National Forest, which lies east of the Teton Range in northwestern Wyoming (fig. 1). This area of 1,695,000 acres (686 235 ha) is roughly bounded by the Snake River on the west; Yellowstone National Park on the north; the Absaroka Range, Continental Divide, and Green River hydrographic divide on the east; and the Wyoming Range on the south and west.

The major drainage is the Snake River, which flows southerly through Jackson Hole from its source in the Teton Wilderness. Principal tributaries include Pacific Creek and the westerly flowing Buffalo, Gros Ventre, and Hoback Rivers. The only major northerly flowing river, the Yellowstone, heads in the Teton Wilderness. The Teton Wilderness occupies 557,311 acres (225 632 ha) in the northern third of the Teton Division.

Elevation ranges from 5,800 ft (1 768 m) at Bailey Creek on the Snake River to 12,165 ft (3 709 m) on Younts Peak in the northeastern quarter of the Teton Wilderness. Many peaks and high plateaus lie above 10,000 ft (3 049 m).

Geology

Six major physiographic features are recognized (Fenneman 1931): the Snake River, Hoback and Gros Ventre Rivers, Mount Leidy and Pinyon Peak Highlands, and Hoback Basin. Compared with other Rocky Mountain ranges, these features are geologically young, having been uplifted to nearly their present elevations less than 10 million years ago during Pliocene time (Love 1956).

Following uplift, land features were subjected to successive erosion cycles that stripped away great quantities of material, particularly highly erosive sedimentary formations. A final period of extensive alteration occurred during the Pleistocene ice age. The region was first strongly glaciated by local ice caps, followed by individual valley glaciers. Five glaciations separated by warmer interglacial periods have been recognized (Bailey 1971). Following the warm-dry Altithermal interval, about 6,000 years ago, minor episodes of cirque glaciation took place during the Little Ice Age interval about 70 and 400 years ago (Bray 1971; Benedict 1968). Glaciation, especially during the initial stages, buried some areas under glacial debris while stripping rock and soil from others.

Topography

Topography, as described by Love (1968) and Bailey (1971), is that of a dissected plateau resting upon sedimentary rocks of complex structure. Even where best preserved, much of the original plateau has been destroyed by the growth of deep valleys. Recent uplifting and glacial activity have developed many steep slopes, except in areas of highly erosive materials and low relief. Long, sharp ridges and rugged peaks cut by steep canyons 2,000 to 3,000 ft (610 to 915 m) deep are common. Those formations, highly resistant to erosion, have been dissected by streams into an intricate pattern of narrow, deeply incised V-shaped drainages. Level ground occurs only as narrow flood plains along major streams, as small remnants of slightly undulating surface representing old valley levels, and on glacial outwash plains. Because of low gradients, meandering streams are common in the valleys.

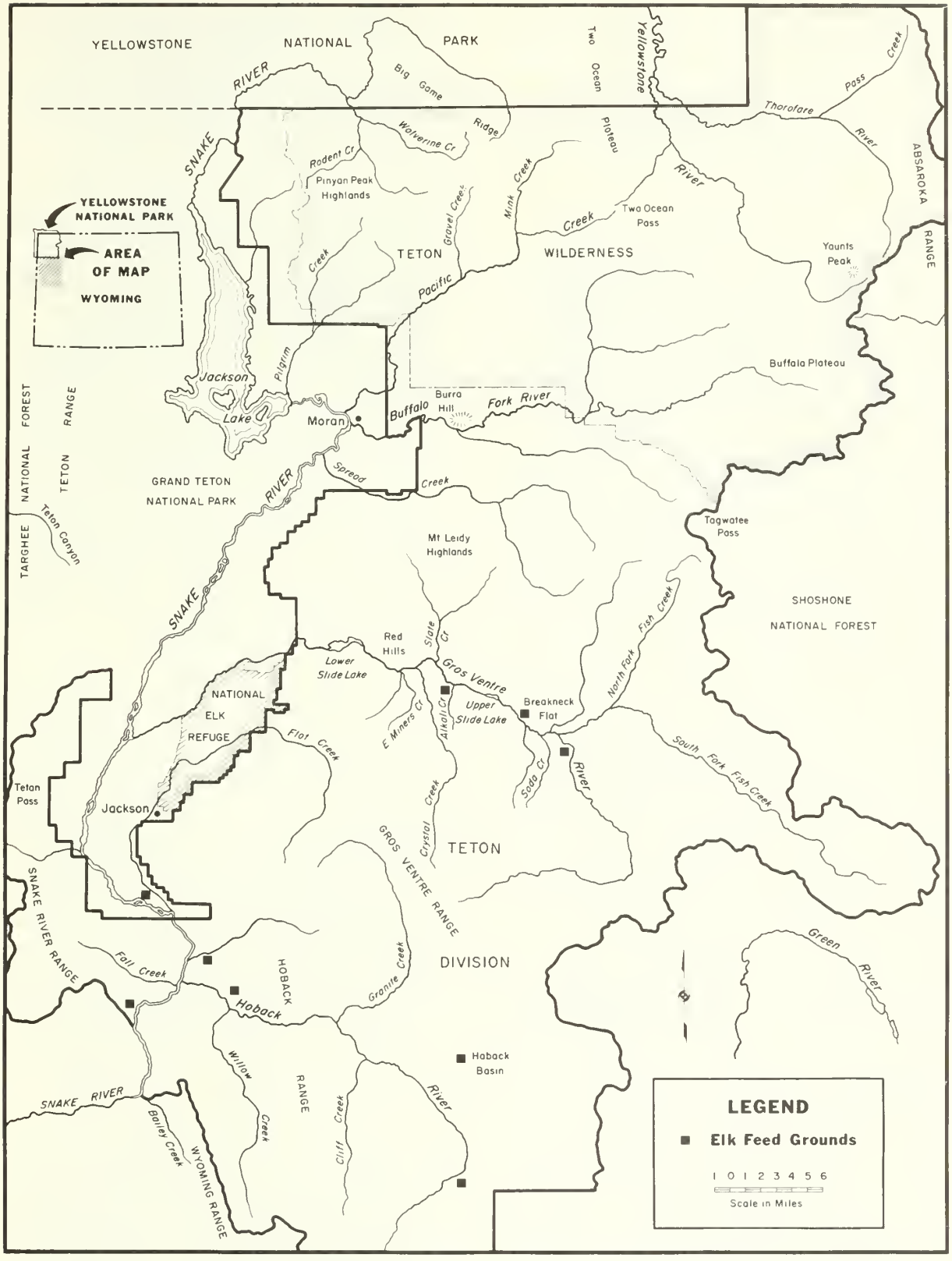

Figure 1. Study area, showing major physiographic features.

On many slopes landslides are frequent because of weak parent materials, high relief, undermining by stream cutting, and high seasonal precipitation.

This region constitutes one of the largest landslide-prone areas in the United States.

Soils

Soils differ due to considerable variation in soil-forming processes. Complex geology alone accounts for many differences in soil textures. Sandy and heavy clay soils are sometimes interbedded along the same exposure. Loam and clay loam soils are most common.

Soil productivity varies; sites with high productivity potential are commonly only a few feet from sites with low potentials. Overall, highly productive sites are more extensive than sites of low productivity. Productive sites are characterized by deep soils and ample moisture. Shallow soils on ridges and south-facing slopes have much lower productivity.

Soil erosion rates are strongly affected by steepness of slope and the amount of litter and vegetation covering the soil surface. The amount of cover required to minimize soil loss decreases as slope gradients decrease. Most of the soils in the area are inherently not very erosive; however, all soils on steep slopes without good vegetative and litter cover are moderately to highly erosive.

Climate

The region's climate is classified by Alyea (1966) as a cold-snowy-forest type with humid summers. Summers are short and cool; winters are long and cold. Snow covers the valley of Jackson Hole about 5 months each year whereas the high country above 9,000 ft (2 744 m) is snow-covered about 8 months. Local conditions vary widely because of differences in elevation and exposure. Semiarid conditions prevail in the lowermost valleys on south-facing slopes. Prevailing winds are from the southwest. Strong winds are much rarer than in most of Wyoming, but occasionally brief storms may bring gusts exceeding 75 miles (121 km) per hour. Because of the cold air flow from Canada, cold air drainage from surrounding mountains, rapid nighttime radiation cooling, and high elevation, freezing temperatures can occur at any time of the year.

Temperatures range widely between summer and winter and between daily maximums and minimums. The mean annual temperature from 1931 to 1960 was 38° F (3.3° C) at Jackson elev. 6,244 ft (1 904 m) compared with 33° F (0.6° C) at slightly higher Bondurant elev. 6,504 ft (1 983 m) in the Hoback Basin. December and January, the coldest months, averaged 11.7° F (-11.3° C) and 7.4° F (-13.7° C), respectively, and July, the warmest month, averaged 56.3° F (13.5° C) at Jackson. Summer temperatures rarely exceed 90° F (32.2° C) at low elevations. A lapse rate of 4.4° F (-I5.3° C) per 1,000 ft (305 m) elevation developed by Potter (1969) for northwestern Wyoming suggests that the mean annual temperature at 9,000 ft (2 744 m) elevation is about 26° F (-3.3° C).

Mean annual precipitation varies from 15 inches (38 cm) in Jackson to 50 or 60 inches (127 or 152 cm) in the Absaroka Range. Most precipitation falls as rain in Jackson, while approximately three-quarters of the total above 7,000 ft (2 134 m) is snow. Snow depths at the highest elevation exceed 100 inches (243 cm). Snow cover normally remains nearly complete at high elevations until mid-June or even through mid-July. Peak runoff occurs during May, June, and early July. Recurrent summer thunderstorms cause some streams to become muddy very rapidly and produce wide fluctuations in flows, but do not contribute significantly to the annual runoff.

Vegetation

The flora of the Jackson Hole area is typical of the central Rockies. Shaw (1976) recognized 836 indigenous and 85 alien species in Teton County, ranging from alpine plants to cold desert species more characteristic of the semiarid Green River region in a few localities. Scientific names of most species found

on elk summer and winter ranges, along with less conspicuous species referred to in the text, and listed in appendixes II and III, are after Hitchcock and Cronquist (1973). Common names largely follow Plummer and others (1977).

As a whole, the plant cover is predominantly herbaceous species, and production potential is high. Shrubs, excepting mountain big sagebrush are localized in distribution. Common shrubs in range habitats are bitterbrush, serviceberry, and chokecherry. Willows predominate on flood plains and along tributaries.

Seven broad plant communities were recognized in this study: sagebrush-grass, aspen, lodgepole pine, Douglas-fir, spruce-fir, whitebark pine, and tall forb vegetation (herblands). Many habitat types occur within these communities.

Sagebrush-grass mainly occurs on glacial outwash plains, river terraces, and well-drained slopes. This community is a conspicuous feature of the landscape, particularly at lower elevations where it is interspersed with aspen, lodgepole pine, Douglas-fir, and spruce-fir. Many streams, ponds, and wet meadows within this complex provide habitats for plants adapted to moist environments. Mountain big sagebrush predominates in the sagebrush-grass community. Associated grasses usually include many species, and growth potential is high. Long-leaf sagebrush occurs on stony soils or those with root restricting layers but is replaced on more droughty sites by fringed sagebrush, Douglas rabbitbrush, and winterfat.

Aspen is the most common deciduous tree up to 9,000 ft (2 744 m) elevation except in the northern two-thirds of the Teton Wilderness where it only occurs in a few isolated stands. Best development of aspen is on loamy soils between 6,500 to 7,500 ft (1 982 to 2 287 m) in elevation. Stands are rarely large and vary from those with closed canopies to those with widely scattered, mature and overmature trees. The understory beneath intact stands usually contains many different herbaceous plants. Increased sunlight in deteriorated stands has allowed the invasion of mountian big sagebrush and other shrubs. Where plant communities have progressed from seral to coniferous forest; aspen have died out with advancing succession.

Lodgepole pine is the most abundant conifer at intermediate elevations. It forms a more or less continuous cover where the landscape is not dissected by drainages. More often, however, it grows in small stands or is intermixed with Engelmann spruce, subalpine fir, or whitebark pine. Most stands are between 100 and 250 years old. Because stands have had many trees with relatively large diameters and thick phloem layers, lodgepole pine has been susceptible to mountain pine beetle *(Dendroctonus ponderosae)* attacks over wide areas. This has often resulted in widespread mortality of lodgepole pine followed by a predominance of subalpine fir. Understory vegetation varies from sparse elk sedge cover under closed stands to an association of various shrubs and herbaceous species in open stands.

Douglas-fir is more restricted in distribution reaching best development at 6,500 to 7,500 ft (1 982 to 2 287 m) elevation in pure stands about 100 years old on north and west slopes along the Gros Ventre, Snake, and Hoback River drainages. Distribution at higher elevations is usually restricted to southerly exposures or ridges where scattered individuals may exceed 300 years of age. Understory vegetation is sparse beneath closed stands, but contains a wide assortment of species under more open stands.

Engelmann spruce and subalpine fir predominate on north slopes above 8,000 ft (2 439 m) and along drainages. Blue spruce is restricted to localized areas in the lower valleys. Engelmann spruce occurs in nearly pure stands or in association with subalpine fir, lodgepole pine, or both. Subalpine fir predominates at the highest elevations. Herbaceous vegetation in the spruce-fir community is characterized by a profusion of grasses, sedges, and forbs in forest openings,

mountain meadows, and parks, while shrubs often predominate beneath the tree canopy.

Whitebark pine occurs in pure stands above 8,500 ft (2 591 m) or mixed with spruce-fir, lodgepole pine, or limber pine. At timberline, whitebark pine dominates. Herbaceous vegetation in the whitebark pine community varies from sparse to abundant, depending upon the site.

Tall forb communities are usually found above 8,000 ft (2 439 m) elevation where they occupy forest openings, open slopes, and ridges. Characteristic species are mountain brome, duncecap larkspur, thickstem aster, western yarrow, silvery lupine, and sticky geranium. Production varies from low density vegetation on shallow soils to dense, luxuriant growth on deep soils. Optimum development occurs above 9,000 ft (2 744 m), where stands sometimes exceed several hundred acres.

HISTORY OF THE STUDY AREA

Various Indian tribes, including the Blackfeet, Shoshone, and Gros Ventre, visited the Jackson Hole region during the summer for centuries before the appearance of mountain men and explorers.

John Colter, in 1807, was probably the first white man to see the region; however, he may have been preceded by French fur trappers prior to 1800. From 1809 to about 1840, numerous mountain men visited the Jackson Hole region to trap beaver. Unfortunately, only a few recorded their travels. The first to do so were Hunt and Stuart (Rollens 1935) who guided the Astorians from St. Louis to Oregon in 1811. Stuart returned east via Jackson Hole in 1812. An insight into prevailing big game populations is contained in their journals.

Others who frequented western Wyoming during the trapping era, including a few who left a written record, were the celebrated Jim Bridger, William Sublette, David Jackson, Edward Robinson, John Hoback, Jacob Rezner, W. A. Ferris, Samuel Parker, Nathaniel Wyeth, Joe Meek, and Osborne Russell. Russell left the most explicit diary, including a precise description of wildlife (Haines 1965). William Sublette named Jackson Hole for David Jackson in 1829.

After the trapping era ended about 1840, the region was seldom visited for the next 15-20 years. Then a succession of geographical, topographical, geological, and biological surveys were initiated by the Federal government. The official reports documenting these surveys provide some of the best descriptions of conditions before settlement.

The first survey was led by Captain W. F. Raynolds, with Jim Bridger as guide. The group traveled down the Gros Ventre River and over Teton Pass in the summer of 1860 (Raynolds 1868). Raynold's report is a good commentary on the remote and rugged nature of the country at that time.

During the 1860's an occasional exploratory mining party passed through Jackson Hole. DeLacy's (1876) account of his 1863 trip contributed to an understanding of early wildfire occurrence. Henderson (1867), also a miner, came through Jackson Hole in 1867.

Barlow and Heap (1872) conducted an engineering reconnaissance in 1871 that penetrated into the northern portion of the present Teton Wilderness. Their report, although lacking detail, gives some insight on watershed conditions and big game populations at the time. Bradley (1873) led a contingent of F. V. Hayden's Geological and Geographical Survey Of The Territories to the same general locality in 1872. His report provides information on watershed conditions, past fire occurrence, and elk populations. In 1873, Captain W. A. Jones led an engineering reconnaisssance along the upper Yellowstone River, down the Buffalo River, and over Togwotee Pass (Jones 1875).

Lieutenant G. C. Doane entered the region by way of the headwaters of the Snake River in the early winter of 1876 (Doane 1877). Despite many hardships, part of this group floated by boat down the Snake River and through Jackson Hole. This report is one of the most interesting and informative records of pre-settlement conditions. Elk were observed in what is now the Teton Wilderness. The diary records the earliest instance of a white man (John Pierce) wintering in Jackson Hole. It also provides the first written record of elk wintering in Jackson Hole.

Ingersoll (1883) left a fine narrative of his experience with the Hayden survey while in the Green River and Hoback River drainages during the summer of 1877.

In 1878, W. H. Jackson, the famous pioneer photographer and a member of the Hayden Survey, took the first photographs of Jackson Hole. Coming into the Hoback drainage from the East, he found the region enveloped in haze from forest fires and was unable to take good photographs. On his return from Yellowstone National Park in the fall, conditions were favorable, and he captured a number of outstanding scenes on glass plates.

Thomas Moran, the distinguished painter, had a similar experience in 1879 on the west slope of the Teton Range. His objective of painting the Tetons was most difficult, because of the pall of smoke enveloping the higher peaks (Fryxell 1932).

Baille Grohman, a wealthy English sportsman, was one of the first sportsmen to enter Jackson Hole (Grohman 1884). He spent 10 days in the valley in September 1880, and found that the region was virtually unfrequented by whites. Buxton (1893) also reports seeing only two whites during several weeks in Jackson Hole in 1884.

President Chester Arthur and his army escort traveled down the Gros Ventre River in 1883. A detailed account of the journey was not kept; however, F. J. Haynes did take photographs that have been useful in interpreting current conditions.

The first permanent settlers came to Jackson Hole in 1883. They consisted of three bachelors, John Carnes, John Holland, and Mike Detweiler, who homesteaded, built cabins, and spent the winter a few miles northeast of the present town of Jackson.

Owen Wister, author of *The Virginian*, made yearly fishing and hunting trips to the region starting 1886. His diaries and several photographs provide valuable documentation of early conditions. Another celebrity who came to Jackson Hole to hunt was Theodore Roosevelt (Roosevelt 1893). In September 1891, he hunted elk and other big game in the Two Ocean Plateau-Big Game Ridge locality with good success. His narrative provides a good insight on the availability of game and factors affecting distribution.

Between 1884 and 1904 Arnold Hague, a geologist who had been with the Hayden Survey, led an intensive geological study of Yellowstone National Park and adjacent mountain ranges. Hague had a compelling interest in wildlife and was a close personal friend of Theodore Roosevelt and other noted conservationists. Many hours of observation equipped this man with a comprehensive knowledge of wildlife in the area. His paper, *The Yellowstone Park as a Game Reservation* (Hague 1893), informed administrators about the importance of the Yellowstone region as wildlife habitat. The Yellowstone Geologic Survey also provided important early photographs by Professor Iddings in 1886 and T. R. Jagger in 1893.

In 1891 the Federal government moved to protect natural resources south of Yellowstone National Park through creation of the Yellowstone Park Forest Reserve. The reserve extended from the Wyoming state line on the west to a partially surveyed line between ranges 109 and 110 west on the east and the 44th parallel on the south. A further conservation measure was taken in 1897 by including in the Teton Forest Reserve all land south of the Yellowstone Park

Forest Reserve to the south boundary of Township 43 north. In 1905 most of the Yellowstone Park Forest Reserve and the north portion of the Teton Forest Reserve were included in the Teton Game Preserve. Elk hunting was prohibited in most of the area until termination of the Preserve in 1945. Forest conditions on the two Forest Reserves were examined for 3 months in 1897 by Dr. T. S. Brandegee (Brandegee 1899). His reports provide valuable data on forested conditions before 1900. In 1908 both Forest Reserves were combined with added acreage to the south to form the Teton National Forest, which was, in turn, combined with the Bridger National Forest in 1973 to form the Bridger-Teton National Forest.

One of the better accounts of early elk distribution was provided by Sir Rhodes Lambert Price, another English hunter (Price 1898). During a long stay in the fall of 1897, he wrote that the trout fishing was the best he had experienced and surpassed any that he had known in various other parts of the world.

The distinction of conducting the first comprehensive fisheries survey in Yellowstone National Park and the northern part of the Teton Wilderness belongs to Dr. B. W. Evermann (1893).

By 1897, Jackson Hole contained 21 ranches (Brandegee 1899). Long harsh winters and limited arable land discouraged all but the most hardy individuals from settling in the valley. Most ranches were small, had little land in cultivation, and were devoted to raising cattle with numbers limited to the amount of hay that could be cut and stacked for winter use. Early residents of Jackson were keenly aware of the importance of wildlife, particularly the winter elk herd, whose range completely encircled the town. Income was usually supplemented by or, in some instances, entirely dependent upon outfitting hunters and fishermen. The experiences of these early residents are not only interesting but also help interpret early wildlife conditions.

The settlement of Jackson Hole progressed steadily after the turn of the century, with less productive lands being taken up last. By 1908, nearly all arable land was privately owned.

INFLUENCES ON THE LANDSCAPE

Elk, Deer, and Other Ungulates

The past and present status of elk and other wild ungulate populations have been described by Anderson (1958), Houston (1968), Cole (1969), Gruell (1973), and Gruell and Loope (1974). Elk were indigenous to western Wyoming, and large numbers migrated annually from summer to winter ranges in the valley of Jackson Hole and along the Gros Ventre River drainage. Elk populations fluctuated widely due to starvation during severe winters such as in 1886-87, 1889-90, and 1896-97. Subsequent conversion of important valley winter range in Jackson Hole to ranching left the elk herd with reduced winter forage, and large numbers died during the severe winter of 1908-09. Concern over the situation led men such as S. N. Leek to initiate a winter feeding program. Heavy winter losses in 1909-10 and 1910-11 brought investigations by professional range and wildlife biologists (Preble 1911; Barnes 1912). Reports by these men and others focused national attention on Jackson Hole that resulted in the establishment in 1912 of a refuge on purchased land northeast of Jackson. This facility was first operated by the Biological Survey and was known as the "Elk Ranch." By a Presidential executive order of August 10, 1912, it became the National Elk Refuge. Initially containing only 1,760 acres (713 ha), subsequent land purchases increased the refuge to its present 23,972 acres (9 705 ha).

Another outcome of early elk investigations was restriction in 1919 of livestock

grazing on winter game range where conflicts with elk were apparent. Some cattle and horse permits were revoked, seasons of use were cut, and regulations imposed which restricted livestock grazing on specific areas, including lower elevations along the Gros Ventre River, slopes east of the National Elk Refuge, and low-lying National Forest lands east of the Snake River below Jackson and north of the Hoback River from its mouth to the Hoback Canyon.

The present elk population wintering in areas drained by the upper Snake River (above Alpine, Wyoming) and its tributaries numbers between 15,000 and 20,000. Of these, 7,000 to 9,000 are fed supplements on the National Elk Refuge near Jackson, while 6,000 to 9,000 winter at nine feedgrounds operated by the Wyoming Game and Fish Department. The balance free-range on traditional wintering areas, primarily on the Buffalo Fork, Spread Creek, and Gros Ventre drainages.

In recent decades, moose *(Alces alces shirasi)* have also become an important biotic influence on the landscape. This large ungulate was apparently rare in Jackson Hole prior to and immediately following the turn of the century. They were not mentioned during the fur trapping era, and government survey people in the 1870's as well as hunters in the 1880's rarely observed them (Ingersoll 1883; Buxton 1893). The moose population gradually increased through the late 1800's and early 1900's. By 1916, it was considered large enough to support 27 hunting permits in western Wyoming. The population has continued to increase or has leveled out depending on the locality. In 1975, 807 moose were harvested in Jackson Hole on 1,005 permits.

Other wild ungulates that have used Jackson Hole ranges over the years include mule deer *(Odocoileus hemionus),* bighorn sheep *(Ovis canadensis),* pronghorn antelope *(Antilocapra americana),* and bison *(Bison bison).*

Mule deer were apparently scarce prior to 1930 but had increased markedly by 1950 (Murie 1951). The summer population is widely distributed, with the primary range being south of the Gros Ventre Mountains. Most of the herd winters south and east of Jackson along the Snake and lower Hoback Rivers.

Fragmentary accounts from hunter diaries suggest that bighorn sheep were more numerous than today. The current population in Jackson Hole is about 200. Except for some areas in the Teton Wilderness, most of these sheep winter along the Gros Ventre River.

Early settlers recounted that several thousand pronghorn antelope grazed in the valleys of the Snake, Gros Ventre, and Hoback River drainages during the summer. Numbers were decimated by the turn of the century, but have increased in recent years to more than 600.

Bison were numerous in Jackson Hole until about 1830, but were eliminated prior to settlement (Fryxell 1928). Currently, a herd of about 20, which originated from Yellowstone National Park stock, range freely on Grand Teton National Park and adjacent lands.

Domestic Livestock

Cattle (about 100) were first brought into Jackson Hole in 1883 (Van Derver *ca.* 1939). During the following decade, cattle numbers gradually increased. Brandegee (1899) described livestock distribution in 1897 as follows: "The number of cattle and horses in Jackson Hole is very small, being limited by the amount of forage which can be cut and stored for winter use. At present they range in the valley, to all parts of which their range does not yet extend!" After 1900, homesteads were taken up in the Gros Ventre and Hoback River drainages. Cattle numbers increased quite rapidly thereafter, and by World War I approximately 15,000 were permitted on the Teton National Forest. Numbers have fluctuated somewhat over the years, currently numbering about 14,500.

Domestic sheep grazing has almost entirely been limited to range west of the Hoback River at the headwaters of the Hoback, Cliff, and Willow Creek drainages where some 45,000 sheep reportedly grazed when the Teton National Forest was established in 1908. Numbers were reduced to 20,000 by 1913. Currently some 4,000 are permitted on the Teton Division.

Over the years, range examiners have been impressed with the high production of forage and generally good condition of Teton National Forest livestock ranges. "First-class" or "surprisingly good" have been used at times to describe conditions. These descriptions were no doubt influenced by comparing local conditions with those of other regions with less potential for forage production and heavier stocking. Stocking intensity was materially limited by the amount of hay that could be put up to overwinter cattle.

Insects and Diseases

Insects, mites, and diseases have affected vegetation for milleniums. Furniss (1972) lists 228 insects and mites believed to damage five shrub families on western game ranges. Krebill (1972) accounted for 111 diseases caused by fungi, bacteria, viruses, and parasitic plants, which likewise attack seven shrub families on western game ranges. These lists are incomplete and only cover a few of the plants indigenous to Jackson Hole.

The influence of these agents on plant communities is usually subtle with little of the growth conspicuously affected. In most instances damage sets the plant back and new growth develops from the stem and base. Plant mortality can result, however, from repeated attack on trees or shrubs which do not regenerate by sprouting. A noteworthy example has been loss of lodgepole pine to infestations of the mountain pine beetle.

Small Mammals

Rodents influence plant communities depending upon the situation and rodent species involved. Both the red squirrel *(Sciurus hudsonicus ventorum)* and the white-footed mouse *(Peromyscus maniculatus maniculatus)* benefit regeneration of some deciduous shrubs and conifers by dispersing or caching seeds and cones some distance from where they were gathered. Seeds that are not eaten sometimes germinate.

Mice can damage sagebrush, bitterbrush, and other shrubs considerably by girdling stem bases during the winter months. During a 12-year study of bitterbrush in Idaho, Phillips (1970) found that 10 to 20 percent of 200 plants were killed by girdling during two of three eruption years. On eight areas in southwestern Montana which varied from 20 to 1,200 acres (8 to 986 ha), 10 to 84 percent of the big sagebrush was killed in one year by voles *(Microtis montanus)* (Mueggler 1967).

During this study, I observed mortality of mountain big sagebrush girdled by the snowshoe hare *(Lepus americanus)* during winter and early spring when food was scarce. During population highs, the white-tailed jackrabbit *(Lepus townsendi campanius)* heavily utilizes half-shrubs on the Gros Ventre elk winter range.

Porcupines *(Erethizon dorsatum)* kill conifers and some deciduous trees by eating the cambium, especially during winter. Although impact on coniferous forests is usually not great, porcupine damage around developments or where timber is being managed for future harvest may not be tolerable.

Beaver *(Castor canadensis)* have had a striking impact on stream-bottom vegetation. With successional advances and a shrinking food supply, these industrious mammals have virtually eaten themselves out of house and home. Old dams, cuttings, and felled aspen indicate that in the past the habitat was able to support much higher populations than currently.

The pocket gopher *(Thomomys talpoides)* affects vegetation and soil throughout the study area. Gophers are particularly numerous in high elevation, tall-forb

vegetation where they often move great quantities of soil and eat considerable forage. In recent years, ideal habitat for pocket gophers has been created by clearcutting timber. The resulting eruption of pocket gophers has in some cases made reforestation difficult. This rodent extensively damages seedlings by girdling stems and eating terminal buds under the snow cover.

Fire

Various investigators have demonstrated that wildfire was a key environmental factor influencing plant communities of North America in primeval times (Phillips 1962; Wellner 1970; Swain 1973). Wildfire's role in the Jackson Hole area has been described by Loope and Gruell (1973). The fire history on the Teton Division was reconstructed in some detail from early narratives and photographs, sampling of fire scars, and examination of fire records dating from 1931.

In early times, fires were frequent and widespread, but did not completely burn the landscape except under extreme weather conditions and continuous fuels. Burning was often irregular, ranging from stands untouched by fire to others that were entirely burned. Where slope, fuels, and weather allowed uniform spread, fires intensified until they crowned. Today these localities show a contrast between younger, even-aged trees in the burns and larger, older trees in adjacent stands. Fires that produced the even-aged stands often stopped on or near ridgetops, in discontinuous fuels, or because of changes in weather. During cool weather, burning was largely on the forest floor, with only scattered tree mortality.

DeLacy (1876) observed wildfires in August 1863 between Swan Valley, Idaho, and Jackson Lake. He described the landscape as being under a pall of smoke from fires burning north of Jackson Lake and noted that in summer, smoke from forest fires was common in the mountains. The area's greatest fire year on record was 1879. Van Derver (*ca.* 1939) reported that much of Jackson Hole was swept by fire in late August. Artist Thomas Moran witnessed the 1879 fires in the Teton Range and described widespread burning during August 25 to 27. In 1880 a large, fast-moving fire was observed by an English hunter camped on Jenny Lake (Grohman 1884).

The recurrent nature of fires in the region is suggested by Government Survey personnel in the 1870's who noted that burns covered by young tree growth were a common feature of the landscape (Bradley 1873; Hayden 1878).

The appearance of the landscape in the northern half of the study area around 1900 contrasted sharply with that of today. Brandegee (1899) commented:

> *It is only occasional that tracts of timber of merchantable size are found, and areas containing notable quantities of merchantable forest are few and limited. This condition appears to be simply and soley due to fires which have swept over the country so completely and persistently that scarcely any part has been entirely exempt from them, while nearly all portions have been burned again and again within a generation.... Under present conditions the tree-bearing regions as a whole decrease, while the aspen areas increase at the expense of those now producing conifers.*

Covering the timber preserves systematically, Brandegee found a mosaic of burns. Conifer stands in varying stages of succession ranged from a few acres to 4 or 5 square miles or even larger as indicated by fire scars sampled in recent years. For example, fire scars suggest an 1879 burn extended about 8 miles (5 km) along the south side of the Gros Ventre River from the Forest boundary to Miner Creek. An 1872 burn of comparable length appears to have covered the south side of the Gros Ventre River between Alkali Creek and Soda Creek.

Only fragmentary fire history is available for 1900 to 1930. Records for Yellowstone National Park suggest that 1900

was an extremely dry year with many fires, three of which were considered serious (Taylor 1969). The summer of 1910 was one of the most extreme fire years in recent history in Idaho, Washington, and Montana (Wellner 1970); the largest known fire on the Teton Division in 1910 was approximately 2,500 acres (1 012 ha) on the Cliff Creek drainage. In 1919, another extreme year, several thousand acres burned on the Jack Creek drainage in the Hoback Basin

Some indication of the frequency of early fires was obtained from 72 fire-scarred trees, primarily lodgepole pine, in the Gros Ventre River drainage. Wildfire was apparently equally prevalent in the 1700's and 1800's. Fires occurred on the Gros Ventre in every decade of the 1800's. Fire frequency was apparently highest in the 1840's, 1870's, and 1880's.

Good fire records kept on the Teton Division since 1931 have been invaluable in interpreting the area's susceptibility to wildfire. Through 1976, 1,023 fires have been suppressed. Only seven have burned 1,000 acres (405 ha) or more.

Location	Year	Acres	Hectares
Gravel Creek	1931	10,980	4445
Mosquito Creek-Taylor Creek	1934	5,500	2227
Fall Creek-Munger Mountain	1934	12,000	4858
Upper Yellowstone River	1935	1,000	405
Red Creek	1937	1,020	413
Mink Creek	1940	4,000	1619
Sheffield	1940	1,000	405

From 1931 through 1940, 21 fires burned more than 100 acres (40 ha), while from 1941 to 1951 none exceeded 100 acres (40 ha). Since 1951, only eight fires have ranged from 100 to 700 acres (40 to 283 ha). Since 1931, burning conditions have varied, not only from year to year, but also during a single season. As indicated by acreage burned and number of fires larger than 100 acres (40 ha), only during July 1931, September 1934, and August 1940 were conditions extreme enough to thwart suppression. "Fire" years since 1931 (40 or more fires/year) were: 1931 (72 fires), 1934 (40), 1935 (55), 1940 (40), 1953 (43), and 1974 (45). Low fire years were: 1936 (9), 1950 (4), 1951 (10), 1955 (9), 1965 (6), and 1972 (7). Periods of high fire danger are invariably brief and are abruptly terminated by cool weather, precipitation, or both.

Since settlement, the potential for fire spread has been reduced by yearly consumption of fine fuels by livestock grazing. The consumption of fine fuels has, in turn, contributed to the success of initial attack by fire suppression crews.

Climatic Fluctuations

Houston (1976) reconstructed the climate of Yellowstone National Park by summarizing climatological studies by several researchers. From 25,000 to 8,500 years ago, glaciers covered much of the landscape and mean temperatures were about 10.6° F (4° C) colder than at present. A warming trend ended the glacial period, culminating in the warmer, drier "Altithermal" period dated variously from 9,000 to 4,500 years ago. During the warmest part of the Altithermal, temperatures at snowline were 4.7° F (2.6° C) higher than at present (Richmond 1972).

Bray (1971) analyzed temperatures over the past 2,000 years by comparing various physical measurements such as glacial advances, drift ice off the coast of Iceland, freezing of the Thames River in England, successful crop harvests, and altitudinal changes in tree growth. These data indicate that, with some exceptions, temperatures during the first 3 or 4 centuries A.D. were probably similar to the 1930's. A period of general stability followed, then slight cooling around 600-700 A.D. From 900 to 1200 A.D., temperatures between 40° to 90° N. latitude were warmer than today and the warmest since the "Thermal Maximum" around 4,000 B.C. This warm period was followed by a fluctuating decline in temperatures that bottomed out around 1650-1700 A.D. Notable lows occurred in the 1430's, 1560's, 1590's, and especially the 1690's and early 1700's. Reversions to milder temperatures occurred in the late 1300's, the mid-to-late 1400's, par-

ticularly the early to mid-1500's and briefly in the 1630's and mid-1600's. After 1810, temperatures followed an upward trend. Notable warm periods occurred in the 1730's, around 1780, in the 1830's and 1870's, and especially in the 1930's. Exceptions to the warming trend occurred in the 1740's, around 1790, especially in the early 1800's, around 1850, in the 1890's, and around 1910.

Worldwide alpine glacial advances during the past 2,000 years were largely confined to between 1600 and 1900. Most occurred from 1700 to 1900, with a maximum from 1800 to 1850. Peak activity occurred during the Little Ice Age from 1700 to 1850. This sequence is particularly noteworthy as there was a lag between the time of lowest temperatures and maximum glaciation.

Since 1850, glaciers in the Wind River Range 30 airline miles (48 km) from the study area have receded. This corresponds to the observed worldwide retreat of glaciers, which was gradual until about 1920 then rapid (Mears 1972). The present episode of warming temperatures in the Northern Hemisphere began about 1920 (Mitchell 1970). Twelve glaciers in the Wind River Range have shrunk 7 to 41 percent since their maximums during the Little Ice Age (Dyson 1952).

Since about 1950, there apparently has been a slight reduction in world temperatures. Although some glaciers are no longer receding and others are advancing worldwide, observations and photographs by Finis Mitchell (personal communication 1977) have shown a general retreat since 1942 in the Wind River Range. Since 1952, the Dinwoody Glacier has retreated 0.3 mile (0.5 km).

The amount of warming necessary for glacial retreat need only be a small systematic change in climate (Bryson 1974). Similarily, glacial advances take place when accumulation is greater than melt by a tiny amount. Richmond (in Houston 1976) postulated that the climate during neoglacial advances may have been characterized by later springs, earlier falls, more cloudy weather, greater flow from springs, more water in streams, and more swampy ground. Plants requiring mesic conditions would obviously be favored under these circumstances.

Bray (1971) concluded that vegetation was sensitive to climatic change on the order of centuries and millennia. He states: "This sensitivity is in marked contrast to the usual failure to establish vegetation - climate relationships based on yearly or decadal means which has led some scientists to consider climatic change of little significance in interpreting vegetation dynamics." If one accepts this hypothesis, it follows that changes in plant communities most likely occurred on the most climatically sensitive sites. This possibility is discussed in volume II.

THE PHOTOGRAPHIC RECORD

This investigation has proved the old axiom "a picture is worth ten thousand words." Repeat photographs have allowed visual interpretations of the early landscape, how it is changing, and what may be expected in the future.

The photographic record has been arranged in three geographical sections that are vegetatively dissimilar. The northern section includes the Teton Wilderness and adjacent lands. A central section takes in the Gros Ventre River drainage, while a southern section includes lower Jackson Hole, the Hoback River drainage, and Teton Canyon. All photographs are on the Teton Division of the Bridger-Teton National Forest or closely adjacent lands except those in Teton Canyon, which are on the Targhee National Forest.

The paired scenes have been numbered consecutively; the original labeled "a" is on the left page and the retake labeled "b" on the right. Dates of the originals are as precise as possible. Estimated dates are considered to be accurate

within 5 years. Elevations to the nearest 100 ft (30 m) were determined from USGS quadrangles. Captions briefly describe important relationships and the changes observed. Causes of apparent changes are discussed in volume II. Scientific equivalents of common plant names used in the captions and elsewhere are in appendix II and III. The eight or more willow species in Jackson Hole are usually referred to collectively as "willow." The collective term "spruce" is used where the species is questionable.

Northern Section--

Teton Wilderness and Vicinity

INTRODUCTION

The northern section is represented by 27 plates in the Teton Wilderness 557,311 acres (225 632 ha) and adjacent areas within 3 miles (4.8 km) of the wilderness boundary (fig. 2). Elevations range from 6,900 to 12,165 ft (2 104 to 3 709 m). The eastern part of the wilderness is a high elevation, dissected volcanic plateau cut by steep-sided canyons. To the west are a series of ridges and valleys formed by uplifting and erosion of sedimentary beds.

The landscape is characterized by expanses of forest interspersed with open parks, meadows, and herblands. Lodgepole pine is the principal conifer below 9,000 ft (2 744 m). Douglas-fir grows on warmer slopes and ridges in the southern part of the wilderness. Engelmann spruce grows in moist valley bottoms, on north slopes, and in association with subalpine fir with increasing elevation. Whitebark pine often dominates above 9,000 ft (2 744 m). On drier sites it is sometimes associated with limber pine. Nonforested areas are largely comprised of herbaceous plants. Where soils are shallow or well drained, plant cover is sparse. Willow is often conspicuous along primary drainages and in large, moist meadows.

Major drainages include the Thorofare, Yellowstone, Buffalo Fork, and Snake Rivers. Runoff from these drainages fluctuates widely with seasons. Peak flows occur in early summer when high elevation snowpacks are rapidly melting. Most streams carry heavy loads of sediment during this period and immediately following high intensity summer storms.

Wildlife is an intregal part of the ecosystem. The elk herd which frequents Big Game Ridge and other high elevation summer range is of primary importance.

Man's influence on the Teton Wilderness has been restricted to hunting, fishing, trapping, camping, fire ignition and suppression, and limited livestock grazing. Fire suppression since the early 1900's has effectively kept all but a few fires from exceeding 1,000 acres (405 ha). With the exception of pack and saddle stock, livestock grazing is confined to portions of three cattle allotments covering 36,700 acres (14 858 ha) on the southern boundary. None of the photographs inside the wilderness are on cattle allotments. Past cattle grazing in localities pictured outside the wilderness has varied from moderate (plate 27) to incidental. Domestic sheep have never grazed in the wilderness.

Plates 1 to 13 show conditions on river bottoms and meadows at elevations of 6,800 ft to 8,100 ft (2 073 to 2 470 m). Plates 14 to 27 depict conditions on tall forb and alpine habitats from 7,500 ft to 10,100 ft (2 287 to 3 079 m).

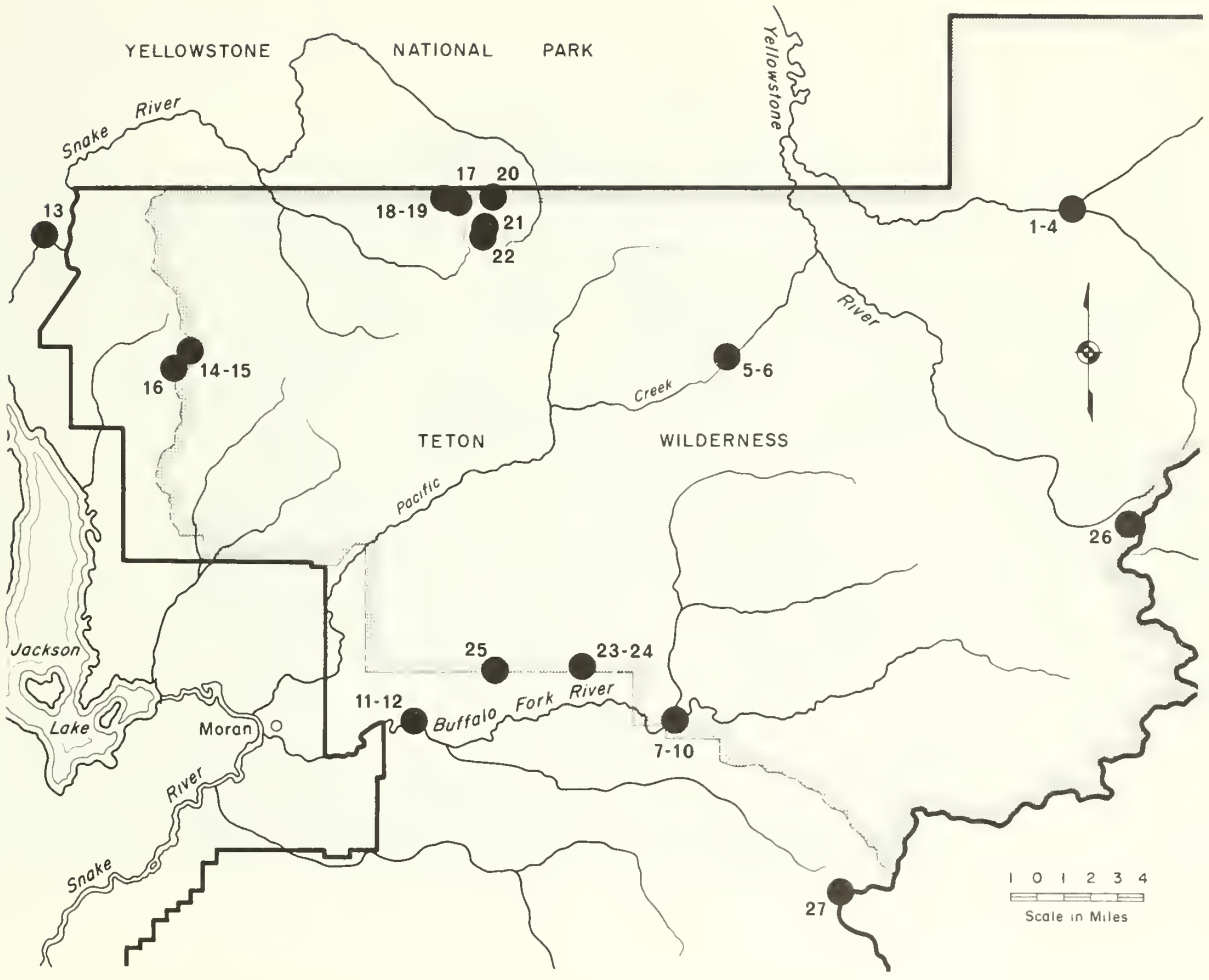

Figure 2. Location of camera points in northern section.

Plate 1a *(September 16, 1893)*

Elevation *8,000 ft (2 439 m)*

Looking east up the Thorofare River from a point immediately above the outlet of Pass Creek. Dead trees are the result of a ground fire or insect epidemic. Arrow points to conifers in early succession on distant slope. The Thorofare River flows through the middle of the floodplain at right center. Shrubs in openings on far bank are willow.

U.S. Geological Survey (USGS) photograph 125 by T. Jaggar.

Plate 1b *(September 18, 1968)*

75 years later

***Lodgepole pine, Engelmann spruce,** and subalpine fir have regenerated and put on added growth. Little evidence of insect damage can be seen. Note the heavy conifer growth on far slope which was in early succession in accompanying plate. Willow on opposite bank has been replaced by conifers. The river has swung south and now runs along the far bank. Arrow points to patch of conifers growing on site which was occupied by river 75 years ago.*

Plate 2a *(September 16, 1893)*

Elevation *8,000 ft (2 439 m)*

A southwest view down the Thorofare River as seen from a position just east of the outlet of Pass Creek. Dead trees appear over the entire area. Shrubs on flood plain below are willow, while mountain big sagebrush predominates on slope in foreground.

USGS photograph 126 by T. Jaggar.

Plate 2b (September 18, 1968)

75 years later

Camera was moved forward some 40 feet to avoid conifers which now block former scene (inset). Rock in foreground identifies original camera position. Timber stands are more dense. Willows below were removed by shift in channel of Pass Creek. Mountain big sagebrush is less dense in foreground (not shown) than in Plate 2a.

Plate 3a *(September 16, 1893)*

Elevation *8,000 ft (2 439 m)*

The camera faces northwest across Pass Creek just above its outlet. Shrubs on far bank and around spring are willow. Distant timber stands include a high incidence of dead trees.

USGS photograph 127 by T. Jaggar.

Plate 3b *(September 18, 1968)*

75 years later

Pass Creek has swung west, removing much of the willow. An increase in conifers is evidenced by lodgepole pine growth in foreground. Openings on far slope retain their former appearance.

Plate 4a *(September 16, 1893)*

Elevation *8,000 ft (2 439 m)*

The camera faces northeast up Pass Creek from a position at its outlet. Camera points for plates 1 and 2 are on river terrace off photo on right. That for preceding plate is on ridge at left-center. Willows and lodgepole pine predominate on flood plain in midground. Debris and wide flood plain are indicative of heavy spring runoff. Prostrate aspen persist on near slope, which is composed of coarse gravels and boulders (arrow). Timber stands have a high incidence of dead lodgepole pine.

USGS photograph 128 by T. Jaggar.

Plate 4b *(September 18, 1968)*

75 years later

A portion of the willow community on extreme left has disappeared as a result of a shift in the stream channel. Willows that remain on flood plain are of reduced growth form and in competition with lodgepole pine, which have increased. The aspen indicated by arrow in plate 4a are now obscured by lodgepole pine. Their growth continues to be of a prostrate form comparable to early scene. Timber stands are more thrifty, with fewer snags.

Plate 5a *(August 20, 1921)*

Elevation *8,100 ft (2 470 m)*

Looking south in the vicinity of Two Ocean Meadow. Vegetation in foreground is primarily sedges and willows. Willow border far edge of meadow. Tree cover includes Engelmann spruce, subalpine fir, and lodgepole pine. Dead conifers are conspicuous throughout the stand.

Yellowstone National Park photograph by Charles Adams.

Plate 5b *(September 12, 1972)*

51 years later

Willow density has increased in foreground and decreased on the far edge of meadow. Conifer cover on far slopes has increased significantly and a majority of dead trees visible in 1921 have since fallen to ground.

Plate 6a *(August 21, 1921)*

Elevation *8,100 ft (2 470 m)*

The camera faces southwest across Two Ocean Meadow toward outlet of Two Ocean Creek. Meadow vegetation is primarily sedges, perennial grasses, and willow. Lodgepole pine, Englemann spruce, and subalpine fir covers far slopes. Many dead trees are evident.

Yellowstone National Park photograph by Charles Adams.

Plate 6b *(September 12, 1972)*

51 years later

Willow appear to be more dense in foreground. Lodgepole pine have invaded the edge of meadow. Most of the dead trees on far slope have fallen to the ground and the conifer cover is more dense.

Plate 7a *(Fall, 1893)*

Elevation *7,100 ft (2 165 m)*

Looking east at Owen Wister camp on Buffalo Fork River about one-quarter mile from confluence of the north and south forks. The sparse ground cover in foreground and midground is comprised of herbaceous species and mountain big sagebrush. The Buffalo Fork cannot be seen, but flows in front of large willows on left. Dead lodgepole pine in distance were killed by wildfire. Scarred trees suggest two fires, the most recent occurring in the late 1800's.

Owen Wister photograph, courtesy of his daughter, Mrs. Walter Stokes.

Plate 7b *(September 15, 1975)*

82 years later

A closed stand of mountain big sagebrush now occupies foreground. Site has been enhanced since 1893 by flooding, which deposited accumulative sediments. Conifer cover has increased markedly.

Plate 8a *(Fall, 1893)*

Elevation *7,100 ft (2 165 m)*

Camera point is a short distance to right of preceding plate. View is northeast towards Terrace Mountain. Young lodgepole pine and scattered mountain big sagebrush interrupt the otherwise smooth, grassy plain in foreground. The Buffalo Fork River can be seen at left of tent, while willow of large growth form occupy far bank at right.

Owen Wister photograph, courtesy of his daughter, Mrs. Walter Stokes.

Plate 8b *(September 15, 1975)*

82 years later

Camera was moved forward some 40 feet to avoid lodgepole pine that obstructed original view. Jacket (arrow) approximates position of left tent corner. The increased density of mountain big sagebrush evident in plate 7b is emphasized in this scene. The Buffalo Fork River has swung south during the past 82 years, cutting away much of the bank and removing the willow. Conifers have increased markedly and many lodgepole pine have been killed by mountain pine beetle.

Plate 9a *(Fall, 1893)*

Elevation *7,100 ft (2 165 m)*

View is southwest down Buffalo Fork River in opposite direction of preceding plate. Fire scars on lodgepole in foreground show the stand had burned at least once in the 1800's. Stumps suggest this was a favored campsite. Distant open slopes show the effects of wildfire.

Owen Wister photograph, courtesy of his daughter, Mrs. Walter Stokes.

Plate 9b *(September 15, 1975)*

82 years later

Camera is positioned approximately 30 to 40 feet behind and 3 to 5 feet below original station, which was removed by a shift in river channel. This scene typifies the dramatic increase and growth of lodgepole pine on sites burned in earlier years.

Plate 10a *(Fall, 1893)*

Elevation *7,100 ft (2 165 m)*

Camera point is just beyond tent in plate 7a and view of distant slopes is quite similar. In foreground, the Buffalo Fork River swings in a wide meander, while willow of large growth form grow on opposite flood plain. Near slopes show the effects of wildfire in the late 1800's.

Owen Wister photograph, courtesy of Western History Department, University of Wyoming.

Plate 10b *(September 15, 1975)*

82 years later

Lodgepole pine regeneration screens much of former view. The river now flows to the north, with the channel situated where willows were growing in 1893. With this shift, the former channel has been bypassed. It presently carries water only during floodstage. Accumulative sediments support a sedge-grass-willow complex. Willows are of smaller growth form than those in early scene. The lodgepole pine stand in distance contains many trees killed by mountain pine beetles.

Plate 11a *(Fall, 1893)*

Elevation *6,800 ft (2 073 m)*

Looking east up the Buffalo Fork River from a point about 1 mile southeast of the Heart Six Ranch. Bush cinquefoil is the predominant shrub in foreground. The large shrubs in sunlight and on flood plain are various species of willow. Scattered mountain big sagebrush shrubs can be seen on near slope on left (open arrow). Trees on flood plain are almost entirely cottonwood. Aspens occupy north slope of Burro Hill in distance on right.

Owen Wister photograph, courtesy of Western History Department, University of Wyoming.

Plate 11b *(September 8, 1969)*

76 years later

In 1893 willow foliage was comprised of accumulative growth, whereas in 1969 current growth makes up a major portion of these shrubs. Note the long leaders. Sagebrush density has increased markedly on near slope. Cottonwoods on flood plain have largely been replaced by spruce. A channel change removed willow from opposite bank, while in distance depositional areas are now occupied by willow. Aspen cover on Burro Hill has deteriorated.

Plate 12a *(Fall, 1893)*

Elevation *6,800 ft (2 073 m)*

From the same camera position as preceding plate, the view is southeast across the Buffalo Fork River flood plain. The south slope of Burro Hill is on left and Hatchet Ranch vicinity in distance. Cottonwoods occupy far edge of flood plain, while willow dominate the scene.

Owen Wister photograph, courtesy of Western History Department, University of Wyoming.

Plate 12b *(September 8, 1969)*

76 years later

Willow now occupy site in right-foreground formerly covered by low growing vegetation. Except for increased bank cutting, the river channel has not changed significantly. As a whole, willow distribution and height appears similar to that in early scene. In distance, cottonwoods are being invaded by spruce.

Plate 13a *(September, 1896)*

Elevation *7,100 ft (2 165 m)*

Looking northwest across Soldier Meadow some 2 miles south of the south entrance to Yellowstone Park. The large contingent of men includes the William Seward Webb hunting party accompanied by General Coppenger and 50 soldiers. The meadow in foreground has a well-utilized appearance, having been grazed by horses and mules. Dead lodgepole pine appear to be the result of attacks by the mountain pine beetle. Cabins in distance were quarters for U.S. Army personnel assigned to patrol Yellowstone Park and adjacent country.

F. Jay Haynes photo, courtesy of Samuel B. Webb.

Plate 13b *(October 4, 1968)*

72 years later

The camera is positioned several feet lower, since the hill from which early scene was photographed had been removed to accommodate road. Lodgepole pine have increased on margin of meadow. A loss of trees to pine beetles has altered the skyline at right. The site formerly occupied by cabins is now forested. Willow on far edge of meadow at right are of smaller growth form.

Plate 14a *(July 24, 1928)*

Elevation *9,500 ft (2 896 m)*

View is south from head of Rodent Creek near Wildcat Peak. Ground cover consists of herbaceous species. The Brown's Meadow-Coulter Creek Trail is on right. A network of subsidiary trails reflect the high occurrence of summering elk in 1928. Several conifers show the effect of mountain pine beetle attacks.

Fish and Wildlife Service photograph 22-WB-34027 by Olaus Murie, courtesy National Archives and Record Service.

Plate 14b (August 28, 1969)

41 years later

A difference in lighting, season, and lenses limits value of photo in determining trend in herbaceous vegetation. Mountain lupine and longleaf arnica are the conspicuous forbs. Other species common to the site include western yarrow, mountain dandelion, thickleaf aster, and sedges. A pronounced increase in the regeneration of subalpine fir is evident in midground. A long-term decline in the summer elk population is suggested by fill in of plants on former trails. Historically, the Brown's Meadow-Coulter Creek Trail has received infrequent human use.

Plate 15a *(July 24, 1928)*

Elevation *9,300 ft (2 835 m)*

Looking southeast from slopes of Wildcat Peak across headwaters of Pilgrim Creek. Tall forbs comprise the predominant ground cover, while whitebark pine and subalpine fir are the primary conifers. This locality has been historic elk summer range and was described by Olaus Murie in 1928 as a summer elk feedground.

Fish and Wildlife Service photograph 22-WB-34028 by Olaus Murie, courtesy of Mrs. Murie.

Plate 15b (August 28, 1969)

41 years later

Ground cover looks more dense than in previous photo. This contrast is partly explained by a seasonal difference in plant development. Gully system in foreground appears comparable to early scene. Conifers show increased growth in midground. Arrow points to old slump, which has become well vegetated.

Plate 16a *(August 2, 1928)*

Elevation *9,100 ft (2 774 m)*

Historic tall forb elk summer range on extreme west end of Wildcat Ridge at headwaters of Pilgrim Creek. Vegetation patterns vary widely on this southeast exposure, being characteristic of high elevation summer ranges in the Teton Wilderness. Olaus Murie described this locality as a favorite elk summer range in 1928.

Fish and Wildlife Service photograph 22-WB-34048 by Olaus Murie, courtesy of National Archives and Record Center.

Plate 16b *(August 27, 1969)*

41 years later

Taken at midday, this scene lacks shadows and corresponding contrast of original photo. Nonetheless, it is evident that variable vegetal patterns persist and are quite comparable to those 41 years ago. Predominant species include thickstem aster, big mountain brome, showy stickseed and tall larkspur. Elk still prefer this locality as summer range.

Plate 17a *(August 19, 1915)*

Elevation *9,600 ft (2 927 m)*

The view is northwest at headwaters of the middle fork of Wolverine Creek on Big Game Ridge. Elk in foreground are grazing small subalpine meadow on historic elk summer range. Sparse plant cover on adjacent slopes is comprised of herbaceous species. The steep, bare slopes are snowbank sites. Snags in distance resulted from a wildfire that occurred about 1885.

Fish and Wildlife Service photograph 22-WB-16073 by Vernon Bailey, courtesy of National Archives and Record Center.

Plate 17b *(August 13, 1969)*

54 years later

The herbaceous plant cover is more dense. This is particularly apparent on meadow edge where skyline bluegrass has thickened (closed arrow) and on snowbank sites where spreading community of longleaf arnica is more conspicuous (open arrow). Growth of whitebark pine and subalpine fir contrasts sharply with the earlier photo.

Plate 18a *(August 19, 1915)*

Elevation *9,600 ft (2 927 m)*

Westerly view of herbland vegetation and slope dissected by numerous deeply eroded draws at head of west fork of Wolverine Creek. Camera point is about 1 mile west of previous plate. The photographer took this scene to document elk occurrence. Though obscure, some 55-60 elk are present.

Fish and Wildlife Service photograph 22-WB-B16070 by Vernon Bailey, courtesy of National Archives and Record Center.

Plate 18b *(August 19, 1971)*

56 years later

Camera position may be lower than original. Conifers are more conspicuous, while changes in herbland vegetation are comparable to plate 17b. Improvement in plant cover is particularly noticeable on near snowbank site (arrow).

Plate 19a *(August 19, 1915)*

Elevation *9,800 ft (2 988 m)*

A northwest view from Big Game Ridge into a tributary of the Snake River. Scene is just outside the Teton Wilderness in Yellowstone Park. The darker vegetation is herbaceous plants. Note the occurrence of young conifers in midground, which are comparable in growth stage to those in plates 17a and 18a.

Fish and Wildlife Service photograph 22-WB-16076 by Vernon Bailey, courtesy of National Archives and Record Center.

Plate 19b (August 13, 1969)

54 years later

As in previous two plates, herbaceous growth patterns appear more extensive than in 1915. Talus slopes, sites which support late-melting snowbanks and ridges continue to support sparse ground cover. In midground, conifers have increased in density and height.

Plate 20a *(August 27, 1935)*

Elevation *8,900 ft (2 713 m)*

The camera faces northwest from a position along the Yellowstone Park-Teton Wilderness "boundary trail" on northeast side of Big Game Ridge. Plant cover in foreground consists of herbaceous species. Bare interspaces between plants are the result of soil brought to the surface by pocket gophers. Subalpine fir dominate midground. Distant slopes in Yellowstone Park are prime elk summer range.

Yellowstone National Park photograph 9283-4 by Christensen.

Plate 20b (August 21, 1973)

38 years later

Alignment is accurate, but camera placement is farther back than before. Note position of snag, with reference to skyline in accompanying plate. Density of herbaceous vegetation in foreground was increased. This, however, is exaggerated, because pocket gophers continue to perpetuate many bare interspaces, which are occupied by low-growing annuals. This scene demonstrates the widespread increase in the growth of subalpine fir on Big Game Ridge.

Plate 21a *(September 2, 1928)*

Elevation *9,400 ft (2 866 m)*

The camera faces southeast towards Mink Creek from the east side of Big Game Ridge. The more productive slope in foreground supports a good herbaceous cover, while plants on near slope are sparse because of less favorable site. Tree cover is largely whitebark pine.

Fish and Wildlife Service photograph 22-WB-34073 by Olaus Murie, courtesy of National Archives and Record Center.

Plate 21b (September 16, 1969)

41 years later

No appreciable changes in herbland vegetation are evident. Gully at lower-center shows no change in headcutting. At left, several whitebark pine have been killed by mountain pine beetles, while many others along with subalpine fir have regenerated since 1928. The open slopes in distance were burned in the Mink Creek fire of 1940.

Plate 22a *(September 21, 1928)*

Elevation *9,500 ft (2 896 m)*

Big Game Ridge approximately 1 mile north of pass between Wolverine Creek and Fox Creek. Bare soil in foreground is pocket gopher mounds and winter casts. Conifers are mostly subalpine fir and whitebark pine.

Fish and Wildlife Service photograph 22-WB-34070 by Olaus Murie, courtesy of National Archives and Record Center.

Plate 22b (September 16, 1969)

41 years later

Density of herbaceous plants in foreground has increased. Primary species include subalpine needlegrass, skyline bluegrass, cloud sedge, thickstem aster and lupine spp. Ponds such as the one pictured are frequented by elk. Some conifers have died, while a majority have survived and grown substantially. The Mink Creek burn of 1940 can be seen in distance.

Plate 23a *(September, 1878)*

Elevation *7,500 ft (2 287 m)*

The camera faces southwest from a position high on the ridge overlooking Turpin Meadow. Rosie's Ridge is immediately beyond the Buffalo Fork River and Leidy Mountain is in distance. Lodgepole pine and Douglas-fir dominate the slopes below. Profuse downfall at lower-right attests to past wildfire. Arrow points to river meander which has been largely bypassed as a result of a channel change.

USGS photograph 57-HS-605 by William H. Jackson, courtesy of National Archives and Record Center.

Plate 23b *(September 4, 1968)*

90 years later

Conifers on slopes below have increased in distribution and size. The Douglas-fir snag at left has largely disappeared and a new tree, which obstructs view of Turpin Meadow, now dominates foreground. The old river meander continues to carry a low volume of water (closed arrow), while another 1878 meander has been bypassed and the area is now well vegetated (open arrow). As a whole, the flood plain shows a significant increase in vegetation, particularly lodgepole pine and spruce.

Plate 24a *(September, 1878)*

Elevation *7,500 ft (2 287 m)*

The scene is west towards the Tetons from a point immediately below previous plate. Mt. Randolph is in distance on extreme right. In foreground, Dr. F. V. Hayden and companions view landscape. The surrounding vegetation has been dusted by an early season snowstorm. The extent of burn noted in previous plate is better appreciated in this scene.

USGS photograph 57-HS-1216 by W.H. Jackson, courtesy of National Archives and Record Center.

Plate 24b (September 4, 1968)

90 years later

In foreground, mountain big sagebrush is more dense and composites less conspicuous. The Douglas-fir snag at right of Bill Jackson has largely disintegrated. An increment sample from large Douglas-fir in center of photo showed 296 rings, thus indicating the tree to exceed 300 years of age. This tree and others in vicinity were scarred by past fires. The old burn, conspicuous in the 1878 scene, is now covered by a maturing conifer forest. Tall forb openings on distant slopes show no apparent change. The camera point for plate 25 is in large opening at upper right.

Plate 25a *(About 1906)*

Elevation *8,000 ft (2 439 m)*

The camera faces southeast from high on the slopes of Mt. Randolph. Turpin Meadow is in center of photo and the Buffalo Fork River is on right. Camera points for plates 23 and 24 are behind tree on left. The early stage of conifer development on burn suggests a later burn than that pictured in plate 24a. Aspen in early succession occupy site near patch of snow at left-midground.

Ben Sheffield photograph, courtesy of Grand Teton National Park.

Plate 25b *(August 1, 1968)*

62 years later

The ground cover in foreground is composed of herbaceous plants. Predominant species include perennial grasses, mountain lupine, arrowleaf balsamroot, helianthella spp., thickstem aster, horsemint, and thick-stem groundsel. The larger subalpine fir which occupied foreground in early scene has since died and the smaller tree now dominates scene. Lodgepole pine, subalpine fir, and Douglas-fir are growing profusely on old burn. Many lodgepole pine have reached maturity and have been killed by mountain pine beetles. The aspen stand has also reached maturity (arrow). Meander changes noted in plate 23b are also evident in this scene.

Plate 26a *(September 4, 1893)*

Elevation *10,100 ft (3 079m)*

Looking southeast from Buffalo Plateau on Continental Divide at headwaters of the Marsten Fork tributary of South Fork Shoshone River. The small lake drains into Lost Creek and South Fork of Buffalo River. Late season snowbanks attest to the harsh environment at this elevation where the growing season is about 5 weeks. The low-growing dark vegetation in midground is sedge. Arrow points to willow community on knoll in distance.

USGS photograph 117 by T.A. Jagger.

Plate 26b *(September 10, 1968)*

75 years later

The sparse plant cover in foreground is predominately sedges in association with mountain dandelion, varileaf cinquefoil, bluegrass spp., Eschscholtz butter cup, and parsley spp. Though not readily distinguishable because of film contrast and differences, there has been a significant increase in sedge over the past 75 years. Examples of sedge plants not present in early scene are indicated by arrows. Soils are silt loam derived from breccia parent material. Close comparison of rocks in the two scenes indicates amount of soil loss. The willow commmnity has decreased in density. A gully at upper left appears to be headcutting, while the lower portion is stable and more uniformly vegetated. Perennial snowbanks are smaller sized. The small patches of snow are from an early season storm.

Plate 27a *(August, 1921)*

Elevation *9,700 ft (2 957 m)*

Looking east towards Togwotee Pass from a position about one-quarter mile south of Highway 26-287. The occasion is the dedication of the Togwotee Highway completion. A herbaceous plant cover occupies foreground. The only species readily identifiable is showy elkweed. Conifers are whitebark pine, Douglas-fir, and subalpine fir.

F. J. Haynes photograph, courtesy of Wyoming State Archives and Historical Department.

Plate 27b (August 1, 1968)

47 years later

A log worm drift fence, which marks boundary of Shoshone and Bridger-Teton National Forests (and cattle allotments), now bisects scene. The old highway has been long abandoned, being used only by hunters and cattlemen. The foreground continues to support an excellent ground cover. Representative species include western yarrow, common dandelion, lupine spp., fleabane spp., bluegrass spp., carex, mountain timothy, varileaf cinquefoil, thickstem groundsel, mountain sorrel, elephanthead pedicularis, and showy elkweed. Showy elkweed is not as conspicuous as in 1921. An increase in mountain big sagebrush is indicated on slopes in midground, while whitebark pine are more dense.

CONCLUSIONS

The 27 plates representing the Teton Wilderness and vicinity cover a maximum period of 97 years. Vegetative changes vary considerably, depending upon site potential and time since disturbance. Some photographs show pronounced changes, while others show none. The more noteworthy changes include:

1. Increased density and growth of conifers.
2. Reduction in height and decline in distribution of willow.
3. Increased in size and density of mountain big sagebrush.
4. Increase in density of herbland and alpine vegetation.
5. No observable change in the rate of geologic erosion.
6. Striking changes in stream channels.

The most extensive change is the increased density and growth of coniferous species at all elevations. More subtle, perhaps, has been the invasion of the drier margins of meadows by coniferous forest (plates 5, 6, 13). Changes on valley bottoms and along tributaries are pronounced. Spruce are replacing cottonwoods (plate 11), and lodgepole pine are increasing on flood plains and alluvial soils (plates 1, 4, 7). The degree of change is often striking (plates 9 and 23).

The current appearance of coniferous species depends largely upon the amount of time since the last fire. Plate 15 shows older stands of spruce, subalpine fire, and whitebark pine that apparently had not been burned for many years. In 1969 some new trees were evident, while those that persisted became large. A similar situation is illustrated by plates 21, 22, and 27 where the tree cover is principally whitebark pine. As in plate 15, new trees have invaded openings, but the overall change is not striking.

Pronounced changes have occurred in localities which were in an early stage of succession when originally photographed (plates 17, 18, 24, 25). Plates 17 and 18 were first taken about 30 years following fire. Accelerated growth over a 54-year period accounts for the marked contrast. The modern scenes in plates 24 and 25 contrast sharply with those 65 to 90 years ago.

The increased age of conifers has made them vulnerable to attacks by forest insects. For example, lodgepole pine in plates 8 , 10, and 25 have developed to where they are susceptible to heavy attack by mountain pine beetles. Evidence of earlier insect activity is suggested in plates 1 through 4.

With few exceptions, willows have changed significantly since the late 1800's. Of particular interest is a reduction in height and change in growth form (plates 4, 10). On some valley bottoms the height of willow is similar to that of earlier years, but much of the canopy now consists of current growth (plates 11 and 12). Willow has declined where it is competing with conifers (plates 1, 4). Stream channel changes have also caused losses of both willow and other vegetation (plates 1-4, 7-8). This loss is often compensated by establishment of new plants in the old channels (plates 10,11).

The general trend of mountain big sagebrush has been toward increased growth and density (plates 3, 7-9, 11, 24). However, a decrease in density is suggested in plate 2.

Changes in tall forb vegetation have been less pronounced. Plant density lacked uniformity, thereby producing uneven patterns of growth. Snowbank sites have historically been sparsely vegetated as have sites with shallow, well-drained soils (plates 16-19). More productive sites apparently did not change (plate 21). The overall trend of tall

forb vegetation appears to be toward increased plant density. This is particularly evident on the thinner soils (plates 19, 26) and snowbank sites (plates 15, 17, 18). Plate 25 suggests that on sites capable of carrying fire the composition of herbland vegetation has varied depending upon the successional stage. At the turn of the century this site was predominantly grasses, whereas forbs predominate today.

High elevation watersheds (plates 14-25) show no observable change in gully patterns. Geologic erosion has continued, but not at an accelerated rate. Sediments are transported from slopes and down gully systems as they have been for centuries. All evidence points to a state of dynamic equilibrium.

Lateral movement of stream channels has been occurring over the centuries, but the rate of change is often underestimated. The photographs dramatically show the dynamic nature of this process. Great quantities of material are washed away from stream banks (plates 3-4, 8-9, 11), which takes the stream on a new course. With reduced flows, sediments are deposited in the old channels that in time become vegetated (plate 10).

Central Section--

Gros Ventre River Drainage

INTRODUCTION

The 35 plates in this series depict conditions on the Gros Ventre game winter range at elevations from 7,000 to 8,400 ft (2 143 to 2 561 m) (fig. 3). Semiarid conditions prevail on southerly exposures. Soils are droughty and vegetation is characteristic of a drier climate. North-facing slopes and bottom lands are quite productive.

Lodgepole pine or Douglas-fir are the primary conifers near the camera points. Aspen stands are widespread and of advanced age. Willows are the principal shrubs along streams and on wet soils. Mountain big sagebrush dominates openings.

Elk have historically wintered on the Gros Ventre River drainage because of southerly exposures and low snow accumulation. Since the early 1960's, most wintering elk have been fed hay at Wyoming Game and Fish Department feedgrounds. Moose have increased dramatically during the past several decades. The area is also winter range for bighorn sheep.

Suppression of wildfires has allowed the vegetation to develop toward climax. Since 1930 only one fire has reached 1,000 acres (405 ha).

Cattle have grazed the Gros Ventre River drainage since 1900. This use has been restricted primarily to spring, fall, or both, in those localities photographed.

Allowing for deviations on tributaries, the order of plates is progressively west to east up the Gros Ventre River.

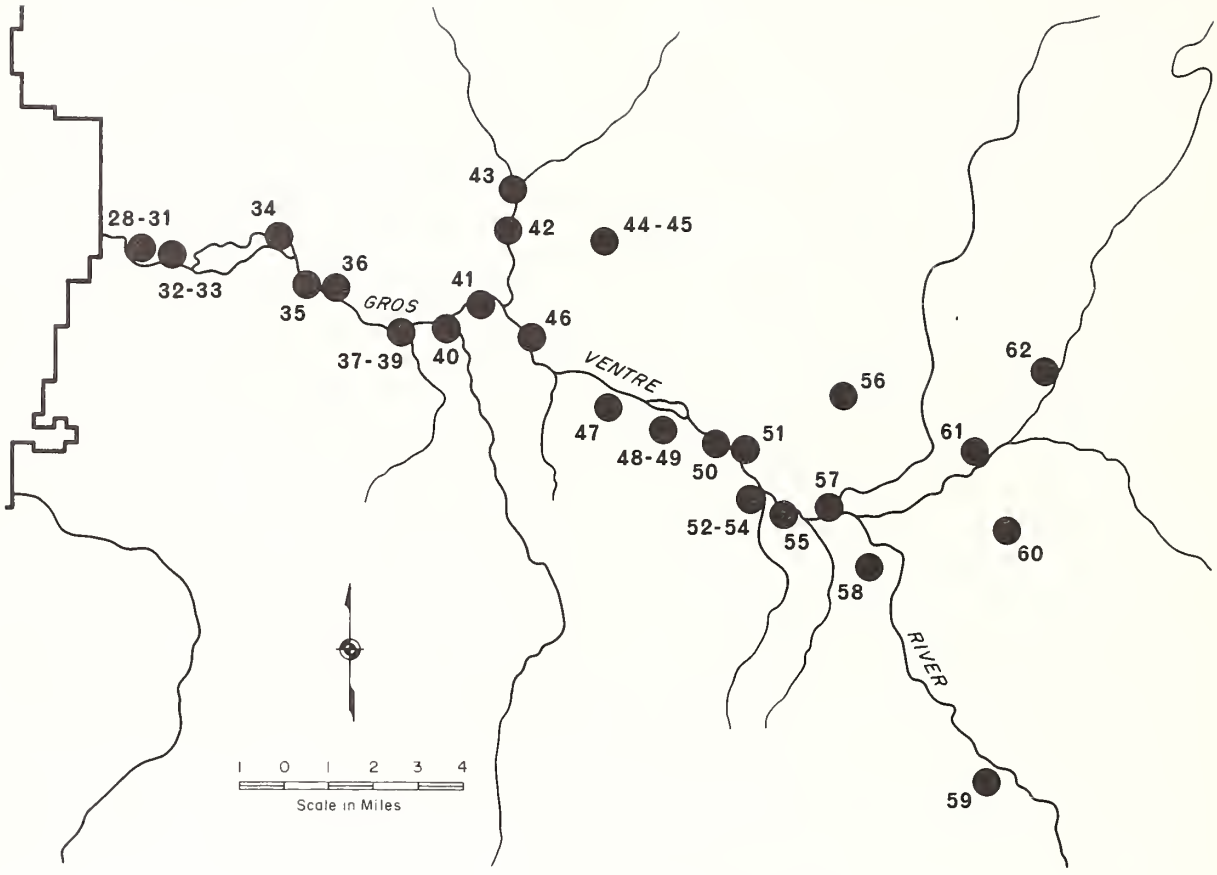

Figure 3. Location of camera points in central section.

Plate 28a *(1899)*

Elevation *7,100 ft (2 165 m)*

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 are also present. Aspens at left and right midground are in early succession. Note even-aged aspen (closed arrow) on terrace across river. Bitterbrush and serviceberry shrubs prevail on deeper soils between sparsely vegetated areas on southeast exposure in distance (open arrows). Haze obscures Teton Range in distance.

Stimson photograph, courtesy of Wyoming State Archives and Historical Department.

Plate 28b (July 28, 1971)

72 years later

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.

Plate 29a *(1899)*

Elevation *7,100 ft (2 165 m)*

Southeasterly view of the Gros Ventre River valley from a position slightly east of preceding plate. Young aspens dominate vegetation in foreground. Near shrubs have a hedged appearance. Ground cover on southwest facing slope in midground is sparse. Parent material is continuation of conglomerates pictured in plate 28a. Trail was historic travel route. Fire scars suggest foreground and far slopes at right burned in 1879. Note the numerous fire-killed snags and response of aspen, willow, and other shrubs on lower slopes that have burned.

Stimpson photograph, courtesy of Wyoming State Archives and Historic Department.

Plate 29b (July 28, 1971)

72 years later

A maturing aspen stand completely screened view, making it necessary to move camera about 50 ft right to an elevated position. Ground cover on near slope remains sparse. Primary plant species are horsebrush, rabbitbrush, fringed sagebrush, grasses, and forbs. Timber-producing sites on far slopes are now dominated by Douglas-fir and lodgepole pine. Upper Slide Lake below, formed following the Gros Ventre Slide of 1925.

Plate 30a *(About 1908)*

Elevation *7,100 ft (2 165 m)*

Looking up Gros Ventre River from Turpin Hill immediately below plates 28 and 29. Trees in right-foreground are aspen in early succession. Hedged growth form and multistem development suggest suppression by winter elk foraging. The open herbaceous and half-shrub cover in foreground and midground is comparable to that in plate 28a. This vegetation appears to have been grazed. Summer utilization would have been by livestock.

Photo courtesy of Slim Lawrence; photographer unknown.

Plate 30b *(September 6, 1968)*

60 years later

Today's scene contrasts sharply with that of 60 years ago. Aspen growth obstructs much of the view, while dense mountain big sagebrush occupies the once open terrain in the foreground. The growth form of bitterbrush (darker shrubs, arrow) has increased considerably.

Plate 31a *(August, 1907)*

Elevation *7,000 ft (2 134 m)*

Camera faces west from a position 75 yards northwest of the Turpin Hill overlook and about 150 yards below plate 30. The aspen stand on left is in early succession while an association of grasses and forbs occupies the foreground. Mountain big sagebrush is of low density.

General Land Office photograph, courtesy of Bureau of Land Management.

Plate 31b *(July 20, 1971)*

67 years later

Aspens show a significant increase in growth. Plant cover in foreground appears more profuse. Note that boulders are partly obscured. Mountain big sagebrush at right shows marked increase.

Plate 32a *(August, 1907)*

Elevation *7,000 ft (2 134 m)*

Looking west from the Gros Ventre road, 0.4 mile east of preceding plate. The far slope is a mosaic of burned and unburned conifer stands. Lodgepole pine and Douglas-fir in early succession occupy burned areas. Young aspens predominate at left-center of photo. Burned areas are primarily attributed to the fire of 1879.

General Land Office photograph, courtesy of Bureau of Land Management.

Plate 32b *(July 20, 1971)*

64 years later

A closed conifer stand now occupies far slopes, while aspens are in advanced succession. The boulder-strewn flood plain and change in the Gros Ventre River channel resulted from a 1927 breach in the lower Slide Lake dam.

Plate 33a *(About 1900)*

Elevation *7,000 ft (2 134 m)*

Looking southeast across the Gros Ventre River towards the outlet of Bierer Creek on left and slopes of Sheep Mountain. Photo point is above Gros Ventre Slide overlook, 0.4 mile from preceding plate. View includes a continuation of the burn pictured in plate 29.

S.N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 33b *(September 25, 1970)*

70 years later

This scene typifies the dramatic increase in timber cover on the Bridger-Teton Forest. Trees are approaching maturity and have been attacked by the mountain pine beetle in recent years. Forest openings comparatively free of trees are edaphically controlled. The landscape in midground is covered by material from the 1925 Gros Ventre Slide, which also obliterated the original camera point and covered the rock ledge in early scene.

Plate 34a *(April 12, 1920)*

Elevation *7,100 ft (2 165 m)*

Looking north at slopes west of Tent Creek from a point 2.5 miles east of plate 33. Much of aspen and conifer cover is in early succession. Network of trails attest to recurrent winter elk use. Note lone elk highlighted by lower snowbank.

Fish and Wildlife Service photograph B-20648 by Goldman.

Plate 34b (May 4, 1970)

50 years later

In foreground, density of mountain big sagebrush has increased. Elk use on near slopes has been almost entirely eliminated by winter feeding. Today, the primary big game foraging in this locality is by moose. Sections from mature aspen on distant slope showed a stand age of 100-120 years. With advancing succession, stand density has declined. Willows (arrow) show an increase in growth.

Plate 35a *(August, 1883)*

Elevation *6,800 ft (2 073 m)*

Camp Arthur, the third of six camps established by President Arthur and his party. Camera faces north, with Gros Ventre River in midground and Horsetail Creek in distance. Although a haze impairs view of distant slopes, it is evident that aspen and conifers are in early succession.

F. Jay Haynes photo, courtesy of Haynes Foundation; Mrs. Isabel M. Haynes, President.

Plate 35b *(September 26, 1970)*

87 years later

The valley bottom is now covered by Lower Slide Lake, which provides ideal habitat for various waterfowl. Aspens on far slopes, which were not visible in 1883, are now quite conspicuous. The conifer cover is also heavier.

Plate 36a *(About 1900)*

Elevation *7,400 ft (2 256 m)*

High on the southeast slope of Russold Hill, the camera faces east-northeast toward the Red Hills. Downfall in midground is fire-killed aspen, as evidenced by charred remains in 1970. Scattered shrubs in midground are mountain big sagebrush. White spots (arrow) are Unita ground squirrel diggings.

S.N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 36b *(September 21, 1970)*

70 years later

Camera point was precisely duplicated. Original view is now screened by aspen, spruce, and limber pine. Dense plant cover prevails in foreground and in draw below. Mountain big sagebrush in particular, has increased (inset). In contrast, the Red Hills in distance support a sparse plant cover comparable to earlier years. No appreciable changes can be detected in watershed conditions. The Unita ground squirrel diggings continue to be occupied (inset).

Plate 37a *(August, 1883)*

Elevation *7,000 ft (2 134 m)*

President Arthur's party crossing Gros Ventre River at outlet of Miner Creek. View is southwest with fork of Miner Creek at left. Willows line the river banks, while the darker shrubs in foreground, based on present composition, appear to be Woods rose. Ring counts of fire-scarred lodgepole pine suggest the fire of 1879 killed the spruce in foreground and swept the far slopes. At the time, aspen were in advanced succession.

F. Jay Haynes photo, courtesy of Haynes Foundation; Mrs. Isabel M. Haynes, President.

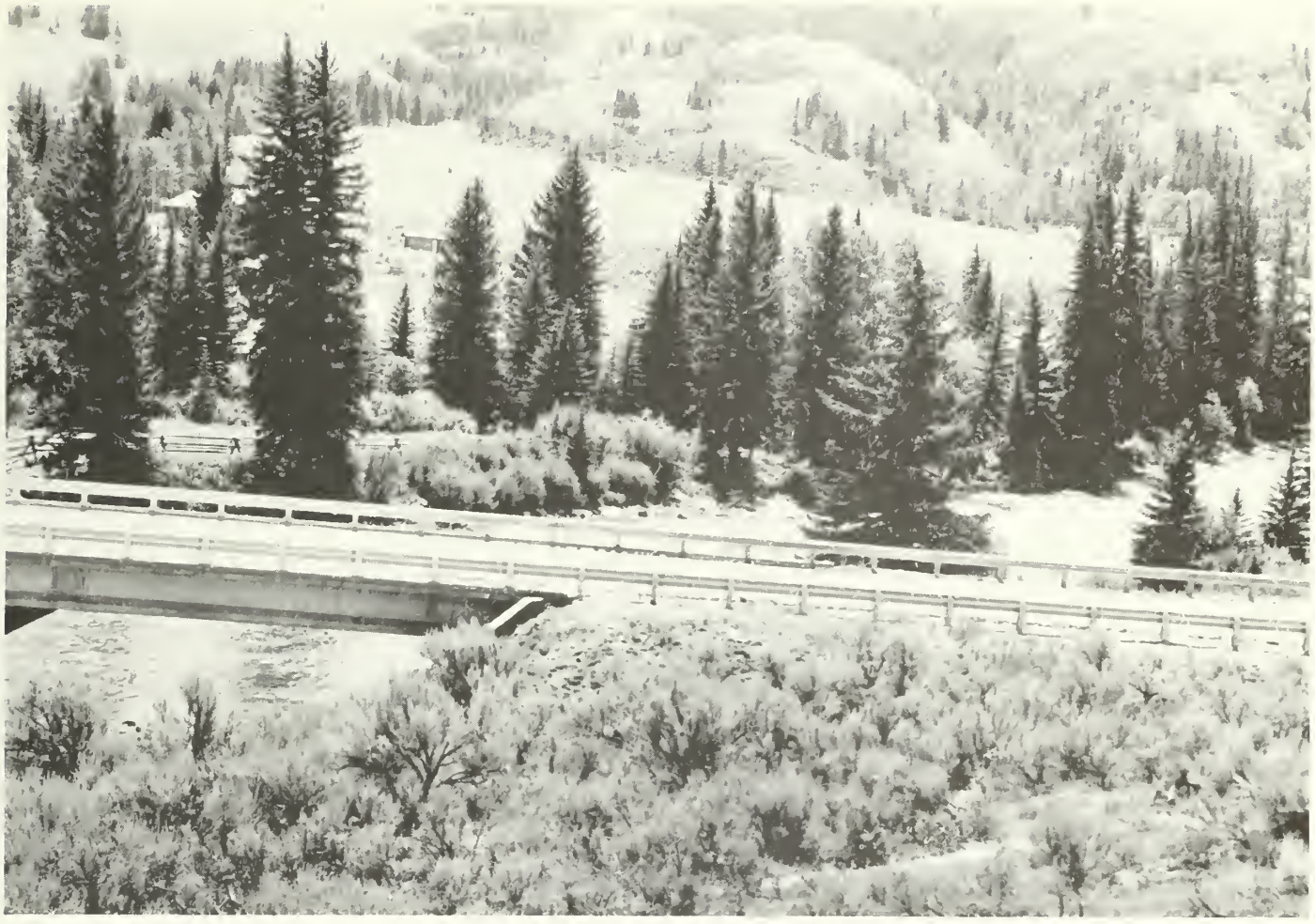

Plate 37b *(August 21, 1970)*

87 years later

Mountain big sagebrush has replaced Woods rose in foreground and is now conspicuous across the river. The Gros Ventre cattle driveway runs through foreground. Disturbance from bridge construction has removed much of the vegetation in the road right-of-way. Blue spruce now dominate midground. Conifer cover in distance has increased at the expense of aspen.

Plate 38a *(Between 1900 and 1906)*

Elevation *7,000 ft (2 134 m)*

Looking north toward Red Hills from below Gros Ventre Bridge. Camera point in previous scene is at left edge of photo. Mountain big sagebrush, the most conspicuous shrub, occupies deeper soils. Based on present composition, the primary plant species on sparsely vegetated sites include perennial grasses, Hoods phlox, rabbitbrush spp., fringed sagebrush, winterfat, and horsebrush. Gully and rill patterns attest to recurrent runoff from snow and rain. This slope has been historic winter range for bighorn sheep and elk. Note series of game trails.

S.N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 38b *(May 6, 1973)*

67-73 years later

The view is now partly obscured by a new bridge.

Mountain big sagebrush has increased on localized sites. Erosion patterns and extent of cutting is comparable to former condition. Vegetative changes have been subtle, being comparable to those in plate 36 on the west end of the Red Hills.

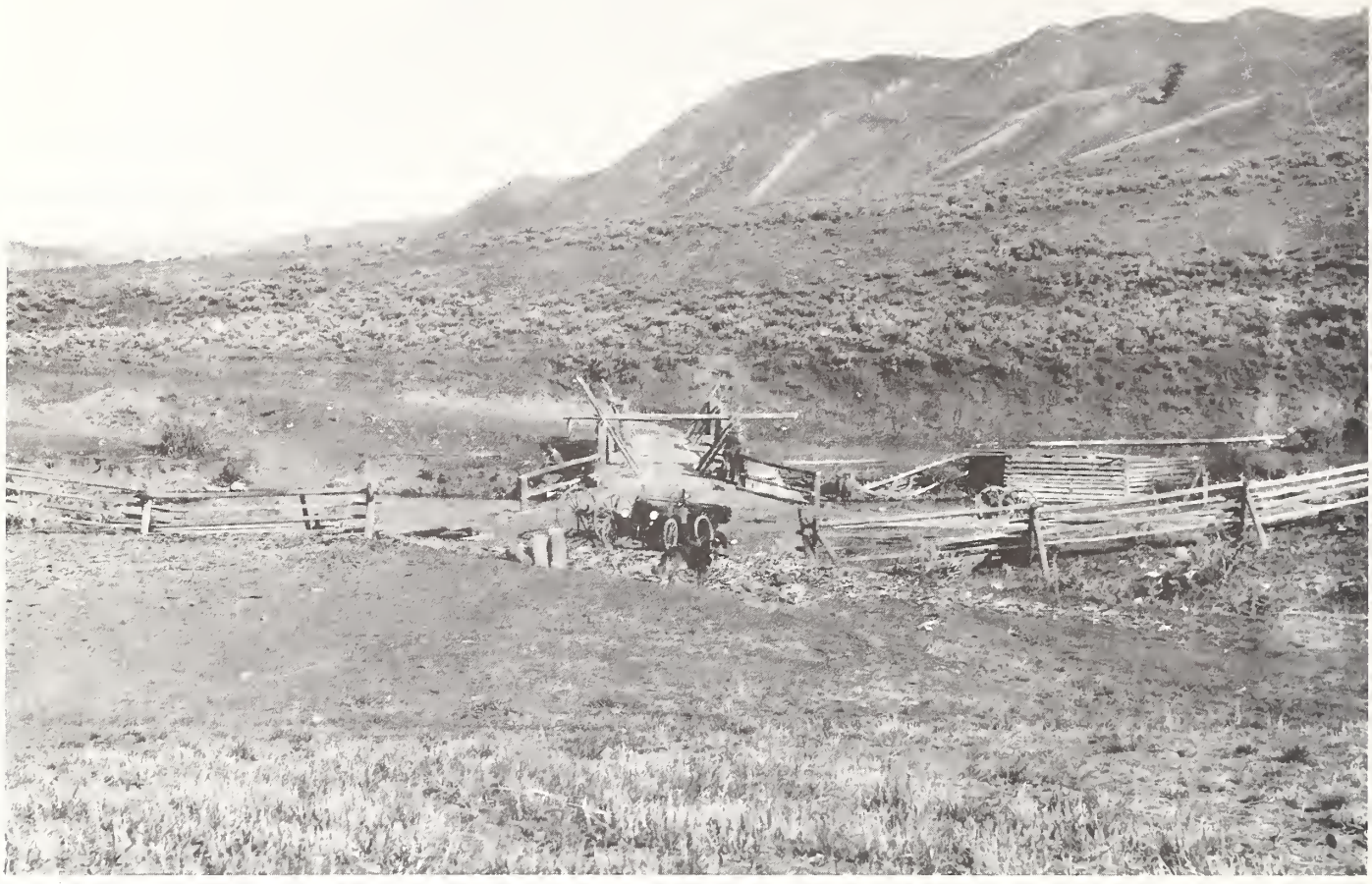

Plate 39a *(1918)*

Elevation *7,000 ft (2 134 m)*

Taken just below preceding plate, the view is northwest toward the Red Hills. Foreground is on edge of hay meadow, while cattle driveway and road occupy near slope. Mountain big sagebrush constitutes principal shrub cover. Men are working on new bridge, the previous two having been washed out during high water in 1907 and 1918.

Forest Service photograph, photographer unknown.

Plate 39b (July 18, 1968)

50 years later

Mountain big sagebrush has increased in density. Willow now grow on sites formerly occupied by bridge abutments. Vegetal patterns on Red Hills in distance are comparable to 1918.

Plate 40a *(1899)*

Elevation *7,000 ft (2 134 m)*

A fall scene on the Gros Ventre River about one mile east of plate 38, which lies immediately below rock outcrops on skyline. The predominant tree cover along river is spruce. Dark shrubs on opposite bank appear to be mostly willows. Dead branches suggest a reduction in size. Shallow soils on far slope are sparsely vegetated, while mountain big sagebrush is confined to deeper soils. Aspen are in early succession on ridge (arrow). Associated conifers are Douglas-fir, lodgepole pine, and limber pine.

Stimson photograph, courtesy of Wyoming State Archives and Historical Department.

Plate 40b *(August 25, 1975)*

76 years later

Spruce have increased in both size and numbers, while the adjacent shrub cover on opposite bank is more dense, being comprised of cottonwood, willow, and silver buffaloberry. The ground cover on far slope is comparable to 1899, excepting that mountain big sagebrush has increased in density on localized sites. With advancing succession, aspen on ridge are being out-competed by conifers.

Plate 41a *(About 1905)*

Elevation *7,000 ft (2 134 m)*

The S.N. Leek hunting party crossing the Gros Ventre River below the outlet of Slate Creek. The view is northwest toward the Lavender Hills. Primary shrubs on opposite river bank are silver buffaloberry, while mountain big sagebrush predominates on the slopes beyond. The dark shrub communities in midground are bush cinquefoil, found on moist sites.

S.N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 41b *(September 25, 1970)*

65 years later

Spruce have regenerated in foreground, while buffaloberry and willow have increased on far bank. Density of big sagebrush has increased. Density of bush cinquefoil has increased slightly. Far slopes continue to support a sparse ground cover.

Plate 42a *(About 1905)*

Elevation *7,300 ft (2 226 m)*

S.N. Leek hunting party crossing a slump on Slate Creek about 1 mile below the junction of the Carmichael and Dallas Forks. East Leidy Peak is in distance on right. The vegetal cover in foreground and midground appears to be an association of scattered mountain big sagebrush, bush cinquefoil, and herbaceous plants. Arrows point to willow communities. Sampling of fire-scarred trees suggested this area burned about 1842 and 1879.

S.N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 42b *(September 10, 1970)*

65 years later

Vegetation has changed dramatically. Mountain big sagebrush and bush cinquefoil dominate the foreground. Note establishment of vegetation in old trail, while the adjacent willow communities are less prominent. Far slopes now support an uneven-aged lodgepole pine stand.

Plate 43a *(About 1905)*

Elevation *7,400 ft (2 256 m)*

A northerly view of Mt. Leidy (left) and East Leidy (right) from the valley floor near confluence of the Carmichael and Dallas Forks of Slate Creek. Location is about 1 mile upstream from previous scene. The foreground vegetation is an association of herbaceous species and mountain big sagebrush; the bottom land below is primarily silver sagebrush, willows, and herbaceous plants. Large shrubs in front of boulders are willow. A willow community dominates the valley bottom beyond boulders, while on the adjacent slope, willow is restricted to the more moist sites (arrows).

S.N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 43b *(September 10, 1970)*

65 years later

The foreground shows an increase in mountain big sagebrush, as does the far slope. Little change is apparent in the herbaceous plant-silver sagebrush association in midground. The willow shrubs near boulders are also much the same. No appreciable differences in the large willow community can be detected from photos; however, field examinations indicate a loss of plants and reduction in size. Willows on adjacent slopes have deteriorated significantly.

Plate 44a *(June, 1918)*

Elevation *8,400 ft (2 561 m)*

From the ridge above the Haystack Fork of Slate Creek, the view is northwest into the Carmichael Fork of Slate Creek. The dark vegetation on valley floor is the same willow community in preceding plate. Sparse ground cover persists on the Pinyon conglomerate formation in foreground. Snags on ridge at right attest to past fire.

Forest Service photograph 39581A by Smith Riley.

Plate 44b *(June 17, 1969)*

51 years later

The Pinyon conglomerate formation in foreground continues to support a sparse ground cover comprised largely of bearded bluebunch wheatgrass, spikefescue, Hoods phlox, milkvetch spp., eriogonum spp., and fringed sagebrush. The willow community on valley floor has deteriorated, a condition exaggerated by a difference in tonal quality of the prints. Tree cover has increased considerably.

Plate 45a *(June, 1918)*

Elevation *8,400 ft (2 561 m)*

Inspection party on ridge between Haystack Fork and Bear Paw Fork of Slate Creek, some 100 yards east of preceding plate. 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.

Plate 45b (June 17, 1969)

51 years later

Plant growth on near slopes is severly limited by poorly developed sandy soils. Ground cover is comparable to early scene despite less precipitation than 1918. Elk foraging has been reduced by the winter feeding program in Gros Ventre valley. Conifers now dominate old burn in Haystack Fork, while little change in the timber cover is evident on slopes above.

Plate 46a *(1911)*

Elevation *7,400 ft (2 256 m)*

Southwest exposure on slopes of Gray Hills between Lightning Creek and Haystack Fork. Parent material is sandstone and claystone. This locality received heavy utilization by elk at the time of this photo.

Fish and Wildlife Service photograph B-13479 by Edward Preble.

Plate 46b *(July 2, 1969)*

58 years later

Lack of snow on far ridge indicates this photo was taken later in the season than the original. Note increased tree cover in locality occupied by snowbank in 1911 scene. Little can be said about plant cover in foreground, except that the two scenes appear comparable. The most conspicuous species include bearded bluebunch wheatgrass, Douglas rabbitbrush, and mountain big sagebrush. Other species represented are rubber rabbitbrush, fringed sagebrush, Hoods phlox, eriogonum spp., pussytoes spp., bluegrass spp., and fescue spp.

Plate 47a *(February, 1919)*

Elevation *7,400 ft (2 256 m)*

Looking south across Goose Lake adjacent to Gros Ventre road. An inspection party took this photograph to show foraging by free-ranging elk. Trees on near slope are aspen. Willow occupy edge of lake at left.

Forest Service photograph 40166A by Smith Riley.

Plate 47b *(February 4, 1970)*

51 years later

The aspen at left have deteriorated, while at right an aspen clone has developed on a site formerly occupied by shrubs. Willow have increased on the opposite shore. Conifers in distance are more conspicuous. Elk foraging in this locality has been reduced by winter feeding at nearby Alkali Creek.

Plate 48a *(1909)*

Elevation *7,500 ft (2 287 m)*

One mile northeast of Goose Lake. Camera points west across Burnt Creek at upper Gros Ventre Slide. Evidence of recent surface movement is suggested by fractures above Burnt Creek. This massive, slow-moving earth flow pinched off the Gros Ventre River in about 1904, forming Upper Slide Lake pictured in plate 49.

USGS photograph 224 by E. Blackwelder.

Plate 48b (June 20, 1968)

59 years later

A smoother appearance suggests that the upper Gros Ventre Slide is more stable than formerly. Advancing plant succession is evidenced by an increase in mountain big sagebrush and growth of aspen (arrow) which were hardly visible in 1909.

Plate 49a *(1919)*

Elevation *7,500 ft (2 287 m)*

The camera points northeast across Upper Slide Lake. Shrubs in the foreground and midground are principally mountain big sagebrush and silver sagebrush, while trees are aspen in early succession. Samples from fire-scarred conifers between Alkali Creek and this vicinity suggest widespread burning in 1872. The far slopes include the heart of the historic elk winter range and were being intensively grazed by elk in 1919.

U.S. Forest Service photograph 49881A by M. Anderson.

Plate 49b (September 6, 1968)

49 years later

Shrub cover in foreground has thickened, while in midground growth of aspen stands screen part of lake. Alluvial deposits in lake originate from unstable lands in the upper watershed. This geologic change favored moose by the establishment of willows on alluvial deposits. Gully patterns on southwest-facing slopes in distance are virtually the same as 1919. The slope was fenced to exclude elk and contour-trenched in 1963.

Plate 50a *(1904)*

Elevation *7,400 ft (2 256 m)*

Game Warden Si Ferrin (right) and assistant Charlie Harvey on south bank of Gros Ventre River. The view is north, with Coal Mine Draw at extreme right. Vegetation in foreground is predominantly herbaceous species, while a low density of mountain big sagebrush and bush cinquefoil shrubs also occupy the site. A willow shrub can be seen under horses muzzle at left.

Photo courtesy of Wyoming State Archives and Historical Department. Photographer unknown.

Plate 50b *(September 23, 1969)*

65 years later

Vegetation in foreground changed markedly from principally herbaceous cover to predominately mountain big sagebrush and bush cinquefoil. Note how the boulder at right behind horse's feet in early photo is obscured by shrub growth. Arrow points to same willow as in 1904 scene. The Gros Ventre River has moved futher north. In distance, vegetative and gully patterns are remarkably similar after 65 years.

Plate 51a *(About 1905)*

Elevation *7,300 ft (2 226 m)*

Camera faces northeast toward spring at present site of Wyoming Game and Fish patrol cabin. Coal Mine draw lies immediately north. Hunter is Henry Moser or one of his party. As in preceding plate, the foreground is principally occupied by herbaceous species. Mountain big sagebrush is of low density, being more prevalent on slopes. The large, dark shrubs around spring are willow.

Photo courtesy of Mr. Almer Nelson.

Plate 51b *(September 15, 1972)*

67 years later

Mountain big sagebrush now predominates in foreground and midground. Dead stems mark location of large willow in 1905 photo. The willow in foreground and others in front of fence became established after 1905. Accelerated erosion above spring is attributal to road which bisects gullies. A sparse plant cover continues to occupy upper slopes.

Plate 52a *(February, 1918)*

Elevation *7,400 ft (2 256 m)*

Westerly view across a willow community near the outlet of Tepee Creek. Note the open growth form of willow. Tree cover on distant slopes is principally aspen and lodgepole pine.

U.S. Forest Service photograph 49868A by M. Anderson.

Plate 52b *(February 5, 1970)*

52 years later

The growth form of willow has been reduced as a result of natural die-back of branches and moose heavily browsing new growth. Aspens on near slope and in distance are less conspicuous, while conifers have increased in size.

Plate 53a *(1925)*

Elevation *7,400 (2 256 m)*

Forest Service patrol cabin near confluence of Tepee Creek and Gros Ventre River. View is northwest, with outlet of Coal Mine Draw at right distance. The aspen stand at left-midground and willow in lower right are also pictured in previous plate. Dark shrubs on valley floor are almost entirely willow.

Forest Service photograph by Dick Winger.

Plate 53b (February 7, 1968)

43 years later

After 43 years, the aspen stand contains fewer stems, but these are of increased size. Associated mountain big sagebrush is more dense. The reduced growth form of willow as noted in preceding plate can be clearly seen by comparing shrub (arrow) with the way it looked in 1925. The Wyoming Game and Fish Department patrol cabin referred to in plate 51a can be seen in distance at right. Wintering elk have been fed in this locality since the early 1960's.

Plate 54a *(Between 1887 and 1896)*

Elevation *7,400 ft (2 256 m)*

The Owen Wister hunting party near the outlet of Goosewing Creek. The camera is facing south-southeast. Tree cover on the near slope is predominately aspen in early succession. Fire scars in the vicinity suggest an 1872 burn. The white 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 high on ridge above tent.

Owen Wister photograph, courtesy of Western History Department, University of Wyoming.

Plate 54b (September 12, 1969)

73-82 years later

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. The site is comparable to plate 45, with available moisture limited by sandy, shallow soils. Heavy use by campers and bedding livestock has altered the plant cover in foreground.

Plate 55a *(August, 1918)*

Elevation *7,400 ft (2 256 m)*

Looking north across Gros Ventre River toward the outlet of Dry Cottonwood Creek. The camera is on the road shoulder 0.3 miles east of preceding plate. Dark shrubs of large growth-form in mid-ground are willow, while the lighter vegetation is primarily mountain big sagebrush and silver sagebrush. Bush cinquefoil, which appears dark, is also present. The trees on flood plain are cottonwood and spruce.

U.S. Forest Service photograph 49901A by M. Anderson.

Plate 55b *(September 23, 1969)*

51 years later

A marked change has taken place in the growth form of willow (arrow). Dead stems attest to former large size. Mountain big sagebrush and bush cinquefoil are of increased size, while losses of cottonwoods are apparent in distance. Both vegetal and gully patterns on far slopes show no appreciable change.

Plate 56a *(July, 1917)*

Elevation *8,200 ft (2 500 m)*

Along the Oil Well Ridge road looking southwest across Dry Cottonwood Creek toward the head of Coal Mine Draw. Tree cover on far slopes is predominatly aspen. Fire scars in the vicinity suggest establishment following burning around 1885.

Fish and Wildlife Service photograph B-18300 by Dr. Field. Photograph courtesy of National Archives and Record Service.

Plate 56b (July 2, 1969)

52 years later

Growth of aspen in foreground necessitated photographing the scene from top of pickup cab. Despite impaired view, aspen stands on the far slope have obviously deteriorated and are now largely occupied by big sagebrush. Where aspen was seral at right of photo, it has been replaced by conifers.

Plate 57a *(July, 1917)*

Elevation *7,500 ft (2 287 m)*

A westerly view of the Gros Ventre River bottoms from a position on the east bank of Cottonwood Creek near its outlet. Dark shrubs are willow. The light shrubs in midground and on near slopes are mountain big sagebrush. Cabin at right is reputed to have been the winter quarters of a notorious hunter who killed elk for their tusks (canines) in earlier days.

Fish and Wildlife Service photograph B-18284 by Dr. Field. Photograph courtesy of National Archives and Record Service.

Plate 57b *(July 13, 1970)*

53 years later

A difference in films tends to exaggerate losses in the willow community. Losses have occurred on marginal sites where a reduction in the water table has resulted from a shift in the adjacent stream channel. The primary change in willow has been that of reduced size, while the density of mountain big sagebrush has increased.

Plate 58a *(August, 1918)*

Elevation *7,600 ft (2 317 m)*

The camera looks northeast across the Gros Ventre River above its confluence with Fish Creek. The junction of the north and south forks of Fish Creek is in left-distance. Willows predominate adjacent to stream meanders. The foreground vegetation is an association of herbaceous species and half-shrubs.

Forest Service photograph 49913A by M. Anderson.

Plate 58b *(September 23, 1969)*

51 years later

The Fish Creek elk feedground now occupies the river terrace and flood plain below. Feeding of elk has allowed perennial grasses to replace the former mountain big sagebrush cover which was trampled out. Obvious changes in the Gros Ventre River include an isolated meander that was flowing in 1918 (arrow).

Plate 59a *(August, 1918)*

Elevation *7,500 ft (2 287 m)*

Looking northeast across upper Gros Ventre River from Brook Post Office. The southwest facing slopes were an integral part of the historic elk winter range. Aspen and conifers comprise the tree cover. Willow dominate the flood plain below. The three large shrubs in center of photo are also willow.

Forest Service photograph 49891A by M. Anderson.

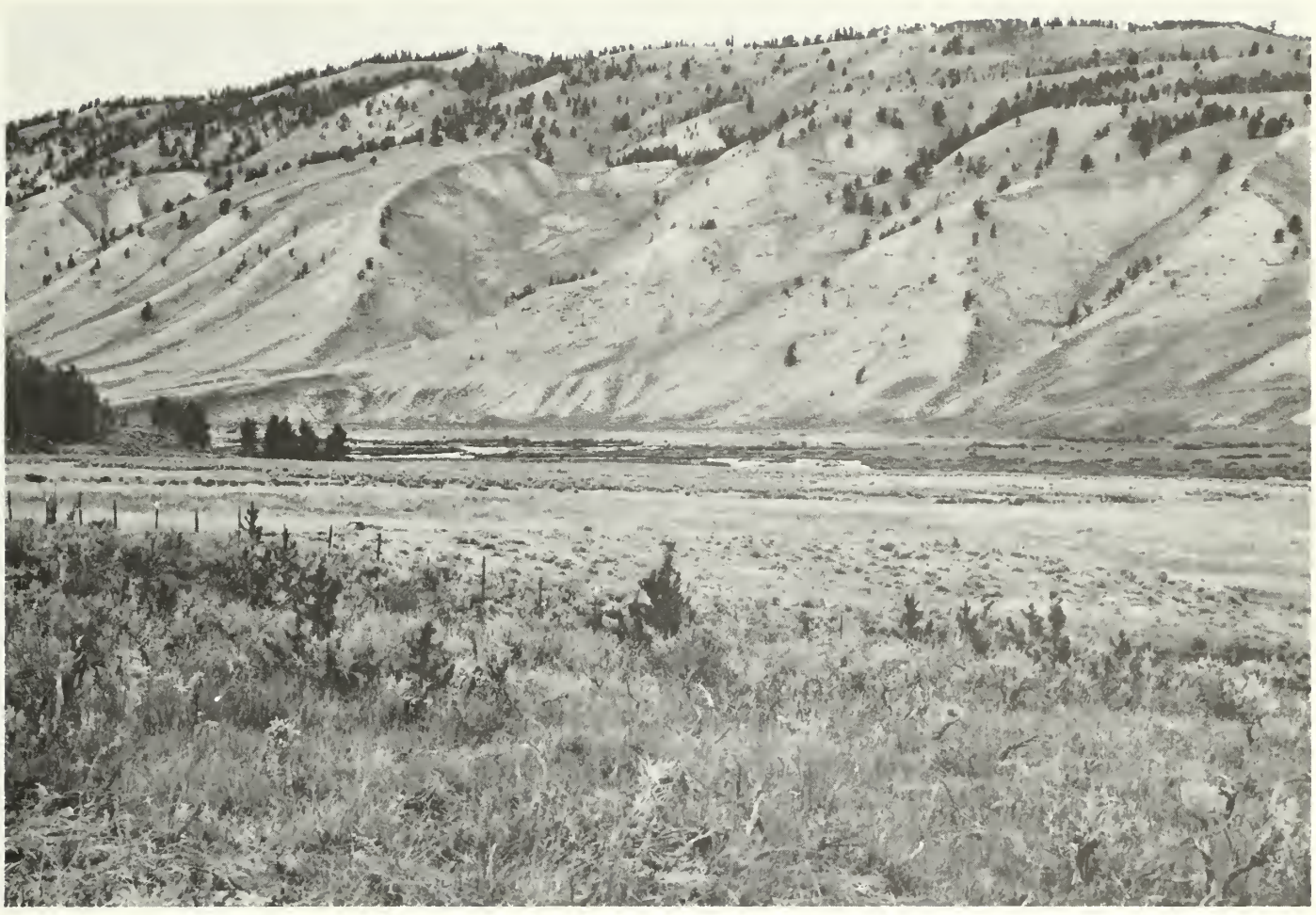

Plate 59b (August 25, 1971)

53 years later

Camera point was moved some 50 ft right to avoid lodgepole pine that obstructed view. No appreciable change on the southwest exposure can be detected, except for a deterioration of aspen and increased growth of conifers. Willow on flood plain show evidence of reduced density. Note that the three shrubs in 1918 scene are no longer distinguishable.

Plate 60a *(1909)*

Elevation *8,400 ft (2 561 m)*

From the ridge between Trail Creek at right and Bacon Creek on left, the view is north across Fish Creek. Standing snags and early stage of succession attest to a late 1800 burn. Aspen clones in early succession are in evidence on the Trail Creek Drainage (arrows).

USGS photograph 209 by E. Blackwelder.

Plate 60b (August 6, 1969)

60 years later

Conifers and mountain big sagebrush now predominate on ridge in midground, while aspen stands in Trail Creek below have deteriorated. Those aspen stands that were seral have largely been replaced by conifer (arrow).

Plate 61a *(1909)*

Elevation *7,500 ft (2 287 m)*

Looking southeast across Fish Creek from edge of road immediately above Elk Track Ranch. Most of the dark shrubs on flood plain are willow. Tree cover on distant slope is primarily aspen and lodgepole pine, much of which is in early succession. Fire-scarred lodgepole pine in this locality suggest vegetation regenerated following an 1885 wildfire.

USGS photograph 223 by E. Blackwelder.

Plate 61b (September 13, 1969)

60 years later

The willow near the arrow seem similar to those in 1909. Periodic flooding from an irrigation ditch has favored willow in foreground, while "drowning out" mountain big sagebrush. Narrowleaf cottonwoods have become established on flood plain. Shifting of the stream channel to the southeast resulted in cutting and loss of bank vegetation at left of photo, while willow became established on old stream bed. This locality receives one of the highest levels of winter moose utilization on the Gros Ventre River. Aspen and lodgepole pine stands on far slope are in advanced succession.

Plate 62a *(1909)*

Elevation *7,800 ft (2 378 m)*

A northeasterly view on the north fork of Fish Creek from the terrace above present drift fence. The outlet of Harness Gulch is in distance. Shrub cover on flood plain is largely willow and bush cinquefoil, while low density mountian big sagebrush occupies the drier, well-drained sites.

USGS photograph 221 by E. Blackwelder.

Plate 62b *(September 13, 1968)*

59 years later

Mountain big sagebrush density has increased while the density of willow has declined on some sites. Shifting of the stream to the far bank has isolated the meander in foreground. Here, willow are becoming established in the silt deposits. This locality receives a moderate level of moose browsing during the winter.

CONCLUSIONS

A maximum period of 92 years is covered by the 35 plates in the Gros Ventre River drainage. Like the Teton Wilderness, changes vary with site and past disturbance. As a whole, changes parallel those in the wilderness despite considerable differences in microclimates and man's influence. Some of the more significant trends are:

1. Increased density and growth of conifers.
2. Establishment of aspen following fire and a general decline in old stands.
3. General reduction in size and distribution of willow.
4. Increase in the size and density of mountain big sagebrush.
5. No appreciable change in ground cover on sparsely vegetated sites.
6. No observable change in the rate of geologic erosion.
7. Channel changes in the Gros Ventre River flood plain.

All plates show varying degrees of conifer establishment and growth. The most pronounced change has occurred on sites that were in early stages of succession when originally photographed (plates 28-29, 32-33). In these scenes, Douglas-fir and lodgepole pine growth today contrasts sharply with that of earlier years. Pronounced changes have also taken place on spruce sites (plates 37, 54); lodgepole pine sites (plates 42, 44, 61); and spruce-fir sites (plates 45, 60) where fires burned in the late 1800's. Changes are less dramatic on sites which were in the later stages of succession when originally photographed (plates 45 (distance) and 53).

Aspen stands are currently old and mostly deteriorated. Successful regeneration in modern times has been negligible. Stands that were in early succession following wildfires when the original photographs were taken are mostly intact but declining (plates 29-32, 35-36, 40, 48-49, 54, 61). Conifer invasion is common (plates 54, 61). Older stands have typically deteriorated (plates 56, 60).

Trends in willow growth are not clearly definable. In most instances, crown size has been reduced (plates 37, 42, 51-55, 57, 59), but in localized areas its form has not changed (plates 34, 40, 61). As a whole, willow distribution has declined, particularly where it is 100 ft (30.4 m) or more from stream channels and in competition with other vegetation (plates 42-44, 52-53, 57, 59, 62). In other localities, willow distribution has increased (plates 34, 47, 50-51, 61), but only on moist sites around springs, pot holes, and river flood plains.

The trend in mountain big sagebrush has been toward increased growth and density. Only in plate 58 at the Fish Creek feedground and part of plate 61 on the Fish Creek flood plain is a decrease indicated. Mountain big sagebrush has increased on all sites where soils are deep enough to provide adequate rooting depth; including benches and ridges (plates 28, 30-31, 48-49, 60), draws (plates 34, 36), toe slopes (plates 37-39, 50-51, 53) and valley bottoms (plates 41-43, 55, 57, 62).

The rate of sagebrush establishment can be reasonably well determined where the approximate dates of disturbances that preceded the early photographs are known. Establishment was quite slow on sites originally photographed 20 years following an 1879 wildfire (plates 28, 30, 31). Slow establishment is also suggested in localities that burned about 1872 (plates 50, 51).

Vegetative trend on harsh south- and west-facing slopes and ridges was shown by 22 plates. Sixteen distant scenes show no change in growth patterns. The lighter colored, sparsely vegetated areas of recent years appear comparable with former conditions (plates 28-29, 34-36, 39-41, 43, 49-50, 55). Six close-up photos (plates 38, 44-46, 51, 54) also show that conditions in recent years on harsh sites are comparable to

earlier years. Without exception, thinner soils continue to support sparse plant cover dominated by native perennial species.

Erosion rates have been unchanged on sparsely vegetated southerly exposures. Gully cutting is geologic, having developed over long time periods (plates 40, 49-50). Both gully patterns and size are remarkably similar after 50 to 60 years. Plates 36, 38, 45-46, 54, and 59 show no evidence of accelerated cutting. High surface erosion continues to occur on steeper slopes during intensive summer storms. Only where roads or trails have interrupted natural drainages have erosion rates been accelerated (plate 51).

The Gros Ventre River flood plain has changed profoundly at various locations. A major landslide and slow moving earth flow formed Lower Slide Lake (plates 29, 33, 35) and Upper Slide Lake (plate 49). The upper portions of these lakes are filling with sediment and willow flats are developing, thus further changing the character of the river. Channel changes have been insignificant where the river is confined (plates 37, 40-41) but are often pronounced where it is unconfined (plates 50, 58, 61-62). Here, the river has moved back and forth across the wide flood plain leaving old channels and creating new ones.

Southern Section--

Jackson Vicinity, Hoback Drainage, and Teton Canyon

INTRODUCTION

The southern section is represented by 23 plates; the first 15 of which are on big game winter range at elevations between 6,000 and 7,000 ft (1 829 and 2 143 m) (fig. 4). Localitites pictured have been influenced by highway construction, homes, motels, dude ranches, elk feedgrounds, and suppression of wildfire.

As a whole, deciduous shrubs are more common than on the Gros Ventre winter range. Overuse of these shrubs has been of concern to various investigators. Winter utilization is largely by mule deer, except areas shown in plates 63, 72, and 73 immediately adjacent to elk feedgrounds. Domestic livestock grazing has been confined to horses and occurs only in areas shown in plates 64 and 65. Cattle grazing has been prohibited since 1918. Plates 78 to 85 depict conditions in the Douglas-fir and spruce-fir communities on summer range between 6,800 and 9,200 ft (2 073 and 2 805 m). Currently, only one locality (plate 78) is grazed by cattle. Domestic sheep have grazed in the Miles Canyon area of the south fork of Teton Canyon from about 1890 to the present (plates 83-85). Use in recent decades has been lighter with no grazing during the past several years.

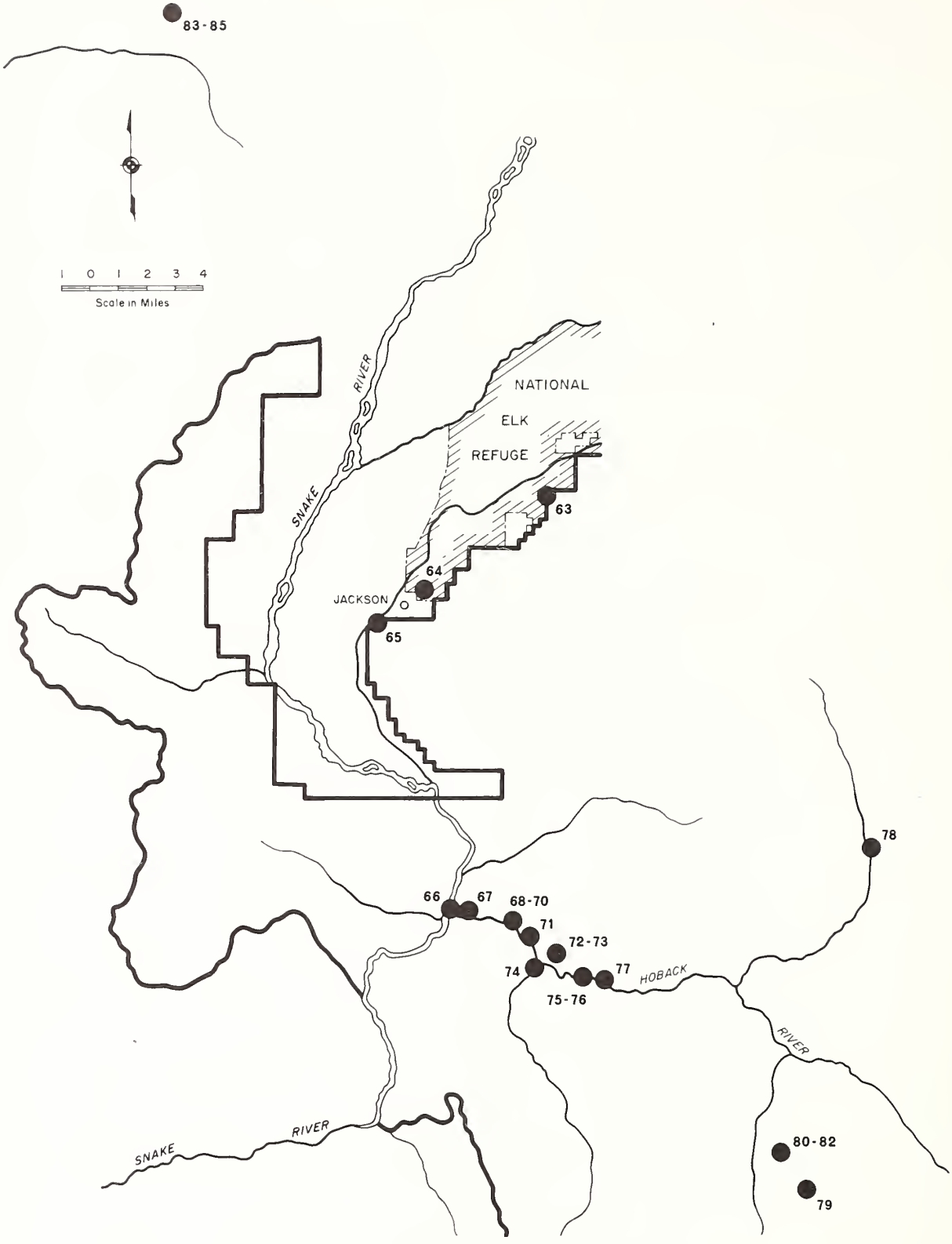

Figure 4. Location of camera points in southern section.

Plate 63a *(May 13, 1936)*

Elevation *6,400 ft (1 951 m)*

A north-facing slope near site of Chambers homestead on east side of National Elk Refuge. A heavily utilized aspen stand dominates skyline. The closely cropped shrubs on near slope include serviceberry, currant, rubber rabbitbrush, and sagebrush spp.

Fish and Wildlife Service photo by Olaus J. Murie.

Plate 63b (May 14, 1970)

34 years later

The parent aspen stand has nearly disappeared, while intensive utilization of suckers by elk has not allowed successful regeneration. Chokecherry and serviceberry shrubs now occupy interior and margin of former stand. Snowberry has appreciably increased in occurrence--notably at upper left of photo. Ground cover is excellent, being comprised of various mat-forming plants and other herbaceous vegetation.

Plate 64a *(1899)*

Elevation *6,200 ft (1 890 m)*

Looking west at East Gros Ventre Butte from point near south boundary of what is now the National Elk Refuge. The homestead in foreground was taken up prior to establishment of the Refuge. When this photo was taken, the East Gros Ventre Butte was part of the historic Jackson Hole elk winter range. Antlers are from bull elk that died of malnutrition during previous winters.

The conspicuous tree cover on northeast-facing slope at left-distance are even-aged aspen stands. Associated shrubs include mountain big sagebrush, bitterbrush, serviceberry, and chokecherry. Douglas-fir, Rocky Mountain juniper, curleaf mountain mahogany, bitterbrush, and mountain big sagebrush occupy the drier southeast slope.

Stimson photograph, courtesy of Wyoming State Archives and Historical Department.

Plate 64b (September 7, 1972)

73 years later

Aspen are now largely in advanced succession, while shrub cover is more dense. The contrast in shrub cover is attributed to an increase in the density of mountain big sagebrush and growth of other shrubs. These changes were strongly influenced by exclusion of elk foraging and wildfire. Elk were fenced off the butte in 1938. The primary foragers today are horses, mule deer, a few moose, and an occasional elk. Trails were largely made by cattle in earlier years and by horses. The vegetative cover continues to be sparse on dry sites.

Plate 65a *(1902)*

Elevation *7,000 ft (2 134 m)*

Looking north from the south end of Snow King Mountain. Elk in foreground are on historic winter range. Adjacent aspen stands are even-aged, having regenerated after the wildfire of 1879. Willow occupy the Flat Creek bottom lands below. The Karns homestead is at right-center, while other homesteads are in distance at right.

Trester photograph courtesy of Fred Muzzula, Denver, Colorado.

Plate 65b (March 10, 1974)

72 years later

The original view was blocked by dense Douglas-fir growth. Camera is above and to right of 1902 position, in the largest opening. With advancing succession, a majority of the parent aspens in the original stands below have died out. A low level of ungulate browsing has allowed spotty regeneration. Elk are now almost entirely confined to the National Elk Refuge north of Jackson in distance.

Plate 66a *(About 1905)*

Elevation *6,000 ft (1 829 m)*

A southwesterly view of the Snake River (right) at its confluence with the Hoback River. The closely cropped shrubs and junipers in foreground attest to persistent browsing by wintering elk. The northwest facing slopes at left-center are in early succession, having burned in 1879.

S.N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 66b *(July 14, 1970)*

65 years later

State Highway 26-89 now follows the right bank of the Snake River, while a motel complex occupies foreground. Few elk now winter in this locality, because they are accustomed to feeding on hay at nearby feedgrounds. Trees and shrubs on river banks have increased. Closed stands of Douglas-fir now occupy northwest-facing slopes in distance.

Plate 67a *(About 1910)*

Elevation *6,000 ft (1 829 m)*

Camera faces southeast across the Hoback River along State Highway 187-189 0.7 mile east of preceding plate. The close proximity to previous scene and comparable stage of succession suggests this north-facing slope also burned in 1879. Note the vegetation diversity produced by uneven burning.

Photographer unknown.

Plate 67b (August 8, 1969)

59 years later

The vegetative cover on far slope is less diversified. Douglas-fir predominates, while aspen stands are deteriorating. Openings not occupied by trees are edaphically regulated. Any change in the mountain big sagebrush community at left is not readily apparent.

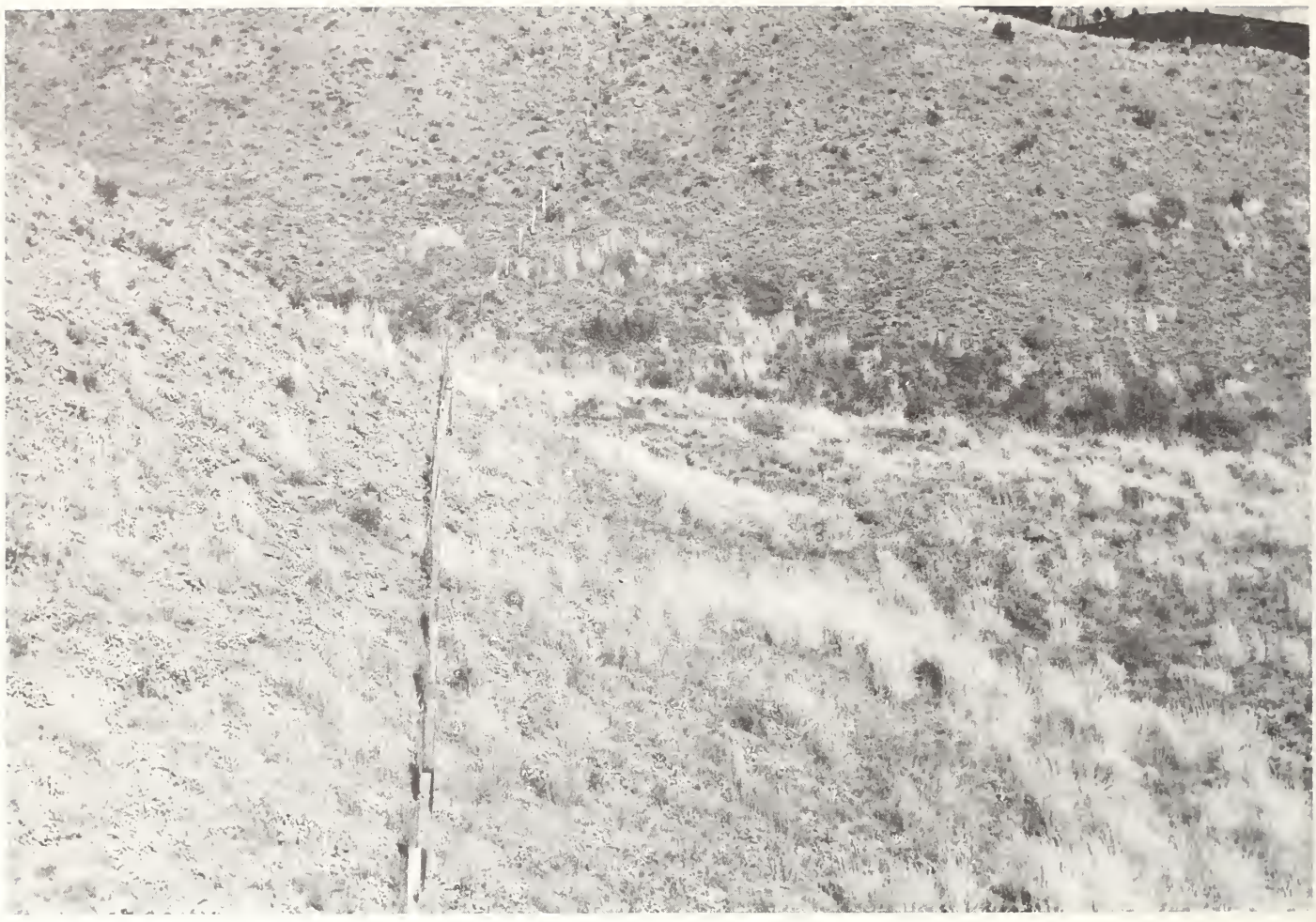

Plate 68a *(September 23, 1942)*

Elevation *6,200 ft (1 890 m)*

Looking east along the upper fence at the Gilcrease exclosure constructed in 1940 on the Hoback game winter range. Location is about one mile east of plate 67. The darker shrubs on far slope are serviceberry and bitterbrush. A chokecherry community persists at foot of slope, while in the foreground and midground the conspicuous grass is Great Basin wildrye. Elk were making heavy use of the Hoback winter range in 1942. Browsing by mule deer was light at this time. Soils in this locality, derived from shale, are rocky and shallow.

Forest Service photo by R. J. Costley.

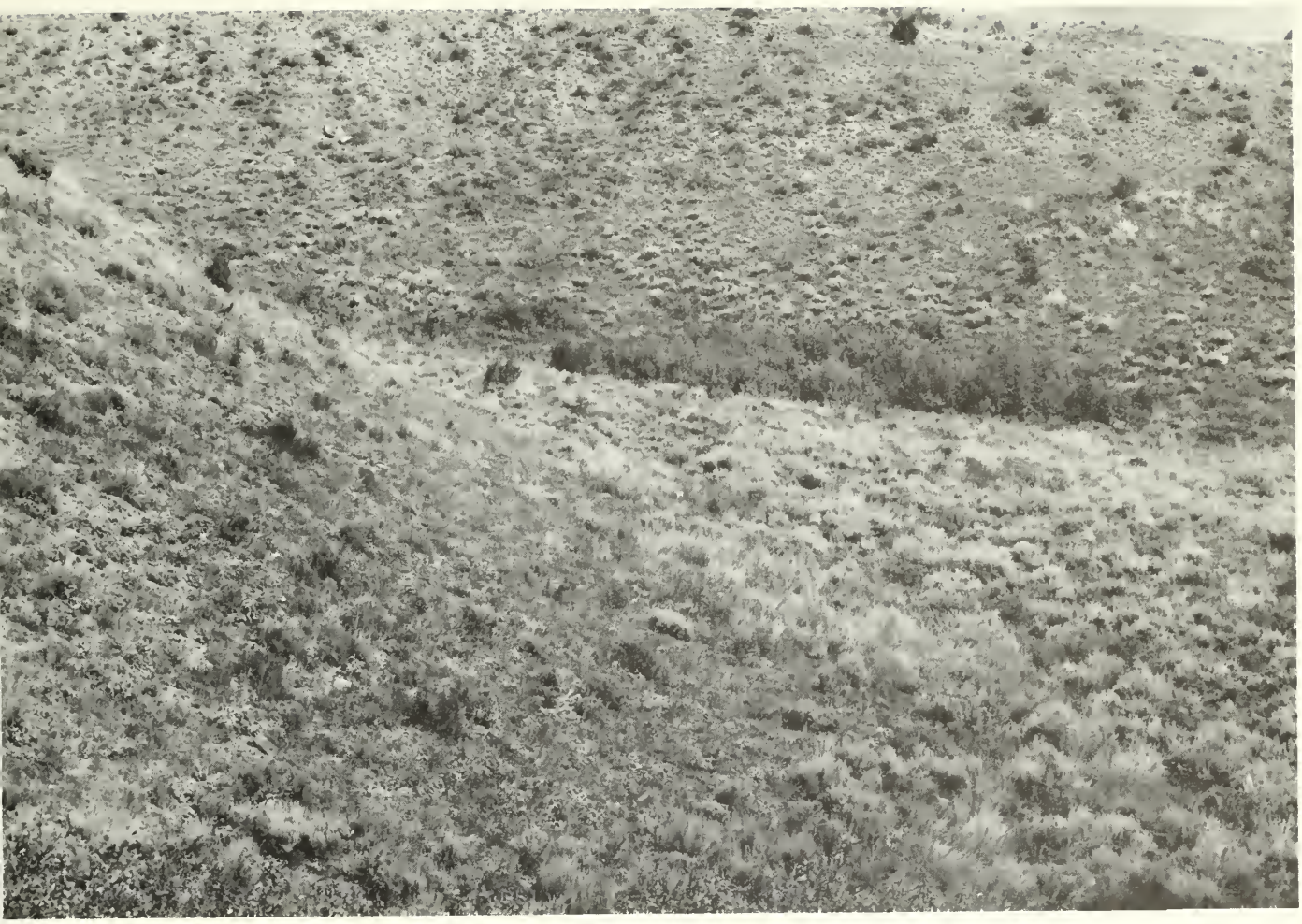

Plate 68b *(September 24, 1970)*

28 years later

The Gilcrease exclosure was removed in the early 1960's after years of costly maintenance and unsuccessful attempts to exclude elk. Significant changes in the vegetation are evident, though only 28 years have passed. Of particular note is the increased growth of serviceberry and bitterbrush. Mountain big sagebrush has also increased in density. Chokecherry at foot of slope has grown appreciably, while that at lower edge of photo is not evident in the 1942 photo. Wildrye appears to have decreased in density. This may be attributed to competition and increased shrub cover which obstructs view. Elk foraging in this locality was greatly reduced after 1960 through winter feeding on the adjacent Camp Creek feedground. Deer use has increased significantly over that of the early 1940's.

Plate 69a *(September 23, 1942)*

Elevation *6,200 ft (1 890 m)*

Looking down the lower fence at the Gilcrease exclosure. Trees at foot of near slope below exclosure are aspen. The prevalence of wildrye is more apparent than in previous plate.

Forest Service photograph by R. J. Costley.

Plate 69b (September 24, 1970)

28 years later

The increased density of mountain big sagebrush and decline of wildrye is more noticeable in this scene. The aspen stand has deteriorated, while a low level of regeneration is becoming established. A large portion of the former aspen stand is now occupied by chokecherry and to a lesser extent, serviceberry. The increased growth form of serviceberry and bitterbrush is further evidenced in this scene.

Plate 70a *(About 1900)*

Elevation *6,000 ft (1 829 m)*

Looking east at historic elk winter range from the north bank of the Hoback River some 2 miles from the Hoback Junction. Lower slopes of mountain at right-distance are in early succession. The primary vegetation on the river banks is spruce, Rocky Mountain juniper, narrowleaf cottonwood and willow. Dark shrubs on bench at left are principally serviceberry. Associated vegetation is mountain big sagebrush, deciduous shrubs, and herbaceous plants.

S. N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 70b (August 10, 1970)

70 years later

Tree and shrub cover along Hoback River has increased. Of note is the stable character of the stream bed, which appears comparable to early scene. Serviceberry shrubs on bench are less conspicuous despite increased growth. Associated shrubs include rose, snowberry, bitterbrush, rubber rabbitbrush, and chokecherry. Shrubs are obstructed by an increase in the density of mountain big sagebrush. The Camp Creek elk feedground lies beyond the ridge on left. Winter feeding has largely eliminated elk foraging on the bench. Mule deer utilize the locality in early winter and spring. Closed Douglas-fir stands dominate distant slopes.

Plate 71a *(About 1900)*

Elevation *6,100 ft (1 860 m)*

The camera faces southeast from hill behind spruce stand at right-center of preceding plate. Camp Creek is behind rock outcrop at left, while Bryan Flat is in distance. Shrubs on southwest-facing slope (arrow) were suppressed by wintering elk. The early stage of vegetative succession on far slope is more noticeable than in plate 70a. Aspen stands are young and even-aged. Fire scars suggest an 1871 burn. The influence of fire is also indicated along Hoback River where the vegetation is largely in early succession.

S.N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 71b (August 8, 1970)

70 years later

A striking contrast prevails. Shrubs on southwest facing slope along river are robust. The winter feeding operation on Camp Creek, highway traffic, and development preclude heavy browsing. Spruce, narrowleaf cottonwood, and willow are reaching advanced succession along Hoback River. Conifer sites on distant slopes are now covered by dense Douglas-fir stands. Douglas-fir has also taken over sites formerly occupied by aspen, while mature aspen stands persist along lower slopes.

Plate 72a *(September, 1939)*

Elevation *6,300 ft (1 921 m)*

Camera is positioned at the southwest corner of Camp Creek exclosure No. 2, 1 year following construction. This exclosure was constructed to study vegetative potential and growth following exclusion of elk. 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 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.

Plate 72b (September 26, 1968)

29 years later

Serviceberry and bitterbrush shrubs have robust growth forms after 29 years protection from elk foraging. The serviceberry shrub on far right has grown approximately 7 feet. Bitterbrush at lower left has spread considerably. Other shrubs that have increased in growth and density include snowberry, rose, and sagebrush spp.

Plate 73a *(September 24, 1942)*

Elevation *6,300 ft (1 921 m)*

Looking north from southwest corner of Camp Creek exclosure No. 2, 4 years following construction. Grazed range is on left and protected range on right. Both serviceberry and bitterbrush plants outside exclosure are closely hedged, but are growing slowly inside fence.

Forest Service photograph by R. J. Costley.

Plate 73b *(September 26, 1968)*

26 years later

Changes in the growth form of bitterbrush and serviceberry outside the exclosure do not appear significant. This exclosure lies less than 1 mile from the Camp Creek feedground. Foraging is accentuated by the fence, which tends to inhibit free movement. The protected plants in exclosure demonstrate growth potential of shrubs when not subjected to intense ungulate foraging.

Plate 74a *(About 1900)*

Elevation *6,600 ft (2 012 m)*

Looking due east toward Stinking Springs (below rock ledges) from a point near the confluence of Willow Creek and the Hoback River. Most of the spruce-cottonwood-willow cover on flood plain is in early succession. The vegetation on southwest facing slopes in midground-left is herbaceous species interspersed by bitterbrush, serviceberry, and mountain big sagebrush. These slopes were also a key part of the historic elk winter range. Arrows denote sites burned about 1871.

S.N. Leek photograph, courtesy of Mr. and Mrs. Claude Crisp.

Plate 74b (July 14, 1970)

70 years later

Cottonwood, willow, and other deciduous species have given way to spruce, which now predominates on flood plain. Vegetal trend on the open, southwest exposure across river is not readily apparent, but appears comparable to that in plate 70. Dense Douglas-fir stands now occupy sites denoted by arrows in previous plate. Aspen have reached advanced succession on the ecotone between conifer and mountain big sagebrush.

Plate 75a *(1878)*

Elevation *6,200 ft (1 890 m)*

A southeasterly view up the Hoback River at Stinking Springs. The slope at right is delineated by left arrow in plate 74a. A burn date of 1871 appears reasonable considering the initial stage of herbaceous and shrub growth. Snags and comparable growth stage of vegetation on left bank indicates this fire burned both sides of river.

W. H. Jackson photograph 7510, courtesy of State Historical Society of Colorado.

Plate 75b (June 25, 1968)

90 years later

The vegetative cover on sites of high growth potential has increased markedly. Shrub community indicated by arrow is largely comprised of serviceberry, mountain big sagebrush, chokecherry, currant, snowberry, and russet buffaloberry. The harsh southeast exposure below cliff at left-center shows no appreciable change except increased growth of conifers.

Plate 76a *(1920)*

Elevation *6,200 ft (1 890 m)*

Covering much of the previous scene, the camera is situated some 150 yards southeast. Plant cover on flat in foreground appears to be predominately herbaceous species interspersed by a low density of mountain big sagebrush. Since 1878 (49 years), re-establishment of Douglas-fir has been slow on upper slope at right. Seral aspens occupy the toe of slope.

Forest Service photograph 150329 by E. S. Shipp.

Plate 76b (June 24, 1968)

48 years later

A marked increase in mountain big sagebrush has taken place on flat, while chokecherry has largely replaced the aspen component in foreground, shown also by arrow in plate 75b. Since 1920, the far slope at right has progressed into a closed Douglas-fir stand. Seral aspen formerly occupying the toe slope have been almost entirely replaced.

Plate 77a *(1878)*

Elevation *6,400 ft (1 951 m)*

From old Indian trail about one mile above Stinking Springs, the view is west across the Hoback River Canyon. Limber pine and Douglas-fir are the primary coniferous species on southerly slope at right, while on the far slope, Douglas-fir predominate.

W.H. Jackson photograph 8763, courtesy of State Historical Society of Colorado.

Plate 77b (June 25, 1968)

90 years later

Construction of Highway 187-189 has altered the canyon bottom and portion of slope at right. Some conifers on near slope have been lost to insects, while others have become established in the intervening years. Thinleaf alder is more conspicuous than formerly. Except for tree growth, plant cover on sparsely vegetated site in foreground-right shows little change after 90 years. Note the similarity in appearance of snag at left-foreground.

Plate 78a *(1906)*

Elevation *6,800 ft (2 073 m)*

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.

Plate 78b (June 27, 1968)

62 years later

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.

Plate 79a *(1878)*

Elevation *8,400 ft (2 561 m)*

The camera faces west toward Clause Creek in distance from a position on ridge separating Cliff and Little Cliff Creeks. Sandy Marshall oil drill site lies directly below. Vegetal cover on near slope is an association of tall forbs and mountain big sagebrush. Douglas-fir comprises the primary tree cover. Evidence of past fire can be seen on near peak and on distant slopes.

W.H. Jackson photograph 7515, courtesy of State Historical Society of Colorado.

Plate 79b (July 16, 1968)

90 years later

Douglas-fir on near slope have grown appreciably. Mountain big sagebrush appears to have decreased. Stunted serviceberry and bitterbrush shrubs in vicinity of arrow were of similar growth form in 1878.

Plate 80a *(1878)*

Elevation *8,400 ft (2 561 m)*

Facing nearly due south up Cliff Creek, the camera is on the ridge 1.25 miles northwest of preceding plate. 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.

Plate 80b (July 16, 1968)

90 years later

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.

Plate 81a *(1878)*

Elevation *8,300 ft (2 530 m)*

Looking northwest down the ridge separating Cliff and Little Cliff Creeks from a point about 25 yards west of preceding plate. Note the well-worn trail in foreground. Its relative location and condition suggests it may have been an access route into the Hoback Basin.

W.H. Jackson photograph 7576, courtesy of State Historical Society of Colorado.

Plate 81b (July 16, 1968)

90 years later

Taken from a slightly different camera position, the slope in midground is not comparable to early scene. An increase in the density and growth of Douglas-fir is apparent, while mountain big sagebrush also appears to have increased in density.

Plate 82a *(1878)*

Elevation *8,200 ft (2 500 m)*

A view northeast across Little Cliff Creek from about 30 yards below preceding plate. Vegetal cover on open slope is principally mountain big sagebrush and tall forbs. Aspens occupy skyline at left midground. A past burn can be seen to right of lone subalpine fir. Haziness was result of wildfire somewhere in the Green River country or Jackson Hole. Horses (lower right) belong to Hayden Survey party.

W.H. Jackson photograph 7517, courtesy of State Historical Society of Colorado.

Plate 82b (July 16, 1968)

90 years later

The tall forb-mountain big sagebrush association shows little change after 90 years. Subalpine fir show both losses and regeneration in midground. A new stand of timber occupies old burn, while the upper portion of this timber stand is in advanced succession. Aspen stands have matured.

Plate 83a *(1872)*

Elevation *9,200 ft (2 805 m)*

A southeast view down Miles Canyon and up the South Fork of Teton Canyon. Snags and the early growth stage of vegetation on benches and valley bottoms attest to a relatively recent fire. A low density tall forb community occurs in foreground.

USGS photograph 57-HS-1219 by W. H. Jackson.

Plate 83b (August 5, 1969)

97 years later

Taken later in the season, the foreground plant cover appears more dense. Potential for vegetal growth on near slope is limited by shallow soil and a high occurrence of surface rock. After 97 years the site continues to produce a low density plant cover. Principal herbaceous species include arrowleaf balsamroot, spikefescue, eriogonum spp., tall larkspur, Indian paintbrush, fleabane spp., thickstem groundsel, and phlox spp. Aspen and conifers have matured on benches and valley bottom.

Plate 84a *(1872)*

Elevation *9,200 ft (2 805 m)*

From the same camera point used in the previous scene, the camera has been swung slightly to the left. Evidence of fire is more apparent than in plate 83a. Note how the fire burned some localities and bypassed others. Young aspen stands can be seen occupying various sites.

USGS photograph 57-HS-161 by W. H. Jackson, courtesy of National Archives.

Plate 84b (August 5, 1969)

97 years later

A striking contrast prevails. Conifer sites are heavily forested, while some of the openings of 1872 are dominated by trees (open arrow). Mature aspen stands occupy sites that were formerly quite open (closed arrow).

Plate 85a *(1872)*

Elevation *9,200 ft (2 805 m)*

The view is east toward the Grand Teton from a point adjacent to the previous camera position. Sparse ground cover prevails on near slope, while timber-producing sites in distance show a continuation of the burn pictured in previous two plates.

USGS photograph H. S. 1217 by W. H. Jackson, courtesy National Archives and Record Center.

Plate 85b *(August 5, 1969)*

97 years later

The plant cover on near slope continues to be sparse due to poor growing conditions. Conifers have come in profusely on burned areas.

CONCLUSIONS

The 23 plates covering the southern section span a maximum of 96 years and reveal seven general trends:

1. Increased establishment and growth of conifers.

2. Decline in willows and cottonwoods on sites where competition from conifers is intense and increased growth where conifer competition is less intense.

3. Decline in aspen and deciduous shrubs such as chokecherry, serviceberry, and bitterbrush on sites where they were seral to conifers.

4. Increase in the canopy size of serviceberry, bitterbrush, and chokecherry on open slopes.

5. Overall increase in the size and density of mountain big sagebrush.

6. No appreciable change in plant cover on sparsely vegetated sites.

7. Lack of change in the Hoback River channel where the flow has been confined by topographical features.

The southern section also demonstrates widespread increases in establishment and growth of all conifer species on both winter and summer range. The most pronounced changes have occurred in localities that were in early seral stages following wildfires when originally photographed. Changes have not been confined to any particular habitat. Spruce along the Hoback River are replacing willow and cottonwood, the primary deciduous species (plate 74). However, where conifer competition is lacking or negligible, willow, cottonwood, and other shrubs have grown substantially (plate 71). On adjacent slopes and at higher elevations aspen and various deciduous shrubs have been largely replaced by Douglas-fir, lodgepole pine, subalpine fir, and Englemann spruce (plates 66-67, 71, 75-76, 78-80, 83-84).

Plates 66 and 67 show slow conifer establishment 20 to 30 years after fire. Comparable situations occur on summer range (plates 78, 80). Such slow rates of conifer establishment assure the prevalence of deciduous shrubs and aspen for many years. Note the shrub cover in plate 75 some 7 years following burning and then about 40 years later (plate 76).

Plates 66, 70, and 71 convincingly show that historic elk winter range was heavily used around 1900 and during the 1930's and early 1940's (plate 68, 69, 72, 73) prior to significant supplemental winter feeding of elk. Shrubs were in a hedged condition around 1900 (plate 71) and as late as 1943 (plate 69). Mule deer numbers were extremely low. Canopy size of bitterbrush, chokecherry, and serviceberry has increased with the shift of elk use from traditional areas to feedgrounds. This change appears to be consistent in localities where these shrubs are more numerous. The growth potential of bitterbrush and serviceberry are vividly shown in plates 72 and 73; and that of chokecherry in plates 68 and 69.

The increased growth and density of mountain big sagebrush (plates 64, 68-70, 76, 78) is consistent with trends in the northern and central sections. This increase may have largely occurred during the past 20 to 30 years in some localities (plates 69, 70). Changes in sagebrush density are not apparent in plates 67 and 82, and density has apparently decreased in plate 79.

Plates 64, 75-76 (left of photos), and 77 show no appreciable change in plant cover on sparsely vegetated sites. Change has only occurred on microsites where soils are deeper.

Five scenes show that stream channels have been stable where the flow is restricted by topography (plates 67, 70, 71). Road construction caused changes in plates 75 (1970) and 77. Much of the Hoback Canyon has been affected by road construction. Marked channel changes have occurred on wide valley bottoms where flows are not restricted (plate 74).

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APPENDIX I

Definitions

abiotic - Nonliving, basic elements, and compounds of the environment.

accelerated erosion - Erosion caused by the influence of man.

advanced or late succession - A plant community that has replaced earlier communities and within the writer's judgment, 100 years or more since a major disturbance.

alluvial - Pertaining to material that is transported and deposited by running water.

bedload - Materials larger than sand carried downstream by peak flows.

clearcutting - Harvest of conifers by cutting all trees on a given site.

climax - The highest ecological development of a plant community capable of perpetuation under the prevailing climatic and edaphic conditions.

clones - Individual stands derived by asexual reproduction from a single parent.

deciduous vegetation - Trees and shrubs that shed leaves during dormancy. Most species can regenerate from root crowns or root stalks.

early succession - Refers to a plant community recently established (50 years or less) following a major disturbance - usually a fire, also flood or wind.

edaphic - A condition or characteristic of the soil that influences vegetal growth.

forbs - Herbaceous plants other than grasses, sedges, and rushes.

geologic erosion - Normal or natural erosion caused by geological processes acting over long geologic periods.

half-shrubs - Perennial plants with a woody base whose annually produced stems die back each year.

herbaceous plants - Seed-producing annuals, biennials, or perennials.

hedged condition - Shrubs whose growth form has been suppressed by persistent ungulate browsing.

indigenous - Born, growing, or produced naturally in a region or country; native.

microsite - Climatic condition of a small area resulting from the modification of the general climatic conditions by local differences in elevation, exposure, or vegetal change.

plant community - An aggregation of plants within a specified area.

plant succession - The replacement of one plant community by another over time.

rill erosion - Erosion that forms numerous small channels only several inches deep.

seral - Plant communities that are replaced through successional changes.

sheet erosion - Removal of a uniform layer of soil from the land surface by runoff water.

site potential - The inherent ability of a site to produce vegetation.

wild ungulates - Hoofed big game animals including elk, moose, mule deer, bighorn sheep, and antelope.

APPENDIX II

Plants Collected on Big Game Ridge

Scientific Name	Common Name
GRASSES	
Agropyron caninum (L.) Beauv. ssp. *majus* (Vasey) C.L. Hitchc. var. *latiglume* (Scribn. & Smith) C.L. Hitchc. = A. *trachycaulum* var. *andinum* (Scribn. & Smith) C.L. Hitchc. = *A. subsecundum*	slender wheatgrass bearded wheatgrass
Bromus carinatus Hook. and Arn. var. *carinatus*	mountain brome
Deschampsia caespitosa (L.) Beauv.	tufted hair-grass
Melica bulbosa Geyer	oniongrass
Melica spectabilis Scribn.	showy oniongrass
Phleum alpinum L.	alpine timothy
Poa epilis Scribn. = *P. cusickii* Vasey var. *epilis* (Scribn.) C.L. Hitchc.	skyline bluegrass
Poa reflexa Vasey & Scribn.	nodding bluegrass
Sitanion hystrix (Nutt.) J.G. Smith	bottlebrush squirreltail
Stipa columbiana Macoun. = *S. occidentalis* Thurb. var. *minor* (Vasey) C.L. Hitchc.	subalpine needlegrass
Trisetum spicatum (L.) Richter	spike trisetum
GRASSLIKE PLANTS	
Carex haydeniana Olney	cloud sedge
Carex raynoldsii Dewey	Raynolds sedge
Carex rossii Boott.	Ross sedge
Juncus drummondii E. Meyer	Drummond rush
FORBS	
Achillea millefolium L. lanulosa (Nutt.) Piper	western yarrow
Aconitum columbianum Nutt.	Columbia monkshood
Agoseris glauca (Pursh) Raf.	mountain dandelion
Antennaria rosea Greene = *A. microphylla* Rydb.	rose pussytoes
Antennaria umbrinella Rydb.	
Arabis lyallii Wats.	Lyall rockcress
Arnica cordifolia Hook.	heartleaf arnica
Arnica longifolia D.C. Eaton	longleaf arnica
Aster foliaceus Lindl. *parryi* (Eaton) Gray	
Aster foliaceus Lindl. var. *canbyi* Gray	alpine leafybract aster
Aster integrifolius Nutt.	thickstem aster
Caltha leptosepala DC.	elkslip marshmarigold
Castilleja miniata Dougl.	scarlet painted-cup
Claytonia lanceolata Pursh var. *lanceolata*	lanceleaf spring beauty

Scientific Name	Common Name
Delphinium nuttallianum Pritz.	Nuttal larkspur
Delphinium occidentale Wats.	duncecap larkspur
Descurainia richardsonii (Sweet) O.E. Schultz	Richardson tansymustard
Draba stenoloba Ledeb. var. *nana* (O.E. Schultz) C.L. Hitchc.	draba
Epilobium glandulosum Lehm.	glandular willow-weed
Erigeron callianthemus Greene = *E. peregrinus* (Pursh) Greene ssp. *callianthemus* (Greene) Cronq.	
Erigeron eatoni Gray var. *eatoni*	Eaton fleabane
Erigeron ursinus D.C. Eat.	Bear River fleabane
Eriogonum umbellatum Torr. var. *intectum* Nels. *(neglectum)* Greene	sulfur eriogonum
Erythronium grandiflorum Pursh var. *grandiflorum*	lambstongue fawnlily
Geranium viscosissimum F. & M.	sticky geranium
Hackelia floribunda (Lehm.) Johnst.	showy stickseed
Helianthella quinquenervis (Hook) A. Gray	fivenerve helianthella
Hydrophyllum capitatum Dougl. var *capitatum*	ballhead waterleaf
Ligusticum filicinum S. Wats.	fernleaf ligusticum
Lomatium montanum = *L. cous* (Wats.) Coulti & Rose	biscuitroot
Lupinus argenteus Pursh var. *parviflorus* (Nutt.) S.L. Hitchc.	silvery lupine
Lupinus wyethii S. Wats.	Wyethia lupine
Mertensia ciliata (Torr.) G. Don	mountain bluebells
Mertensia paniculata (Ait.) G. Don	
Microseris nigrescens Henderson	microseris
Mimulus lewisii Pursh	Lewis monkeyflower
Myosotis sylvatica Hoffm. var. *alpestris* (F.S. Schmidt.) Koch	forgetmenot
Pedicularis groenlandica Retzi.	elephanthead
Penstemon whippleanus A. Gray	Whipple penstemon
Plantago tweedyi A. Gray	tweedy plantain
Polemonium pulcherrimum Hook. var. *pulcherrimum*	polemonium
Polygonum bistortoides Pursh	American bistort
Potentilla diversifolia Lahm. var. *diversifolia*	varileaf cinquefoil
Ranunculus escholtzii Schlacht var. *alpina* (Wats.) C.L. Hitchc.	Eschscholtz buttercup
Rumex pauciflorus Nutt.	mountain sorrel
Saxifraga argusta D. Don	
Senecio crassulus Gray	thickleaf groundsel
Senecio triangularis Hook.	arrowleaf groundsel
Sibbaldia procumbens L.	
Taraxacum officinale Weber	common dandelion
Viola nuttallii Pursh	Nuttal violet
SHRUBS	
Ribes montigenum McClatchie	gooseberry currant

APPENDIX III

Representative Plants on Gros Ventre and Hoback Winter Ranges

Scientific Name	Common Name
GRASSES	
Agropyron spp.	wheatgrass
Agropyron dasystachyum (Hook.) Scribn.	thickspike wheatgrass
Agropyron smithii Rydb.	bluestem wheatgrass
Agropyron spicatum (Pursh) Scribn. & Smith	bearded bluebunch wheatgrass
Agropyron caninum (L.) Beauv. spp. *majus* (Vasey) C.L. Hitchc. var. *latiglume* (Scribn. & Smith) C.L. Hitchc. = *A. trachycaulum*	slender wheatgrass
Bromus anomalus Rupr.	nodding brome
Bromus carinatus Hook. & Arn. var. *carinatus*	mountain brome
Bromus inermis Leysser	smooth brome
Bromus tectorum L.	cheatgrass brome
Calamagrostis rubescens Buckl.	pinegrass
Danthonia unispicata (Thurb.) Munro ex Macoun	onespike danthonia
Deschampsia caespitosa (L.) Beauv.	tuffed hair-grass
Elymus cinereus Scribn. & Merr.	Great Basin wildrye
Elymus glaucus Buckl.	blue wildrye
Festuca spp. L.	fescue
Festuca idahoensis Elmer	Idaho fescue
Hesperochloa kingii (Wats.) Rydb.	spikefescue
Hordeum brachyantherum Nevski	meadow barley
Koeleria cristata Pers.	prairie junegrass
Melica spectabilis Scribn.	showy oniongrass
Muhlenbergia richardsonis (Trin.) Rydb.	mat muhly
Oryzopsis hymenoides (R. & S.) Ricker	Indian ricegrass
Phleum pratense L.	timothy
Poa ampla Merr. = *P. juncifolia* Scribn.	big bluegrass
Poa canbyi (Scribn.) Piper = *P. scabrella* (Thurb.) Benth.	Canby bluegrass
Poa fendleriana (Steud.) Vasey	mutton bluegrass
Poa pratensis L.	Kentucky bluegrass
Poa sandbergii Vasey	Sandberg bluegrass
Sitanion hystrix (Nutt.) J.G. Smith	bottlebrush squirreltail
Stipa columbiana Macoun. = *S. occidentalis* Thurb. var. *minor* (Vasey) C.L. Hitchc.	subalpine needlegrass
Stipa comata Trin. & Rupr.	needle and thread
Stipa lettermanii Vasey	Letterman needlegrass
GRASSLIKE PLANTS	
Carex douglasii Boott.	Douglas sedge
Carex festivella Mack. = *C. micranthara* Mack.	ovalhead sedge
Carex geyeri Boott.	elk sedge
Carex hoodii Boott.	hood sedge
Carex petasata Dewey	liddon sedge
Carex rossii Boott.	Ross sedge
Carex rostrata Stokes	beaked sedge
Juncus balticus Willd.	Baltic sedge

Scientific Name	Common Name
FORBS	
Achillea millefolium L. spp. *lanulosa* (Nutt.) Piper	western yarrow
Agoseris spp. Raf.	agoseris
Anemone spp. L.	anemone
Antennaria dimorpha (Nutt.) T. & G.	low pussytoes
Antennaria microphylla Rydb.	rose pussytoes
Apocynum androsaemifolium L.	spreading dogbane
Aquilegia spp. L.	columbine
Arabis glabra (L.) Bernh.	rockcress
Arabis holboelli Hornem.	Holboell rockcress
Arnica spp. L.	arnica
Arnica fulgens Pursh	orange arnica
Artemisia dracunculus L.	tarragan
Artemisia ludoviciana Nutt.	Louisiana sagebrush
Aster canescens (See *Machaeranthera)* (Pursh) Gray	aster
Aster chilensis Nees.	Pacific aster
Aster perelegans Nels. & Macbr.	Nuttal aster
Astragalus alpinus L.	alpine milkvetch
Astragalus bisulcatus (Hook.) Gray	twogrooved locoweed
Astragalus kentrophyta Gray	
Astragalus purshii Dougl.	pursh locoweed
Astragalus vexilliflexus Sheld.	
Balsomorhiza sagittata (Pursh) Nutt.	arrowleaf balsam
Calochortus spp. Pursh	mariposa
Calochortus bruneaunis Nels. & Macbr.	
Calochortus eurycarpus Wats.	
Campanula rotundifolia L.	bluebell
Castilleja gracillima Rydb.	
Castilleja linariaefolia Benth.	Wyoming painted-cup
Castilleja rustica Piper	
Chaenactis douglasii (Hook.) H. & A.	Douglas chaenactis
Chenopodium album L.	lambsquarters goosefoot
Cirsium spp. Mill.	thistle
Cirsium foliosum = *C. scariosum* Nutt.	elk thistle
Cirsium vulgare (Savi) Tenore	bull thistle
Collomia linearis Nutt.	slenderleaf collomia
Camandra pallida A. DC. = *C. umbellata* (L.) Nutt. var. *pallida* (DC.) Jones	bastard toadflax
Cordylanthus ramosus Nutt.	bush birdbeak
Corydalis aurea Willd.	golden corydalis
Crepis acuminata Nutt.	tapertip hawksbeard
Cryptantha spp. Lehm.	cryptantha
Cymopterus spp. Raf.	
Descurainia spp. Webb and Berth.	tansymustard
Epilobium spp. L.	willowweed
Epilobium angustifolium L.	fireweed
Equisetum spp. L.	horsetail
Erigeron compositus Pursh	fernleaf fleabane
Erigeron pumilus Nutt.	low fleabane
Eriogonum chrysocephalum Gray	goldball eriogonum
Eriogonum umbellatum Torr.	sulfur eriogonum

Scientific Name	Common Name
Eriophyllum lanatum (Pursh) Forbes	woolly eriophyllum
Fragaria virginiana Duchense	Virginia strawberry
Frasera speciosa Dougl.	showy frasera
Gayophytum spp. Juss	groundsmoke
Galium boreale L.	northern bedstraw
Geranium viscosissimum F. & M.	sticky geranium
Geum triflorum Pursh	
Gilia aggregata (Pursh) Spreng.	skyrocket gilia
Haplopappus acaulis (Nutt.) Gray	stemless goldenweed
Hedysarum sulphurescens Rydb.	sulfur sweetvetch
Helenium hoopesii Gray	orange sneezeweed
Helianthella uniflora (Nutt.) T. & G.	oneflower helianthella
Heracleum lanatum Michx.	common cowparsnip
Hieracium spp. L.	hawkweed
Hydrophyllum capitatum Dougl.	ballhead waterleaf
Lactuca serriola L.	prickly lettuce
Lappula spp. Gilib.	stickseed
Linum perenne L.	Lewis flax
Lithospermum ruderale Dougl.	wayside gromwell
Lomatium dissectum (Nutt.) Math. & Const.	carrotleaf leptotaenia
Lupinus spp. L.	lupine
Lupinus sericeus Pursh	silky lupine
Melilotus officinalis (L.) Lam.	yellow sweetclover
Mertensia oblongifolia (Nutt.) G. Don	oblongleaf bluebells
Mimulus spp.	monkeyflower
Monolepis nuttalliana (Schultes) Greene	Nuttall monolepis
Orthocarpus luteus Nutt.	yellow owlclover
Osmorhiza occidentalis (Nutt.) Torr.	sweetanise
Penstemon attenuatus Dougl.	sulphur penstemon
Penstemon procerus Dougl.	littleflower penstemon
Penstemon radicosus A. Nels.	matroot penstemon
Perideridia gairdneri (H. & A.) Math.	yampa
Phacelia spp. Juss	phacelia
Phlox hoodii Rich.	Hoods phlox
Physaria australis (Pays.) Roll.	common twinpod
Polygonum douglasii Greene	Douglas knotweed
Potentilla spp. L.	cinquefoil
Potentilla glandulosa Lindl.	
Potentilla gracilis Dougl.	
Ranunculus spp. L.	butterfoot; crowfoot
Rumex crispus	curly dock
Saxifraga spp. L.	saxifrage
Sidalcea spp. Gray	checkermallow
Sedum stenopetalum Pursh	wormleaf stonecrop
Senecio spp. L.	groundsel; ragwort; butterweed
Senecio canus Hook.	woolly groundsel
Senecio serra Hook.	butterweed groundsel
Smilacina stellata (L.) Desf.	starry solomon-plume
Solidago multiradiata Ait.	low goldenrod
Taraxacum officinale Weber	common dandelion
Tragopogon dubius Scop.	
Trifolium spp. L.	clover
Trillium spp. L.	trillium
Valeriana edulis Nutt.	edible valerian
Valeriana occidentalis Heller	western valerian

Scientific Name	Common Name
Viguiera multiflora (Nutt.) Blake.	showy goldeneye
Viola spp. L.	violet
Viola nuttallii Pursh	Nuttall violet
Zigadenus paniculatus (Nutt.) Wats.	foothill deathcamas
TREES AND SHRUBS	
Abies lasiocarpa (Hook.) Nutt.	subalpine fir
Acer glabrum Torr.	rocky mountain maple
Alnus tenuifolia Nutt.	thinleaf alder
Amelanchier alnifolia Nutt.	Saskatoon serviceberry
Arctostaphylos uva-ursi (L.) Spreng.	bearberry
Artemisia cana Nutt.	silver sagebrush
Artemisia frigida Willd.	fringed sagebrush
Artemisia longiloba (Osterhout) Beetle	longleaf sagebrush
Artemisia tridentata Nutt. subsp. *tridentata*	big sagebrush
Artemisia tridentata Nutt. *vaseyana* (Rydb.) Beetle	mountain big sagebrush
Artemisia tripartita Rydb.	threetip sagebrush
Atriplex spp. L.	saltbush
Berberis repens Lindl.	creeping barberry
Betula glandulosa Michx.	bog birch
Ceanothus velutinus Dougl.	snowbrush ceanothus
Chrysothamnus nauseousus (Pall.) Britt. var. *nauseousus*	rubber rabbitbrush
Chrysothamnus viscidiflorus (Hook.) Nutt.	Douglas rabbitbrush
Clematis columbiana (Nutt.) T. & G.	Columbian clematis
Cornus stolonifera Michx. *stolonifera*	redosier dogwood
Crataegus spp.	hawthorne
Eurotia lanata (Pursh) Moq.	common winterfat
Gutierrezia sarothrae (Pursh) Britt. & Rusby.	broom snakeweed
Juniperus communis L. var. montana Ait.	mountain common juniper
Juniperus scopulorum Sarg.	Rocky Mountain juniper
Lonicera involucrata (Rich) Banks	bearberry honeysuckle
Lonicera utahensis Wats.	Utah honeysuckle
Menziesia ferruginea Smith	false huckleberry
Pachistima myrsinites (Pursh) Raf.	mountain lover
Picea engelmanni Parry	Engelmann spruce
Picea pungens Engelm.	Colorado blue spruce
Pinus albicaulis Engelm.	whitebark pine
Pinus contorta Dougl.	lodgepole pine
Pinus flexilis James	limber pine
Populus angustifolia James	narrowleaf cottonwood
Populus tremuloides Michx.	quaking aspen
Populus trichocarpa T. & G.	black cottonwood
Pontentilla fruticosa L.	bush cinquefoil
Prunus virginiana L. var. *demissa* (Nutt.)	western common chokecherry
Pseudotsuga menziesii (Mirbel) Franco *menziesii* Torr. var. *glauca* (Beissn) Franco	Douglas-fir
Purshia tridentata (Pursh) DC.	antelope bitterbrush
Ribes spp. L.	currant; gooseberry
Ribes cereum Dougl. var. *cereum*	wax currant
Rosa woodsii	woods rose
Salix spp. L.	willow

Scientific Name	Common Name
Salix bebbiana Sargent	Bebb willow
Salix brachycarpa Nuttall	barrenground willow
Salix drummondiana Barratt	Drummond willow
Salix exigua Nutt. spp. *interior*	sandbar; interior willow
Salix geyeriana Anderss. (Rowlee) Cronq.	geyer willow
Salix pseudocordata (Anderson) Rydberg	blueberry willow
Salix phylicifolia L. var. *planifolia* Pursh	planeleaf willow
Salix lutea Nuttall	yellow willow
Salix scouleriana Barratt	Scouler's willow
Salix wolfii Bebb	wolf's willow
Sambucus cerulea (glauca) Raf.	blueberry elderberry
Sarcobatus vermiculatus (Hook.) Torr.	black greasewood
Shepherdia argentea (Pursh) Nutt.	silver buffaloberry
Shepherdia canadensis (L.) Nutt.	russet buffaloberry
Sorbus spp. L.	mountain ash
Spiraea densiflora Nutt.	meadowsweet
Spiraea betulifolia Pall.	shinyleaf spirea
Symphoricarpos oreophilus Gray	mountain common snowberry
Tetradymia canescens DC.	gray horsebrush
Vaccinium membranaceum Dougl.	big whortleberry
Vaccinium scoparium Leiberg	grouse whortleberry

Gruell, George E.
1980. Fire's influence on wildlife habitat on the Bridger-Teton National Forest, Wyoming. Volume 1--Photographic record and analysis. USDA For. Serv. Res. Pap. INT-235, 207 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.

Volume 1 (of two volumes) provides 85 pairs of photos documenting changes in vegetation and wildlife habitat on the Bridger-Teton National Forest, 1872-1975. Conifers and mountain big sagebrush have increased. Willow, aspen, and deciduous shrubs have been replaced where seral to or in competition with conifers. Fire has been the most important influence on plant succession. Volume II explains why vegetational changes took place.

KEYWORDS: wildfire, wildlife habitat, plant succession, range condition, historic photographs, photographic record.

☆ U.S. GOVERNMENT PRINTING OFFICE:1979—677-019 / 65

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