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MONTANA FISH AND GAME DEPARTMENT

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GAME MANAGEMENT IN MONTANA

Edited by
Thomas W. Mussehl
and
F. W. Howell

MONTANA FISH AND GAME DEPARTMENT
Game Management Division
Helena, Montana

Federal Aid Project W-3-C

1971

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First Printing

Foreword

Montana's future is linked to its colorful past by an almost indestructible bond of wildlife heritage. Early exploration of the State was prompted by the potential harvest of wildlife. The settlement of the State was enhanced because of the wildlife populations. Wildlife was, and is dependent on the habitat, and it was this habitat, the mountains, the prairies, the clear streams and the clear big sky, that made Montana so attractive to settlement.

In man's desire and effort to develop what he assumed to be an unlimited quantity of natural resources he began to alter that habitat. This attention has not been insignificant. There are few areas left that do not carry the scars of man's activity. Progress is desirable, but in this, the 20th century, it can and should be made compatible with maintaining a quality environment for man and wildlife.

This book depicts a history of wildlife management and is a tribute to those men and women who firmly believe in and work untiringly for a liveable environment for wildlife because it is a quality environment for man.

A handwritten signature in dark ink, reading "Frank H. Dunkle". The signature is fluid and cursive, with a large, stylized initial "F" and "D".

FRANK H. DUNKLE, DIRECTOR
MONTANA FISH AND GAME DEPARTMENT

Preface

This publication serves as a tribute to the Federal Aid in Wildlife Restoration (Pittman-Robertson) program which began in 1941 and has since provided the major funding for scientific game management in Montana. The game management program is financed by the Federal Excise Tax on the manufacture of guns and ammunition (P-R) matched with 25 percent hunting license monies. Thus, game management is supported directly by hunters using Montana's wildlife and not by the State's general tax fund.

The year 1966 marked the end of the 25th year of game management in Montana under the Pittman-Robertson program. At that time a Division bulletin was initiated to report the development and progress of a quarter-century of game management in Montana. Due to delays in completing the various assignments necessary to provide a comprehensive report, the completion date was extended several times. Some time lags exist between the completion of various segments of the book, causing minor discrepancies in the reporting. For instance, though the chronology includes 1970, at the time of writing game harvest data were available only through 1969. This publication now represents a summary of 30 years of game management and a brief history of 100 years of Montana wildlife.

Wildlife has been an important part of the heritage of Montanans. Hunting and year-around enjoyment of wildlife is an integral part of our standard of living. Intensifying land use and accelerating demands for recreation challenge the future quality and quantity of wildlife in Montana which are tied inseparably with land and people. Being a product of the land, the destiny of wildlife resources depends upon what is further done with, on, for, or to the land. What is or is not done to the land depends upon the attitudes, needs, knowledge, and hopefully, the conscience of the people owning or using the land.

Public land recommendations now before the President and Congress may jeopardize the future of wildlife in Montana and other western states. The Public Land Law Review Commission report (*One-third of the Nation's Land*) of 1970 includes recommendations: that public land management be based on "dominant" rather than multiple uses; that some public land privileges be turned into private rights; and that certain wildlife management authority be transferred from the states to Federal agencies.

Obtaining maximum harvests of game on a sustained basis in the face of future demands will be a challenging task and will require the understanding and support of all Montanans. The support of organized sportsmen for higher standards of land and wildlife management, and the growing civic interest for environmental problems attests to the public's concern for wildlife.

The future role of game management will remain essentially the same as that defined by Aldo Leopold in 1932, "Game Management is the art of making land produce sustained annual crops of wild game for recreational use."

We are hereby reminded of the quotation from the Game Management Section of the 1941-42 Biennial Report of the Montana Fish and Game Commission:

"Something to Think About"

"To permit an increase of any wild bird or animal over and above the available food supply is to destroy that bird or animal just as surely as by overshooting."

March 1, 1971

Wynn G. Freeman, Chief
Game Management Division

Acknowledgements

This publication is the result of group effort by the Game Management Division with assistance from numerous other Department personnel. Division biologists who wrote the individual game species chapters were chosen in accordance with their work experience and special knowledge. The Division staff completed the writing of other segments of the book. R. J. Mackie did the original planning, coordinated initial efforts and assisted in the final writing. T. W. Mussehl served as major editor, and coordinated the various work assignments until completion. M. J. Rogrud assisted in the planning and contributed major efforts to the historical research and overall writing efforts. J. L. Egan was responsible for the game species distribution maps. W. G. Freeman provided necessary encouragement and support during the several years of preparation.

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1

FACTS ABOUT MONTANA

Montana is a state of great expanses and relatively few people. The 1970 census reported 694,409 people in Montana, about a 3 percent increase in 10 years. In numbers of people, Montana is exceeded by 40 states. Presently, the average density of people in Montana is slightly more than 4 persons per square mile compared with an average of almost 51 persons per square mile in the United States. Montana is the fourth largest of the 50 states -- its total area being 147,138 square miles. The extreme length of the state is about 550 miles east and west and the extreme breadth is almost 325 miles north and south. The total area of the largest county, Beaverhead, is 5,580 square miles which is larger than the state of Connecticut.

A large portion of Montana is under public ownership. About 30 percent is owned, held in trust, or leased by the Federal government (Table 1). The U. S. Forest Service and Bureau of Land Management together administer nearly 25 million acres (27 percent) in various categories. State land is over 5 million acres (6 percent). Thus, a large share of the wildlife habitat in Montana is open for public hunting.

The Rocky Mountains occupy the Western third of the State (Figure 1). These mountains lie in a generally northwesterly direction in a series of high, parallel mountain ranges. Within this rugged, generally forested region are found 25 or more mountain ranges between which are located many basins and valleys the larger of which are 10 to 20 miles wide and 25 miles long. The highest elevation is 12,850 feet at Granite Peak in Park County near the southcentral boundary with Wyoming. Stretching across the eastern and central two-thirds of the State are the Great Plains. Commencing as broad Piedmont slopes more than 3,500 feet above sea level, the plains slope gently from the foothills of the Rockies towards the northeastern portion of the State where elevations as low as 1,900 feet occur along the course of the Missouri River. The levelness of the plains is further modified by the streams that have entrenched themselves in a dendritic pattern of broad, fertile valleys paralleled by back-stepped benches and bluffs.

GAME MANAGEMENT IN MONTANA

PHYSIOGRAPHIC MAP

FACTS ABOUT MONTANA

Table 1. Ownership of land in Montana, 1970.¹

Classification	Number Acres	
Federal Land		27,654,289
Forest Service	16,669,099	
Bureau of Land Management	8,217,414	
Bureau of Indian Affairs	125,473	
National Parks	1,154,766	
Bureau Sport Fisheries and Wildlife	497,370	
Other Federal	990,167	
State Land		5,231,724
Fish and Game Department	100,724	
Lands and Investment Department	5,131,000	
Private Land (includes Tribal)		<u>60,385,027</u>
STATE TOTAL		<u>93,271,040</u>

¹ From: "One Third of the Nation's Land — A Report to the President and to the Congress by the Public Land Law Review Commission." Washington, D. C., June, 1970.

Montana's large area and great differences in elevation result in a highly diverse climate. While the lowest temperature recorded in the United State (minus 70 degrees F.) occurred in Montana, temperatures in excess of 100 degrees F. have been many times recorded at Montana stations. These extremes are unusual however. The climates of Montana's larger cities during the winter months are on the average warmer than or comparable to those of several major mid-western cities. West of the Divide the climate is of a semi-marine or north-Pacific coast type while to the east a continental climate prevails. The mountains give the western region some protection from the cold waves which sweep out of interior Canada on the average of 6 to 12 times each winter and which are usually confined to the northcentral and eastern parts of the State. Sometimes the position of the mountains gives warming benefits to portions of the eastern region with chinook winds. These result from the heating of eastbound air as it descends from the higher elevations. The Indians called this wind "snow eater" because of its warming effect. During the winter months, Montana experiences the widest range of wind chill of any state in the nation. Average annual precipitation for the State is about 15 inches with the western region having about 18 inches and the eastern region about 13 inches. Usually the maximum occurs during the early summer months and the minimum during the winter months.

Table 2. Economic ranking of various industries in Montana for 1969.¹

1. Agriculture	\$647.3 million
2. Mining and Petroleum	\$285.6 million
3. Manufacturing	\$207.5 million
4. Outdoor Recreation (not including transportation)	\$145.5 million
5. Forest Products	\$104.5 million

¹ From Montana Department of Planning and Economic Development.

The high plains of central Montana are interrupted by scattered mountains and the rugged Missouri River "breaks" country shown here. Most of the timber in eastern Montana occurs as a series of islands or patches. — (F & G photo by Gene Allen)

The two principal agricultural commodities in Montana are wheat and beef cattle. A large portion of the State is under public ownership and about 30 percent is administered by the Federal government. — (Photo by Montana Chamber of Commerce)

FACTS ABOUT MONTANA

Agriculture ranks first as Montana's most important economic activity (Table 2). The two principle commodities are wheat and beef cattle. The mining-petroleum industry and manufacturing rank second and third ahead of outdoor recreation. The estimate of \$145.5 million dollars for outdoor recreation includes hunting and fishing licenses, sporting equipment, lodging and meals but not travel costs. Thus the outdoor enthusiasts, including hunters and fishermen, are big business in this State with all indications pointing toward an accelerating increase.

One-fourth of Montana's area is forested land. Thirteen million acres of forest lie west of the Continental Divide and 9 million acres lie east of the Divide. Where there are mountains, there are forests. East of the Divide the dryer climate pushes the lower margin of the forest high on the mountain slopes. Most of the timber in eastern Montana occurs as a series of islands or patches. The unforested area is predominantly grassland or grassland-shrub mixtures. The 11,000-foot difference between the highest and lowest points in Montana results in considerable variation in natural vegetation.

Facts obtained from Montana Almanac, 1959-60.

2

EARLY HISTORY

When the Lewis and Clark Expedition (1805-06) explored the area now recognized as Montana they found a variety of productive environments, abounding with wildlife, extending from the eastern prairie grasslands to the rugged western mountains. The Journals of Lewis and Clark provide the first written records of native wildlife abundance and distribution in Montana. They vividly describe vast herds of buffalo, elk and antelope along river valleys and prairies of what is now eastern and central Montana. Deer, bighorn sheep, waterfowl, prairie and mountain grouse were widely distributed and abundant. Grizzly bear were observed as far east as the present North Dakota border and moose as far east as the mouth of the Milk River. In contrast, wildlife was reported to be less abundant in the western mountain ranges and intermountain valleys near the headwaters of the Missouri and Columbia River systems.

FUR, GOLD AND BUFFALO ERA

A golden era of continental fur trade followed rapidly on the heels of the Lewis and Clark Expedition and lasted into the 1850's. During this era, Montana streams in the plains and mountains were explored by fur trappers in search of beaver pelts. Although venturesome trappers found their way to the headwaters of even the most remote streams, they had little effect on the vast game herds. Like the Indian tribes with whom they traded, and at times fought, they killed only enough game to satisfy their needs for food, clothing and shelter. While the fur trade era was brief, it represented a vital epoch in the course of westward national expansion, when trappers and explorers functioned as the first businessmen and agents for expansion. This expansion would eventually result in alteration of most of the native wildlife habitat and exploitation of many of the native species. The brisk fur trade that had been maintained for nearly half a century dwindled by about 1850 and attention turned from fur trapping to a booming trade in elk, deer and buffalo hides.

GAME MANAGEMENT IN MONTANA

The fate of buffalo was not determined simply by man and guns. Removal of buffalo eliminated the main food supply of Indians and made room for the plow. — (Photo by Gerry Atwell)

Midway through the 1800's several important advances and changes occurred to accelerate expansion and exploitation. The arrival of river steamers on the upper Missouri and Yellowstone in the early 1860's created a convenient transportation link with down river ports. Discovery of gold in Montana triggered a rush of prospectors and resulted in lusty gold camps. An urgent demand for meat in the vicinity of these settlements brought about heavy hunting that had at least a local impact on game numbers. The arrival of the first trail herds of cattle in the early 1860's marked the beginning of the domestic livestock industry. Livestock was confined largely to western Montana until the overthrow of powerful plains Indian tribes after the Battle of the Little Big Horn in 1876. By the mid-1880's grazing was wide-spread in Montana with large livestock companies running herds on range forage throughout the year. Although the impact of this early grazing has never been fully evaluated, the profound changes in the vegetation of rangelands undoubtedly altered the quality of these areas as wildlife habitat and contributed to a decline in big game populations over much of the State.

Buffalo hunting picked up momentum in the 1860's and was over by 1883. The headlong slaughter of the vast buffalo herds is vividly recorded as one of the most wasteful exploitations of a natural resource in history. Usually only the hides and tongues were saved and the meat rotted where the animals fell. A brief antilimatic traffic in bones followed as a fitting reminder of the exploitation.

While the fate of the buffalo is popularly attributed to man and his guns, several strong political opinions prevailed against attempts to conserve the buffalo during the 1860's and 1870's. The Department of the Interior proposed that the best way to control and civilize the Indians was to eliminate their main food supply — the buffalo. Settlers wanted the soil-grass—buffalo-Indian relationship destroyed to make room for farming and domestic livestock. Many people were led to believe that the productive grasslands, that evolved during centuries of the buffalo-Indian economy, were being trampled and destroyed by the buffalo. In the face of strong

EARLY HISTORY

opposition, several attempts were made in Congress to recognize the buffalo as a national asset and proposed utilization by saner methods. One act passed both houses of Congress and was sent to President Grant in 1874 where it remained unsigned, thereby allowing the slaughter to continue.

LAWS AND PROTECTION

Prior to the turn of the century, public reaction to uncontrolled hunting developed in the Montana Territory. The once seemingly limitless buffalo herds were gone. Deer, elk and antelope survived only in remote areas or in remnant groups. The Audubon mountain sheep of the river breaks and badlands were near extinction. A feeling for wildlife conservation that began during the buffalo slaughter was now strong enough to provoke legislative action in Montana Territory.

The buffalo slaughter and a real or imagined fluctuation in other game numbers, inspired the Territorial Legislature to give serious consideration to enacting some type of conservation program in the late 1860's. The first conservation law, passed in 1869, closed the hunting season on introduced game birds. Initial grouse hunting seasons were set in 1870. In 1872 the hunting season on buffalo, moose, elk, deer, bighorn sheep, mountain goats, antelope and hares was closed February 1 to August 15 each year. Market hunting for game birds was prohibited in 1877. Bounty payments for predator control were authorized in 1879. In 1895 the first bag limits appeared and in 1897 the sale of all game animals and birds was prohibited. While these first laws merely attempted to regulate hunting of game by proclamation, the measures enacted represented a sincere desire to protect and build up game populations. For the most part, the new laws were ignored by the settlers and not enforced by the Territory. However, when Montana

The arrival of river steamers on the upper Missouri in the early 1860's accelerated expansion and exploitation of the Montana Territory. — (Historical)

GAME MANAGEMENT IN MONTANA

became a state in 1889, the laws became more stringent and other management tools were added to the conservation program.

The first State laws of 1889 continued the protection of bison, quail, moose, elk and beaver. The open season on deer, mountain goat, mountain sheep and antelope was set September 15-December 31.

In 1895, the Legislature established a Board of Game Commissioners and specified bag limits of 3 bull elk, 100 grouse or prairie chicken, 8 deer, 8 sheep, 8 goat and 8 antelope. A trapping season from October 1-April 1 was established. A September 1-December 1 open season on waterfowl was declared but no bag limits were mentioned.

The philosophy of the early Montana conservation program was influenced by programs in other states and Europe. The formula was sincere and direct. To allow recovery of game populations, laws were passed to restrict hunting and men were hired to enforce the laws. The first State Game Warden was appointed in 1901 by the Governor of Montana and a Fish and Game Department was first organized. The State Game Warden was at first assisted by eight Deputy Game Wardens located throughout the State. These Wardens were the first and at that time the only field employees of the Department. Game laws became increasingly restrictive

Discovery of gold triggered a rush of prospectors and an urgent demand for meat. In 1872, the first laws affecting big game closed hunting from Feb. 1 to Aug. 15. — (Historical)

EARLY HISTORY

during the early 1900's. In 1907 the open season on deer was October 1-December 1 with a 3-deer bag limit. The limit on elk, sheep and goat was set at one of each species. The upland bird season was October 1-November 1 with a bag limit of 5 per day of any species. A bag limit on waterfowl was 20 ducks per day. In 1913 the Montana Fish and Game Commission was reorganized. Bag limits included 2 deer, 5 upland birds and 20 ducks in 1915.

The codes of 1921 gave the Commission power to open and close seasons when residents showed that such action would be in the interest of fish, game and people. Antelope and caribou were placed among protected big game animals. Several counties were closed to elk hunting and a buck deer season was proclaimed for much of the State open to deer hunting. The sheep and goat seasons were closed. Upland bird hunting was specified for October 1-15 with a 5-bird bag and possession limit. The waterfowl season was set as September 16-December 31 with a limit of 20 ducks and 8 geese. The bear was classed as a predatory animal.

Between 1935-40, the black-footed ferret was classed a predator, the raccoon a fur bearer and the bear was reclassified as a game animal. Elk and deer seasons were held October 15-November 15 in specified areas. Buck deer seasons were prevalent but either-sex deer could be hunted in Mineral, Glacier, Lake, Sanders, Missoula, Granite and Ravalli Counties. The season on sheep and goats was closed unless opened by the Commission. The upland bird season was only from September 16 to September 25 with 5 birds in the aggregate of all species in bag and possession per day. The waterfowl season was September 15-December 31 with 25 ducks and 8 geese bag limits. The fur season was limited to December 1-April 15. Moose, bison, caribou and antelope were protected by closed seasons.

EARLY CONSERVATION PROGRAMS

The main programs initiated by early conservationists in addition to protective laws and regulations, included trapping and transplanting of wild game, installation of game preserves, planting farm-reared animals and birds, game herding and haystack fencing. In 1910 the first elk were transplanted to Montana from Yellowstone National Park, marking the beginning of a brisk game transplanting program. The first game preserve was created in 1911 and signaled the start of an era of effort to set aside certain areas for all forms of wildlife. The number of game preserves increased to a maximum of 46 by 1935, and decreased thereafter. The first game farm was established in 1929 by the Fish and Game Department. Prior to that time, many game species were planted by private individuals and conservation clubs, with and without the permission of the Fish and Game Commission. Game herding and haystack fencing became popular for controlling big game damage to private property in the 1930's.

The first half of the 20th Century was relatively peaceful for the conservation program. The program consisted of a restricted harvest of game, abundant game preserves and liberal bounty payments. During this period the Fish and Game Commission regularly requested game management recommendations from local communities. Most recommendations were determined by appraisal of local game

GAME MANAGEMENT IN MONTANA

conditions in light of early concepts of conservation. Some were based on a combination of hocus-pocus and politics. When the local game warden didn't fit into the local concept of game management, it was easy to find one that would. The program also carried with it the seeds of ultimate failure because of two incorrect assumptions: 1) the only important drain on any wildlife population was due to guns and predators; and 2) if wildlife numbers were low or absent, all that was needed was to plant farm-reared wildlife, control predators and close hunting seasons. Little was known about ecology and little or no thought was given to habitat and biological needs of wildlife. It was only when wildlife administrators and other conservationists began to look further and more scientifically at these needs that it was realized that wildlife populations were basically controlled by certain biological principles and that abundance of wildlife was determined and limited by the quality of the habitat in which it lives.

Signs of failure in initial conservation programs came early, but were largely ignored. The consequences of big game animals being in surplus to the amount of range forage available had not even been imagined by most people.

Big game malnutrition, starvation, range abuse and loss of historical winter ranges to settlement had been recognized as problems in the northern Yellowstone elk herd as early as 1892. Summer range for this herd had always been adequate, both before and after establishment of Yellowstone National Park in 1872. In earlier times the elk escaped deep winter snow and marginal winter range by moving far to the north along the Yellowstone River into what is now Montana. They wintered in the broad open valley and nearby foothills. When this area was taken over for agriculture and domestic livestock production, the elk were no longer welcome on their historic winter range. In turn, the elk were intolerant of the new civilization and wintered on marginal, often snow-covered, winter range near the Park boundary. All hunting was prohibited in the Park in 1883 and controlled outside the Park by the states. By 1914 the herd had multiplied to the point where the remaining marginal winter range was overstocked with about 35,000 elk spending the winter around the Park boundary. While malnutrition and some starvation had been observed each winter, during the winter of 1919-1920 about 14,000 elk died of starvation. This problem continued chronically until 1961-62 when significant numbers of elk were removed and the first signs of range recovery were noted. Despite recent minor improvements in the winter ranges, that area will remain as a sad monument of what unchecked numbers of big game animals can do to their habitat.

With the serious drought of the 1930's, there was a growing concern about habitat for wildlife. Many Montana winter game ranges were in jeopardy due to past abuses by domestic livestock and the problem was compounded by the dry years. Problem areas were observed on winter deer and elk ranges of the Sun River, South Fork of the Flathead, Gallatin, Little Belts and the Madison. In some areas of the State, mule deer had reached extremely high densities in the mid-1930's. By 1940, deer numbers in the St. Regis and Rock Creek areas declined after they had over-used the winter ranges. This was only the beginning. Most other ranges were suffering from the effects of big game over-populations by the 1950's.

Game laws were more restrictive during the early 1900's. The 1895 Legislature specified a limit of eight deer. In 1913, the Fish and Game Commission set a two deer limit. — (Historical)

The 1900-41 period consisted of a restricted harvest of game, numerous game preserves and liberal bounty payments on predators. — (Historical)

GAME MANAGEMENT IN MONTANA

Trapping and transplanting of wild game was one of the main programs of early conservationists. Little was known about wildlife ecology and early transplanting was primarily a "hit or miss" operation. — (F & G photo)

The drought of the 1930's intensified another problem — conflict between livestock and game. Since the late 1800's, numbers of domestic livestock and settlers had increased on land occupied by increasing numbers of game animals. It was not surprising that winter damage of haystacks and crops by elk and deer became common especially on lands that were formerly winter ranges. At first, game damage complaints from private landowners were lightly regarded. The concept of too many game animals for the range was unthinkable. However, in March 1939, out of season, a landowner killed a wild elk on his ranch. He contended that the elk was doing damage to his property. A game warden investigated and the landowner was arrested and convicted in District Court. The landowner appealed his case to the Supreme Court of Montana. The Supreme Court reviewed the case and returned it to the lower court with some guidelines which recognized both the State's right to preserve free-ranging game animals and the citizen's right, under certain conditions, to defend his property. The higher court also said each case must be judged on its own merits. This case became known as the *Rathbone Case* and has served as a valuable precedent to the Fish and Game Department for game damage complaints.

In an effort to keep game animals off haystacks and crops, an elaborate herding and haystack fencing program was developed in the 1940's. Proper harvest of game animals by hunters was resisted by the public and the Department.

MANAGEMENT ON THE HORIZON

As the 1940's approached, the Montana Fish and Game Commission realized that difficult problems loomed ahead. The peaceful era was ending. Growing public participation and economic interests associated with the rapidly expanding game populations began complicating conservation issues. The popular desire was to build

EARLY HISTORY

up unlimited numbers of all forms of game. Few people were realistic about the problems and the need to cope with deteriorating winter game ranges, overused by both big game and livestock, range forage shortages, game starvation and game damage to public and private ranges. The need for new approaches, for technically trained people and for factual scientific information was evident. However, the Commission had neither the power nor the money to meet these needs.

The U. S. Forest Service, under a special budget for emergency relief work during the 1930's, had established winter game studies on important ranges in National Forests in Montana. Very little of this information on forage, game numbers and range conditions was applied to game management. Later, joint programs to gather data were established. Forest Rangers, Park Rangers and State Game Wardens worked together making game counts, checking winter losses of game and forage use. Although some of this information was considered in developing hunting regulations, hunting seasons and regulations were basically set by the State Legislature and were still very restricted. Increased hunter harvests were allowed only occasionally, in local areas, and following loud complaints of game damage to private property.

Gradually, informed citizens and Commissioners asked for the employment of a technical force in the Fish and Game Department. Creation of the new position of State Big Game Manager in the Department in 1940 marked the first step, as small as it was, toward development of a scientific game management program that would later be recognized as a full time function of the Montana Fish and Game Department.

A chronological list of events during the 1869-1940 period is presented in Appendix I, page 217-222.

3

GAME MANAGEMENT 1941-70

The year 1941 marked a significant milestone and turning point in the history of wildlife conservation in Montana.

In 1937, the United States Congress had passed the Federal Aid in Wildlife Restoration (Pittman-Robertson) Act, earmarking funds from a special excise tax on sporting arms and ammunition for wildlife management in the states. Assenting acts to make these funds available to Montana, including a law prohibiting diversion of hunting license fees for purposes other than wildlife restoration, were passed by the Montana State Legislature in 1941. At the same time, jurisdiction for setting all hunting seasons and regulations was transferred from the State Legislature to the Fish and Game Commission.

Adoption of these measures greatly increased the responsibilities of the Commission. For the first time, the authority and the funds were available to hire a staff of trained game biologists to undertake sorely needed programs of surveying game populations and searching for answers to the looming wildlife problems. Recognizing this and its changing role in the administration of the State's wildlife resources, the Fish and Game Commission adopted scientific management of wildlife as basic policy in 1941. This policy called for a program of investigational work and a foundation of facts about game animals and their relationships to the environment as the basis for management. It also called for State leadership in game management in Montana.

The Fish and Game Department, which previously served mainly to enforce legislative game policies, took on a new look. The Wildlife Restoration Division, fore-runner of today's Game Management Division, was formed to administer projects and activities undertaken with Pittman-Robertson funds. The State Big Game Manager became the Big Game Leader in the new Division and additional positions were established to lead work on game birds and fur animals. By the end

GAME MANAGEMENT IN MONTANA

of 1941, more than a dozen technically trained fieldmen were employed on surveys, inventories, and land development projects. However, this force was spread thinly on extensive statewide assignments.

In spite of Commission policies and support in some official conservation circles, the new Game Management program was faced with many challenges. The early protective conservation philosophy had become traditional and concretely set by laws, regulations, and public opinion. Under these conditions, administration had hardened into a blind routine, and the change to a more "enlightened" approach was difficult. There was also some question about the value of biology in wildlife conservation during these early years, even within some institutions of higher learning. The application of well known biological principles, observed in the laboratory or in field studies elsewhere, to Montana's wildlife was not easily understood. Internal problems also existed. The new game managers and biologists were generally considered invaders into a field considered the sanctum of other Department employees who neither understood the new biologists nor accepted application of their thinking in game management. The new program endured, however, and gradually grew to be a generally accepted and respected function of wildlife administration.

In 1955 the Fish and Game Department was reorganized into seven regional districts and game management personnel received district assignments. Experienced biologists were assigned as District Game Managers, with the responsibility for developing district game management programs. As needs dictated, and funds allowed, additional biologists were assigned to districts to increase the quantity and quality of information obtained on game populations and

The game management program is financed essentially by hunting license monies matched with federal aid from a manufacturers' excise tax on guns and ammunition. — (F & G photo)

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assist in the development of effective management programs. In 1958, formal research began with the Game Management Division conducting special studies on game species and management problems. The Game Management Division now totals more than 40 people, including 7 Game Managers, 16 Game Management Biologists, 4 Division Staff Officers, 8 Research Biologists and 3 Special Project Biologists. Since 1952 a Master of Science degree in Wildlife Management has been required for professional positions. This has resulted in the recruitment of personnel with outstanding ability, training, and devotion to wildlife conservation and has contributed greatly to a progressive game management program in Montana.

FUNDING

Dollars, or the lack of them, historically have played a key and often a critical role in wildlife conservation in Montana as elsewhere. Traditionally, nearly the entire cost has fallen on hunters and fishermen. Most conservation efforts were born and have progressed in accordance with funds collected from sportsmen. Early protective programs were enforced with revenues from fines. Before 1941, these efforts were carried out largely with money from hunting and fishing license sales. Federal Aid, under the Pittman-Robertson (P-R) Act of 1937 was the base for establishment of the Wildlife Restoration Division in the Montana Fish and Game Department in 1941. Pittman-Robertson funds are obtained from an 11 percent tax on guns and ammunition sold to sportsmen. P-R funds have since been essential in continuing the Game Management program.

Occasionally the stipulation built into the use of Federal Aid funds prohibiting the diversion of State license revenues has served to maintain this financial base for all Department operations. On numerous occasions, unsuccessful State legislative attempts have been made to use Fish and Game funds for other politically expedient programs.

Since 1941 the Game Management program has operated primarily on Federal P-R funds which support 75 percent of the cost of approved projects. Matching funds from State hunting license sales provide the other 25 percent of the cost. Certain general game management activities and game farm operations are exempt from Federal Aid and are supported entirely by State license monies. Occasionally grants, contracts, and cooperative programs with State and Federal agencies and with private industry and individuals have provided some support for certain research studies.

The Game Management Program had a modest beginning under a total budget of \$93,977 in 1941. Both Federal Aid and State appropriations were decreased during World War II as sales of sporting arms and ammunition and hunting licenses declined. In 1947 the Federal apportionment increased to \$117,429. There has been a gradual increase in the amount of money available for game management in Montana since that time, and present funding is more than ten times greater than 1941. However, amounts of money necessary for management have also increased greatly during this period. Since game management is essentially self - supported by license sales and Federal Aid funds (without State general funds) it must operate

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conservatively. Biennial budgets are drawn according to anticipated revenues based on actual income in previous years. Both budgets and expenditures are carefully reviewed and approved by the Fish and Game Commission, Federal and State Auditors, and the State Legislature. If income for any year does not come up to expectations, the Division must cut back its planned program to reduce expenditures accordingly.

GAME MANAGEMENT PROGRAM

From its beginning in the early 1940's, Game Management has had three major objectives: 1) to develop and sustain the maximum game populations consistent with available habitats and other uses of the land; 2) to insure maximum production and utilization of annual game surpluses; and 3) to provide the maximum possible amount of recreational opportunities for sportsmen. In striving toward these goals, management functions by recommending programs, seasons, and regulations to the State Fish and Game Commission through the Director of the Fish and Game Department and by carrying out game management programs and policies adopted by the Commission. These tasks embrace various operations including management surveys and investigations, basic and applied research, land acquisition and development projects, public information, and cooperation with other agencies and institutions. The organized collection and analysis of data from statewide, regional, and district management surveys and investigations provides the basis for identifying management needs and recommending season dates, hunting area boundaries, and bag limits.

Research personnel conduct studies of the life requirements and ecology of game animals for the purpose of identifying problems and providing basic reference data for management. They also systematically test techniques and management practices and seek solutions to specific management problems. Through land acquisition and development projects, management personnel acquire, develop and maintain lands as big game winter ranges or as foraging, nesting, and breeding areas for upland game birds and waterfowl. The dissemination of information by Department personnel about the purpose and progress of management programs, through technical reports, popular writings, news releases, and talks, is designed to keep the public aware of management needs and to obtain acceptance of new programs. Cooperative programs with State and Federal agencies and the University System serve to maintain close working relationships and to combine resources and efforts in solving game management and research problems.

Field Surveys and Investigations — Throughout its history, Montana's game management program has been based on field investigations that provided knowledge of the status and trends of game populations. Initially, these were concerned largely with surveys and inventories to generally establish the distribution, status, and relative abundance of game populations throughout the State. Although the general relationships of animals to their environments were recognized by early wildlife workers, detailed ecological relations were either unknown or not widely understood. Management recommendations and practices were often influenced more by knowledge from animal husbandry than wildlife

Standardized methods developed to obtain trend information on game populations include aerial surveys of antelope. — (F & G photo)

biology and ecology. It was not until after World War II that serious efforts were made to obtain more detailed information and basic facts about the requirements of wild animals and their relationships to the environment and to the activities of man. At that time more sophisticated attempts were begun to census game populations, determine range carrying capacities, evaluate the effects of parasites and diseases, and to enumerate hunter harvests, predation and winter losses. A few special management studies were also undertaken to determine the status of important big game herds such as the Gallatin and Sun River elk herds, and on special species such as the grizzly bear and bighorn sheep.

During the 1950's the program was reorganized to include more intensive regional and district management investigations. Concurrently, research studies were initiated to establish basic facts about the habits, requirements, and habitat relationships of game animals and to provide methods and criteria for management. The broad general surveys and inventories were replaced by standardized methods which provided comparative, quantitative information on game populations, habitat conditions, and harvest to better identify management needs and to generally improve the basis for management recommendations and programs.

Gradually, as knowledge accumulated, views concerning game management changed. New concepts gave rise to new and different management practices. Many old or earlier ideas and approaches were discarded or modified. The values of game preserves, magpie control, bounties on predatory animals, game bird stocking, big game salting, buck (or male) only hunting seasons, and many other less widely applied practices established in earlier conservation programs, were re-appraised and either de-emphasized or discarded. Appraisal of game preserves showed they serve poorly to stock adjacent areas (their original purpose) and in many cases were unnecessarily removing areas from public use. Of 46 game preserves in effect in 1936, only 20 remained by 1970. An extensive magpie control program in the State

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was discarded in 1949. A later study showed that nature, at no cost, accomplished the same magnitude of magpie population reduction as bounties. The last bounty, on mountain lions, was discontinued in 1962. Game farm rearing and stocking of chukar was abandoned in 1956 after chukar were established in the few areas suitable to their requirements. Stocking of pheasants was de-emphasized and greatly reduced by the early 1960's, after it was evident that it was a costly practice that did not benefit future pheasant populations.

A salting program to improve the distribution and winter range use of big game animals was not effective and was dropped as a management practice in 1956. Buck-only deer seasons were wasteful, and they did not control deer herds and were replaced by either-sex seasons statewide by 1958. Extensive either-sex hunting also came to be employed in management of most other big game animals during this period. The first either-sex hunting season on pheasants was established on an experimental basis in 1959 in northcentral Montana. In 1969, one hen pheasant was allowed in the statewide bag limit.

Trapping and Transplanting — One long-standing game management practice which has contributed significantly to certain game populations and hunting opportunities in Montana is trapping and transplanting.

Early surveys determined areas of suitable habitat for certain native species from which pre-existing populations had been eliminated or reduced to the extent that introductions of animals from other areas would be beneficial in re-establishing new populations or hastening recovery of existing herds. Under this program, antelope were re-distributed throughout the State, both species of deer were released into many areas, and elk herds were established in some ranges which had not been occupied by elk for many years. A number of mountain goat herds were established through transplanting which began in 1941. Mountain sheep were also transplanted, but success was not as pronounced as with some other species. A large-scale beaver transplanting program was begun in 1941. The fisher, another important furbearer, was re-established in portions of northwestern Montana through transplant releases in 1959.

Two exotic species that were introduced and successfully established in Montana early in the century are ring-necked pheasants and Hungarian partridge. Chukar partridge were first introduced in 1933 and later established in limited areas by extensive transplanting efforts during the mid-1950's. Merriam's turkeys were first introduced in 1954 and transplanting efforts have since established this bird in many areas where suitable habitat exists. The introduced species have added considerable variety and quality to the Montana bird hunters' sport.

The early program of transplanting aided in distributing certain native and introduced game species throughout available habitat and set the stage for sound management. Once suitable habitat is occupied by a species, it is neither biologically nor economically sound to continue transplanting. Today, through proper management the need for wholesale transplanting has been eliminated.

Harvests — Montana's game management program has emphasized big game. This emphasis reflects both the popular appeal of big game animals to sportsmen and the relatively large number of problems associated with maintaining

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widespread, sizeable big game populations. Big game populations have the reproductive capacity to increase in numbers beyond those which forage supplies, especially winter food, can safely support. When excessive populations continue, the inevitable results are rapid depletion of available forage, extensive animal losses, and lowered production and survival of young animals. One of the consequences of this is reduction in numbers of animals available to hunters. In the long run, and of greater significance, if the process continues there can only be progressive deterioration of food plants and a lowered capability of the range to support a productive population. Other undesirable consequences may be damage to crops, haystacks, and other private property as well as competition with domestic livestock and other big game animals.

Through the years, much of the game management effort has been to establish hunting regulations designed to balance big game populations with their forage, to obtain maximum use of annual surpluses and to provide permissible increases in hunting opportunity for all game.

Hunting seasons have become the primary tool to manage big game in Montana and elsewhere. Harvest is the best means by which the grazing and browsing of big game animals can be regulated and populations may be manipulated in relation to their habitat. Special harvests are also occasionally employed in preventing or reducing game damage to agriculture and other private property.

Between 1947 and the late 1950's, either-sex deer seasons progressively replaced buck-only seasons across the State; season length was increased to 35 days or more; and bag limits were increased to include two deer in many areas. Special early and late seasons were established in certain problem areas to alleviate chronic damage to range and/or agriculture. Additional deer tags for resident hunters and

Either-sex deer seasons allow better herd control and improves a hunter's chances. More bucks are harvested now than in the 1940's buck-only seasons. — (F & G photo by R. J. Mackie)

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special nonresident licenses were also made available. Hunting seasons were similarly increased for all other big game species. The additional hunting opportunity provided by liberalized seasons and regulations greatly increased hunter harvests and success. It has also helped to maintain or improve big game habitat and herd vigor.

The total statewide deer harvest first reached 100,000 in 1955 and deer hunter success reached 90 percent in 1956. Both of these figures were more than double those attained prior to 1950. In 1957, a record of 134,600 deer (101,000 mule deer and 33,600 white-tailed deer) was harvested – 112 deer for each 100 hunters. The 1957 harvest included 90,000 bucks, more than double the total deer harvest under the last statewide buck-only season in 1947. Since 1958, the entire state has been open to either-sex deer hunting; the statewide harvest has remained near or above 100,000 each year; and hunter success has been maintained at about 90 percent.

Elk harvests rose from less than 10,000 annually prior to 1950 to 10-15,000 with longer, either-sex seasons. Record harvests of 16,000 elk were achieved in 1955 and 1968.

Permit hunting of pronghorn antelope (closed to all hunting from 1937 to 1942) was initiated in 1943 and progressively liberalized through 1963. Early seasons were primarily on bucks. By 1958, all antelope permits were issued for

Record harvests of 16,000 elk were achieved in 1955 and 1968. Checking stations, hunter mail questionnaires and automatic data processing systems are used to obtain harvest information valuable for setting subsequent seasons. — (F & G photo)

either-sex. Harvests and hunter success progressively increased. More than 79 percent of the pronghorn hunters were successful in 1963 when more than 26,000 antelope were harvested.

Hunting of moose was resumed in 1945, after 50 years of closed seasons. The number of permits issued were increased from 90 for bulls-only in the first season to 400 in 1957 and more than 800 for animals of either-sex in 1962. Hunter success on moose has consistently remained at 70-80 percent annually.

Prior to 1953, hunting seasons on mountain goats varied from closed to a maximum of 5 days in certain areas. Permit hunting was initiated in 1953 with 90 permits. This number was progressively increased to more than 600 each year by the mid-1960's. A few unlimited permit areas were also established and seasons were generally lengthened to 2 months or more. Since 1960, the annual harvest of goats has been 292-513 as compared with less than 100 each year prior to 1955.

A hunting season was first established on bighorn sheep in 1953. Although hunting of bighorns is mostly restricted to trophy rams, hunting opportunities have generally been increased by longer seasons, greater numbers of permits, and the addition of some unlimited permit areas. Harvests increased slightly during the 1960's as compared with the previous decade.

Bear hunting was also liberalized somewhat with longer seasons after 1959, the legalized hunting of females with cubs (after the end of August) since 1960, and the issuance of special nonresident licenses since 1961. Since 1967, hunters have been permitted to take one black bear and one grizzly bear. The grizzly bear was also given trophy status at that time. Opportunities for hunting grizzly bear were increased somewhat by the abandonment of certain refuges and preserves during the 1950's and early 1960's.

Although contributing relatively little to game harvests or herd control, the establishment of special archery seasons on big game increased recreational and hunting opportunities for many sportsmen. Special statewide archery seasons were established for deer in 1956 and in certain areas for pronghorn antelope in 1959. Special archery seasons for elk in some areas began during the early 1960's.

Because harvest is a key management tool, determinations of big game harvest trends in hunting districts and special management areas are important. The first attempts to measure Montana game harvests occurred during the late 1940's. The use of hunter mail questionnaires, automatic data processing systems beginning in 1959, and computers after 1964 greatly expanded and improved the quantity and quality of harvest information available for management.

Significant progress was also made in increasing use of annual surpluses from game bird populations and providing additional opportunities for upland game bird hunters. Hunting seasons on upland game birds were extremely restrictive and variable during the 1940's and early 1950's. Hunting of native species was either closed or open for a maximum of 3 days. The total combined daily bag limit was three birds. Pheasant seasons extended a maximum of 3 weeks with a daily bag limit of three cocks. Banding studies during the 1950's pointed out that Montana hunters were taking only a very small proportion of annual surpluses. This provided the basis for liberalized regulations. During the late 1950's and the early 1960's,

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game bird seasons were progressively liberalized in both length and bag limits. Mountain grouse seasons were extended to range from 57 to 78 days since 1960. The daily bag limit was raised to 5 birds. An early September opening date was also established to make greater numbers of upward migrating blue grouse available to hunters.

The season and bag limits on prairie grouse were increased generally to 2 weeks and three birds of each species in 1959 and subsequently to a 1 month or longer season and up to four birds of each species daily in the mid-1960's. The pheasant season was also extended to about 1 month over most of the State. Although a three-bird daily bag limit has persisted, the opportunity to harvest pheasants has been increased by either-sex hunting. The legal harvest of hens began in 1959 on an experimental basis and became general in most of eastern Montana during the early 1960's. In 1969 one hen pheasant was permitted in the daily bag throughout the State. Prior to 1958 Hungarian partridge (Huns) were hunted concurrently with pheasants and hunters were limited to an aggregate three-bird daily bag limit. Beginning in 1958, a daily bag limit of six Huns was allowed during the pheasant season, and also allowed during the earlier prairie grouse season.

Two new species, chukar and Merriam's turkey, were added to Montana's huntable game bird list during the late 1950's, providing new and different hunting opportunities for sportsmen. Wild turkeys were first hunted in 1958 under a 3-day season in southeastern Montana. This was just 4 years after the first turkey introduction. Regular fall seasons of up to 30 days have since been established in several areas of the State. In 1962 a spring gobbler hunt was first allowed in southeastern Montana and has since been held in other areas. The chukar became legal game in 1959 in 17 Montana counties. Seasons have since been set concurrently with Hungarian partridge, with an aggregate bag limit.

Annual harvests of most upland game birds vary directly with the success of the hatch in a given year. Liberal seasons have enabled Montana hunters to derive much additional recreation and greater utilization of surpluses in years of high hatching success while not endangering basic populations in years of lower production.

Waterfowl seasons and regulations are established by the Federal government. However, game management efforts have led to shifts in flyway boundaries and changes in regulations which provided increased waterfowl hunting for Montanans. In 1961, the Pacific Flyway boundary was shifted eastward to include Montana west of the Continental Divide. Montana thus became the first state to be divided into two flyways for waterfowl hunting. The Pacific Flyway boundary was moved further eastward to its present location in central Montana in 1965. These changes resulted in longer seasons and increased bag limits on waterfowl in much of the State. Banding studies also led to a special post-season hunt on drake mallards in the Central Flyway portion of Montana in 1968. In 1970 the first hunting season on swans was held at Freezout Lake. A chronological list of game management events from 1941-70 are presented in Appendix II, page 223.

Research — Research efforts in the 1940's were limited mainly to a few special studies of big game species including: Sun River mountain sheep, Sun River

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and Gallatin elk, Absaroka Mountains moose and statewide goat populations. Extensive statewide surveys of upland game birds and pheasant-agriculture relationship studies were also completed during the decade.

The development of a wildlife research program can be attributed to the foresight of early administrators. The requirement of a graduate degree by Division technical personnel and cooperative programs with Montana State University and the University of Montana have been key steps in building a research effort into an integral part of the game management program. The first degree in Wildlife Technology was granted at the University of Montana in 1939. In the following decade wildlife management curriculums were initiated at Montana State University and the University of Montana.

The development of a wildlife program at Montana State University in Bozeman in 1949 began a cooperative effort with the Fish and Game Department in which graduate students received training while conducting research on wildlife problems for the Department. This research has contributed significantly to game management. Studies of elk led to improved management plans for herds in the Gallatin, Sun River, Gravelly Mountains and other areas. Mule deer food habits and range relationship studies provided a basis to liberalize hunting seasons in attempts to control over-populations of deer. Studies on mountain goats, bighorn sheep, moose and antelope provided important data on the populations and ecology of these species in specific areas. Studies on game birds helped provide a basis for experimental hen pheasant shooting, more liberal hunting seasons for grouse and turkeys, and investigated the effects of insecticides and herbicides on birds. Several waterfowl studies led to improved wetland habitat development. Special investigations on mink, otter and beaver contributed to the early development of a fur management program.

In 1950 the Cooperative Wildlife Research Unit was founded at the University of Montana at Missoula through the cooperative efforts of the U. S. Fish and Wildlife Service, the University of Montana, the Montana Fish and Game Department and the Wildlife Management Institute. A variety of studies have been completed that have provided valuable information for game management. Research on mule deer produced findings on their reproductive physiology, behavior, food habits and the ecology of a western Montana winter range. Elk studies provided information on food habits, forage competition with livestock and breeding biology. Other big game studies provided data on the ecology and biology of mountain goats, antelope, bighorn sheep, moose, bison and black and grizzly bears. Bird studies delved into the biology and ecology of pheasants, magpies, chukar, white-tailed ptarmigan, Canada geese, redhead ducks and golden eagles. Fur studies provided age criteria for mink and information on the ecology of the pine marten.

A list of the graduate theses (and resulting publications) completed at Montana State University (Bozeman) and the University of Montana (Missoula) in cooperation with the Fish and Game Department are found in Appendix III, pages 231 to 238.

The beginning of full-time research efforts by Game Division personnel started in the mid-1950's to help maintain a sound basis for game management

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Big game food habits are determined by laboratory analysis of rumen contents and by careful examinations of vegetation at sites where game animals feed. — (Photo by Gerry Atwell)

activities. A Wildlife Investigations Laboratory was established at Bozeman in 1957 to provide facilities for analyses of biological materials in support of both research and management programs. Game researchers during the mid-1950's developed browse and grass survey methods that subsequently were adopted as standard techniques for measuring utilization and condition of important big game forage plants in Montana and other western states. A study on antelope food habits and relationships to agriculture was completed and published in 1958. In 1959 research biologists were assigned to studies on the ecology of blue and sharp-tailed grouse. In 1960 studies were initiated on the ecology of elk in the Sun River area; deer, elk and cattle food habits and range relationships in the Missouri Breaks; and black bear population and ecology studies in northwestern Montana. Subsequent studies included research on northern Yellowstone and Gallatin elk; ecology of moose in southwestern Montana; ecology of Hungarian partridge in relation to agriculture; and cooperative efforts with Federal agencies on wildlife-pesticide problems. The

cooperative studies included: evaluation of the effects of experimental spruce budworm insecticides on forest grouse completed in 1969, and a 10-year study of the effects of chemical and mechanical sagebrush control on associated flora and fauna that began in 1965.

As one study is completed, another is undertaken on the basis of priority established by the needs of management. In 1970 studies were initiated to determine the effect of timber harvest on elk habitat and to evaluate and upgrade the browse survey system used by big game managers.

Some of the notable results of wildlife research include: development of elk management plans for the Gallatin and Sun River herds; improvements in bear hunting seasons; liberalization of grouse hunting seasons; development of big game forage utilization survey methods; guidelines for the extensive transplanting of wild turkeys; addition of Montana to the Pacific Flyway with improved waterfowl hunting for many Montanans; discovery of objectionable levels of DDT in forest wildlife that led to the discontinuance of DDT spraying on Federal forests; and early development of a fur management program.

The results of research through the years, individually and cumulatively, have contributed much to knowledge of the biological requirements and ecological relationships of wildlife as well as to developing a better understanding of many important game management problems. These findings have done much to further the establishment of sound game management practices in Montana and throughout the world.

Land Acquisition and Development — Game management progress in Montana has been significantly enhanced by the acquisition and development of key habitats for game animals. This program has had as its primary objective the provision of suitable winter range for big game, especially elk. It has also served to maintain and develop important nesting, feeding, and resting areas for waterfowl and to provide public hunting areas throughout the State.

Although a few small tracts of land had been acquired earlier, the acquisition program essentially began in 1940 with the purchase of the Setter property on the Judith River near Utica as winter range for elk. Since then, as opportunities and funds allowed, lands totaling 152,978 acres have been purchased or leased in 15 different areas for development of big game winter ranges. These areas are located primarily in the foothills and valleys of westcentral and southwestern Montana where much of the primary big game winter range occurs on private lands. Here they have served to alleviate severe game damage or game-livestock competition problems and/or allowed the development of big game populations which otherwise would not have been tolerated or were limited by winter range deficiencies. Today, more than 5,000 elk plus numerous deer, moose, antelope, and bighorn sheep winter on or in association with these acquired game ranges. The Judith River Game Range, the Gallatin Game Range, the Sun River Game Range near Augusta, the Blackfoot-Clearwater Game Range near Ovando, and the Madison-Wall Creek Game Range south of Ennis are examples of some important areas.

Development of big game winter ranges has generally eliminated livestock grazing and improved fencing of boundaries has precluded further use by livestock.

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Administrative and limited public use facilities have been developed on some of the larger areas. All game ranges are open to public use for hunting, picnicking, hiking, and other types of public recreation, though this use may be restricted when and where human activities would interfere with use of the area by big game. In many cases these areas provide access for public use of adjacent Federal lands and/or to game populations which otherwise were unavailable to the public.

Acquisition and development of important waterfowl management areas such as Freezout Lake near Fairfield, Fox Lake in Richland County, Nine Pipes and Pablo Reservoirs in the Flathead Valley, and others have resulted in greatly increased waterfowl usage and hunting opportunities for Montanans. While much of the development on these areas has been directed toward waterfowl, such areas provide valuable habitat for upland game birds and other wildlife. Like big game ranges, these game management areas are open to many forms of public use when such use is consistent with the basic objectives of the particular area.

Today, the total acreage of lands owned or controlled by the Montana Fish and Game Department for wildlife management stands at 205,870 acres (Table 1). These lands were acquired with sportsmen's dollars under the Pittman-Robertson Act. Compared to the total area of the State (93,271,040 acres), these areas are

Development of waterfowl management areas has improved nesting conditions for local ducks and "stop-over" places for migrating ducks and geese. — (Photo by C. J. Henry)

Table 1. Commission owned and leased lands-managed or administered by the Game Management Division -- 1970.

NAME	COUNTY	BIG GAME RANGE ACREAGE			SMALL GAME AREAS ACREAGE			GRAND TOTAL ACRES
		Owned	Leased	Total	Owned	Leased	Total	
Alberton Game Range.....	Mineral.....	--	666	666	--	--	--	666
Augusta Check Station.....	Lewis & Clark.....	1 lot	--	--	--	--	--	--
Beartooth Game Range.....	Lewis & Clark & Cascade....	27,000	5,318	32,318	--	--	--	32,318
Big Creek.....	Park.....	--	1,920	1,920	--	--	--	1,920
Bitterroot Game Range.....	Ravalli.....	2,289	160	2,449	--	--	--	2,449
Black Bluff.....	Yellowstone.....	--	--	--	--	52	52	52
Blackfoot-Clearwater Game Range.....	Missoula & Powell.....	11,420	37,951	49,371	--	--	--	49,371
Bowdoin.....	Phillips.....	--	--	--	--	156	156	156
Bowser Lake.....	Flathead.....	353	79	432	--	--	--	432
Bull Mountain.....	Jefferson.....	1,993	1,559	3,552	--	--	--	3,552
Canyon Ferry.....	Broadwater.....	--	--	--	--	5,000	5,000	5,000
Clark Canyon.....	Beaverhead.....	--	--	--	--	1,200	1,200	1,200
Flathead Lake.....	Lake.....	--	--	--	136	--	136	136
Fleecer Mountain.....	Silver Bow.....	6,425	877	7,302	--	--	--	7,302
Fox Lake.....	Richland.....	--	--	--	1,202	160	1,362	1,362
Freezout Lake.....	Teton.....	--	--	--	4,872	6,477	11,349	11,349
Gallatin Game Range.....	Gallatin.....	7,258	3,200	7,258	--	--	--	7,258
Garry Mountain.....	Deer Lodge.....	--	1,760	1,760	--	--	--	1,760
Haymaker Game Range.....	Wheatland.....	1,360	150	1,510	--	--	--	1,510
Isaac Homestead.....	Treasure.....	--	--	--	535	--	535	535
Johnson Reservoir.....	Dawson.....	--	--	--	--	68	68	68
Judith River Game Range.....	Judith Basin.....	4,639	234	4,873	--	--	--	4,873
Madison-Bear Creek.....	Madison.....	3,455	960	4,415	--	--	--	4,415
Madison-Wall Creek.....	Madison.....	5,348	918	6,466	--	--	--	6,466
Milk River.....	Phillips.....	--	--	--	379	1,668	2,047	2,047
Moiese Bird Farm.....	Lake.....	--	--	--	80	--	80	80
Muddy Creek.....	Cascade.....	--	--	--	680	--	680	680
Ninepipe.....	Lake.....	--	--	--	2,755	--	2,755	2,755
Pablo.....	Lake.....	--	--	--	387	--	387	387
Pompeys Tower.....	Yellowstone.....	--	--	--	--	94	94	94
Red Rock Lake.....	Beaverhead.....	--	--	--	27	--	27	27
Sun River Game Range.....	Lewis & Clark.....	12,173	7,555	19,728	--	--	--	19,728
Threemile Game Range.....	Ravalli.....	5,739	--	5,739	--	--	--	5,739
Tiber Reservoir.....	Toole & Liberty.....	--	--	--	--	--	--	--
War Horse Reservoir.....	Petroleum.....	--	--	--	--	19,485	19,485	19,485
Warm Springs Bird Farm.....	Deer Lodge.....	--	--	--	--	1,629	1,629	1,629
Warm Springs Game Area.....	Deer Lodge.....	--	--	--	--	15	15	15
Willow Creek Camp.....	Lewis & Clark.....	19	--	--	--	4,335	4,335	4,335
Yellow Water Reservoir.....	Petroleum.....	--	--	--	--	--	--	19
TOTAL		89,671	63,307	152,978	11,053	41,839	52,892	205,870

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Intensive forestry practices, including clear-cut logging, terracing and massive road systems can be disruptive to ecology and management of wildlife. — (F & G photo by T. W. Mussehl)

small. To game management and to the sportsmen of Montana, however, they have been very important. In 1969, more than 114,000 hunter days and more than 50,000 man days of other recreational activity occurred on State Game Management areas. Cash payments in lieu of taxes are made to all counties in which these lands occur. The Fish and Game Department is the only State agency which makes such tax payments on State-owned land.

Land Management and Interagency Relations — Wildlife is a product of the land, and the fortunes of game populations are inseparable from events which influence the quantity and quality of the habitat that land provides. During the past 100 years, livestock grazing, cultivation, timber harvest, mining, and urbanization, among other forces, have greatly and often repeatedly altered the landscapes and vegetation of Montana's prairie and forest lands. The effects upon wildlife have been extensive — varying from destructive to beneficial and from the obvious to the unknown.

Rangelands, on which livestock grazing is a dominant use, comprise nearly 50 percent of the State's land area. Few of these lands, private or public, have escaped serious overgrazing. The resulting changes in vegetation composition and condition have decreased their productivity for both livestock and game animals, and frequently led to severe competition as well as decreased tolerance of grazing by big game on private lands. The cultivation of prairies in many parts of Montana converted lush mixtures of native vegetation to croplands with simpler stands of one species of plant such as wheat — destroying habitats of certain forms of wildlife

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while converting some areas to habitats suitable for imported species such as pheasants and Hungarian partridge. Subsequent trends toward intensified agriculture, combining larger farms with mechanization, large single crop field units, clean farming, fall plowing, and intensive weed control, have now greatly reduced the habitat for these species in most areas. In some agricultural areas, a trend toward livestock production has resulted in replacement of grain by hay and conversion of cropland to pasture; virtually eliminating pheasant habitat and populations.

Prior to man's improved ability to control wildfire, forest fires created vast areas of wildlife habitat in western Montana. Logging, in some ways, replaced fire in opening dense forest and creating productive wildlife habitats. Early emphasis on selective cutting provided mixed-age stands of trees and shrubs important to wildlife. More recent timber harvest and forest management practices have had some detrimental, or at least questionable, effects upon wildlife habitats and populations. Programs emphasizing large clearcuts, intensive tree planting and development, single species and single age stands, terracing, and vast road systems opening forest land are being severely questioned as to their impact on wildlife.

The future of wildlife habitats and populations in many parts of Montana may depend greatly upon the methods employed in extracting coal and other minerals and reclamation practices which follow. The history and visible evidences of coal-stripping operations in eastern Montana and elsewhere, attest to its destructive impact upon soil, range, and wildlife habitat.

Most of the large-scale programs to remove sagebrush have been based upon single-minded goals with little regard for the values of associated flora and fauna. Range treatments that convert large areas of mixed vegetation to simpler stands of grass usually also convert the area to a lower quality wildlife habitat. — (F & G photo by Tom Smith)

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The Fish and Game Department, while responsible for the development, perpetuation, and proper use of game populations throughout Montana, controls and can directly influence wildlife habitat on less than 0.2 percent of the lands upon which these populations must live and reproduce. Because of this, game management has long been vitally concerned with identifying and clarifying relationships between game animals and prevailing land management practices and with encouraging consideration for wildlife in the use of all lands. Efforts have included special research projects, joint and coordinated information gathering, and cooperative management programs with Federal and State land management agencies; participation in various meetings and on various boards, councils, and commissions concerned with various problems in resource management; and, upon request, providing assistance and advice to private landowners and other groups. This has resulted in determined, and sometimes misunderstood and controversial, opposition to certain land management programs and practices which are detrimental to wildlife.

A large share of wildlife habitat in Montana occurs on public lands, of which the Federal Government administers about 30 percent, the State about 6 percent. Most State-owned lands are administered by the Department of State Lands and Investments and leased to private individuals or corporations whereby they are treated much as private land. The major Federal public land administrative agencies include the U. S. Forest Service, which administers more than 16,600,000 acres of forest lands, much of it in western Montana; and the Bureau of Land Management, which is responsible for some 8,200,000 acres, primarily rangeland in eastern and southwestern Montana. In addition, the National Park Service controls about 1,154,000 acres, mostly in Glacier and Yellowstone National Parks; and the Bureau of Sport Fisheries and Wildlife controls more than 497,000 acres in Federal Game Ranges and Refuges throughout the State.

Formal agreements have been developed with each of the Federal land management agencies to facilitate closer working relations, particularly at field levels. Special agreements and management plans have also been effected for certain studies, certain areas, or with respect to particular problems. One example is the development and initiation in 1962 of the Cooperative Gallatin Elk Management Plan between the Fish and Game Department, U. S. Forest Service, and the National Park Service. In addition, Fish and Game Department biologists work closely with biologists and other Federal agency personnel in the State and elsewhere. Game managers and biologists now devote considerable time to evaluating various spray, logging, road-building, and drainage projects on Federal lands to determine the probable impact on wildlife habitat values and game populations. Occasionally, certain Federal lands have been turned over to the Game Management Division for administration and development as game ranges and management areas. The Clark Canyon and Canyon Ferry waterfowl management areas were thus obtained from the U. S. Bureau of Reclamation. Recently, a cooperative study to assess the effects of Libby Dam and Reservoir on game habitats and populations was established with the U. S. Army Corps of Engineers.

Over half of the land area of Montana, including most of the more fertile and

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productive land, is held in private ownership. The existence and productivity of game populations on these lands is determined essentially by the landowner through economic needs and agricultural practices. However, through working agreement with the U. S. Soil Conservation Service, Game Management personnel review and evaluate proposals for certain spray and drainage projects to be supported by Federal cost-sharing programs. In some cases, cooperation with private corporations and organizations has led to improved conditions for game populations in the State. Agreements concerning regulation of water levels on certain streams and reservoirs has improved waterfowl nesting conditions and waterfowl hunting opportunities. In 1970, the Nature Conservancy, a private conservation organization, played a major role in the acquisition of the extensive Beartooth Game Range.

Proper consideration of wildlife values in land management will be an increasingly important goal for the game management effort. Increased demands for recreation, including hunting, dictate the necessity to temper land use decisions with consideration for wildlife. The immediate profits of misguided or unrestricted development will be at an irreversible price to future generations. In the words of the eminent early ecologist, Aldo Leopold, "Harmony with land is like harmony with a friend; you cannot cherish his right hand and chop off his left."

4

BIG GAME MANAGEMENT

Montana is famous for its big game hunting. In terms of hunter participation and expenditure, and money or effort spent by the Department in administration and management, the nine big game species represent the most important wildlife resource of the State.

Mule deer are the most common, most widely distributed, and the most popular big game animal in the State. White-tailed deer are found in northwestern Montana and along the river bottoms of eastern Montana and the foothill uplands of central Montana. Elk are probably the most prized big game animal. Elk are distributed primarily in the forested and mountainous regions. Antelope hunting success is high and this fleet-footed animal provides much sport to hunters. Most bear are taken incidentally while hunting other big game. Moose, goats and sheep provide hunting for limited numbers of hunters drawing special permits. Grizzly bear is the rarest big game species in the State. Caribou were last seen in northwestern Montana in the 1930's.

The objective of the big game management program has been to produce and maintain a maximum breeding stock on all suitable lands in the State in harmony with other land use interests and to utilize the annual surplus by recreational hunting. The basis for big game seasons has been Department surveys of range forage condition, harvest trends and population condition. Continuing research studies have developed new techniques and improved knowledge and understanding of plant and animal ecology as it applies to big game management.

A proper big game management program requires that animals be adjusted to their winter food supply. Reduction of deer and maintenance of lower deer populations to allow recovery of overbrowsed winter range is not a popular program. Unpalatable as such a program may be, it is imperative that deer and other foraging big game be adjusted to their winter range in order to perpetuate these animals.

If management is unduly influenced by public sentiment and attempts are made to save or stockpile game by too conservative seasons, the future big game resource will be further depleted. A balanced management program based on sound information coordinated with other resource development will provide much recreation and hunting opportunity for citizens of the State and others to enjoy.

5

ELK

By M. Rognrud and R. Janson

The Rocky Mountain elk or wapiti (*Cervus canadensis*) was widely distributed in Montana during the period of exploration. Early records indicate elk were abundant in eastern, central, and southwestern Montana. On the plains they were seen mostly along wooded stream bottoms and river breaks. Elk also occurred in the mountains and intermountain valleys where they were most common along the foothills. They were scarce in the forests of extreme northwestern Montana.

Elk declined over much of their historical range with settlement of the state. The large herds were reduced to fragments which survived in the mountains of western Montana. Elk regained abundance in many areas following protection, transplanting, and creation of new range by forest fires.

Sportsmen have long prized the elk for its trophy value, large size and palatable meat. The elk is Montana's most prized big game animal from the standpoint of hunter interest although it ranks below deer and antelope in number harvested. Today Montana is one of the most important elk hunting states in the Nation.

The distribution of elk in Montana was changed before the turn of the century. Elk were eliminated from eastern Montana. They survived in the region around Yellowstone National Park and in the Rocky Mountains along the Continental Divide. Some native elk also remained in a few other mountain areas.

Elk increased and spread in the mountainous part of the state following hunting season closures beginning in 1913. Transplants, which were begun in 1910, created new elk herds. The northern Yellowstone elk herd increased beyond the carrying capacity of its range early in the century. According to Rush (1932), severe winters killed 2,000 to 5,000 elk in 1892 and 1899. Despite these losses the herd increased until in 1915 it was estimated to be over 37,000. The peak elk die-off occurred in the severe winter of 1919 when an estimated 14,000 elk died by

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Fig. 1. MONTANA ELK DISTRIBUTION – 1970.

spring. The Gallatin, Sun River, and Flathead herds increased during the 1930's to create similar management problems. Some elk herds continued to expand and occupy more range between 1940 and the present (Figure 1). Elk are now well distributed in most of the mountainous and forested portions of the state.

Montana elk habitat varies from the arid Missouri Breaks to the moist forests of northwestern Montana. Regardless of differences, each type of habitat provides several basic requirements. They require large blocks of undeveloped land. Major herds are associated with public lands. Elk can cause considerable conflict when they compete with livestock for forage or damage crops and fences of private landowners.

Elk prefer native bunch grasses for winter food. However they are very adaptable and will feed on other grasses, sedges, forbs, and browse (Table 1). They also quickly acquire a taste for hay from ranchers' stacks. Elk feed heavily on green grass in the spring, but switch mostly to forbs such as dandelion, geranium, and aster in the summer. Grasses again become the most important food in the fall. On browse ranges 90 percent of the winter diet and 50 percent of the summer diet may be browse.

Their habitats are classified as browse ranges and grass ranges on the basis of winter food availability. Browse ranges predominate in the heavily forested areas of western Montana. There is a gradual transition in plant composition from western browse ranges to east slope grass ranges. Major forage plants on browse winter ranges are willow, *Ceanothus*, maple, serviceberry, chokecherry, and sedges. These plants occur in greatest quantity on burned-over areas, where the forest canopy is absent or sparse. Elk populations thrive best during the shrub stages of plant succession. Elk numbers decline as coniferous trees invade the old burns and replace browse and herbaceous plants. Major forage plants on grass ranges are Idaho fescue,

bluebunch wheatgrass and rough fescue. These desirable grasses are reduced by over-grazing and are replaced by undesirable plants on continually overused ranges.

Elk can deplete their forage supplies by prolonged excessive use on either a browse or grass range. The end result is a reduced population. Extreme chronic overuse will eventually cause destruction of plant cover and loss of soil. Three chronically deteriorated elk winter ranges developed before 1940 and have persisted to the present time. They are in the South Fork of the Flathead, the Gallatin and the Yellowstone. Other winter ranges in the state have either improved or remained in relatively good condition, although livestock grazing problems exist on some.

Logging may favor the growth of forage and increase elk carrying capacity when it occurs within the winter range zone. Unfortunately, much of the timber cutting occurs at higher elevations. Lodgepole pine clear-cutting in the Little Belt Mountains created forest openings for elk on summer ranges, but provided no improvement to critical wintering areas. Timbered areas which are potential elk winter ranges occur mostly west of the divide. Studies have begun to determine the effects of logging and roads on elk ecology and to provide guidelines aimed at making timber harvest practices more compatible with elk management.

Elk breed in September and October. During this period, the musical bugling of the bulls provides a thrilling experience to back-country visitors. The calves are born in late May and early June. Reproduction varies considerably in relation to habitat conditions. Production and survival of calves is higher on good ranges than on poor ones. An elk is capable of breeding as a yearling and of producing a calf when about 2 years old, but most do not breed until they are 2½ years old. Mature cows usually produce a calf every year. Twins are very rare. Winter ratios of about 50 calves per 100 cows indicate adequate reproduction and survival of the calf crop. Elk populations which are chronically low producers include the South Fork of the Flathead herd, the Gallatin, and the Sun River herds. The northern Yellowstone

Table 1. Summaries of elk winter food habits on eight Montana winter ranges.

Area	FORAGE CLASS				
	(percent)				
	Browse	Grass	Forbs	Major browses	Two major grasses
Bitterroot-Selway	25	65	Tr.	serviceberry chokecherry	Idaho fescue bluebunch wheatgrass
Flathead	60-90	10-40	Tr.	mountain maple willow	Idaho fescue
Gallatin	23	69	8	big sage horsebrush	bluebunch wheatgrass Idaho fescue
Gravelly Range	7	90	3	big sage horsebrush	bluebunch wheatgrass Idaho fescue
Little Belts	6	88	7	Kinikinnick Oregon grape	Idaho fescue bluebunch wheatgrass
Missouri Breaks	5	91	4	big sage Rocky Mountain juniper	western wheatgrass Sandberg bluegrass
Moiese Bison Range.....	Tr.	100	Tr.	fringed sage	Idaho fescue
Sun River	10	85	5	horizontal juniper	rough fescue

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herd, prior to 1961, also showed low production. Since reduction of this herd, range conditions have improved and calf production has increased. In recent years, inadequate harvests have suppressed calf production in segments of the Sun River herd. Table 2 shows production ratios for several elk herds.

Table 2. Cow: calf ratios from seven Montana elk herds.

Area	AVERAGE RATIO		
	Cows	Calves	Range
Bitterroot.....	100	54	100:43-73
Flathead.....	100	25	100:18-31
Gallatin.....	100	30	100:24-35
Gravelly Range.....	100	61	100:58-65
Little Belts.....	100	54	100:51-58
Missouri Breaks.....	100	53	100:47-60
Sun River.....	100	31	100:25-40

On poor winter range, elk production varies with the severity of the winter. During a series of mild winters, calf production and survival may be nearly three times as high as during a series of severe winters. Such drastic fluctuations have not been noted in herds which are in balance with their winter forage. Cows with

Elk reproduce more slowly than deer. Single calves are the rule and most cows do not breed until they are 2½ years-old. More calves are produced and survive on good condition ranges where some cows begin breeding as yearlings. — (Photo by Gerry Atwell)

adequate forage are able to carry a viable calf to term, and suckle it through the first precarious weeks of life. When winter forage is chronically inadequate, the survival of calves is lowered.

In areas where deer and elk compete for the same supply of winter forage, the elk have been able to maintain or increase numbers at the expense of deer. This phenomenon has been observed in the Gallatin, Yellowstone, Bitterroot, and other ranges. Despite the higher reproductive potential of mule deer and white-tailed deer, the elk is better able to survive in winter. Elk are larger and can reach higher for forage, paw through deeper, crusted snow, and can utilize both grass and browse. Bighorn sheep also compete with elk in the Gallatin and Yellowstone for winter forage.

Elk-cattle competition often exists in areas used by elk in winter and cattle at other seasons. Special studies of elk-livestock competition have been conducted in the Gravelly Range, Elkhorn Mountains, Bitterroot, and Lima Peaks areas. Elk graze mostly on flowering plants in summer and switch to grasses or browse in fall. Cattle are primarily grass eaters all year long. If winter ranges were properly used by both species, forage competition would be slight. Cattle tend to use the stream bottoms and gentle slopes while elk use the higher slopes and ridge tops. In actual practice, however, ranges are often overstocked and cattle move onto the higher slopes and ridges for forage. Range managers often develop springs and establish salt grounds on ridges and slopes to further induce cattle to use these areas thereby increasing competition with elk. Conflict of elk with ranching interests occurs where elk descend onto private land in winter or spring and use forage ranchers need for their livestock. Elk-sheep competition may occur on areas where both species graze in summer on weedy plants, or on winter ranges where both graze grasses and browse.

MANAGEMENT

Early objectives of elk management were to protect remnant herds of elk to allow them to increase. Game preserves, closed areas and restrictive hunting regulations helped accomplish this purpose.

A transplanting program re-established elk herds in suitable areas from which they had been eliminated. More than 6,000 elk have been transplanted into Montana areas since the first release in 1910. From 1941 to 1970, 4,140 elk were transplanted. Most of these were trapped and hauled from Yellowstone Park. As elk populations increased, emphasis shifted from protecting elk to managing them in relation to other resources. The number of game preserves and closed areas was gradually reduced. At present the existing preserves have little influence on the status of elk in adjacent areas. Preserves are no longer needed since elk populations can be manipulated by flexible hunting regulations. Hunting seasons have generally been liberalized. Much of western Montana has relatively long either-sex seasons. These are necessary to achieve adequate harvest in rough, heavily-timbered country. Bull seasons, short either-sex seasons, and controlled permit hunts are used to regulate the harvest in easily accessible areas.

Elk habitat was created by natural processes including fire and plant succession. Man's activities such as agriculture, grazing, and forestry have modified natural

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habitat. These changes have sometimes been favorable, and sometimes unfavorable to the elk. There has been little deliberate development of habitat for elk. Certain areas have been reserved for exclusive grazing by game. Proper timber harvest and controlled burning can be used to improve elk habitat in winter range areas which are reverting to dense forest. Indiscriminate logging may unfavorably disrupt key habitat.

Salting was advocated between 1941 and 1955 as a means of improving the distribution of elk and alleviating problems of range overuse. Salt blocks were dropped by air and distributed by pack-horse throughout much of the elk range. Intensive evaluation of the program indicated salting was not accomplishing its objective and the practice was discontinued.

The problems of winter range and overuse of forage by elk are not limited to public lands. Elk often graze private ranges and damage haystacks and fences. In some cases the Department is faced with the choice of either eliminating the elk or providing winter range for them. Land for elk winter range was purchased by the Department in several critical areas after Pittman-Robertson funds became available in 1941. The Sun River and the Blackfoot-Clearwater Game Ranges were the first winter elk ranges acquired. Land acquisition of winter elk range has progressed slowly because of financial and political limitations. A total of about 63,000 acres in ten different areas has been purchased at a cost of approximately one million dollars through 1969.

Each area presently supports several hundred elk over the winter and will continue to do so indefinitely. Each area was a one-time purchase; an investment which permanently improves the situation for elk. Grazing rights have been leased on some additional acreage. The future of elk hunting in many areas will depend upon additional purchase of key winter ranges.

Elk have been the subject of scientific studies since people became concerned about the welfare of the Yellowstone herd in the 1920's. W. M. Rush conducted an investigation of the status and life history of the northern Yellowstone elk population to allow range recovery. Rush recommended hunting under a limited permit system to control the herd.

The U. S. Forest Service initiated winter studies of big game in Montana in the 1930's. These surveys provided much inventory information to be used as a basis for elk management. The Montana Fish and Game Commission initiated big game surveys in 1941. The first studies were patterned after the earlier Forest Service work, and were often conducted on a cooperative basis. These surveys continued on important elk ranges until 1955 when the Department undertook elk surveys on a district basis. Establishment of wildlife curriculums in the University System, publication of *The Elk of North America* by Olaus Murie in 1951, and interstate elk workshops stimulated elk investigations. Research projects provide basic information needed for proper management of elk on such subjects as food habits, competition, movements, life history, behavior and habitat requirements.

The continuing goal of elk management is to adjust elk populations to forage supplies. Elk herds that are too large for the available winter range destroy natural food plants and frequently damage private property. A major problem in elk management is to achieve annual harvests needed to adjust the number of animals to

Knowledge of elk movements and migrations is important for successful herd management. Elk calves were tagged on the spring range and tag returns from hunters indicated herd movements and distribution during the fall. — (F & G photo)

A number of present day Montana elk herds were established from transplanted elk. Transplanting is no longer an important program in the State. Elk now occupy nearly all suitable range and are distributed in all regions where they can thrive. — (F & G photo)

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their forage supply. Adequate harvests are often difficult to achieve because of opposition by misunderstanding groups of the public. There is great need for an improved public understanding of the basic goals of elk management and the specific action needed to attain them.

Winter feeding of elk is often the basis for heated discussion and controversy. At first glance, it would appear to be a simple solution to a simple problem—"The animals are starving; let's feed them." When all aspects are considered, however, the problem is complex and the solution anything but simple. When heavy winter mortality occurs, it is but a symptom of a much more serious problem—insufficient winter range for the number of animals. Feeding only compounds the problem by attempting to carry even more surplus animals. Not only is an annual feeding program under these circumstances extremely expensive, but it does not solve the problem. At best, feeding attempts to maintain the status quo with no intention of habitat improvement or increasing elk numbers. Often, the situation deteriorates. A

1924

About 50 years-ago good stands of willow browse occurred along the West Gallatin River bottom near Black Butte on critical elk winter range. Termination of livestock grazing in the upper Gallatin began as early as 1908.—(F & G photo)

1949

Heavy grazing by elk had reduced willow browse by 1949. The trees are highlined and less browse occurs in the foreground. Browse was heavily used during the winter when other forage was in short supply. —(F & G photo)

good example is the elk herd at Jackson Hole, Wyoming, where after 50 years of intensive (and expensive) winter feeding, the elk herd is considerably smaller than it was when feeding began.

Chronic elk problems still exist in some areas of Montana such as in the northern Yellowstone, the Gallatin, Sun River, Bitterroot, and Flathead. Other herds have a problem potential which is kept under control only by adequate annual hunting harvests.

Recommendations for hunting seasons are based upon the results of annual surveys conducted by Department biologists assisted by other personnel. Range surveys are an important part of this work. Browse and grass plants on established sample units of winter range are examined each year. The condition of the plants and the degree of annual use by game are recorded. Population surveys of elk are made each year by aerial trend counts and sex-age classified counts. Aerial counts must be interpreted with care since they are rarely total counts, and are greatly

1961 Willow stands continued to deteriorate under heavy browsing pressure. Soil erosion caused by overgrazing and trampling is evident as foreground rocks are bare. Even trees have been killed by browsing. — (F & G photo)

1969 Herd management has improved range conditions. Elk harvests were increased in the mid 1960's and better winter distribution of elk allowed some recovery in browse condition along the river bottom. — (F & G photo)

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influenced by weather and other variable factors. Harvest surveys to determine the number of elk killed by hunters are made chiefly by mailing questionnaires to a random sample of license buyers. Checking stations provide a means of collecting biological information and obtaining harvest trends in certain areas.

HUNTING AND HARVEST

A trend toward more liberal hunting regulations during the past 25 years has occurred in Montana as elk populations increased and spread. Either-sex seasons more than 2 months in duration are allowed in remote or heavily forested areas. These areas have opened in September to encourage recreational pack and camp hunting trips during the period when bulls are bugling.

The number of elk hunters increased between 1946 and 1955. Since 1955 the number of hunters has fluctuated between 50,000 and 80,000. The majority of resident big game hunters, as well as a growing number of non-resident hunters, hunt elk. Total hunters are expected to increase.

Table 3. Montana elk harvest data — statewide, 1941-69.

Year	Resident Licenses	Non-resident Licenses	Estimated Hunters	Estimated Harvest	Percent Success
1941	46,478	481	*	*	
1942	47,899	339	*	*	*
1943	46,892	374	*	*	*
1944	45,335	479	*	*	*
1945	52,694	1,085	*	*	
1946	74,316	2,907	*	10,000	*
1947	71,819	954	*	7,600	*
1948	77,390	1,074	*	9,600	*
1949	79,329	754	*	9,500	*
1950	87,261	897	*	11,300	*
1951	100,740	1,245	*	10,800	*
1952	116,566	1,615	*	6,400	*
1953	117,984	1,607	55,000	13,200	24
1954	121,712	1,547	51,540	13,400	26
1955	124,932	2,180	55,380	16,000	29
1956	121,026	2,974	50,870	11,700	23
1957	118,235	3,374	55,650	12,800	23
1958	121,019	3,923	53,040	12,200	23
1959	118,649	4,088	63,180	13,900	22
1960	120,040	4,279	56,320	10,100	18
1961	121,629	4,541	61,470	15,500	25
1962	122,659	5,537	69,710	12,200	18
1963	122,291	7,183	66,620	11,100	17
1964	86,171 ^{1/}	8,114	56,900	11,300	20
1965	84,146	7,615	42,350	7,700	18
1966	91,240	9,268	55,110	13,400	23
1967	75,391 ^{2/}	7,491 ^{2/}	71,880	14,500	21
1968	81,159	7,165	76,190	16,000	21
1969	75,374	8,612	73,848	12,100	16

* No data available.

¹ The license system was changed in 1964 to allow the purchase of an elk license separate from deer license.

² The cost of an elk license was increased in 1967.

ELK

The statewide elk harvest was less than 10,000 prior to 1950. Since 1950 the harvest ranged between 10,000 and 16,000 except during the 1952 and 1965 season (Table 3). Although northwestern and southwestern Montana formerly produced a major portion of the statewide elk harvest from the Yellowstone, Gallatin, Sun River, and Flathead herds, west-central Montana has recently become a major elk-producing district of the state.

Growing human population is expected to subject elk to increased hunting pressure, while developments such as roads, industries, and housing projects will encroach upon existing elk ranges. These pressures will probably necessitate closer regulation of hunting. Either-sex seasons will likely be shortened, and the harvest of antlerless elk may eventually be restricted to limited permit seasons.

FUTURE OUTLOOK

Demands of intensified, multiple-use of land will require allotment of forage and land acquisition, to resolve conflicts of elk with agriculture, grazing, and for-

The elk is a large, highly prized game animal pursued for its large trophy antlers and its palatable meat. With sound management, the opportunity to hunt elk can remain an important part of the Montana scene. — (F & G photo)

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Elk management is the perpetuation of maximum breeding stock in suitable habitat, compatible with other land use. Elk require critical winter range which, in some key areas, is provided by Department game ranges. — (F & G photo by Bob Cooney)

estry. Manipulation of timber stands to produce elk forage on western Montana winter ranges may improve conditions for elk. There is no doubt that habitat acquisition programs will pay greater dividends than the “self-defeating” feeding programs used in some other states. Only through proper management can we expect to increase the number of elk and the recreational opportunity for the Montana sportsman.

Elk are now well established in Montana so transplanting to establish new herds will not be important in the future. However due to policy, law, and the need to regulate their numbers in Yellowstone Park, elk will probably continue to be available for transplanting. Other solutions to this problem should be sought because transplanting elk for hunting is not economically or biologically sound.

The distribution of elk cannot be increased appreciably, but more intensive management of the species and its habitat should allow maintenance or even a somewhat increased crop to be harvested for recreation. The value of elk will likely increase because of the limited supply.

The elk is a magnificent game animal. With sound management, the opportunity to hunt, view and hear elk in their natural habitat can be an important part of the Montana scene indefinitely.

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MULE DEER

By J. Egan

Mule deer (*Odocoileus hemionus*) have been an important big game animal in Montana as far back as records exist. The popularity of this native deer among the Indians might be ascribed to the fact the meat, fresh or cured, is very palatable; the hide was used to make buckskin, and even the bones and antlers made useful implements.

The early explorers, fur trappers and settlers also used and depended on the mule deer as a source of food and clothing. The hides were even used as legal tender (\$.50 per hide) in parts of Montana just before the turn of the century.

Lewis and Clark can be credited with writing the first detailed account of mule deer habitat requirements. There is evidence that Lewis coined the name, "Mule Deer," when he stated, "We have rarely found the mule deer in any except rough country. They prefer the open grounds and are seldom found in woodlands or river bottom."

Although the early explorers and pioneers were vague in describing the abundance and distribution of mule deer, their journals, as well as Indian legend and lore, indicate they were found in nearly all parts of the land that later became Montana. During the early part of this century, deer were an important food item to homesteaders. Presently, the mule deer is no longer a food necessity of most Montanans, but it has become their number-one big game animal. Many thousands of dollars are spent annually by residents and nonresidents in pursuit of mule deer.

In the Lewis and Clark journals, some attention was given to the kinds and abundance of wildlife along the expedition's route of travel, but there is little indication of game abundance outside this route. Many of their references to mule deer were made while the party was in eastern Montana, leaving an impression that they were more common in the prairies than in the mountains. The journals also

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point out that on several occasions the expedition's hunters came back to camp empty-handed, even in eastern Montana.

Mule deer distribution in 1941 is shown in Figure 1. Compared to a description of 1910 "hunting grounds" (1913-1914 Biennial Report) there appears to have been some expansion in the distribution pattern, particularly in eastern and northern Montana. Mule deer numbers apparently have fluctuated considerably during the past six or seven decades. Population peaks reportedly occurred in the late 1880's, the early 1900's and the late 1920's in southeastern Montana. The reported peak of the late 20's was of small magnitude and was preceded by a period when many residents considered the deer extinct. During the mid-30's and early 40's mule deer were generally scarce in most of Montana except in some western Montana locations.

By 1950, mule deer were present in all parts of the state. In many areas, they were so numerous they damaged their winter ranges and agricultural operations. The major concentrations were in the same areas where deer had been reported in prior years. Since 1950 there has been little change in the distribution pattern; mule deer are still present in all parts of the State (Figure 2).

There are many indications that the peak mule deer populations which began in the late 40's and extended into the late 50's and early 60's were greater than has occurred in the past hundred years. However, there apparently has been considerable change or fluctuation in numbers of deer during the past hundred years in various areas throughout the State.

Thus, during the period 1941-69, mule deer not only increased in number, but also expanded in distribution over the entire State, with peak numbers and distribution being reached around 1950-55. There has been little change since.

Today there are few areas in Montana, either from the standpoint of topography or vegetation, where mule deer cannot be found. They occur more than just casually from Yaak to Alzada and from Monida to Westby and on almost every square mile in between. They are found at all elevations from under 3,000 feet on sagebrush flats in eastern Montana to over 8,000 feet in western Montana. They seem to be equally at home in the ponderosa pine forests of southeastern Montana and the spruce forests of northwestern Montana. River bottoms, badlands, high mountains and rolling foothills are all home for the mule deer.

All wild animals need specific kinds of food and cover, and the mule deer is no exception. In late spring, summer, and early fall, certain weed type plants are a necessity in the mule deer's diet. Leaves and twig ends of certain bushes are also eaten. With the approach and arrival of winter, the mule deer shifts almost entirely to specific types of brush for food. As new green growths of weeds appear in the spring, deer begin to use them. Also at this time deer use some grass. Food habit studies have shown beyond any doubt that grass is not used extensively by mule deer. Browse and weeds (forbs) are the mule deer's primary food. In Montana, the quality and quantity of browse (the winter food supply) is the factor most often limiting deer numbers. The list of plants that must be present in a healthy condition for a large deer population varies only slightly from one end of the State to the other. The main browse plants are mountain mahogany, bitterbrush, chokecherry, serviceberry, common and creeping juniper, mountain maple, evergreen and red

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Fig. 1. MULE DEER DISTRIBUTION – 1941.

Fig. 2. MULE DEER DISTRIBUTION – 1970.

stemmed Ceanothus, big and fringed sagebrush, silver sagebrush, skunkbrush, rabbitbrush and dogwood. Several other browse plants may be used under certain conditions. The above named plants constitute only a small part of the total number of brush-type plants that grow in Montana, indicating that not all brush is good deer food. When good browse plants are overused, as on many Montana

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ranges, deer are forced to eat unpalatable plants which do not provide adequate nutrition to maintain healthy, productive animals.

In a general way, it can be said that mule deer prefer a rather open type country containing an adequate supply of the food plants mentioned, interspersed with an escape cover of moderate to heavy timber, aspen groves, brushy draws and coulees, or the "breaks" type country found along the Missouri River and the badlands of eastern Montana. Fawning areas are usually a fairly dense stand of brush or trees such as chokecherry, aspen, fir, willow, alder, juniper or sagebrush. Although mule deer are quite adaptable, they are still products of and dependent upon, their environment or habitat. It is biologically impossible to divorce deer, or any animal for that matter, from its habitat. The quality and quantity of the habitat strictly controls the quality and quantity of deer. The status or changes in a deer population are therefore merely the results of the status or changes in the habitat. No assessment of deer can be made without assessing the habitat.

Because habitat is comprised largely of vegetation, soil and water, with weather acting as a catalyst, change is usually a slow process, often unnoticed. Few people have neither the time nor inclination to properly assess what is happening or what has happened to the deer's habitat. The death of a plant or the complete extermination of a plant species on a deer range simply does not generate the public interest as does a declining deer population. But it is by far the most important.

The widespread deer population of the late 40's and early 50's was the result of certain habitat changes that began much earlier. Extensive grazing and farming operations over nearly all of Montana beginning in the 1900's influenced vegetation changes from grasses to forbs. The several droughts during this period left many plowed fields abandoned. Sheep and cattle prices declined, horses were replaced by the tractor. Vast areas of western Montana, denuded of trees by the great fires of the late 1800's, 1910, and 1919, were revegetating with shrubs, thereby providing more food for deer. These various situations laid the foundation for extensive increases in deer habitat. In addition, water supplies in the form of impoundments and spring developments were established by the Civilian Conservation Corps and others. The reduction of the coyote and other carnivores prior to 1940 may have had an influence. Then around 1940, two things happened that may have triggered deer numbers upward, World War II and rain. Hunting was curtailed and the drought of the 30's ended. By 1949, it was apparent that Montana had deer, and lots of them.

Before Montanans could be convinced that it was not a sin to shoot does and fawns or bucks with antlers less than 4 inches, the prolific muleys ravished nearly every winter deer range in the State. Either-sex deer seasons were inaugurated primarily because of the damage to haystacks, alfalfa fields, gardens and assumed competition with livestock. The either-sex seasons came too late; the damage to the winter deer ranges had already occurred. Montana was repeating the sequence that happened in the Kaibab of Arizona between 1900 and 1930. It was also occurring in Wyoming, Colorado, Utah, Idaho, and California. The sequence is as follows: During the era of the "good old days" of explorers, mountain men and pioneers, it was assumed there were inexhaustible numbers of deer, but with settlement and

The mark left by mule deer on haystacks indicates that Montana has deer problems. The area behind the haystack is typical deer habitat. The timber and rough terrain provide escape cover from the feeding sites on the lower foothills and open stretches of ground. When haystacks occur in this situation, high fences or panels are needed to keep deer out. —(F & G photo)

changes in habitat, deer numbers were greatly reduced. This was followed by a period of low deer populations due to depletion of habitat; then when favorable conditions occurred, the deer increased. When it becomes apparent that deer are numerous, there is so much resentment against liberalizing hunting seasons that the deer populations eat themselves out of house and home, resulting in a collapse of the herd.

People seemed tied to a deer numbers philosophy, habitat being some unrelated scientific term. It is impossible to accurately count deer numbers, but it is possible to measure the habitat and the effects of good habitat in terms of deer health. It has been repeatedly shown that mule deer does on poor range may have a reproductive rate of only 25 percent, while does on good range can and generally do have a reproductive rate of 75 percent. In terms of hunting potential, 75 fawns: 100 does is far superior to 25:100. Reducing the doe population by half still means 37+ fawns:50 does. Survival and condition of deer on poor range, especially the fawns, is not good. Those on a healthy range are bigger, thriftier, the bucks have bigger antlers and the deer are just better animals in every respect.

At the present time, the major winter deer ranges in Montana are in very poor

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condition, and some are so badly deteriorated they may be beyond recovery. We are not going to "run" completely out of deer, but unless Montanans quit thinking solely in terms of numbers of deer and become oriented to a habitat management philosophy, deer hunting will get worse instead of better.

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Mule deer management must be defined with respect to time. There was absolutely no need for regulations or a management program during Lewis and Clark's time. There were no fences, no wheat fields, no superhighways, no logging, none of the products of our present complex society. There were undoubtedly build-ups and die-offs of mule deer before 1850. If a winter range was completely demolished, the 50 or 100 years necessary to again become productive was a meaningless term.

From about 1810-80, early settlers felt there was no end to the grass, minerals, timber, water and space that spread out before them, even though the fur industry was nearly over by 1850. Between the 1860's and 1880's many people came to Montana. Some were seeking gold, some brought livestock. Many sawmills and smelters were built. The influx of people, and their activities, brought about great changes in the territorial landscape. The exploitation of that landscape, of which the mule deer was a product, reached a magnitude almost beyond comprehension. Creek bottoms in the gold fields were literally turned upside down. Willow bottoms were replaced with gravel piles. The prairies of eastern Montana were fenced, plowed and intensively grazed. Horses, cows and sheep were to be found in nearly every corner of the territory. Entire hillsides were indiscriminately logged off to supply wood for the gold and silver furnaces.

The use of venison as food, and buckskin for clothing, by these early settlers probably had some effect on deer numbers, but this effect was not as far-reaching and of the magnitude that resulted from the extensive alteration of the mule deer's habitat.

By 1890, there were a few people interested in the welfare of game in Montana. The first Board of Game and Fish Commissioners, established by legislative enactment, took office in March, 1895. The big game season, as set by this Board, was open from Sept. 1-Jan. 1, with a limit for each hunter of eight deer, eight mountain sheep, eight mountain goat and eight antelope. With the appointment of W. F. Scott, the first State Game Warden, on April 1, 1901, and the formation of a Fish and Game Department, more attention was directed to hunting seasons in Montana. In 1903, the deer season was open from Sept. 1-Dec. 1, with a bag limit of three deer. From 1904-11, the deer season varied from Sept. 1-Dec. 1, and from Oct. 1-Dec. 1, with a bag limit of three deer. In 1907, the season was open from Sept. 1-Dec. 15. In 1913, the deer season was held from Oct. 1-Dec. 1, and the bag limit was three deer, but only one could be a doe, and taking of fawns was illegal. During the 1917 deer season (Oct. 1-Dec. 1), hunters were limited to one deer per person, with most of eastern Montana closed to deer hunting.

After 1920, deer seasons became even more restrictive. In most areas of the State, bucks were the only legal deer. Many counties, particularly in eastern Montana, were closed entirely to deer hunting. By the mid-30's, the regular deer season

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was Oct. 15-Nov. 15, a legal deer was a buck with antlers no less than 4 inches in length, many counties were closed, and the State Legislature was setting the season.

The great drought of the 1930's resulted in much national and state conservation legislation. People in Montana voiced concern over declines in wildlife, including deer. Many preserves were established, hunting was curtailed and deer transplanting suggested. Between 1941-56, more than 1,300 mule deer were trapped and transplanted in the State. This program was designed to increase the lagging deer population of the 30's. Although many of the deer were not transplanted until around 1947-50, it is likely this postwar segment of the program only hastened along the natural deer increase that was already underway.

Early deer management centered around "how many deer" and "how many are being killed (by hunters, predators, poachers, etc.)." This philosophy remained in affect until after World War II, even though guidelines for managing game based on habitat were available from many sources. Aldo Leopold, in his book, *Game Management*, published in 1933, stated:

"History shows that game management nearly always has its beginnings in the control of the hunting factor. Other controls are added later. The sequence seems to be about as follows: 1. Restriction of hunting. 2. Predator control. 3. Reservation of game lands (as parks, forests, refuges, etc.). 4. Artificial replenishment (restocking and game farming). 5. Environmental controls (control of food, cover, special factors and disease)."

Montana, by 1940, had followed the first three of Leopold's "sequence" almost to the letter, and had made attempts at the fourth.

It is interesting to note the following statements in the Montana State Fish and Game Commission 1935-1936 Biennial Report:

"In many cases the big game populations are limited entirely by the extent of the winter range." "To many people, the idea of wildlife management means only game wardens and closed seasons . . . bounties on coyotes and cougar . . . and game preserves closed to hunters . . . but years of experience now indicate that modern wildlife management includes a far broader field of endeavor. It comprehends such problems as maintaining and improving the environment of the animal, maintaining a proper balance between numbers and the available feed, securing desirable utilization, as well as making provisions for a continuous supply."

Following World War II, Montana began to expand its Fish and Game Department. Participation in the Pittman-Robertson program made funds and manpower available. The initial programs concerning mule deer involved the transplanting program, the use of salt in an effort to increase and distribute deer, and "deer counts." The transplanting program lasted only a short time, and a thorough analysis of the salting program soon proved it of little value. By the early 1950's, it was apparent that deer were overusing their winter ranges in many areas, and the value of the "deer counts" was questionable.

The variations in numbers of deer observed during deer counts on successive

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days was as great as 300 percent, and it was impossible to determine whether 10 percent or 90 percent of the actual number of deer in a given area had been seen. At the same time, it became obvious to the Department that there were too many deer. The key forage plants on the winter range began to show overuse and produce less growth for deer food. With less food available in winter, deer declined. The Department developed a program to inventory winter deer ranges. Methods were developed or modified from those used by other states to determine the condition of the key forage plants, the number and extent of deer ranges in trouble and the condition of the deer using them. The decline in the number of fawns produced, the general health, and antler size was noted for specific deer herds. Deer counts, used in attempts to determine actual numbers of deer per area were discontinued. Aerial and ground surveys were increased to determine the number of fawns per doe (reproductive rates) and distribution and movement patterns with respect to specific winter ranges.

Studies were initiated to determine food habits of mule deer by season and locality. By the mid and late 1950's, the Department's Game Management Division developed and was capable of approaching the mule deer situation with an ecological viewpoint. An overbrowsed winter deer range means that the surplus deer will be reduced by starvation, disease or in some manner designed by nature.

When you invest in poor deer management the "interest" can come in the form of wasted deer. These deer carcasses were gathered in the spring from a deteriorated winter deer range. These deer were "saved" from what is often referred to as "slaughter" type two-deer either-sex hunting seasons. They starved to death instead. — (F & G photo)

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In some instances, the numbers involved were not enormous, but a deteriorated range means too many deer whether there are 50 or 5,000 deer. The most desirable method to reduce the various deer populations was by hunter harvest. Two-deer, either-sex seasons and the use of the special nonresident deer license was employed. Even though this was done on nearly a statewide basis for several years, the winter ranges continued to deteriorate.

G. F. Cole, in a Department bulletin stated:

"The primary reason that increased harvests have failed to keep deer populations within the limits of their food supply is that Montana simply does not have enough hunters. Even the 100,000 or so hunters in recent years appear to have little effect on present deer populations. This is somewhat understandable when we realize that we have deer spread over a 146,000 square mile area."

So Montana has deer to the extent they are detrimental to themselves in that they are overusing the winter ranges, but not enough hunters to reverse the downward trend. Any animal, wild or tame, facing a tough Montana winter without adequate food is in trouble. Artificially feeding deer either a prepared ration, alfalfa hay, or cut browse is often suggested and has been tried. It has been tried in Montana, Wyoming, Colorado, Utah, Idaho, and nearly every state where mule deer

A successful deer hunt is like shooting browse baled in a deer hide. This browse will not produce much of a deer hunt. If this degree of over-use is allowed to continue, hunting will become poorer, not better. People rarely get alarmed at the loss or condition of the deer's winter food supply, but it dictates whether or not a hunt will be successful. — (F & G photo)

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starved because they over-ran their natural food supply. The following excerpt listed under the heading *Impractical Management Suggestions* is taken from "The Jawbone Deer Herd" published in 1951 by the State of California:

"It frequently is proposed that starving deer be fed supplementary rations. Repeated experiments with artificial feeding in many deer states have led invariably to failure and abandonment. In the first place the cost is excessive. To distribute feed in all the home ranges of Jawbone deer, or even a fair portion of them, would be most expensive. What is of more importance, no supplementary feed has yet been found which will winter more deer than the natural browse can support. Careful experiments in Utah showed that feeding even the best supplement did not pull through the winter any more animals than survived on unfed ranges. Deer died with bellies full of alfalfa. The reason for this is not known — perhaps it relates to specific processes of protein digestion which adapt the deer to a diet dominated by certain types of succulent browse. In the vicinity of Pacific, along the American River and near Salt Springs Reservoir on the Mokolumne River north of the Jawbone area, local sportsmen conscientiously fed alfalfa to the deer on a badly overgrazed and grown-over winter range. The deer died anyway. In our present state of knowledge there seems to be no future in artificial feeding.

"Many attempts have been made to achieve better distribution of deer on winter ranges by salting. After 3 years of salting around the traps of Jawbone Ridge, we are of the belief that salt attracts only the deer in whose home ranges it is placed. No evidence was obtained that salt induced any general re-distribution of the animals.

"Trapping surplus deer and moving them to other ranges has been tried in several places in California. The expense of trapping and moving deer varied from \$30 to \$80 per head. Since the average annual surplus on the Jawbone area alone is 1,400 deer, the impracticality of this approach to herd control is obvious. Likewise understocked ranges to which the animals could be moved are rare in this state."

Montana has even employed late winter hunts in an effort to bring deer into balance with their range. Such seasons were often met by much public criticism. The mule deer management program in Montana has reached an "hour of decision." We must in some manner reduce deer to the extent the ranges can recover.

HUNTING AND HARVEST

The history of deer seasons has been discussed. Table 1 lists Montana deer harvest (mule deer and whitetail) from 1941-1969. The figures illustrate a condition very similar to that of our neighboring states. The "buck law" of the 30's and 40's resulted in few deer harvested and instilled in the minds of many that shooting does and fawns was sinful.

The re-establishment of doe seasons in 1950 and 1951 gave more people an opportunity to hunt and take deer. The hunter was also using surplus deer instead

Table 1. Montana deer harvest, 1941-69.

Licenses sold										
Year	Resident	Nonresident Big Game	Nonresident Deer	Total	Number Deer Hunters	Estimated Deer Harvest	Percent Hunter Success	Percent		
								Mule Deer In	Harvest	
1941	46,487 ¹	481 ¹		46,968 ¹						
1942	47,899	339		48,238						
1943	46,892	374		47,266						
1944	45,335	479		45,814						
1945	52,694	1,085		53,779	50,000 ¹	19,500	39		75	
1946	74,316	2,907		77,223	70,571	24,700	35		77	
1947	71,819	954		72,773	66,368	25,600	38		71	
1948	77,390	1,074		78,464	73,750	29,500	40		79	
1949	79,329	754		80,083	75,348	32,400	43		74	
1950	87,261	897		88,158	86,832	38,300	44		77	
1951	100,704	1,245		101,985	98,870	39,000	40		75	
1952	116,566	1,615		118,181	115,230	53,800	47		76	
1953	117,984	1,607		119,591	106,630	80,000	76		77	
1954	121,712	1,547		123,259	112,000	84,300	75		74	
1955	124,932	2,180	2,623	129,735	114,500	100,000	87 ³		78	
1956	121,026	2,974	6,445	130,445	110,500	100,500	91 ⁴		83	
1957	118,235	3,774	5,038	127,047	120,000	134,600	112		75	
1958	121,019	3,923	7,533	132,475	115,130	116,000	100		75	
1959	118,649	4,088	9,291	132,028	119,870	120,300	100		78	
1960	120,040	4,279	12,042	136,361	122,490	123,500	101		83	
1961	121,629	4,541	13,047	139,361	125,010	129,100	103		79	
1962	122,659	5,537	7,860	136,056	126,740	125,700	99		83	
1963	122,291	7,183	10,505	139,979	124,565 ²	119,095	96		80	
1964	121,163	8,114	10,058	139,335	113,990	107,366	94		79	
1965	121,262	7,615	9,631	138,508	109,828	90,141	82		75	
1966	125,215	9,268	6,028	140,511	106,180	98,104	92		73	
1967	139,201	7,491	4,439	151,131	115,185	88,640	77		75	
1968	158,753	7,165	5,106	171,024	125,711	99,250	79		73	
1969	150,879	8,612	7,850	167,341	128,180	102,800	80		77	

¹ Includes both elk and deer licenses.

² Deer hunters only, 1963 to 1969.

³ Some two deer areas.

⁴ General two deer areas.

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of permitting them to be wasted. Unfortunately, the either-sex seasons, the two-deer seasons, and the use of the nonresident special deer license as employed did not solve the problem. If hunter harvest is to be used in the future as a method to bring deer into balance with the range, it will have to be expanded considerably beyond the framework that existed a few years ago. The number of deer harvested per 100 hunters will have to far exceed the 112 experienced in 1957.

Mule deer are products of and dependent on the environment in which they live. Whether or not this deer survives the winter depends completely on the health of plants.—(F & G photo)

Table 2. Montana Big Game License Sales and Human Population for Selected Years Between 1900 and 1970.

Year	Human Population	License Sales ¹		Percent of Resident Population Buying Big Game Licenses
		Resident	Nonresident	
1900.....	234,330			
1910.....	376,053			
1913.....		64,337	237	
1915.....		67,792	206	
1916.....		69,466	251	
1917.....		72,113	102	
1918.....		42,744	31	
1920.....	548,890			
1930.....	537,600			
1934.....		27,760	69	
1935.....		29,779	81	
1940.....	559,460	38,943		
1950.....	591,000	88,774 ²	897	15
1960.....	674,770	120,040	16,321 ³	18
1970.....	694,409	150,879	16,462	22

¹ Includes deer and elk licenses.

² Includes 1,513 special deer licenses.

³ Includes 12,042 special nonresident deer licenses.

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In 1961, some 129,000 deer were harvested in Montana (Table 1), when about one out of every five Montanans hunted deer (Table 2). All information shows, however, that the majority of Montana's hunters do not harvest a second deer. Today, the average Montana hunter can get a deer, and in most cases, with a minimum of effort.

FUTURE OUTLOOK

Though Montana's deer ranges are not now producing maximum deer numbers because of deterioration, there seems to be enough to meet the demands of the people. But unless the situation is improved, deer hunting will not remain static nor will it improve; it will get worse. Ranges are still deteriorating, and unless this trend is reversed, there will eventually be less deer than there are now. At that level, there won't be enough deer for Montanans. If the trend of increasing deterioration of deer ranges is to be reversed, enough deer must be annually removed and kept at a level to allow the primary forage species to recover. Recovery in vegetation can be a very slow process. The most severely deteriorated ranges may take 20 or even 30 years to recover, and it is even possible some ranges are beyond recovery. However, for the bulk of our winter deer ranges, 10 or 15 years is a reasonable length of time to expect recovery, provided deer harvests are adequate. To harvest each year the number of deer necessary to relieve the overuse pressure, Montanans will have to

Deer would be eliminated from such settings, just as surely as if they were shot, if the surrounding vegetation did not exist. The browse in the foreground supplies all-important winter food, while the conifers provide cover. It is biologically impossible to maintain a free-ranging deer herd without healthy vegetation of the right type. — (F & G photo)

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This is one of the things that deer management is all about. Few people question the thrill of bagging a trophy buck, but a sound management program necessitates that does must be taken too. Since either-sex hunting began, the kill of bucks has more than doubled. — (F & G photo)

hunt harder and demonstrate more enthusiasm for multiple-bag deer seasons than they have in the past. The current trend in deer seasons and bag limits seems to be drifting toward restriction of the present programs, but this is of little consequence, considering the two-deer season resulted in only nine or ten more deer per 100 hunters than the one-deer season. An intelligent approach to a sound deer management program would define multiple-bag deer seasons as 4 or 5 or perhaps in some areas even 10 deer per hunter per season. Montanans will have to take more deer or else there will have to be more Montanans. The latter may come too late to insure that our "deer factory" will eventually produce at maximum.

Another consideration, used in conjunction with or added to increased harvests by Montanans, is nonresident hunters. In 1966, a little less than 11 percent of all deer hunters in Montana were nonresidents. Using nonresidents to assist Montana with her deer management will bring some cries of "commercialization," but the fact remains they can help and there will be monetary gains for the State.

Our deer herds are declining because the ranges are becoming less productive due to overuse. Unhealthy deer ranges can only mean unhealthy deer herds. Unhealthy in terms that less fawns are produced, deer are smaller, antler growth is impeded, and they become more susceptible to the myriad factors always present in nature that tend to control or regulate animal populations, including disease and predators. Unless a realistic approach is taken toward the needs of the deer themselves, the outlook for Montana deer herds is rather bleak.

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7

WHITE-TAILED DEER

By E. Allen

The white-tailed deer (*Odocoileus virginianus*) was observed by early explorers in the State. The journals of Lewis and Clark state that whitetail, or "common, fallow deer" were most abundant along the Missouri River Breaks from the North Dakota border to Fort Benton, and in the Three Forks vicinity. They were not as numerous along other portions of the Missouri, Jefferson, Beaverhead, Gallatin and Yellowstone Rivers. David Thompson of the Northwest Fur Company and Alexander Ross explored the Kootenai, Clark Fork and Bitterroot Valleys of western Montana between 1808-24. They reported abundant deer; many were presumably whitetails.

Deer played an important role in the early development of Montana. They were a staple diet for most early explorers, trappers, miners, loggers and railroad crews. In northwestern Montana between 1893-1900, deer hides were considered legal tender at 50 cents each. Over the years, deer have remained an important resource to people of Montana. Use of this resource has gradually changed from one of necessity to one primarily of recreation.

In the early 1940's whitetails were most abundant in the mountainous regions west of the Continental Divide (Figure 1). The largest concentrations were found in the northwest corner of the State in such areas as Fisher River-Wolf Creek in Lincoln County, Fish Creek in Mineral County and the Swan Valley in Flathead County.

East of the Continental Divide whitetails primarily inhabited river-bottoms. Prior to 1941 they had disappeared from much of their historic eastern Montana range and were found mainly along portions of the Missouri, Yellowstone, Milk and Musselshell Rivers, with the largest numbers in the Missouri Breaks of northcentral Montana.

Since 1941 whitetails have gradually extended their range over most of the

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Fig. 1. WHITETAIL DEER DISTRIBUTION – 1941.

Fig. 2. WHITETAIL DEER DISTRIBUTION – 1970.

State. Every county now has at least a small population (Figure 2). West of the Divide they have extended their range southward though the largest concentrations are still in northwest counties. Western Montana populations have declined from levels of the early 1940's. East of the Divide whitetails have gradually extended their range along bottomlands of most major rivers and streams. They have also moved into mountainous habitat including the Bear Paw Mountains in Blaine

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County, the Long Pines area in Carter County and the Judith and Snowy Mountains in Fergus County. The latter area presently supports the largest population east of the Continental Divide.

A trapping and transplanting program was initiated in 1945 to re-introduce whitetails into favorable habitat east of the Divide. By 1951 a total of 426 deer were released in nine counties. In retrospect, this program only supplemented the natural range expansion of the whitetail taking place at that time.

Habitat occupied by white-tailed deer differs greatly west and east of the Continental Divide. On the west side whitetails are usually found in closed canopy Douglas-fir-ponderosa pine forests with the number of deer dependent on the amount of edge and low-growing browse on winter ranges. A typical whitetail winter range is a Douglas-fir-ponderosa pine type on a south or southwest exposure where fir thickets provide both cover and browse. Important browse often is a combination of serviceberry, chokecherry, snowberry, maple, kinikinnick and Oregon grape. Juniper and bitterbrush are locally important. Plants such as ninebark, ocean-spray and russet buffalo berry are often present but seldom used.

A white-tailed deer food habits study was conducted on an over-populated winter range in the Swan Valley of western Montana during the winter of 1957-58. Browse was the most important forage used. Oregon grape was the most used browse plant. Douglas-fir and other conifer browse was important, especially during periods of deep snow. Use of forbs and grasses was consistent but minor. Palatable browse, such as maple and serviceberry, were present in insignificant amounts because of past over-browsing.

East of the Divide, whitetails are usually associated with the deciduous vegetation growing on bottomlands along drainages, often close to agriculture. Vegetation on these bottoms generally includes a combination of ash, box elder, cottonwood, willow and associated shrubs, forbs and grasses. Preferred browse plants include chokecherry, serviceberry, skunkbrush, snowberry and dogwood. Other browse plants include rose, green rabbitbrush, greasewood, buffalo berry and various species of sagebrush. Another important habitat type is found in the Long Pines area of southeastern Montana. This is an isolated area of relatively open ponderosa pine scattered over rugged terrain. Fingers of deciduous trees extend from the pine stands into the surrounding prairies. Preferred browse plants are similar to those on the river bottoms.

Stomach samples from white-tailed deer of the Missouri River bottomlands collected during 1964-65 showed that browse was the most important forage during all seasons except summer, when forbs were most important. Grass was a minor item except in spring. Western snowberry was the most important single plant in the year-long food of the whitetail while cottonwood ranked second. Alfalfa and grain were important when available. Willow was abundant but was used very little.

Land-use must be considered when discussing whitetail habitat. Perhaps the most important factor affecting their range has been fire. The low shrubs which grow following a fire make favorable deer habitat. However, natural plant succession is toward a closed-canopy, coniferous forest with very few low-growing browse plants. This natural succession may be one of the primary factors causing a

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decline in whitetail numbers west of the Divide. Logging opens the forest canopy and can be beneficial to whitetails on certain sites. The Swan Valley is an example where recent logging operations have been followed by a wider distribution of deer. On the negative side, gigantic reservoirs such as Libby Dam will eventually flood a large area of valuable whitetail winter range. Large tracts of land that have been clear-cut are also not suitable for whitetailed deer.

The best whitetail habitat east of the Divide is currently used for agriculture. Bottomlands are used mostly for livestock production and irrigated crops. Since 1941, intensified agriculture has decreased food and cover for whitetails in some areas. Heavy livestock use on whitetail winter ranges may decrease forage for deer. Brush removal by spraying and mechanical means and stream alteration programs have also been detrimental.

MANAGEMENT

Many whitetail ranges west of the Divide already had a history of overpopulation by the early 1940's. Most herds reached peak numbers between 1935-45. These overpopulations caused range deterioration which resulted in fewer deer. This is still the problem in many areas.

The first attempts at modern deer management were begun on western Montana deer ranges in the early 1940's. First work started in the Swan Valley. Early techniques used for deer management studies were: pellet group counts, strip census surveys, sex and age classifications, checking stations, and range use plots to determine deer population levels in relation to range carrying capacity. In 1942, an experimental salting program was initiated in an attempt to get better distribution of deer on winter ranges. This program, largely ineffective, was discontinued in the mid-1950's. In 1949 whitetails were tagged in the Fisher River-Wolf Creek area for use in a deer censusing study. Browse reseeding and planting studies about 1950 showed that artificial revegetation of deteriorated ranges was not possible until existing deer numbers were reduced to range carrying capacities.

In the early 1940's deer were scarce east of the Divide and the hunting season was closed. While deer were declining west of the Divide, they were increasing on the east side. Peak deer numbers were reached in most areas in the early 1950's.

The information necessary for deer management today is basically the same as that needed in 1941. Total population estimates are no longer attempted because of their questionable accuracy. Census techniques are sometimes used locally to determine a population trend and winter kill. Data processing machines are now used to analyze harvest data and other information from hunter questionnaires. Sex and age classifications, checking stations and range use plots are still employed, using improved techniques.

Of the criteria necessary to successfully manage a deer herd (or any other animal population), by far the most important are those related to habitat. With an abundance of quality habitat, the potential exists for a good-sized, thrifty deer herd that can take care of itself. Without good habitat, despite the most intensive and expensive management practices, only a dwindling, unstable population will result.

Because deer are completely dependent upon their environment, the most

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important management techniques are those which gather data revealing the condition and trend of the habitat. Range plots are designed not only to indicate condition, but also to point out habitat deficiencies. Only by knowing the cause of problems can the proper corrective measures be employed. It is for this reason game biologists spend a great deal of their year-around effort examining the many and varied aspects of habitat.

Hunting season regulations are an important management tool and a variety

Deer are browsers. Browse plants can only withstand a certain amount of overuse before they die. Fewer plants will support fewer deer. — (Photo by Gerry Atwell)

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have been used since 1941 in an attempt to maintain proper harvests and alleviate certain problems. Most have met with limited success. The first specific whitetail regulation appeared in the mid-1940's when certain central and eastern counties were closed to whitetail hunting following transplants. In 1954 most of Flathead County was open to one deer; either whitetail or mule deer. West of the Divide, B-tag mule deer only seasons were common in the late 1950's and east of the Divide, B-tag whitetail only seasons have been used since 1958. Split seasons have been used in southeast Montana since 1960 when certain areas were opened for two whitetails during the early season and for two deer, B-tag whitetail only during the remainder. In 1964, a portion of the special nonresident deer permits was designated "Whitetail Only" for the first time.

HUNTING AND HARVEST

The chronic problem of whitetail management is obtaining an adequate harvest, particularly in rugged terrain and on private land where hunting is restricted. On private land, livestock competition for food often becomes acute and deer damage to haystacks and other crops is common. In some instances, deer have hindered reproduction of commercially valuable pine. Competition with elk is sometimes a problem; and in some areas, elk out-forage whitetail. Proper hunter distribution in rugged, forested terrain is also a major problem. The head of each drainage is not usually hunted, since few hunters are willing to pack deer long distances. Road-hunting is popular and usually provides only light harvests except when heavy snow forces deer to lower elevations where they become more vulnerable to road hunters. Although logging operations have opened some areas, many remain inaccessible to vehicle travel.

West of the Divide, many hunters prefer whitetails, while mule deer are the favorite in the east. In each area, the favorite deer is usually the most abundant. Regulations are often set by population status of a game species in local areas and are often aimed at preserving the favorite species and reducing the other. In the east, many old-timers scornfully remark, "the whitetail is chasing out the mule deer." While district harvest figures (Table 1) do not indicate this is happening on a

This is the result of a successful hunt. Since 1945 the number of Montana deer hunters has nearly doubled and the deer harvest has quadrupled. — (Photo by Merle Rognrud)

Table 1. Percent of white-tailed deer in district deer harvests, 1956-69.

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
District 1:														
Kill.....	10,856	14,532	11,762	10,582	8,210	9,243	9,019	7,973	6,914	6,107	7,556	7,745	9,809	6,055
Percent WT.....	79	68	68	77	68	81	72	80	82	83	82	81	84	76
District 2:														
Kill.....	11,628	12,027	12,087	10,031	7,146	10,523	7,641	6,935	5,618	6,205	6,602	9,390	9,210	8,053
Percent WT.....	35	35	34	33	40	35	34	35	41	43	39	35	33	32
District 3:														
Kill.....	25,080	23,831	16,424	15,786	20,021	23,996	23,790	23,818	18,973	13,262	18,456	17,063	19,591	20,400
Percent WT.....	—	—	8	8	6	7	5	6	5	5	5	3	4	5
District 4:														
Kill.....	33,800	43,661	32,652	37,079	35,460	33,850	33,702	33,803	27,143	21,540	24,650	22,414	25,684	24,809
Percent WT.....	15	13	17	—	14	21	15	14	16	18	21	18	20	20
District 5:														
Kill.....	11,530	9,290	6,949	9,136	15,206	15,506	15,098	14,109	13,991	13,690	16,997	11,267	12,171	13,537
Percent WT.....	5	4	7	6	5	5	7	8	5	5	7	8	9	7
District 6:														
Kill.....	9,114	12,270	11,494	11,060	11,175	9,988	9,834	9,290	10,162	10,127	10,365	9,395	10,535	12,004
Percent WT.....	30	42	34	26	22	35	28	37	31	42	45	47	47	39
District 7:														
Kill.....	13,749	14,766	20,518	23,137	22,557	24,603	26,355	24,195	26,778	20,879	15,464	12,310	13,605	16,421
Percent WT.....	13	22	—	20	14	16	13	13	10	14	31	25	23	21

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large scale; it may be of local significance. On a statewide basis, the whitetail has been the secondary deer species, consistently averaging 20 to 25 percent of the total deer harvest (Table 2).

Table 2. Percent of white-tailed deer in statewide harvests, 1941-69.

Year	Estimated Deer Harvest	Percent Whitetail	Year	Estimated Harvest	Percent Whitetail
1941.....	*	*	1956.....	100,500	17
1942.....	*	*	1957.....	134,600	25
1943.....	*	*	1958.....	116,000	25
1944.....	*	*	1959.....	120,300	22
1945.....	19,500	25	1960.....	123,500	17
1946.....	24,700	23	1961.....	129,100	21
1947.....	25,600	29	1962.....	125,700	17
1948.....	29,500	21	1963.....	119,300	18
1949.....	32,400	26	1964.....	107,300	19
1950.....	38,300	23	1965.....	90,100	22
1951.....	39,000	25	1966.....	98,100	25
1952.....	53,800	24	1967.....	88,640	25
1953.....	80,000	23	1968.....	99,250	25
1954.....	84,300	26	1969.....	102,800	22
1955.....	100,000	22			

* No data recorded.

With the onset of winter, hardships for deer increase. During winter, deer are restricted to a small portion of their yearlong home range. Food plants, which must be both available and palatable, are usually in short supply. A winter range like the one below does not have the potential for supporting a large and thrifty deer herd. — (F & G photo)

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The status of Montana's white-tailed deer herd 20 years from now will be completely dependent upon the amount of quality habitat available to deer at that time. Sound habitat management today is the only sure route to deer abundance tomorrow. — (Photo by Gerry Atwell)

While the average number of hunters has nearly doubled since 1945, the total harvest has increased more than four times and hunter success has risen two and one-half times (Table 3). During this period, the whitetail harvest increased more than three times.

Table 3. Deer harvest statistics for two five year periods.

Period	Number Hunters	Statewide Deer Harvest	Whitetail Harvest	Percent Success
1945-49	67,400	26,300	6,600	39
1961-65	119,000	115,600	22,200	95

FUTURE OUTLOOK

The future status of Montana's white-tailed deer herd will be determined entirely by the amount of quality habitat available to deer at that time. Nature's changes through plant succession and man's activities in land use, either separately or in combination, will be major influents affecting future deer herds. Practices such as restocking and winter feeding programs will not substitute for deer

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management programs designed to maintain quality habitat by properly harvesting excess deer.

Two very important factors which may adversely affect deer habitat are — people and deer. Human activities can be detrimental to wildlife. Whether it be brush-clearing, sagebrush-spraying, new super highways, increased competition with domestic livestock, or big dams, the end result is the same — less quality habitat available to deer. This is not to imply that these activities are inherently bad or that we should eliminate all activities that may compete with wildlife; obviously this is impossible and in many cases, undesirable. However, on Montana's large blocks of public land, activities tempered with consideration for wildlife are justified.

Deer can also be detrimental to deer. The deer has been said to be his own worst enemy. Many of our range problems today are the result of too many deer in the past. Many management programs have been designed to relieve the overpopulated conditions and allow range recovery — some succeeded; some did not.

The white-tailed deer population in Montana represents a potential for hunting recreation which has not reached its full capacity. Only by genuine public interest and wholehearted support for sound habitat management can we expect to develop this resource to its full potential. If we can succeed in improving the poor ranges and maintaining the good ones, we can expect to have whitetails in Montana indefinitely.

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8

PRONGHORN ANTELOPE

By H. Compton, J. Egan and R. Trueblood

Pronghorn antelope (*Antilocapra americana*) were abundant and widespread in Montana before settlement. Most prairie habitat contained antelope. Their distribution was nearly statewide with the exception of forested and mountainous areas of western Montana. Lewis and Clark reported seeing and shooting numerous antelope during their journey through what is now Montana. An early estimate of 2,500,000 antelope was reported for Montana; they were numerous as late as 1896. Human disturbance before settlement was slight as few antelope were used for food by fur trappers and Indians.

Antelope populations fluctuated during settlement of Montana. The antelope population dwindled to about 3,000 in 44 areas of central and southwestern Montana by 1924. After the early 1930's antelope population estimates steadily increased from 10,600 in 1937 to about 75,000 in 1965. During the past two decades antelope have become very popular as big game animals and today they are an integral part of the Montana scene.

In 1941, before trapping and transplanting, antelope were mainly distributed in central and southeastern Montana (Figure 1). Through a transplanting program, 3,554 antelope were released in 33 areas where none existed. In nine other areas, transplants supplemented small, existing herds. As a result of transplanting and natural expansion of their distribution, antelope are now widespread in the eastern two-thirds of the state (Figure 2).

Habitat is the key to the status and future of any wildlife population. Optimum antelope habitat consists of open, rolling sagebrush-grasslands relatively free of human encroachment. Sagebrush and weeds are items essential in the year around pronghorn diet. Much of the original antelope habitat was destroyed during the first two decades of this century when thousands of acres of native Montana

Fig. 1. PRONGHORN ANTELOPE DISTRIBUTION – 1941.

Fig. 2. PRONGHORN ANTELOPE DISTRIBUTION – 1970.

prairie were overgrazed or cultivated. While some antelope were taken for food by homesteaders, the alteration of native prairie to cultivated farmlands was another reason for the population low reached by 1924. With the great drought of the 1930's, homesteaders left by the hundreds. The abandoned, cultivated fields gradually reverted back to vegetation more favorable to antelope. The early stages of vegetation succession, comprised mostly of weeds, were used heavily by

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antelope. With the additional food and space, antelope populations steadily increased with only temporary setbacks due to severe winters in 1948-49 and 1964-65. The highest recent population in eastern Montana was observed in the summer of 1964.

MANAGEMENT

Prior to 1940, the big game producing potential of eastern Montana had seldom been recognized and very little game survey work was done. The first antelope hunting seasons were opened to alleviate local crop damage.

After 1941, both aerial and ground reconnaissance surveys were made to investigate the big game potential in prairie areas, but early surveys covered only a small part of the antelope range. In 1953, a six-mile strip aerial census method was adopted for standard use over more extensive areas. This method assumed a random antelope distribution and consisted of flying north-south strips six miles apart across the major antelope range. Population estimates were derived from this sample, however, random antelope distribution was not found and this census

Due to their gregarious nature and use of open habitat, antelope populations can be checked by low altitude airplane counts better than other Montana big game. About one-third of each administrative district is counted annually on a rotating basis. — (Photo by Robert Fischer)

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procedure was discontinued in 1959. The census method was changed to a total count method in 1961 with about one-third of each administrative district being counted annually. This method is currently used and provides the most reliable population trend figures.

The present antelope management policy was adopted by the Montana Fish and Game Commission on June 27, 1955. Management practices were specifically delineated. Briefly, they include objectives and methodology for producing and maintaining an optimum breeding herd from which the annual surplus is to be harvested through recreational hunting. Antelope management should be consistent with other range uses and provide the greatest sport without being a detriment to succeeding populations. Antelope permits are issued on a quota basis. Each hunting district is assigned a yearly license quota based on census, fawn production, and past harvest information.

Past research has contributed to antelope management. Food habit investigations revealed the importance of specific types of range vegetation to antelope and relationships to agriculture. Antelope reproduction has been studied and age determination techniques using tooth replacement and wear have been developed. Winter mortality of "Hi-Line" (northcentral Montana) antelope has been attributed to deficiencies in winter habitat, primarily lack of sagebrush.

HUNTING AND HARVEST

Prior to 1872 antelope hunting seasons were open year around. Hunting was first closed for a period (Aug. 1 to Feb. 15) each year from 1872 to 1894. No bag limits were imposed at that time. From 1895 to 1902, an annual bag limit of eight was established and the hunting season was open Sept. 1 to Dec. 1. There were no open seasons from 1903 to 1934. In 1935, a 30-day season (Nov. 1-30) was opened on a permit basis in Carter and Powder River counties and in 1936 the season was opened in Choteau County. Hunting seasons were closed from 1937 to 1942. Antelope hunting resumed in 1943 and has continued on an annual permit basis.

Season lengths and types have varied greatly since 1943. Prior to 1954 the hunting seasons were relatively short. Longer seasons, from 60 to 70 days, have been the rule in eastern Montana since 1954. During the 1940's and early 1950's, permits were mainly for bucks. Since 1958, all antelope hunting has been for either sex. Many different season dates have been tried. In recent years the most acceptable opening date for the general season has been mid-October. Antelope archery seasons have been held prior to the opening of the rifle season since 1959. During the archery season, archers must possess both archery and antelope licenses. Applications for antelope licenses are submitted for a machine drawing. Successful applicants are issued licenses for their chosen areas. Excess licenses are sold to residents and nonresidents on a first-come, first-served basis.

The trend in antelope hunting and harvest has been upward in Montana (Table 1). From the standpoint of numbers harvested, it is second only to deer. The biggest year was in 1964 when 33,954 hunters killed 26,982 antelope for hunter success of 79 percent. A special nonresident antelope license began in 1955. The increased harvest since then has primarily been through nonresident hunters using

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Table 1. Antelope harvest statistics, 1941-1969.

Year	Permits Issued	Number Hunters	Antelope Killed	Percent Success
1941 ¹				
1942 ¹				
1943 ²	750	--	553	73
1944	650	--	540	83
1945	1,575	--	1,400	89
1946	2,424	--	2,300	95
1947	2,854	--	2,800	98
1948	2,652	--	2,800	106
1949	3,932	--	3,800	97
1950	8,345	--	7,700	92
1951	9,272	--	8,171	88
1952	18,622	--	18,096	97
1953	23,677	--	19,145	81
1954	20,866	--	17,737	85
1955	39,055	--	26,000	67
1956	25,923	--	22,818	88
1957	25,820	--	14,400	65
1958	19,850	--	14,000	69
1959	21,148	19,402	15,658	81
1960	20,820	18,853	14,981	79
1961	27,103	24,337	19,278	79
1962	32,164	29,026	22,937	79
1963	31,346	27,907	22,238	80
1964	37,109	33,954	26,982	79
1965	27,886	25,417	18,630	73
1966	21,770	19,556	13,900	71
1967	19,933	18,052	12,599	70
1968	18,358	16,150	11,500	71
1969	23,167	19,871	14,543	73

¹ Season closed in 1941 and 1942.

² 1943-1958 - No statewide estimate of hunters; success based on total permits issued.

permits in remote areas. Hunter success has remained high, thus, hunter opportunity has been increased and distributed so it is not detrimental to future antelope herds in Montana.

FUTURE OUTLOOK

Antelope numbers will probably never again be as high as before settlement because land use is orientated toward domestic livestock and agriculture rather than wildlife. People will determine the fate of antelope by future husbandry of the land upon which they live. Recreational opportunities provided by antelope for hunters, photographers, and people who just like to look at them should be enhanced and increased in the coming years.

There are problems in multiple-use management that must be solved. Domestic livestock, agriculture and recreation are compatible if managed correctly. Too often one use supersedes and is detrimental to other uses. Over-use by domestic livestock, particularly sheep, can be a direct detriment to antelope.

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Sheep-tight fences, if extensive and located in strategic areas, can inhibit both normal and seasonal antelope movement patterns. Chemical and mechanical reduction of sagebrush, in order to enhance grass growth, can reduce the food supply of the antelope. In 1965, a long-term study of sagebrush control and wildlife populations was begun in central Montana in cooperation with the Bureau of Land Management. The study is aimed to provide guidelines to sagebrush management as it effects wild animal populations. Plant-animal relationships are complex, and full understanding of the over-all changes caused by sagebrush control will require intensive study. It is folly for public land managers to embark on brush control programs without proper knowledge of the overall impact on all resources under their responsibility, including wildlife habitat.

A major need for future antelope management is a better understanding of antelope-range-livestock relationships. More information is needed about antelope range requirements and the overlap in requirements of antelope and livestock.

The resident human population in much of Montana's antelope range is low. This poses a problem in obtaining a sufficient harvest in many remote areas. The problem of hunter distribution, particularly with the increase of posting and lack of access to both private and public land, will continually influence the effectiveness of harvests. Management tools to help alleviate this situation should include: (1) smaller antelope management units to further focus hunter pressure; (2) a nonresident quota to retain this essential segment of our antelope hunters; and (3) multiple licenses in areas where hunting harvests have been inadequate for proper antelope management. Information must continually be collected and management tools improved in order to meet future demands and assure that the antelope remains an integral part of the Montana scene.

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SHIRAS MOOSE

By D. Stevens

The Shiras moose (*Alces alces shirasi*) is Montana's largest native big game animal. This subspecies was isolated from the rest of the Rocky Mountain moose populations during the last ice-age. Compared to other North American moose it is medium sized with paler coloration. It is found throughout the mountains of southwest Alberta, southeast British Columbia, Montana, Idaho, Wyoming and Utah, and occasionally in Colorado.

Early information on moose in Montana is limited. An early report in 1832 told of moose being killed near the confluence of the Milk and Missouri rivers in northeast Montana. Most moose were found in western Montana. Their solitary nature in dense forests and bottom lands often made them less conspicuous than other big game animals. The first laws protecting moose were enacted about 1872. The hunting season was closed from Feb. 1 - Aug. 15 every year. Hunting was prohibited in the entire state in 1897 as a result of an apparent decline in numbers. The season remained closed for almost 50 years.

George Shiras III explored Yellowstone National Park from 1908 to 1910 and found high moose populations in that area. The estimate for the remainder of Montana (1909-1910 biennial report) was only 300, with the largest herd in Ross Fork of Rock Creek, Granite County. An increase in the moose population was apparent by 1936, particularly in the Gallatin, Absaroka, and Rock Creek areas. Forage was still relatively plentiful and harvest was not recognized as imperative.

By 1941 additional concentrations of moose were observed in the Flathead, Bitterroot, Big Hole, Ruby, Madison, and Gallatin River drainages. Many other isolated populations were also reported. These same areas still support many moose. Moose distribution appears to have expanded considerably in the last 25 years, see Figures 1 and 2. They are now common in the northwest and southwest portions of the state. Part of this expansion may merely be due to increased knowledge of

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Fig. 1. MOOSE DISTRIBUTION – 1941.

Fig. 2. MOOSE DISTRIBUTION – 1970.

moose distribution. Moose often emigrate from areas of high population density and this could explain certain expansions of their distribution. Early authorities believe the populations in the Absaroka and Gallatin areas were a result of egress from former high density populations in Yellowstone National Park. Moose have not been transplanted in Montana.

Historically, moose in Montana were associated with willow and aquatic

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areas. Early photographs showed the solemn bull either standing in the willows watching the photographer, or standing belly deep in water munching aquatic plants. This was habitat where they were most accessible and easily observed. Later studies show moose occupy many other areas with different vegetation types.

The adaptability of moose was not recognized before scientific studies began in 1941. Moose were found in areas with vegetation types not considered good habitat in the past. Spruce-fir forests, Douglas-fir forests, and deciduous forest types may support resident populations. Moose adapt their food habits to browse available in the various habitat types. At higher elevations, low huckleberry, willow and subalpine fir are most important. At lower elevations, Douglas-fir, dogwood, serviceberry and chokecherry may form the bulk of the diet. Where available, willow is important to moose.

As with most big game species, moose productivity is related to range condition. They have a higher reproductive potential than elk. Cow moose often breed as yearlings and twins are common on better ranges. A population on good range can increase 25 percent annually.

With improved knowledge about moose, it became apparent that populations were larger than previously believed. Prior to the resumption of hunting in 1945, the populations increased substantially. Since then, most populations have been relatively stable. In some areas, numbers of moose have died of malnutrition on deteriorated ranges before hunting was implemented for population control. The Absaroka area and the Gravelly-Snowcrest area have experienced losses from malnutrition and emigration. The Gravelly-Snowcrest ranges are now improving and can continue to, if moose numbers are properly managed.

MANAGEMENT

With the advent of the wildlife restoration program, a complete survey of the Absaroka area was made in 1942. The objective was to derive a management plan for moose. The result was a recommendation for hunting on a limited basis. The state legislature, however, did not pass a law enabling the Fish and Game Commission to set moose seasons until 1945. During the fall of 1945, the first moose hunting season was held after a lapse of almost 50 years.

Since resumption of hunting, moose management has been directed toward controlled harvest. Early hunting districts and quotas were set on the basis of information provided by extensive surveys, primarily in the Absaroka, Gallatin and Big Hole areas.

Intensive scientific studies of moose were initiated in Yellowstone Park in 1947. In Montana, two intensive studies were initiated in 1958; in the Rock Creek drainage, Granite County, and in the Upper Ruby drainage, Madison County. Information from these intensive studies has generally given impetus to management practices that now exist.

The most commonly used management techniques are range surveys to determine browse condition and trend, and aerial observation flights to determine moose population trends and relative productivity. Hunter harvest questionnaires are important for providing information on hunter success and the location, age and

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sex of the kill. Hunter success rates, considered to be an indicator of population density, have been used in setting harvest quotas. Since 1960 lower jaws and reproductive tracts have provided information on age structure and productivity of several moose populations. A study was initiated in southwestern Montana in 1965 which currently is providing information about moose winter habits, range requirements and seasonal movements.

HUNTING AND HARVEST

When hunting resumed in 1945, 90 bull permits were issued: 40 in the Absaroka, 30 in the Gallatin and 20 in the Big Hole. The moose quotas increased to a high of 836 either-sex permits in 1962. Generally the harvest has kept pace with the increase in permits available to prospective hunters (Table 1). During the past 24 hunting seasons, 63 to 86 percent of moose permit holders bagged an animal. The best success was reported in 1951 with 86 percent, followed by 1961 with 84 percent.

Moose hunting in Montana has been carefully controlled by a permit system. The trend has been toward more liberalized hunting. Either-sex permits, initiated in 1952, are now issued statewide. Most moose hunting seasons run simultaneously

Table 1. Moose quotas, harvest, and hunter success from 1945-69.

Year	Number Permits	Number Moose Harvested	Percent Hunter Success
1897 - 1944		closed	
1945	90	75	83
1946	90	65	72
1947	95	70	74
1948	80	50	63
1949	82	60	73
1950	76	60	79
1951	105	90	86
1952	252	210	83
1953	142	100	70
1954	182	140	77
1955	343	270	79
1956	405	280	69
1957	411	340	83
1958	572	470	82
1959	505	410	81
1960	553	441	80
1961	633	530	84
1962	836	610	73
1963	821	587	75
1964	703	476	71
1965	688	439	66
1966	703	510	74
1967	631	433	70
1968	659	457	71
1969	668	457	71

Like other members of the deer family, the male moose grows a new set of antlers each year. During the growth period they are covered with "velvet." — (Photo by Gerry Atwell)

with other big game seasons. Quotas are set for each hunting district after evaluation of forage supplies, reproductive rates, and the results of the previous harvest.

FUTURE OUTLOOK

Present knowledge of moose ecology indicates that the total population probably cannot be increased much beyond present numbers. Certain individual ranges need reduction in moose populations to bring a balance with forage supplies. When moose are harvested from any given herd on a sustained annual basis, in relation to range condition, the productivity of the herd can be increased. A higher

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Moose frequent marshes, rivers, lakes, dense timber, meadows, and even sagebrush flats. Where available, willows are an important food item for moose all seasons of the year. —(F & G photo)

proportion of that herd may then be harvested annually without reducing the basic breeding population. Future management will need better control of hunter distribution and better overall knowledge about moose.

Most Montana moose habitat is located on public lands. Constant monitoring of all future land uses is needed to protect moose range. For example, brush removal to increase grass forage for livestock is receiving considerable attention. Herbicides, used specifically for livestock forage improvements on public lands, have taken a serious toll of key moose forage and resulted in local declines of moose. If the future of moose herds is to remain bright, further steps will have to be made to protect various range areas. Practices favoring private livestock on public lands have to be questioned. Is brush control on public lands, to improve grass forage for livestock at the expense of browse forage for public big game, consistent with the concepts of multiple use?

The future of moose in Montana will not be secure until the place of wildlife in multiple use management is firmly established.

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BIGHORN SHEEP

By F. Couey and A. Schallenberger

The journals of Lewis and Clark noted Rocky Mountain bighorn sheep (*Ovis canadensis*) throughout the area that is now Montana. The bighorn sheep in the lower Missouri and Yellowstone breaks were later classified as the Audubon subspecies. It was estimated that overall, there were two million North American bighorn sheep in 1880. Even though they were numerous in Montana, wild sheep decreased markedly with domestic livestock range competition, contraction of diseases from domestic sheep, and hunting.

Historically, contact between domestic sheep and wild sheep has resulted in large die-offs of the latter. The events associated with these deaths have been range competition and overuse, followed by malnutrition and subsequent death from scabies, anthrax, lungworm, and pneumonia-like disease. The Sun River herd was decimated during the winter of 1925. Similar die-offs occurred in 1927 and 1932. The bighorn sheep die-offs preceded extensive die-offs of elk by a few years. Elk are more hardy range competitors. Other sheep die-offs have been noted in Glacier Park and in the Stillwater and the Rock Creek sheep herds. Glacier Park bighorn sheep numbered about 1,500 in 1916. An estimated group of 180 was present in 1965. Hunting in Glacier Park is not allowed. The last known kill in Montana of the now extinct Audubon sheep was in the Billy Creek area of the Missouri Breaks in 1916.

By 1930 bighorn sheep were reduced to small remnant bands. They were unhealthy, unproductive and considered an endangered species. Records of 1941 show that bighorns were at a low ebb both in density and distribution.

MANAGEMENT

With availability of Pittman-Robertson wildlife restoration funds in 1941, the Montana Fish and Game Department began a bighorn sheep research and

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Fig. 1. BIGHORN SHEEP DISTRIBUTION – 1970.

management program with the objective of increasing populations of this desirable native big game animal. Studies have shown that the critical winter range of bighorn sheep is usually located at elevations with low snow depths and adequate rocky cliffs for escape habitat. Palatable browse plants, forbs and grasses are all used for food during all seasons. Bighorn sheep are capable of foraging in a variety of habitats. They are vulnerable to competition from elk, deer, and domestic livestock. The bighorn sheep migrate to the same areas year after year and even use the same

These bighorns, on their way to a new home, may be the forerunners of a trophy specimen. Many attempts to establish mountain sheep via transplanting have failed. — (F & G photo)

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These rams are in habitat typical of that required by bighorns. Escape cover is comprised of rocky ledges and walls interspersed with open slopes. Lower elevations, used during winter when deep snows blanket the high country, must have similar features. — (Photo by Danny On)

beds. Both sexes will breed as yearlings and twin lambs are common with good range conditions. Disease can be a contributing factor because the animals may become infected and re-infected with parasites or other disease-causing organisms.

The present improved distribution of bighorn sheep in Montana (Figure 1) is a result of transplanting efforts and more favorable range conditions in specific areas. Eleven major native herds of bighorn sheep now live in Montana. Thirteen other areas have been stocked by transplanting with variable results (Table 1).

Improved conditions for bighorn sheep in Montana have resulted because of management practices since 1941. Acquisition of the Sun River Game Range

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Table 1. History and status of transplanted bighorn sheep herds in Montana.

Location	Number Transplanted	Year	Present Status
Gates of the Mountains (Lewis & Clark Co.)	14	1942	Not successful
C. M. Russell Game Range (Garfield Co.)	42	1947	Failed after 1952
C. M. Russell Game Range (Fergus Co.)	31	1965	Sheep surviving near area
Sixteen Mile Creek (Gallatin Co.)	16	1954	Not successful
Wildhorse Island (Lake Co.)	2	1939	Increased to 137
Wildhorse Island (Lake Co.)	6	1947	In 1957, range base
Kootenai Falls (Lincoln Co.)	13	1955	Huntatable population
Bull Mountain (Jefferson Co.)	23	1955-57	Very few surviving
Blue Hills (Custer Co.)	13	1958	Limited hunting
Thompson Falls (Sanders Co.)	19	1959	Surviving
Doris Mountain, Lake Blaine, (Flathead Co.)	14	1963	Surviving
Sheep Creek (Meagher Co.)	18	1962	Not determined
Sheep Creek (Cascade Co.)	21	1956-60	Not successful
Tobacco Root Mountains (Madison Co.)	25	1964	Not determined
Highland Mountains (Madison Co.)	21	1967	Not determined
Olson-Foster Gulch (Deer Lodge Co.)	25	1967	Not determined
Sieben (Lewis and Clark Co.)	34	1968	Not determined
Petty Creek (Missoula Co.)	16	1968	Not determined
Teakettle Mtn. (Flathead Co.)	15	1968	Not determined
Troy-Bull River (Lincoln Co.)	33	1969	Not determined
Highland Mountains (Madison Co.)	30	1969	Limited hunting

allowed elk to move out of mountainous winter range to foothills, taking considerable pressure from bighorn sheep range. There has been a marked reduction of domestic sheep on national forest ranges. Bighorn sheep also benefit from reductions of other big game species. Ram hunting has increased and limited either-sex seasons are held in some areas to maintain thrifty populations. The transplanting program supplemented harvest, particularly in the Sun River.

HUNTING AND HARVEST

Estimates of annual bighorn sheep kill by hunters ranged from 20 to 70 for the 1953 to 1958 period. Since 1959 kill figures have been obtained from questionnaires to special sheep permit holders. A somewhat stable harvest of 55 to 80 sheep has been maintained during the 1959-69 period (Table 2). Hunter success in limited permit areas has ranged from 59 to 74 percent and in unlimited permit areas from 5 to 14 percent.

The largest native bighorn sheep herd in Montana is in the Sun River drainage. Recent census figures indicate over 600 in the Sun River herd. From 1957-69, 40 to 60 permits for 3/4-curl rams were issued. Hunter success has been about 80 percent, making this a popular hunting unit. The area has also provided animals for stocking other areas.

The Ural-Tweed herd along the Kootenai River near Warland has provided limited hunting since 1954. Five surplus rams from the National Bison Range were released there in 1963. One of these tagged rams was killed in 1963 at Waldo, B. C., 35 air miles from the point of release.

Mountain sheep have a true horn supported by an internal bone core. The horn continues to grow during the animal's entire life. On occasion the tip is broken or splintered and is referred to as "broomed". Half, three-quarter and full refer to the degree of curl. — (Photo by Gerry Atwell)

Both sexes of the Rocky Mountain sheep have horns. "Legal" rams in most of Montana's sheep hunting areas are $\frac{3}{4}$ curl. These sheep, located on the Fort Peck Game Range, were introduced into the area which was once the home of the Audubon Bighorn. — (Photo by F. R. Martin)

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Table 2. Bighorn sheep harvest statistics, 1959-69.

Year	Permits Issued	Sheep Killed	Percent Hunter Success	
			Limited Areas	Unlimited Areas
1959	327	60	72	11
1960	413	55	61	5
1961	380	70	69	12
1962	456	80	62	9
1963	518	80	64	9
1964	495	70	61	9
1965	551	80	67	14
1966	570	76	59	11
1967	273	68	73	8
1968	328	68	74	7
1969	359	67	65	7

A small group of bighorn sheep in Ravalli County roam the Watchtower Creek drainage. The population of the Watchtower Creek herd has not increased for years. A few either-sex permits have been issued since 1965.

The Rock Creek area in Granite County has supported up to 100 bighorn sheep. Recent counts indicate less than 20. Their numbers have fluctuated widely as have the number of permits for hunters. Range competition from mule deer in winter and domestic sheep in summer makes survival of the Rock Creek herd questionable.

The Hilgard herd is a small herd that winters along the Madison River near the Idaho line. It also summers in the mountainous range. The herd has increased in recent years.

Gallatin bighorn sheep inhabit a rugged area northwest of Yellowstone National Park. A few have been trapped and removed from this area. Unlimited ram hunting of the Gallatin herd is allowed.

Sweetgrass County bighorn sheep are located in the Stillwater and Rosebud River drainages. Unlimited ram hunting of the Sweetgrass herd is permitted.

The National Bison Range sheep herd was introduced on original habitat near Moiese. Numbers have fluctuated but appear to be increasing with control of other big game species. It has been the source of stock for several transplants. No hunting is allowed.

FUTURE OUTLOOK

Many Montana sheep herds have reached a balance between productivity and forage. Harvest of 3/4-curl or larger rams only allows harvest of older rams. It is not possible to attain maximum reproductive potential by harvesting only mature males. Where range overuse is evident, surplus females and males should be harvested by permit hunting. Unless Montana herds are kept in balance with ranges die-offs will again occur.

In the future there will be only limited need for transplanting programs. Success of transplanting has declined as suitable bighorn sheep habitat is planted and populated. Successful transplanting of bighorn sheep requires wilderness-type

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Grass is an important food for bighorn sheep. Browse is also important, especially in the winter. Other plants eaten are forbs (weeds) and even the lichens on the rock which these rams appear to be considering. — (Photo by Danny On)

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ranges and little competition from livestock and other big game species. This type of range is scarce.

In 1941 bighorn sheep were considered an endangered species and all western states were trying to unravel the mysteries of its loss. It appears now that use of better range management should insure perpetuation of this species. Vigilance will be necessary on critical ranges to avoid over-crowding and competition with livestock and other big game species. More information is needed about the life cycle of the lungworm and possible ways it may be controlled. We also need to be continually watching population dynamics of this species. Continued field investigation will be necessary to measure herd productivity, status and well-being. Application of known management techniques and continued research is needed in order to maintain stable populations. There should be an understanding with all related administrative agencies and the public that good land management practices are essential if we are to maintain our bighorn sheep.

Consideration should be given to managing certain selected public lands specifically for bighorns to insure maintenance of prime habitat for this high quality big game species.

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ROCKY MOUNTAIN GOAT

By A. Foss and M. Rognrud

The early distribution of the Rocky Mountain goat (*Oreamnos americana missoulae*) in Montana is not well recorded. Early explorers and fur traders followed waterways and had little opportunity to observe goats. Goats were occasionally confused with mountain sheep; therefore, old records should be interpreted with care. Early authorities considered the goat a hunter's myth rather than a creature of reality. The journals of Lewis and Clark had few entries concerning goats. Members of the expedition of Alexander Ross in 1823 and 1824 saw numerous goats in the Bitterroot Valley. The goat is one big game animal not displaced by the encroachment of civilization. Their rugged habitat is unsuitable for man's purpose.

Mountain goats were recognized as a valuable part of the big game fauna in Montana at an early date. Regulations governing hunting were established in 1905. Today the mountain goat is valued for sport hunting and for esthetic enjoyment.

Information on goat distribution suggests they were native to major mountain ranges of western Montana. They apparently were absent from isolated mountain ranges where habitat later proved suitable. Distribution prior to 1940 is comparable to native existence. In 1941, the Fish and Game Department initiated a transplant program and subsequently moved goats to 12 new areas (Table 1). The original and present distribution of goats in Montana is shown in Figure 1.

Goats inhabit rugged terrain often showing well-defined evidence of glaciation. In Montana, goat ranges lie between 5,000 and 11,000 feet elevations. Goats tend to make use of the higher areas during the summer and move to lower elevations for winter. The reverse has been observed in some locations where they moved up in winter to forage on slopes exposed by wind action.

A limiting factor of goat populations is suitable forage for nutritional needs. This need is most acute during the winter season when snow accumulations prevent

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Table 1. Mountain goat transplants in Montana, 1941-69.

Area of Plant	Time Sequence	Number Goats Introduced	Date of First Hunting Season
Crazy Mountains	1941-43	21	1953
Beartooth Mountains	1942-53	44	1960
Gallatin Area	1947-50	9	1964
Tobacco Root Mountains	1955	14	1965
Madison Range	1950-59	42	1965
Highwood Mountains	1943	4	1957
Gates of the Mountains	1950-51	19	1960
Snowy Mountains	1953-54	20	No Season
Elkhorn Mountains	1956-58	17	No Season
Absaroka Mountains	1956-58	17	1964
Highland Mountains	1962*	5	No Season
Bridger Mountains	1969	13	No Season

*No Transplants from 1963-68

use of areas available at other seasons. At elevations inhabited by goats, vegetative growth is dwarfed due to the short growing season and cool temperatures. Cliffs and steep rock slopes, typical of goat ranges, produce little forage.

Food habit studies show grasses and grass-like plants are used year-long and are most important in fall and winter. Forbs are most important during the summer. Shrubs are used most during the winter and spring. In some areas shrubs are important during the summer. Water does not appear to limit goat populations in Montana. Their ranges are in areas where snow provides abundant water at all seasons. Goats use natural or artificial salt grounds, particularly during the spring. There does not appear to be any advantage in attempting to artificially provide salt. The natural diet provides the minerals necessary for physiological needs.

Fig. 1. MOUNTAIN GOAT DISTRIBUTION – 1970.

ROCKY MOUNTAIN GOAT

Singles or twins, born in late May or early June, are soon able to follow the nanny in their rugged habitat. Cliffs are a necessary part of the escape cover for goats. — (F & G photo)

A variety of environmental factors affect goats. Hazards most commonly associated with losses are snowslides, landslides, falls and inclement weather. Predatory animals such as eagles, bears, coyotes, cougars and bobcats live in the same area with goats. The effect these predators have on populations tends to be exaggerated although occasional losses occur from predation. Significant population decimations by predators have not been verified. A number of diseases and parasites have been found in goats in Montana. Studies suggest parasites and diseases are most pronounced on crowded winter ranges.

MANAGEMENT

Goat hunting has improved through better management and research information during the past 25 years. Considerable effort was devoted to the trapping and transplanting program. From 1941-69, about 228 goats were trapped from native and established herds, and released in new areas. Hunting seasons usually were not opened until 10 to 15 years after transplants (Table 1). The

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transplant program substantially increased hunting recreation. Of the 650 limited goat permits issued to hunters in 1965, 190 (29 percent) were for hunting areas where goats did not exist prior to the transplant program.

Studies have been conducted on goat behavior, food habits, population and range conditions with more intensive management as a result. Hunting areas have been better defined with respect to population abundance, hunter access and harvest needs. Season length and bag limits have gradually been made more liberal. A mail questionnaire survey was initiated in 1959 which provides a reliable estimate of hunter harvest from each hunting area. The questionnaire also provides information on number of hunters, hunter success, and effects of weather on harvest. Presently all goat hunting is regulated by a permit system which allows a more refined control of hunter numbers and harvest.

HUNTING AND HARVEST

Hunting regulations for mountain goats were established in 1905 when the hunter was restricted to one goat per hunting season. The regulation was in effect for several years, and was followed by a closure of the entire state to the hunting of goats. From 1929 through 1935, a season was authorized for goats on the west side of the Bitterroot River in Ravalli County. A closure was in effect for the entire State from 1936 through 1938. In 1939 and 1940, seasons were again opened in parts of Flathead, Lewis and Clark, Missoula, Powell and Ravalli Counties. During the preceding interval, the season length was approximately 1 month with a variety of opening dates (mid-September to early November).

Mountain goat horns are sharply pointed. The goat pelt has long, warm fur and gives the appearance of pantaloons on the legs. The males are often solitary animals. Goats occupy rough mountainous habitat and are seldom far from cliffy terrain. — (F & G photo)

ROCKY MOUNTAIN GOAT

From 1941 through 1950, hunting seasons fluctuated considerably from one year to the next. Parts of Ravalli County were most consistently open to goat hunting during this interval. Flathead, Lewis and Clark, Missoula and Powell Counties were open to hunting during most years during this time. In 1951 goat hunting was open only in the upper south fork of the Flathead River. During 1952 and 1953, the upper middle fork and Spotted Bear drainages were included for a 5-day period.

A special goat license was created in 1953. Prior to this time goat hunting was permitted on the general big game license. The use of the special permit marked the first attempt to control the number of hunters in a given area. The first licenses were issued for the Crazy, Pioneer and Pintlar Mountain areas. Goat seasons in 1954 were similar to 1953 with a slight increase in the number of permits available. By 1955 permit quotas were considerably higher, 225 as compared to 50 in 1953. Fourteen hunting areas were open to hunting of mountain goats and seasons located in the upper Flathead tributaries were opened to an unlimited number of hunters. From 1956 through 1969, the general season pattern was similar with the majority of the seasons running from mid-September through late November. Permit quotas in limited areas increased from 250 in 1956 to about 650 in 1965. Several areas having difficult access have been open to an unlimited number of hunters during this time period. Since the initial regulations were established for goats in 1905, the bag limit has been one goat per person for a season.

Records of goat harvest from 1941 through 1955 show the annual bag fluctuating between 30 and 130 animals. In 1956 the goat harvest was estimated at 220 animals; by 1958 it had increased to 460 goats. In 1959 a statewide mail questionnaire was initiated to obtain hunting statistics. Part of the results obtained from these surveys (1959-1969) are shown in Table 2. Harvest levels hit a high of 513 goats in 1963, then showed some gradual reduction through 1969. The harvest peak and downward trend results from the reduction in the number of hunting areas having no limit on numbers of goat permits available. The 10-year average for goat harvest, in the areas where permit numbers have been regulated, has been reasonably stable.

Table 2. Mountain goat harvest statistics, 1959-69.

Year	Permits Issued	GOATS KILLED		HUNTERS		HUNTER SUCCESS	
		Limited Areas	Unlimited Areas	Limited Areas	Unlimited Areas	Limited Areas	Unlimited Areas
1959	1,203	138	105	345	839	40	13
1960	1,217	197	204	330	633	60	32
1961	1,138	191	141	358	504	53	28
1962	1,358	245	236	394	715	62	33
1963	1,640	217	296	420	846	52	34
1964	1,664	245	184	443	843	55	22
1965	1,667	230	112	536	589	43	19
1966	1,948	228	250	462	836	49	30
1967	994	294	90	589	256	50	35
1968	998	263	29	598	200	44	14
1969	896	267	66	543	213	49	31

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Fluctuations are observed in goat harvest from one year to the next for any given period of years. Weather is one of the most significant factors affecting harvest fluctuations. In many goat ranges, fall snow makes travel difficult or impossible in much of the steep terrain. If these conditions persist for an extended period, it will result in lower hunter success and overall harvest of goats.

The increased harvest noted from the mid-50's through the present is due primarily to liberalization of permit quotas and longer seasons. Also of importance is the number of new hunting areas created by the transplant program. In summary, Montana hunters are presently provided with about five times the goat hunting recreation that was available 25 years ago.

FUTURE OUTLOOK

The mountain goat will continue to be an important part of the big game fauna in Montana. As the demand for hunting increases, more refined field techniques for determination of harvestable surpluses will be needed. Much effort will be devoted to proper use of existing resources.

The quality and quantity of mountain goat habitat is expected to remain stable in the future. Suitable ranges in Montana are already occupied and conversely, it appears little habitat will be lost to encroachment of civilization. Most ranges are on public lands, and are too broken and rough for man's purpose. Other big game and domestic animals are not physically capable of competing in goat habitat for forage and space. These factors, coupled with proper game management, will assure perpetuation of Rocky Mountain goats in Montana.

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12

BLACK BEAR

By R. Weckwerth

Montana has a sizeable population of black bear (*Ursus americanus*) in much of the timbered portions of the State. They are native to western Montana and probably became more numerous in some areas when the grizzly bear population declined. Their habitat is continuous from western Montana to the wooded foothills east of the Continental Divide. Black bear are found in a few isolated mountain areas east of the Divide. They are found in a variety of forest habitats varying from open ponderosa pine to spruce-fir forests. Distribution of black bear in Montana has not changed noticeably since 1941 (Figure 1).

The Fish and Game Department conducted intensive studies of black bears in the Whitefish range of northwestern Montana during 1959-66. Bears were found to inhabit spruce-fir areas during the entire year, but make seasonal use of other habitats whenever certain foods become abundant. They appear to thrive best wherever human habitation, logging or agriculture have not significantly altered their environment. They avoid logged areas which have been clearcut until regrowth of brush and conifers takes place.

Black bears in the lower spruce-fir type had small seasonal movements. Female home range size was about 2 square miles and male home range size was about 12 square miles.

Black bears eat a variety of grasses, sedges and forbs as soon as they emerge from their winter dens. Fruits, pine nuts and berries are also an important part of their diet during late summer and fall. They sometimes kill animals, eat carrion, or feed in garbage dumps, especially in early spring or late fall.

Black bears go into dens for the winter although they are not "true" hibernators in that their body temperatures do not drop significantly. Most bear dens are located beneath large conifer or cottonwood trees at fairly low elevations. Denning bears appear to be awake and move slowly, but if disturbed they may become

GAME MANAGEMENT IN MONTANA

Fig. 1. BLACK BEAR DISTRIBUTION – 1970.

irritated and make a rush for the den entrance. Bears in the Whitefish range appear to den up from late October to early May. The breeding season takes place mainly in June. Bears are characteristically seen as small family groups or alone.

MANAGEMENT

Black bear management has changed somewhat in the past 25 years. Changes were made in types and lengths of hunting seasons. From 1943-59 the hunting season was split with a 1-month spring season, and a fall season opened concurrently with the deer and elk season. Since 1959 the black bear season has opened in mid-March and closed with the big game season in the fall.

Studies in the Big Creek drainage of the Whitefish range of Flathead County showed more bear could be harvested. During the first year of the study only 3 percent of the marked population was harvested. Later, after considerable publicity about the availability of bear, the harvest of the tagged population increased. Because of this study, special non-resident licenses were made available in many areas in 1961. The non-resident licenses can be used during spring and summer when other big game seasons remain closed. The killing of females with cubs after the end of August was made legal in 1960. Research findings indicate cubs are self-sufficient after that date. Cubs over 6 months of age and as small as 18 pounds can survive without the female.

Female black bears are capable of breeding at 2½ years, but more have been known to be near 6½ years of age before breeding successfully. No female bears in the Big Creek drainage were found to be in estrus until they reached 4½ years of age. Female bears are believed to undergo a type of delayed egg implantation after breeding in June or July. The fertilized egg changes very little until the late stages

BLACK BEAR

of pregnancy. The egg then implants in the uterus and begins to grow. The implantation probably takes place in November.

The young are born in January or February and weigh only from 9 to 12 ounces at birth. The average litter size is two but may range from one to three. Cubs stay with their mother and den with her as yearlings. Bears can have litters every other year although they are not consistent. Yearlings are not closely associated with the mother during the breeding season but remain on the female bear's home range for a considerable time after the close family ties are severed.

Black bear management problems have stemmed mainly from bear depredations. A study of reported predation and claims of the Predator Control Division, U. S. Bureau of Sport Fisheries and Wildlife, indicate many livestock losses are falsely attributed to black bear on both sides of the Continental Divide in Montana.

HUNTING AND HARVEST

Hunting and harvest information from the annual hunter questionnaire shows the bear kill fluctuates considerably (Table 1). When statewide spring and summer hunting became legal in 1959, the harvest increased (Table 1). This increase was also partially due to the availability of non-resident black bear licenses. Although black bear hunting has improved, the seasonal bag limit of one bear per season (either black or grizzly) remained the same until 1967 when one bear of each species

A fine trophy black bear may appear to have a hump at its front shoulders, but this is not as pronounced as in grizzly bears. Active at periods of daylight and darkness, they are omnivorous, eating both plant and animal material. — (Photo by John and Frank Craighead)

GAME MANAGEMENT IN MONTANA

Table 1. Black bear harvest in Montana, 1947-69.

Year	Number of Bear Killed	Year	Number of Bear Killed
1947	800	1959	1,480
1948	680	1960	1,460
1949	760	1961	1,790
1950	410	1962	1,300
1951	740	1963	1,120
1952	730	1964	1,500
1953	550	1965	1,080
1954	200	1966	1,950
1955	200	1967	2,100
1956	390	1968	1,950
1957	680	1969	1,700
1958	1,060		

became legal. The number of bear hunters increased during the 1960's, with the advent of longer seasons, non-resident black bear licenses and more publicity on techniques and opportunities of spring bear hunting. The statewide black bear harvest has varied from about 1,000 to 2,100 animals annually.

FUTURE OUTLOOK

Little more can be done to govern black bear harvest by manipulating season lengths. Black bears might become a more popular trophy if their status were elevated to that of deer or elk by placing a bear tag with a fee on the big game license. This may make hunters more bear conscious. More publicity on the value of the black bear as a trophy and food animal would also make the black bear a more desirable game species.

Hunting black bears with dogs is a popular sport in many states and should be tried in Montana. Baiting may also be a useful hunting technique in areas where a higher bear harvest is desired. Black bear hunting success in the early spring could be enhanced if hunters concentrated their efforts on open snow slide areas where bears do much of their foraging. These areas furnish the earliest green vegetation and tend to concentrate the bears in the early morning or late evening hours.

As with other big game species the future of bear habitat will depend greatly upon public forest management practices. Current silvicultural practices of clear-cutting large blocks of trees can limit the amount of bear habitat in some areas.

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13

GRIZZLY BEAR

By R. Weckwerth

Montana, with the exception of Alaska, has the largest remaining grizzly bear (*Ursus arctos*) population in the United States. They were extirpated from Arizona, New Mexico and California when these states became more populated. They are unique, majestic game animals which are now considered a rare species. Early explorers wrote of seeing them in eastern Montana but the plains grizzlies have vanished from the plains habitat.

Grizzlies are found in the more remote forested regions of the State (Figure 1). These areas include Glacier National Park, Yellowstone National Park, the Flathead and Kootenai National Forests and remote areas such as the Mission Mountains, Absaroka Mountains, Cabinet Mountains, Bob Marshall Wilderness Area and a few other isolated areas. The largest huntable population is found in the Bob Marshall Wilderness which encompasses almost 1 million acres in northwestern Montana. Grizzly bears are not compatible with increasing human population, and their habitat in Montana is constantly being reduced. Logging activities can have an adverse effect on the habitat and make it more accessible to man. The amount of habitat changed since 1941 is unknown because precise information on optimum grizzly habitat is limited.

Important components of the overall mountain habitat for grizzlies include rock slides, alpine meadows and heavy timber. Snowslide areas are especially important sources of early spring foods. Alpine meadows are used in late summer by grizzlies feeding on vegetation and rodents. Heavily timbered areas furnish security and fall foods such as berries and white-bark pine cones. Grizzlies are opportunists and will eat almost anything. Grasses and sedges probably make up a large portion of their diet, but they will eat carrion, fruits, pine nuts, roots and other animals.

Studies in Yellowstone Park by Drs. John and Frank Craighead show that grizzlies breed in June and July, have a 4- to 5-month delay of implantation with a 6-

GAME MANAGEMENT IN MONTANA

Fig. 1. GRIZZLY BEAR DISTRIBUTION — 1970.

to 8-week fetal development, or true gestation period. The young are born in the winter den and are described to be the size of “squirrels” at birth. Young female grizzlies in Yellowstone did not breed successfully for the first time until they were 4 years of age, producing their first litters at 5. The average litter size was 2.2; the largest litter observed was 4. The birth rate averages 19 percent of the total population annually, slightly higher than the death rate. Grizzly bears in Yellowstone Park den in caves excavated on northern exposures. These dens are normally not used year after year and are located at elevations from 8,000 to 9,000 feet.

MANAGEMENT

Grizzly management policies in Montana have not changed appreciably over the years. The big bears can be hunted each fall during the open big game seasons. The grizzly bear closure in the south fork of the Flathead was abandoned in 1955. The only remaining refuges are National Parks and the Sun River Game Preserve. A national park is not entirely a refuge because some bears are eliminated if they bother park visitors. Predator control has also made inroads on the population, especially where grizzlies range into ranching areas.

Extensive grizzly bear surveys have been made by Fish and Game Department personnel in the Bob Marshall Wilderness and nearby areas of northwestern Montana. The major grizzly bear research project has been outside of Montana, in Yellowstone National Park. Many bears in the Park have been captured, weighed, measured and marked. Radio-equipped bears have been tracked and monitored to determine home and seasonal ranges, social behavior, food habits, pre-hibernation behavior and to locate the winter dens. The study also is providing information

GRIZZLY BEAR

about age structure of the population, mortality rate, birth rate, reproductive biology, longevity, growth and development.

HUNTING AND HARVEST

The grizzly bear hunting season runs concurrently with elk and deer seasons. Prior to 1967 a license holder was allowed one bear of either species each year. In 1967, legislative action created a special grizzly bear license. The successful hunter is also now required to purchase a trophy license within 10 days after killing a grizzly bear. The licensing system specifically for grizzlies is expected to provide more accurate harvest information for future management. The number of licenses sold will indicate trends of hunting pressure. Previously, harvest information was gathered through big game checking stations, big game questionnaires, outfitter reports, and from U. S. Forest Service personnel. A somewhat stable harvest of grizzlies has been maintained for the past 2 decades. From 10 to 60 grizzly bears are killed annually by hunters in Montana, with a 20-year average of 37 per year.

Grizzly bears, not commonly seen in groups such as this, have often been attracted by artificial food in the vicinity of Yellowstone Park. Seasonally, meadows and slopes of the mountains are used for natural foraging. — (Photo by John and Frank Craighead and Jay Sumner)

GAME MANAGEMENT IN MONTANA

In 1969 there were 1,638 grizzly bear hunting licenses sold; 1,474 to residents, and 164 to non-residents. This indicates a considerable number of hunters regard the grizzly as a valuable trophy. A legal harvest of 33 bears was derived from the trophy licenses sold in 1969. Several other bears were killed illegally, accidentally, or for nuisance reasons.

FUTURE OUTLOOK

Any future management plans will have to consider the lack of compatibility of grizzlies with man and civilization. Only inaccessible wild areas are left for the grizzly. If these remain inaccessible and fill habitat requirements of the species, we may be able to sustain grizzlies with an annual huntable population. Their value as a big game trophy will continue to grow.

Some new regulations and practices can help the future status of the grizzly. The proper and prompt disposal of all garbage in logging camps, national park campgrounds, and U. S. Forest Service trail camps and campgrounds will reduce bear harassment and damage complaints. All grizzly kills of livestock should be investigated by appropriate personnel. Many kills reported as grizzly predation are just opportunistic bears eating a cow or sheep that died by other causes.

Unfortunately, two persons were killed in Glacier National Park and two others severely injured by grizzly bears in northwestern Montana in 1967 and 1968. Other incidents have occurred in Yellowstone National Park. Accidents such as these tend to create public opinion against the grizzly which in turn complicates management of the species.

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GAME BIRD MANAGEMENT

Bird hunting is an increasingly popular sport with Montana hunters. More than 75,000 people usually hunt upland game birds each fall, and about 20,000 hunt waterfowl. Ten species of upland game birds occur in Montana. Native birds are white-tailed ptarmigan, spruce (Franklin's) grouse, ruffed grouse, blue grouse, sharp-tailed grouse and sage grouse. Introduced species are ring-necked pheasant, Hungarian (gray) partridge, Merriam's turkey and chukar partridge. Mourning doves are native and abundant but presently lack legislative designation as a game bird.

Montana's small game management program is based on the knowledge that game bird populations experience a high annual natural loss. Game birds suffer a high death rate which is compensated by a high reproductive rate. Populations tend to increase to a saturation point or capacity of their habitat. Each breeding season produces surplus birds which will not live until the next breeding season. When hunting is allowed, many of these surplus birds can be taken by hunters instead of dying from other causes. A favorable habitat will support a higher breeding population and produce a larger surplus of game birds than an area with poor food and cover. Activities such as intensified farming, heavy grazing, and road construction reduce the quality and quantity of habitat.

The objectives of the game bird management program are to assess and improve habitat conditions, to inventory game populations, and to provide hunters ample opportunity to use harvestable bird surpluses on a continued basis.

Systematic surveys of the game bird species have been conducted by game management personnel since the early 1950's. Bird management recommendations are based on annual trends of breeding populations, production of young and hunting harvests. Game bird restoration through trapping and transplanting of certain introduced species has increased hunting for Montana sportsmen. Research into the ecology of game bird species is continuing to provide guidelines for wildlife and land managers. Increasing recreational demands place a premium on obtaining further knowledge for managing game birds and their habitats in harmony with future uses of water, soil and plant resources.

15

SHARP-TAILED GROUSE

By R. L. Brown

The sharp-tailed grouse (*Pedioecetes phasianellus*) known widely as “pintails” or “chickens” are native to Montana. The unique breeding grounds of the sharptail are interesting to observe in the spring when groups of males fight, spar, bluff and dance to attract hens for mating. Historically, in the Great Plains region, these were grouse of the prairie brushlands. Today their most secure habitat is the upland prairie where heavy grazing or cultivation have not completely altered the native upland grasses and shrubs.

Distribution of the sharptail has become more restricted as agricultural land usage has intensified during the past 25 years. Two subspecies of sharp-tailed grouse remain established in Montana.

The Great Plains sharptail remains seasonally abundant in the less dry upland areas of eastern and central Montana where mixed-prairie rangelands have been maintained in reasonably good condition (Figure 1). Sharptail numbers vary greatly however, between the drier sagebrush and the more moist upland prairies. During high populations breeding sharptails extend their range well into the marginal islands of native grasslands, usually along drainages surrounded by wheat, barley or summer fallow. Conversely, during low populations sharptails are more restricted around the upper limits of drainages with the best stands of inter-mixed tree-shrub grasslands.

The Columbian sharptail, once more widely distributed over grasslands west of the Continental Divide, now persists only in three limited and widely separated areas of the Blackfoot, Flathead and Kootenai River valleys (Figure 1). These fragmentary populations persist only where major remnant stands of bunch grasses and shrubs of the native prairie remain. Because only limited habitat remains, the Columbian sharptail represents an endangered species in northwestern Montana.

Sharptail living requirements vary each day and each season of the year

GAME MANAGEMENT IN MONTANA

Fig. 1. SHARPTAIL GROUSE DISTRIBUTION – 1970.

according to changing requirements for food, water, rest and social interaction. During the year sharptail activities are divided into three main categories: March to June for breeding; June to September for rearing young and feather molt; and September to March in social groups sorting into winter flocks. Farming and intensive grazing commonly remove two items of the native prairie necessary for sharptail existence. The first consists of standing grasses, left over from fall to spring, required for shelter, for protection from predators, for night roosting and for spring nesting activities. Dense trees and shrubs comprise the other essentials needed for food, rest, escape, cover and winter survival. Snow, rain, wind and temperature extremes greatly influence the welfare of grouse, depending of course on condition of the habitat sheltering grouse from the elements. Strong prairie winds and snow are an ever changing stress in the winter. By roosting behind rough topography or in deep snow, sharptails find protection from the weather as well as predators.

Within limits, sharptails adapt to modern agriculture. During winter they readily feed on grain in stubble, in stacks and in cattle feed lots. In feed lots they frequently become as tame and as sassy as sparrows. During dry periods, in July or August, they may collect in large shelter belts where water and shade are available.

In many farming areas of Montana, the consolidation of farm units during the past 25 years has greatly eliminated the adjoining pasture-field-shelterbelt living spaces. Where soils and slopes permit, however, plowing and dryland grain farming continue to increase the economic output and valuation of the land. On many deteriorated rangelands which were grazed into the annual grass-weed stage in the 30's, productivity has been restored by better range livestock management. Grouse prosperity has followed that of grass and brush in these areas. Looking to the sky

SHARP-TAILED GROUSE

for rain isn't the answer to range or grouse management; looking at the ground and its management comes closer to solving these problems.

MANAGEMENT

The mainstay of managing this species continues to be regulated season lengths and bag limits. Hunting season recommendations are based annually upon trends in breeding population numbers and the production of young which are determined by systematic coverage of sampling routes on the breeding range.

Present management practices consist mainly of regulation of the harvest. As much of the habitat is on private land, hunting access is determined by landowners. Some farmers and ranchers are still convinced that hunting holds grouse numbers down, especially those who have seen their pet brood near the shelterbelt reduced to two or three during the hunting season. Seven years of banding studies involving nearly 2,000 banded sharptails generally do not support this. Banding has shown that excessive kills can occur on local areas. Hunter harvests on year-around habitat units of 40 to 100 square miles have ranged between 5 and 30 percent of fall populations with current hunting pressures. On these same areas 65 to 75 percent of breeding populations were lost each year to all causes. Hunting generally takes only part of the natural surplus of birds produced each year. A wild population, naturally short-lived, does not lend itself to "stockpiling" over to the next year.

Research emphasis was shifted from the extensive sharptail inventories conducted in the early 40's to investigations on annual breeding population trends and production 10 years later. Intensive studies on marked populations were begun

Research studies on sharptails have investigated the influence of pesticides, blood parasites and social organization on their survival and reproduction. — (Photo by Neal F. Mishier)

GAME MANAGEMENT IN MONTANA

in 1960. Research projects are stimulated by concern for the welfare of these grouse not only from the viewpoint of sport hunting, but as representatives of the native fauna. Research aims have been to obtain basic information on populations, habitat requirements and factors limiting reproduction and survival. Special study aspects have included the influence of pesticides, blood parasites and social organization on survival and reproduction.

HUNTING AND HARVEST

Sharptails first came under protection of the Legislature in 1870 when hunting was limited for all native grouse by a legal open season which extended from Aug. 15—March 1. The daily bag limit was first fixed at 20 prairie grouse in 1901 with a season length of 3 months.

The restrictive trend in prairie grouse hunting regulations was most pronounced during the 30's when closed seasons were the rule and 3-day seasons the exception. Later, management surveys were expanded and became more systematic in collecting information on breeding populations, production and harvest trends. With information from research studies, more liberalized hunting opportunity was biologically justified. According to hunter questionnaires the statewide harvest of sharptails has ranged from 31,826 to 40,715 during the 1958-62 period and from 49,220 to more than 140,000 during the years 1963 to 1969 (Table 1).

Table 1. Statewide sharp-tailed grouse harvest 1958-69.

Year	Number Harvested	Year	Number Harvested
1958	40,715	1964	107,232
1959	35,664	1965	49,220
1960	37,918	1966	140,585
1961	36,270	1967	79,054
1962	31,826	1968	66,825
1963	85,363	1969	99,776

FUTURE OUTLOOK

Future management objectives for the sharptail must include manipulation of proper harvest and solutions to hunter-landowner problems which diminish hunting opportunities. Action programs are needed to stimulate habitat maintenance and improvement by improved management of water, soil and range resources on both public and private lands. The enjoyment these grouse provide future generations will depend primarily on well managed livestock ranges and lands unsuited to the plow.

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16

SAGE GROUSE

By N. Martin and D. Pyrah

Sage grouse (*Centrocercus urophasianus*), commonly called sage hens or sage chickens, are one of Montana's most important and unique game birds. The largest of all North American grouse, sage hens drew the attention of early explorers and settlers as well as the American Indians before them. The unique behavior of these large grouse strutting on their traditional breeding grounds is a sight still enjoyed by many people.

No matter what these birds are called, the name usually includes "sage." Few other birds are so dependent upon a specific kind of vegetation for food and cover. The original range of this bird was similar to the distribution of big sagebrush and related species.

In pioneer times, sage grouse were considered the leading upland game bird in nine western states including Montana. However, by the mid-1930's, agricultural development including livestock grazing, resulted in an estimated 50 percent decrease of the bird's original habitat. Sage grouse were then considered important only in parts of Montana, Wyoming, Idaho, and Nevada. At present sage grouse are found in the sagebrush-grasslands of 39 counties of eastern, central and southwestern Montana. The overall geographic distribution of sage grouse in Montana has varied little between 1941 and the present (Figure 1).

Live trapping and transplanting were conducted in 1942 in an attempt to re-establish sage grouse to former areas and several new locations. A total of 242 birds was released at eight separate locations in seven counties, including two west of the Continental Divide. The introductions and attempts at re-establishment were not successful.

Few animals are as specialized and specific in their habitat requirements as sage grouse. Because of their thin-walled gizzards, sage grouse depend upon the leafy material of sagebrush and herbaceous plants.

GAME MANAGEMENT IN MONTANA

Fig. 1. SAGE GROUSE DISTRIBUTION – 1970.

Examinations of 186 sage grouse crops collected in various parts of Montana demonstrates their selective feeding habits. Over 90 percent of the food consumed annually consisted of plant material. The summer diet included a variety of plants and some animal matter, however, dandelion, goatsbeard, and sagebrush constituted more than three-fourths of the crop contents. Different species of sagebrush, primarily big sage, supplied the major portion of the food during other seasons. Big sage composed nearly 100 percent of the winter diet.

Characteristics of vegetation used for various daily and seasonal activities further exhibit the inseparable relationship of sage grouse and sagebrush. The composition of vegetation was determined at the summer locations of sage grouse, or groups of sage grouse, in southwestern Montana. Grasses comprised approximately 60 percent and forbs 40 percent of the total herbaceous vegetation at the locations. Common herbaceous plants included bluegrass, bluebunch wheatgrass, Idaho fescue, milkvetch, and dandelion. Big sage was the only low shrub that occurred at the sites with a greater percent frequency than 10. The characteristics of big sage plants were determined at brood, adult, and nesting hen locations. Plant heights at brood locations ranged from 9 inches to 15 inches as compared with 7 inches to 25 inches at adult locations. Crown of big sage at nest sites was like that for early broods, and all but one of the nests found were in areas used by early broods. Early broods were observed in areas having an average sagebrush crown coverage of 14 percent. Adults used sites where sagebrush canopy averaged 25 percent. A similar sagebrush coverage was obtained for early broods in central Montana.

Although sage grouse are not migratory in the usual sense, they move considerable distances in winter to areas of abundant sagebrush. The sagebrush crown density on winter activity sites in central Montana averaged 33 percent.

SAGE GROUSE

Movement to areas of denser sage is expected however, when it is recalled that the winter diet is almost exclusively sagebrush.

The effects of chemical manipulation of sagebrush on a sage grouse population were evaluated in southwestern Montana where a 1700-acre area had been strip sprayed with 2,4-D. Sprayed strips provided only 4 percent of 415 sage grouse observations, despite the fact that they comprised 90 percent of the area. The difference in the number of sage grouse between sprayed and unsprayed strips was related to differences in vegetation composition. The total herbaceous coverage in unsprayed strips was like that at sage grouse locations, grasses 60 percent and forbs 40 percent. The relationship was about 80 and 20 percent in the sprayed strips. Sagebrush coverage and favored food plants were also greatly reduced in the sprayed strips.

MANAGEMENT

Information concerning sage grouse populations prior to 1952 was obtained from incidental observations, as no intensive research was in progress. Limited information suggests they started to decline about 1943, and continued downward for several years, despite closed hunting seasons for 7 years, 1945 through 1951.

In early April, hens congregate on strutting grounds. Adult male grouse are on or near strutting grounds from late February until early June. — (Photo by Harry Lumsden)

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Sage grouse return to traditional areas for breeding each year. Counts of the maximum numbers of birds are made each year on selected strutting grounds to determine trends in their relative abundance. — (Photo by Harry Lumsden)

Although sage grouse have demonstrated both local and statewide fluctuations, populations depend upon the quality and quantity of existing sagebrush ranges.

Since 1952, several research projects on the life history and ecology of sage grouse have been completed. They provided a basis for current management practices including strutting ground censuses, brood surveys, determination of hunter harvest, habitat maintenance and evaluation.

Initial methods of strutting ground census included establishment of trend areas approximately 50 square miles in size located throughout sage grouse habitat. These areas were given complete aerial coverage during strutting ground use. Counts of maximum numbers of birds were also made each year on selected strutting grounds. The results provide year-to-year trends and furnish information regarding relative abundance.

Summer brood surveys and fall checking stations provide annual production information, including regional trends, and guidelines for hunting season recommendations.

Measurements and condition of wing feathers from hunter-killed birds provide sex and age ratios and indicate reproductive and population trends. Estimates of total harvest and hunter participation are obtained from questionnaires.

Habitat maintenance and evaluation require investigation of proposed sagebrush control projects, a major problem involved in sage grouse management, and continued study of seasonal habitat requirements of sage grouse.

Except for fencing of several dozen reservoirs and stock watering ponds in 1941 to regulate livestock usage, no habitat development has been undertaken; instead, maintenance and preservation of existing habitat has been emphasized.

HUNTING AND HARVEST

Montana has had some type of sage grouse hunting season during 21 of the past 29 years; however, it was not until 1955 that season lengths exceeded 3 days. Since that time hunting seasons have been gradually liberalized as banding studies indicate current hunting pressure has not been depleting the year-to-year breeding stock. More liberal bag limits have coincided with longer season lengths. Prior to 1959, possessions were limited to either three birds per day (two in some counties), or three birds in the aggregate, which included all native upland game birds. In 1959, the daily limit was three sage grouse with a possession limit of six after the first day. By 1963, the majority of the counties open to hunting had increased the daily limit to four birds with a possession limit of eight. The liberalized hunting regulations have increased the harvest, which for instance was

Numerous sage grouse have been captured, banded and marked for further observations during studies in central Montana. Data is being obtained on habitat to improve guidelines for the management of sagebrush, the primary plant essential to this bird. — (F & G photo)

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more than five times greater in 1964 than in 1958 (Table 1). The importance of sage grouse recreational potential is evident. They comprise up to more than 10 percent of the total native upland game bird harvest.

Table 1. Statewide sage grouse harvest, 1958-69.

Year	Number Harvested	Year	Number Harvested
1958	18,587	1964	99,138
1959	23,150	1965	30,030
1960	33,876	1966	56,740
1961	27,364	1967	29,493
1962	32,572	1968	29,581
1963	72,363	1969	54,201

FUTURE OUTLOOK

It is impossible to consider the future of sage grouse without considering the future of sagebrush ranges they inhabit. Sage grouse are dependent upon sagebrush and plants associated with sagebrush-grassland ranges for food and shelter demands. In recent years however, accelerated sagebrush control has occurred on both private and public lands in an attempt to convert sagebrush ranges to grass. Many of these ranges presently provide excellent habitat for sage grouse and any program which removes or drastically reduces sagebrush on ranges they inhabit can be detrimental to their welfare. Since sage grouse have not adjusted to patterns of land use which eliminate or seriously disturb any of their seasonal ranges, their existence depends upon man's ability and willingness to maintain vital habitat.

In 1965 a long-term study of the effects of sagebrush control on associated fauna and flora was begun in central Montana by the Montana Fish and Game Department and the Bureau of Land Management. Segments of this study are designed to provide needed information on sage grouse habitat requirements and to improve guidelines for sagebrush management.

If sage grouse are to hold importance as a leading native game bird in Montana, continued research, improved range management and preservation of sagebrush habitat is essential.

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FOREST GROUSE

By T. Mussehl, P. Schladweiler and R. Weckwerth

Three species of forest-dwelling grouse, blue (*Dendragapus obscurus*), ruffed (*Bonasa umbellus*), and spruce (*Canachites canadensis franklinii*) are native to the mountains of Montana. Knowledge of these grouse in the early days is quite limited. The “woods-chickens” shot by early explorers and settlers served more as a food supplement than as a sport.

Forest grouse were recognized as game birds when Montana was in its infancy. Grouse hunting seasons were established in 1870. The recreational value of forest grouse is presently receiving increased recognition. The mid-September opening of grouse hunting spells to many hunters a traditional outing or two, preliminary to big game hunts. To a small but increasingly larger group of ardent nimrods, the forest grouse opener is the first of numerous grouse hunting trips into the hills. The sporting and eating qualities and the widespread distribution of these grouse insures them a favored place with Montana bird hunters.

Except for a few local situations, the distribution of blue, ruffed, and spruce grouse in Montana has probably changed little in the past 25 years. Local populations have been altered by changes in habitat due to effects of logging, burning and forest growth. Transplanting of native forest grouse has not been necessary.

Blue grouse are common in the widespread coniferous forests of western Montana and in isolated mountain ranges as far east as the Judiths, Moccasins, Little Rockies, Bear Paws, Snowies and Pryor mountains (Figure 1). Blue grouse are usually associated with Douglas-fir throughout their range. Ruffed grouse are common in western Montana and east of the Continental Divide in the scattered mountains and associated drainages of central Montana (Figure 2). Spruce grouse have the most limited distribution of Montana forest grouse, being found mainly in western Montana (Figure 3).

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Fig. 1. BLUE GROUSE DISTRIBUTION – 1970.

Fig. 2. RUFFED GROUSE DISTRIBUTION – 1970.

A variety of habitats are important to forest grouse species at different seasons of the year. Blue grouse winter at high elevations. In early spring, they descend to semi-open timber for breeding and brood-raising. Males establish breeding territories adjacent to forest edges and openings, often near thickets of young conifers. Each breeding male defends a territory of one to two acres.

FOREST GROUSE

Fig. 3. SPRUCE (FRANKLIN) GROUSE DISTRIBUTION – 1970.

Abundant herbaceous cover in forest openings is particularly important for brood security during early summer.

Ruffed grouse inhabit denser cover of mixed conifer and deciduous trees and brush and are often found along stream bottoms. They remain within a smaller area and denser year-around habitat than the far-ranging blues. Adult ruffed may spend most of their lives in less than two square miles of habitat. The males generally are found within one-half mile of their "drumming logs."

Less is known about the habitat requirements of spruce grouse. They inhabit the denser forest types such as alpine fir, Englemann spruce or lodgepole pine. During the winter, blue and spruce grouse live mainly on conifer needles. Ruffed grouse depend upon buds of deciduous trees and shrubs. In summer, the various forest grouse subsist on mixed diets of insects, green plants and berries. Insects are the predominant food for young chicks.

Grouse habitat depends greatly upon the stages of forest growth and effects of logging, grazing and fires. The beneficial influence of fires is now limited by modern fire control. The amount and quality of grouse habitat in the future will be determined mainly by forest management. High densities of breeding blue grouse are found in semi-open, ponderosa pine-Douglas-fir areas selectively logged about 20 to 30 years ago. Blue grouse are now scarce and ruffed grouse common on forest lands logged or burned in the 1910-20 period and since filled in with brush and conifers. Accelerated reforestation, such as tree planting, can limit the time that logged or burned areas provide suitable grouse habitat.

Grazing also affects grouse habitat. Blue grouse brood ranges often overlap areas grazed by domestic stock or big game. Heavy grazing on forest openings and edges removes vegetation vital to grouse brood security during early summer. The quality of ruffed grouse habitat may also vary with the intensity of grazing in

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stream bottom areas. Heavy grazing in the higher brood habitat of the spruce grouse is less likely. Domestic sheep summering at higher elevations on public forests have generally been reduced or eliminated. Forest grouse generally benefit from improvement of overall range conditions in mountain and foothill areas.

MANAGEMENT

Distribution surveys of forest grouse were conducted west of the Continental Divide in 1942, 1946 and 1949. In 1942, a six-man crew traveled 1,577 miles of mountain trails surveying grouse numbers. In 1952, several areas east of the Divide were also included. New survey techniques were subsequently added to aid in grouse management. Grouse hunter success, grouse production and other biological data have been collected at checking stations since 1949. Fish and Game Department and U. S. Forest Service personnel began annual summer surveys of forest grouse production in the late 1940's. Annual postal collections of grouse wings from cooperating hunters began in 1959 to supplement checking station data on age and sex of harvested grouse. Ruffed grouse can be censused by spring drumming counts and this is done in many states. The method has been of limited value in Montana because of interferences due to stream noise, mountainous terrain and limitations of manpower.

The first intensive banding study of forest grouse started in the Bridger Mountains near Bozeman in 1957. Blue grouse ecology was studied and evaluations made of the effects of land use and hunting on populations. Research continued in the Judith Mountains near Lewistown during 1959-61 and on the Bitterroot National Forest near Hamilton during 1962-69.

The 12 years of study provided basic criteria for the management of blue grouse. Information obtained on the upward movements during late summer and

The spruce grouse is found primarily in the denser forest types. Its docile behavior has earned it the name of "foolhen." — (F & G photo by T. W. Mussehl)

Ruffed grouse inhabit denser cover and remain within a smaller area than the wide-ranging blue grouse. — (F & G photo by Vern Craig)

growth rates of young blue grouse provided a basis for opening the hunting season in early September. Banding studies in three Montana areas indicated that current hunting pressure was not reducing year-to-year grouse populations as popularly believed. These findings have been supported in several other states. Montana forest grouse hunting regulations are now more generous to the bird hunter. The studies also have been of value in showing the relationship between logging and grazing and blue grouse breeding and brood habitat.

Knowledge of blue grouse ecology was further utilized when the effects of pesticides were evaluated during spruce budworm spraying in 1963-64. Blue grouse survived the one-half-pound DDT applied per acre but carried rather high residues of DDT in the body fat for the next year. The Food and Drug Administration recommended closing or curtailing hunting in DDT spray areas for public health reasons. DDT has since been discontinued for use on public forests because of the growing awareness of its undesirable persistence in the environment. In 1965, the Fish and Game Department began a research contract with the U. S. Department of Interior to ascertain the effects of new, short-residual insecticides on forest grouse. These studies are aimed at helping provide solutions to wildlife-pesticide problems on public forests.

HUNTING AND HARVEST

The opportunity to legally hunt grouse was once quite limited (Table 1). In 1940, a one-day season with a three-bird bag limit was allowed in 38 counties. Since then grouse hunting regulations have gradually been liberalized. Beginning in 1960, season lengths ranged from 57 to 78 days in 29 to 35 counties with bag limits usually of 5 grouse per day and 10 in possession. The recent liberalization of hunting seasons followed intensive blue grouse banding studies which showed that current hunting pressure did not jeopardize subsequent breeding populations.

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Table 1. History of Mountain Grouse Hunting Seasons (1940-1969).

Year	Species	Opening Day	Season Length (Days)	Number Counties	Bag Limit	Possession Limit
1940	Blue, Ruffed, Spruce	September 22	1	38	3	3
1941	"	September 21	3	1 (Lincoln)	3	6
1942	"	September 20	3	4 (W. of Divide)	3	5
1943	"	September 19	3	4 (W. of Divide)	3	5
1944	"	September 17	2	8 (W. of Divide)	3	5
1945	"	September 23	2	7 (W. of Divide)	3	6
1946	"	September 22	2	7 (W. of Divide)	3	6
1947	"	September 21	2	7 (W. of Divide)	3	3
1948	"	closed entire state				
1949	"	September 25	3	9 (W. of Divide)	3	3
1950	"	September 24	3	9 (W. of Divide)	3	3
1951	"	September 23	3	10	3	3
1952	"	September 14	8	10	3	3
	"	September 14	3	2	3	3
1953	"	September 27	8	5	3	3
	"	September 27	3	25	3	3
1954	"	September 26	8	9	3	3
	"	September 19	3	21	3	3
	"	September 15	47	Bob Marshall Area	3	3
1955	"	September 18	15	29	3	3
1956	"	September 16	15	25	3	3
1957	"	September 15	15	30	3	3
1958	"	September 21	15	30	3	3
1959	"	September 13	29	27	5 ¹	10 ²
	"	September 13	8	4	5 ¹	10 ²
1960	"	September 11	58	26	5 ¹	10
	"	September 11	29	5	5 ¹	10
1961	"	September 17	65	29	6 ¹	12
	"	September 17	44	2	6 ¹	12
1962	"	September 9	78	31	6 ³	12 ⁴
1963	"	September 8	78	32	6 ³	12 ⁴
1964	"	September 13	71	32	5	10
1965	"	September 12	78	35	5	10
1966	"	September 11	78	10	5	10
	"	September 18	71	24	5	10
1967	"	September 10	71	18	5	10
	"	September 17	64	16	5	10
1968	"	September 8	85	23	5	10
	"	September 15	78	10	5	10
1969	"	September 13	72	10	5	10
	"	September 13	79	24	5	10

¹ Including no more than three of one species.

² Including no more than six of one species.

³ Including no more than four of one species.

⁴ Including no more than eight of one species.

More generous forest grouse hunting seasons have increased the grouse harvest and provided many additional hours of hunting recreation. The annual total forest grouse kill during the 1960-69 period was usually double that of 1958-59 (Table 2). Despite length of seasons the greatest hunting pressure occurs early. After the opening day surge, bird hunting pressure has been found to decrease rapidly. The

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Blue grouse descend to lower elevations to breed and raise their broods. Logging and grazing practices can influence the quality of blue grouse habitats.—(F & G photo by T. W. Mussehl)

Table 2. Forest Grouse Harvest, 1958-1969.

Year	Blue Grouse	Ruffed Grouse	Spruce Grouse	Total Forest Grouse
1958.....	32,306	28,766	11,506	72,578
1959.....	28,928	32,941	12,642	74,511
1960.....	51,646	44,403	26,070	122,119
1961.....	50,616	72,772	27,018	150,406
1962.....	58,996	85,642	37,832	182,470
1963.....	53,229	60,731	31,807	145,767
1964.....	63,402	62,794	44,783	170,979
1965.....	46,560	48,740	25,790	121,090
1966.....	59,605	50,740	33,685	144,030
1967.....	50,971	67,465	35,548	153,984
1968.....	40,638	44,686	21,720	107,044
1969.....	40,980	38,763	19,455	99,198

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human trait of matching effort against yield is probably more instrumental in controlling upland game harvests than season lengths and bag limits. Most bird hunters lose interest before a harvest occurs that would jeopardize the next year's breeding stock. This human behavior offers a built-in safety feature for longer seasons.

FUTURE OUTLOOK

The future of forest grouse and the recreation they can provide in Montana is potentially very good. Most forest grouse habitat is located on public land. The millions of acres of public lands available in Montana insure more recreational opportunity with forest grouse than with game birds on agricultural lands. The future quality and quantity of forest grouse habitat will be greatly dependent upon forest management practices.

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RING-NECKED PHEASANT

By R. Janson, F. Hartkorn, and R. Greene

The ring-necked pheasant (*Phasianus colchicus*), commonly known as “chink” in Montana, is a composite of the Chinese pheasant, the English pheasant, and the Mongolian pheasant, with traces of other varieties. Pheasants were successfully introduced into Oregon (from China) in 1881 and were apparently introduced into Montana before 1895. By 1902, the Montana Fish and Game Department’s first biennial report stated: “These birds have been imported and turned loose year after year but their propagation has been anything but successful.”

About 7,000 pheasants were released in Montana between 1909 and 1929. Most of these birds were obtained from commercial breeders in other western states. Some were direct releases, other were “farmed out” to poultry growers who attempted to propagate them with varying degrees of success. Several thousand eggs were purchased and distributed to interested people to hatch, rear and release.

Pheasants were abundant in some areas of the State by 1926, and sportsmen’s groups in several counties requested that hunting be allowed. The Legislature authorized the Commission to regulate the hunting of pheasants in 1927. Montana’s first pheasant hunt was a 2-day season in late November, 1928. According to subsequent accounts, a predicted “slaughter” failed to materialize, and few birds were killed.

One of the first projects undertaken by the Wildlife Restoration Division of the Fish and Game Department was the live-trapping and transplanting of pheasants. Pheasants were trapped during the winter in areas of high pheasant densities and transplanted to areas with low pheasant populations. The Yellowstone and Milk River valleys were the chief sources of transplanted birds. A total of 5,677 pheasants was trapped and transplanted during the period 1941-48. During periods of abundance, pheasants caused appreciable damage to farm crops. In 1941-42 complaints of damage to sprouting corn and grain in shocks assumed serious

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proportions in the Yellowstone valley. Since then, damage complaints have been relatively few.

The pheasant's value as a game bird is recognized in many states. A survey by the University of Montana in 1958 placed a monetary value of \$5.00 on each pheasant bagged by Missoula area hunters. Based on that study, and inflation, the present value of the statewide pheasant harvest could be measured in millions of dollars.

In Montana suitable pheasant habitat once occurred chiefly in irrigated areas. The location and size of these areas has not varied greatly during the past 25 years but crop types have, especially changes from small grain to hay. The major difference in distribution is an increase in the amount of pheasant range in central and northeastern Montana, and a decrease in the western one-third of the State (Figure 1.) Pheasant habitat occurs where there are grain crops and weeds for food, and a

Fig. 1. RING-NECKED PHEASANT DISTRIBUTION — 1970.

combination of weeds, brush and trees for cover. Extensive grasslands or forested areas do not provide pheasant habitat. Heavy snows and severe cold also limit pheasant populations even though food and cover conditions may be favorable.

A Fish and Game Department research project investigating pheasant food habits in the Bighorn and Yellowstone valleys during the 1940's showed that cultivated crops furnished 77 percent of the pheasants' diet. Wheat and barley were the two most important items. Other cultivated crops eaten were corn, oats, and beans. Wild seeds of weeds and grasses, green vegetation, and animal matter (chiefly insects) comprised the remainder of the diet.

Montana's pheasant population probably reached a peak in 1941-42, then declined quite rapidly to a "low" in 1945. This followed the trend in the main

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pheasant areas in the nation. Since 1945 several fluctuations of buildup and decline have occurred.

The nationwide "peak" in pheasant numbers during the early 1940's was apparently the result of a combination of climatic and economic conditions which created ideal habitat for pheasants. Large areas of abandoned farm land provided weedy cover and food, while mild weather favored production and survival of pheasants.

Since the early 1940's land use practices have changed drastically. Abandoned farm land was put back into crop production. Fence rows and ditch banks are now mowed, sprayed, or burned to eliminate weeds and brush. Heavy use of pesticides may affect survival and reproduction of pheasants in local areas. Shelter belts have been removed or are now heavily grazed. Land use emphasis has shifted from production of grain to production of hay, pasture, and livestock. This change was very pronounced in western Montana and is believed to be the main cause for the pheasant decline in this area. In 1948 the best pheasant range in western Montana was in the Ronan-Charlo region where observations averaged nine pheasants per mile on a 66-mile route. At that time a biologist predicted "at the present rate of land use intensification this region is going to lose some of its high class cover before long." The prediction has come true, and the pheasants have gone with the cover.

Pheasants are polygamous. Each cock may have a harem of several hens during the breeding season (April-June). The hens seek out residual grass and weed cover for nesting. Nests placed in alfalfa or other hayfields have limited chances for success. Many nests are destroyed by farming operations, weather and predators. If the nest has not been incubated long when destroyed, the hen will persistently try to re-nest and lay a new set of eggs. Pheasants raise only one brood a year. Broods of many different sizes can be seen at any one time during the summer because of re-nesting. This leads some to erroneously conclude that hens raise more than one brood per year.

Winter is a critical time for pheasants. Food and cover are sometimes buried under deep snow for long periods of time. Artificial feeding, however, is not justified, since the birds seldom need additional food. When they do, feeding concentrates them and exposes them to diseases, predators and highway traffic. They become dependent upon "handouts." If feeding must be stopped during a critical period, the pheasants are less likely to survive than if they had not been fed at all. Feeding programs are usually futile in a severe winter since it is not possible to carry them out on a scale large enough to significantly influence survival.

Heavy losses occur during severe blizzards. Birds caught without suitable cover face the storm. Their nostrils and mouths fill with ice and they suffocate. Sometimes whole flocks in small cover patches are buried under deep drifts. After a severe winter, hens in poor condition may die because of the additional stress imposed by nesting. Recovery of the population after these losses is usually rapid if food and cover are adequate.

Predators are often blamed for limiting pheasant populations. All large carnivorous birds and mammals will kill pheasants if they can catch them, but in

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habitat that furnishes sufficient cover, predators cannot catch enough pheasants to affect their population. Deficient cover will not support many pheasants even if predators are scarce. Thus habitat, rather than predator control, is the key to pheasant abundance.

Various attempts have been made to remedy habitat deficiencies by planting vegetation for food and cover. However beneficial these plantings may appear to be, they are so limited in extent that their effect on pheasant populations is usually negligible. The cost of these development projects prohibits applying them on a scale large enough to be effective.

MANAGEMENT

Continuing surveys of pheasant populations and habitat are made by Department biologists. Spring breeding populations are censused by early morning counts of crowing pheasant cocks along established routes. Summer brood counts are made to determine the success of the hatch and survival of young. Hunters' bags are checked in the fall to determine hunting success. Winter counts are made to determine the relative numbers of cocks and hens. Study areas are cover-mapped every few years to document changes in plant cover and land use. The combined results of these various surveys indicate the changes occurring in the pheasant population and the causes.

On Department-owned management areas, grain crops are left standing to provide food, and if natural cover is deficient, trees, shrubs and herbaceous cover patches are planted.

Pheasants were well-established in portions of Montana by 1928. Believing that distribution could be improved by artificial propagation, the Commission established three game farms during the period 1929-1942. Game farm birds were banded before release to permit identification. Band returns indicated that only a small percentage of these birds were taken by hunters and few survived to breed. The Commission concluded that the returns were insufficient to justify the expense and since has closed two game farms.

HUNTING AND HARVEST

Since the first pheasant hunting season in 1928, regulations have become more liberal. In recent years pheasant seasons have been about 1 month, and have been for either-sex in some areas. These liberal seasons are based on the results of research which have shown that it is virtually impossible to overshoot cock pheasants. Shooting cocks has no effect on populations of following years. In Montana, most areas have a sex ratio of from 30 to 50 cocks per 100 hens at the end of the hunting season. This proportion of cocks is more than adequate to ensure fertile hens.

Hunting only cocks does not ensure that all hens will survive to raise broods. The annual turnover or attrition rate of a pheasant population (cocks and hens) is about 70 percent. Only 30 percent of the birds which hatch in any one year will still be alive a year later. This remains true whether the birds are hunted or not. At

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Proper interspersion of heavy cover, food and water is necessary to sustain pheasants. The accelerated trend toward intensive cultivation, clean farming, replacement of grain by hay and pasture causes decreasing numbers of pheasants.—(F & G photo by John Weigand)

the same time many hens are “surplus” and are lost to natural causes. These can be harvested by hunters without detriment to the pheasant population.

Most of the pheasant kill occurs on opening day. After this the birds are wary, scattered and difficult to hunt. Few hunters are afield after opening day, and most are not successful unless they have good dogs. Hunters usually take from one-half to two-thirds of the cock population. When hen-shooting is allowed they take about 20-25 percent of the hens.

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More pheasants are usually harvested by Montana hunters than any other game bird. Harvests have fluctuated considerably, depending largely upon the annual production of young birds and numbers of hunters (Table 1).

Table 1. Montana pheasant hunting harvest.

Year	Number Hunters	Number Pheasants Killed
1948	--	198,000
1953	64,107	171,806
1954	--	392,630
1958	77,147	231,013
1959	70,472	174,882
1960	71,860	157,192
1961	59,213	169,351
1962	74,798	190,331
1963	86,262	309,807
1964	86,646	358,015
1965	86,116	107,190
1966	83,753	221,130
1967	46,712	97,108
1968	48,548	95,196
1969	50,842	114,528

FUTURE OUTLOOK

The future of pheasants and pheasant hunting is tied directly to private land use practices and the relationships of bird hunters with the tolerance of private land-owners. The accelerated trend toward intensive cultivation, clean farming, replacement of grain by hay and pasture, and more hunters seeking recreation can have only one eventual outcome — a decreasing quality of pheasant hunting shared by an increasing quantity of people.

Game management practices operating at the highest efficiency can bring some remedy to the situation. Hunting seasons that allow a maximum harvest of the annual pheasant crop (cocks and hens), on a sustained basis, are the primary tools of management. However, maximum harvests cannot be attained without improved understanding by the general public that pheasants are a short-lived renewable resource representing an annual crop. Additional pheasants can be put in the hunters' bags by more efficiently utilizing wild pheasant populations than would be economically feasible from artificial propagation.

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HUNGARIAN PARTRIDGE

By R. Trueblood and J. Weigand

Hungarian or gray partridge (*Perdix perdix*) have been a successful foreign game bird in North America. Initial stock was imported from central Europe to the eastern seaboard states sometime in the 1870's. It has been most successful in prairie regions of the southern Canadian provinces and adjacent northern states.

Private individuals or groups first introduced Huns to Montana but the exact date is unknown. The first authentic record of the bird was a specimen found dead near Plains in Sanders County in 1915. During the years 1922-26 the Montana Fish and Game Commission purchased 6,000 Huns in Europe and distributed them throughout the State. The species has filled diverse habitat within the prairie regions and currently exhibits years of abundance and scarcity. The Hungarian partridge is now one of the leading game birds in Montana.

At present, partridge occupy most of the range they did in 1941 (Figure 1). They are harvested in each of seven Montana Fish and Game Department districts. Partridge are most abundant in the northcentral and northeastern counties. Local distributions have varied with cultivation and other land uses.

During the winter months Huns are found in coveys of up to 15 or more birds. Larger groups may be seen but are probably aggregations of smaller coveys. The warmer days in February trigger courtship and fighting among covey members. By early March most coveys have broken up and pairs have formed.

Egg laying does not begin until late May or early June. Clutches of 12 to 18 eggs are common; a few nests may contain 20 or more eggs. Hatching occurs after 24 days of incubation. The average peak of hatch during 1964-67 was June 19 to July 9.

The pair-bond continues through the summer with both parents tending the young. In spite of this double protection, brood sizes decrease by one-third or more by September 1. Some interchange of birds between coveys probably occurs during

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Fig. 1. HUNGARIAN PARTRIDGE DISTRIBUTION – 1970.

late summer and fall. Winter coveys again form and persist until the next mating season. Although it is one of Montana's smallest (12 to 14 ounces) upland game birds, Huns have the highest production rate. Wild species exhibiting high rates of annual increase are also subject to high annual mortality. Factors responsible for these losses include adverse weather, farming operations, predation, accidents, disease, hunting and possibly pesticides. Collectively, these factors account for the approximate 75 percent annual mortality of partridge.

As with most upland game birds, climate and vegetative cover are the two most important factors limiting the natural spread and abundance of the partridge. Optimum conditions for a flourishing population are a cool, moderately dry climate and mixture of cultivated and non-cultivated land. Much of northern and eastern Montana meets these requirements.

Partridge populations responded favorably to the increase in grain growing since 1940. Waste grain is one of their staple fall and winter foods. Soil bank lands during 1959-64 probably benefited the birds, too. Such areas provided an abundance of weed seeds and insects, favorite summer foods, and also provided excellent nesting cover.

Although the Hungarian partridge seem to survive under certain intensified agricultural land uses, some farming and ranching practices tend to limit their distribution. Heavy grazing by livestock is a common cause of reduced food sources and protective cover. The trend toward farm consolidation has resulted in destruction of field edges which provide escape and winter cover for partridge. The transition of grain fields to pasture or alfalfa-growing has also reduced the total partridge habitat. More recently, the fall plowing of winter wheat stubble has diminished vast acreages of winter habitat. Weed spraying destroys food and cover plants.

HUNTING AND HARVEST

The Hungarian partridge is an excellent sporting bird. Few hunters can boast of their prowess as Hun-hunters. Many shots are fired at the "gray bullet" each fall but the explosive covey launch, fast speed, and increased wariness with each flush precludes consistent bagging of Huns.

Coveys are not usually found in high densities and are often interspersed through sharp-tailed grouse and pheasant habitats. The partridge is usually taken incidentally while hunting these latter two species.

Huns first became legal game in Montana during a 4-day season in 1929 when they could be hunted in nearly the entire state as part of a three-bird aggregate bag with pheasants. Concurrent pheasant-partridge seasons have been held each year since then except for closures in 1937-39, 1946-48, and 1950. Bag limits varied between three and six, either singly or in the aggregate with pheasants. Beginning in 1958, partridge hunting was also allowed during the earlier prairie grouse season in September.

The trend in the estimated statewide harvest of partridge has ranged from 37,000 to 164,000 from 1958-69 (Table 1). The annual harvest has varied considerably even though season lengths and bag limits have remained about the same. Population levels are apparently determined by conditions for reproduction and survival, and not by the preceding year's hunter harvest. Since 1958, Hungarian

Table 1. Hungarian partridge harvest, 1958-69.

Year	Harvest
1958	77,000
1959	42,000
1960	49,000
1961	37,000
1962	45,000
1963	111,000
1964	164,000
1965	40,500
1966	118,000
1967	70,622
1968	70,157
1969	69,088

partridge have made up 9 to 18 percent of Montana's total upland game bird harvest, contributing substantially to the Montana bird hunter's bag. In 1964 and 1966, the statewide Hun harvest was second only to the pheasant take.

MANAGEMENT

Present management of the Hungarian partridge in Montana is limited to the regulation of hunting. Aside from the initial introduction and transplanting program of the 1920's, the Hun has been given comparatively little emphasis from the management standpoint. The bird does not lend itself to certain census methods such as pheasant crowing counts or prairie grouse breeding ground surveys. Brood counts are obtained during summer pheasant roadside surveys. However, as Huns are widely scattered and often difficult to observe, it has often been difficult for

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"Huns" are often taken incidentally by hunters pursuing sharptails or pheasants. The future of Huns may be better than that of other upland game birds because of their better adaptability to changing agricultural practices. — (F & G photo)

game managers to determine the status of breeding populations and success of the yearly hatch. Fall wing collections from cooperative hunters provide an extensive survey of the production success of the various upland game birds, including Hungarian partridge.

Considering the Huns' widespread distribution, apparent adaptability in certain agricultural areas, and their sporting elusiveness — they probably have more management potential than any other game bird in agricultural areas. An encouraging side of the Montana bird hunting coin appears to be the ability of Huns to use areas that have a decreasing suitability for other game birds.

FUTURE OUTLOOK

Many questions concerning this species and its ecological requirements remain unanswered. While partridge presently inhabit a variety of habitats in Montana, which types support the most Huns per acre? The fewest per acre? Which habitats are absolutely necessary for partridge numbers?

The high annual mortality characteristic of partridge is noticeable in Montana but what factors are responsible? What percent of the annual population is killed by weather, farming operations, hunters, or predators? At which season is each factor most destructive? How do pesticides affect partridge numbers? Can any of these factors be altered or removed in order to provide more Huns for the gun?

A research study to seek answers about Hun population dynamics and habitat requirements was recently begun in northcentral Montana. Increased knowledge of this bird will be needed as it appears to have the greatest potential of game birds closely associated with agricultural practices.

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MERRIAM'S TURKEY

By R. Greene and R. Ellis

Historical records indicate wild turkeys were probably not native to Montana. The Lewis and Clark Journals did not mention them in the area now known as Montana. In May, 1833 Prince Maximillian recorded the following in his journal while camped at Cedar Island (now South Dakota) enroute up the Missouri River:

"This may be considered as the limit to which the wild turkey extended on the Missouri (River). It is true that this bird is, now and then, found higher up, even on the Yellowstone River; but these are the exceptions, for beyond this place the woods are too open and exposed."

This reference was to the eastern subspecies (*Meleagris gallopavo silvestris*). The ancestral range of Merriam's wild turkey (*Meleagris gallopavo merriami*) is considerably south of Montana in the pine-oak forests of Colorado, New Mexico, Arizona, Texas and Mexico.

Private clubs and individuals attempted wild turkey introductions soon after settlement began in Montana. Few authentic records of early turkey releases are available. Most early attempts were probably made with farm-reared eastern wild turkeys and were not successful.

The successful transplants of wild-trapped Merriam's turkeys in Wyoming and South Dakota encouraged the Montana Fish and Game Department to undertake a similar project in 1954. After evaluation of turkey habitat in Colorado and South Dakota, Merriam's turkeys were released in three selected areas of Montana.

The first release, consisting of 13 turkeys (five gobblers and eight hens) from Colorado, was made November 13, 1954 in Limekiln Gulch near Lewistown. On three different occasions, additional turkeys were received from Wyoming. On January 27, 1955, 18 turkeys (5 gobblers and 13 hens) were released near Capital Rock in the Long Pines of southeastern Montana near Ekalaka. In October, 1956 and

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January, 1957, a total of 26 birds were released in the Beaver Creek area near Ashland. No other turkeys have been obtained outside of Montana. These introductions by the Montana Fish and Game Department flourished and provided huntable populations as well as transplanting stock for additional flocks. Since 1954, all of the areas considered to be ideal wild turkey habitat have received transplants (Table 1). At present, there are at least 25 flocks of Merriam's turkeys with huntable populations in seven areas of Montana (Figure 1).

Suitable wild turkey habitat in Montana is generally restricted to open

Fig. 1. WILD TURKEY DISTRIBUTION – 1970.

ponderosa pine forest in rugged terrain. Turkeys have been most successful in forests such as the Long Pines where about one-half the vegetative cover consists of ponderosa pine with the remainder grasses, deciduous trees and brush, in scattered small openings and drainageways throughout the forest. Very large open areas in the forest appear to have little value as turkeys seldom venture far from the cover around the edge of the openings.

The Department undertook a study of turkeys in the Long Pines during 1961-63. This study showed that turkey activities centered around ponderosa pine, grassland and deciduous trees and brush. Mature ponderosa pine trees were preferred for roosting, and denser stands of smaller trees were used for loafing and escape cover. Stands of pole size pine with an open understory and good ground cover were used by turkeys during all seasons of the year. While turkeys used the ponderosa pine community to some extent at all seasons, use of other plant communities was more seasonal.

In summer, grassland received greater total usage than any other type mainly because of increased usage late in the season which was possibly related to a change in turkey food habits from grasshoppers to grass seeds. Little use was made of

Table 1. Turkey trapping and transplanting.

Year Released	Release Area	Source Area	Toms	Hens	Total
1954	Judith Mountains, Lewistown	Colorado	5	8	13
1955	Long Pines, Ekalaka	Wyoming	5	13	18
1956	Beaver Creek, Ashland	Wyoming			26
1957	Slippery Ann, Ft. Peck Game Range	Long Pines	3	13	16
1957	Sappy Creek, Forsyth	Long Pines	2	15	17
1957	Musselshell Breaks, Jordan	Long Pines	9	15	24
1957	Knowlton Area, Miles City	Long Pines	5	14	19
1958	Pine Hills, Miles City	Long Pines	3	4	7
1958	Dry Gulch, Florence	Long Pines	8	9	17
1957	Bull Mountains, Roundup	Long Pines	24	29	53
1958	Ekalaka Hills, Ekalaka	Long Pines	2	11	13
1958	Little Belts, Raynesford	Long Pines	6	13	19
1959	Hilger Ranch, Helena	Long Pines	6	16	22
1959	Lynch Creek, Plains	Long Pines	5	13	18
1960	Judith River, Winifred	Fort Peck Game Range	4	11	15
1960	Larb Hills, Glasgow	Fort Peck Game Range	2	10	12
1962	Judith Game Range, Utica	Musselshell Breaks	8	8	16
1963	Bear Paw Mountains, Big Sandy	Judith Mountains	3	16	19
1963	Shane Creek, Columbus	Judith Mountains	2	18	20
1964	Spokane Hills, Helena	Winifred	10	16	26
1964	North Moccasin Mountains, Lewistown	Winifred	8	11	19
1964	Clancy Area, Helena	Winifred	8	12	20
1964	Southeast of Columbus	Columbus	3	4	7
1964	Tobacco River, Rexford	Roundup	10	17	27
1964	East of Superior	Roundup		4	4
1965	Sieben Ranch, Helena	Roundup	5	8	13
1965	Pine Hills, Pompey's Pillar	Roundup		10	10
1965	Bitterroot Game Range, Corvallis	Roundup		9	9
1966	N-Bar Ranch, Lewistown	Roundup	13	7	20
1966	Pine Hills, Pompey's Pillar	Roundup	9	5	14
1967	Pines Area, Glasgow	Roundup	7	9	16
1967	McCartney Mountain, Glen	Roundup	5	20	25
1968	Bangtail Area, Livingston	Fort Peck Game Range	3	17	20
1969	Roy Area	Fort Peck Game Range	2	5	7
1969	Grass Range	Fort Peck Game Range	1	5	6
1969	Park City Area	Roundup	5	12	17
1969	Ryeagate Area	Roundup	2		2

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grasslands in winter but there was a shift back to grasslands in spring. During winter, turkeys moved into lower drainages of deciduous trees and brush. The mixture of different types of vegetation and the resulting edge effects were essential elements of turkey habitat. In the Long Pines most of the turkeys observed in grasslands were within 100 yards of trees or shrub cover. In snowberry brush, turkeys were associated with brush-grass edges near the forest where many young poults fed and found concealment during the summer. "Most males and all courtship flocks seen in the pine community in the spring were within 50 feet of a clearing." Turkeys used the nearest cover when disturbed, however when there was a choice in the pine community, the preference order was "pole, sawlog, sapling." Nesting activities were associated with the edge of deciduous trees and brush, but one nested in a hay field "100 feet from cover of trees and bushes." Turkeys generally had a tendency "to be in or near the ponderosa pine forest" during all seasons except winter. Properly distributed small openings with grass, and deciduous trees and shrubs were important to turkeys. Except for the "edge effect," large open areas were of little value because turkeys seldom ventured more than 100 yards from cover.

Wild turkeys used a wide variety of food including seeds, fruits, berries, leaves and insects. The seeds of ponderosa pine were preferred when available. The fruits and berries of different plants in the diet varied according to differences in yearly yields. When available, domestic grain was often utilized in winter. Grass was an important food item at all times, especially during the green and seed-head stage. Of the animal matter included in the diet, grasshoppers were the most important item.

MANAGEMENT

Management of turkeys is accomplished by removing the annual surplus through recreational hunting or trapping for transplanting. The Merriam's turkey has a high productive potential. The Long Pines flock increased from the original

Turkeys are captured for transplanting during the winter in baited traps such as this. Most of the primary turkey habitat in Montana has been planted with turkeys. — (F & G photo)

The wild turkey has a high reproductive potential. In the excellent habitat of the Long Pines area the original introduction of 18 birds in 1955 increased to an estimated 700 after three breeding seasons. — (Photo by Frank Martin)

introduction of 18 birds in February, 1955 to an estimated 700 after three breeding seasons. A minimum of 1,469 birds were removed by hunting, trapping, and miscellaneous factors in eight years, 1957-65.

The Long Pines study with banded birds showed that over 50 percent of the turkey population disappears each year whether hunted or not. A complete turnover of the banded population occurred within five years. The object of management is to replace natural mortality with birds in the bag, thereby providing the maximum amount of sport hunting and recreation without depleting the breeding population.

Management of turkey habitat will depend on the maintenance of semi-open stands of ponderosa pine with good ground cover. Selective cutting to preserve roost trees, thinning of dense sapling stands, creating small openings through cutting, burning, or road-building may be beneficial. Proper grazing by domestic stock can be compatible with turkey habitat by helping to maintain an open understory. Overgrazing of the range, however, not only removes important grass food items in the turkey diet but also may reduce essential brood cover. Heavy browsing and trampling of brushy thickets damages food-bearing shrubs and forbs and destroys the cover type used by turkeys so extensively in winter.

HUNTING AND HARVEST

During the years that turkeys have been hunted in Montana, seasons have varied from a 3-day season in a restricted area in 1958 to 30-day seasons. Spring gobbler seasons began in certain areas in 1962. The number of turkey hunters has not been limited by drawings. Since 1959 a turkey tag has been required. Each permit holder is allowed one wild turkey per year. The statewide turkey harvest

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increased from 89 in 1958 to a peak harvest of 993 in 1963 (Table 2). Poor turkey hunting in the Long Pines area in 1967 was attributed to a 37-inch snowfall that interrupted nesting during May.

The problems encountered with turkeys have been few in number and of a minor nature. The tendency of the wild turkey to mingle with domestic flocks and either interbreed or lure the domestic birds into the wild has been exhibited. A few complaints have been received from landowners experiencing damage to straw stacks or hay stacks, particularly grain hay. Hunting usually has helped alleviate these problems as flocks are apparently kept more wary and away from inhabited ranch and farm yards. In a few cases, troublesome birds have been trapped and removed. As a rule, landowners have welcomed the turkey and enjoy having them. Much of the turkey hunting is done on private land and depends on the good behavior of hunters and tolerance by landowners.

Table 2. Wild turkey harvests, 1958-1969.

Year	Licenses Sold	Number Hunters	Birds Killed	Percent Success
1958.....	—	479	89	19
1959.....	814	591	375	48
1960.....	1,144	1,022	193	19
1961.....	1,466	1,318	409	31
1962.....	1,573	1,424	370	26
1963.....	2,410	2,313	993	43
1964.....	2,913	2,664	626	24
1965.....	2,812	2,540	948	37
1966.....	2,960	2,662	618	23
1967.....	1,410	1,185	298	25
1968.....	1,489	1,348	412	31
1969.....	1,592	1,298	360	28

FUTURE OUTLOOK

The outlook for the future of the Merriam's turkey in Montana is very promising. This, the largest of North American game birds, continues to expand its range in many areas. In several localities, they seem to have reached the carrying capacity of the habitat. Removal of the annual surplus by hunting or trapping allows maximum use of the reproductive potential. It might be advisable to increase the bag limit in some of the remote hunting districts to accomplish this. The spring gobbler season also can be extended to include additional flocks. Spring gobbler hunting has proven to be a high quality recreation in many turkey states and with correct timing does not interfere with nesting success. The trapping and transplanting program should be continued where necessary to expand present ranges and to establish additional flocks. Most of the primary turkey habitat in Montana has evidently received turkeys but there are still small but likely islands of habitat that may support additional small flocks of turkeys. New flocks aid in making turkeys more accessible to hunters and tend to ease the pressure on some private landowners.

The turkey population will be directly dependent upon future range and forest management. The general increased nationwide concern for wildlife resources should help insure our turkey flocks a place on public lands in Montana.

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CHUKAR PARTRIDGE

By C. Whitney

Chukar partridge (*Alectoris graeca*) are native to southern Europe, Asia Minor, northern India, Tibet, China, and Mongolia. The term chukar is commonly applied to only one species of the red-legged rock partridges which includes 22 subspecies. The bird introduced into Montana has been identified by the American Museum of Natural History as the India variety (*Alectoris graeca chukar*).

Since 1893 chukars have been introduced in at least 42 states and 6 Canadian provinces. All releases east of the Mississippi have failed. States with huntable populations include Washington, Idaho, Colorado, Wyoming, Nevada, California, Montana, Arizona, Oregon and Utah.

While the chukar is surviving in several areas of Montana, its total range is limited in comparison to other upland game birds. The bird's importance is relatively low from a management and hunting standpoint.

The first of 89 recorded releases of chukars in Montana was made in 1933 below Glendive near the Yellowstone River. Between 1933-40, 365 birds were introduced into 16 counties. The greatest number of releases was made after 1950 under a program for stocking 5,000 chukars in suitable habitat throughout the State. Many of these vanished in succeeding years. By 1958 the stocking goal had been met and the program discontinued.

Figure 1 shows the locations of transplants and known populations at present. The most successful introductions in terms of distribution and hunter harvest have been in the Fromberg-Red Lodge-Bighorn Canyon area south of Billings. Remnant populations in other localities may exist, but they cannot be reported for lack of substantiating data.

The chukar apparently is not restricted to a particular type of habitat in its native land. Native range includes stream bottoms, cultivated fields, barren hilly areas and timbered mountains. Chukars may range up to timberline during winter thaws. In the western United States the most suitable habitat is of a steep, rocky

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Fig. 1. CHUKAR PARTRIDGE DISTRIBUTION – 1970.

semi-arid nature with an abundance of cheatgrass. Brushy slopes and draws are preferred for most activities and grain fields are also used for feeding purposes. Birds released in Montana have been most successful in sagebrush-juniper or sagebrush-bitterbrush areas with an interspersed of cheatgrass and bunch grasses.

While the chukar successfully inhabits areas of sparse rainfall, they are heavily dependent on free water within close proximity. Periods of drought or low-water levels will cause birds to cluster around available water sources. Perhaps the most critical limiting factor is snow conditions during the winter months. Populations may be seriously affected by heavy or prolonged snow covering feeding and roosting areas.

Chukars are quite versatile and adaptive in their food habits. In the early spring, they use the green leaves of grasses and forbs. By summer they have expanded their diet to include the available seeds and insects. With the curing of the vegetation in late summer and fall, available fruit such as chokecherry will be used. During this period, they also frequent springs and other water sources for green grasses. The winter diet is primarily seeds and leaves of grasses and forbs. Waste grain, where available, constitutes an important item.

Because of the drier and more rugged terrain favored by chukars, these areas have been less affected by habitat destruction through intensive land uses. Population movements or die-offs have been primarily the result of inadequate habitat conditions. In many localities where chukars initially survived and bred, severe winters gradually eliminated them.

MANAGEMENT

Management of the chukar has consisted of game farm production, planting and follow-up investigations. Through study of releases, information about habitat

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requirements and successful introduction techniques have slowly accumulated. Investigations carried out between 1951 and 1955 were largely responsible for delineating guidelines for effective introductions. Introductions have been more successful with wild-trapped birds than with game farm-reared birds.

HUNTING AND HARVEST

By 1959 it was obvious that the scattered chukar populations had reached the limitation of the marginal habitat in Montana. Hunting is not expected to be a major limiting factor on this elusive and potentially prolific bird.

Chukar populations in 17 of Montana's eastern counties were judged strong enough to warrant an open season in 1959. Since 1959 an extension of open areas has resulted in chukar hunting in all game management districts within the State. Because of such restricted population distribution, the total prime hunting area is extremely limited. Bag limits have been in aggregate with Hungarian partridge and season lengths coincided with those for Huns.

After extensive transplanting trials, scattered chukar populations have reached the limitations of the marginal habitat in Montana. Though limited in distribution, the exciting chukar provides an interesting variety to Montana bird hunters. — (Photo by Bill Howell)

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FUTURE OUTLOOK

Harvest of chukar increased greatly after the first hunting season (Table 1), probably due to increased hunter participation. Sportsmen have become increasingly aware of this new game bird. With a few exceptions, chukars in Montana have established only marginal or highly localized populations. Evidence assembled thus far indicates that the primary limiting factors are insufficient habitat conditions and sensitivity to Montana winter. Future expansion of the chukar in the cold climate of Montana is quite doubtful. Interest in hunting this sporty bird will probably increase gradually as more bird hunters learn where and how to pursue chukars.

Table 1. Estimated Chukar harvest as indicated by hunter questionnaires, 1959-69.

Year	Number Harvested	Year	Number Harvested
1959	200	1965	2,100
1960	600	1966	4,000
1961	800	1967	2,400
1962	2,000	1968	3,200
1963	3,000	1969	3,000
1964	4,500		

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WHITE-TAILED PTARMIGAN

By H. Chrest

Of the three species of ptarmigan occurring in arctic and alpine tundra of northern North America, only the white-tailed (*Lagopus leucurus*) exists in Montana. The white-tailed ptarmigan is found in the high mountains of Alaska, western Canada and the United States.

Ptarmigan distribution in Montana is limited and not very precisely known. They occupy alpine and subalpine areas in a few higher mountain ranges. Since this distribution map (Figure 1) was first published in 1942, ptarmigan were observed in the Pioneer Mountains, Beaverhead County, in 1954-55.

The rugged physical and climatic features of ptarmigan habitat make study of this bird difficult. Habitat in alpine areas is typically an interspersion of snow, precipitous slopes, rocky areas, rocky ledges, valleys and glacial cirques. Some habitat has been modified by glacial action. Extreme variations in temperature, wind velocity and precipitation are common.

Ptarmigan usually occupy areas above timberline at all seasons. In winter, some are observed in poplar and willow thickets below timberline. They have been observed in all alpine plant communities except those associated with wet and boggy areas. Often vegetation is not taller than the ptarmigan. Many rocky ledges in glaciated benchlands of Glacier National Park are occupied by ptarmigan.

Ptarmigan use a variety of vegetation for food. Preference is shown for new growth, flowers, seeds, and fruits. The main foods used at each season are: spring, new growth of heath and moss; summer, buds and flowers of willow, spring beauty and buttercup; fall, willow, sedges, grass seedheads and monkey-flower leaves; winter, tall willow and heath, or dwarf willow and moss when not covered by snow.

MANAGEMENT

Ptarmigan were first protected by Montana game laws in 1931. Prior harvest records are not available. The rugged nature of the habitat undoubtedly precluded a

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Fig. 1. WHITE-TAILED PTARMIGAN DISTRIBUTION — 1970.

substantial harvest. The ptarmigan was classed a game bird in 1931 but hunting seasons have remained closed because of lack of field information.

FUTURE OUTLOOK

It is doubtful that the status of the ptarmigan will change appreciably in the future because of limited habitat. The possibility of hunting ptarmigan in Montana has sound biological support. Hunting could probably be allowed in certain areas. However, a large portion of ptarmigan habitat is within Glacier National Park where no hunting is allowed. Introductions of ptarmigan into new high elevation areas offer some possibilities.

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WATERFOWL

By D. Witt and J. Salinas

Migratory birds are a highly mobile group, flying across state and national boundaries between nesting and wintering areas. Waterfowl are considered an international resource. They are managed on a continental basis through separate treaties between the United States and Canada, and the United States and Mexico. In the United States, the basic responsibility for migratory bird management is with the U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

The important migratory birds in Montana are ducks, geese and swans (family Anatidae). There are 48 species in this family on the North American continent. In Montana 33 species have been recorded. These include 2 species of swan, 5 geese, 3 mergansers and 23 ducks. The ducks are divided by body structure and habit into two groups, puddle ducks and diving ducks. Puddle ducks are also called dabbling ducks because they tip the front half of their body under the surface when feeding in shallow waters. Diving ducks are associated with deep water and can dive great distances for food. In Montana the puddle ducks, primarily mallards, are preferred by most hunters.

In spring and summer, waterfowl are widely distributed across the State, with about 20 species of ducks nesting here. The distribution and concentration of ducks during this period fluctuates between years, and are closely associated with changing water conditions.

Fall and winter distribution of ducks is associated with weather conditions and migration habits. Species such as pintail and blue-winged teal start migrating in late August. The majority of the mallard migration occurs shortly before freeze-up, usually the latter part of November. A few species of ducks, predominately mallards and goldeneye, winter in the State on warm water areas or open water on rivers and lakes. Large rafts of redhead and coot will occasionally spend the winter on Flathead Lake. During some winters, up to 150,000 mallards remain in Montana.

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The fluctuation of wintering birds in the State is associated more with weather conditions rather than population levels. The number of wintering waterfowl is greater in years with a mild fall and winter than in years with cold temperatures and snow conditions. Winter surveys indicate that between 50,000 to 195,000 ducks and 1,000 to more than 8,000 geese wintered each year in Montana between 1956-67.

The seasonal distribution of ducks has probably not changed significantly during the last 25 years except for a wider distribution and increase on breeding grounds resulting from stock pond construction in the prairie country.

The Canada goose is the only goose species nesting and wintering in Montana. Their breeding range is primarily restricted to large rivers and reservoirs. An exception to this is the Hi-Line flock in Blaine, Phillips, and Valley Counties where geese use small stock ponds for nesting when a good nesting site is present. Inclusion of small islands in the design of new stock ponds can enhance breeding habitat for Canada geese and other waterfowl. Canada geese winter in the State on large rivers that have open water adjacent to a food source. There are at least four Montana populations with different breeding, migration and wintering ranges.

Canada geese are the only waterfowl that have been transplanted in the State. Several areas of improved habitat or areas of extremely low populations have

Canada geese are the only geese nesting and wintering in Montana. Inclusion of small islands in the design of new stock ponds can enhance the breeding habitat. — (F & G photo by Vern Craig)

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received transplants. One of the first transplants of geese was from the Bowdoin National Wildlife Refuge near Malta, to the Medicine Lake National Wildlife Refuge near Medicine Lake. Geese were also transplanted from Bowdoin to Freezout Lake near Fairfield and to the Tongue River near Miles City.

Montana is situated on the edge of the best waterfowl breeding range in North America. Duck population densities in certain parts of the State, such as the lower Flathead Valley and the northern glaciated prairies in eastern Montana, compare favorably with the best on the continent. Unglaciated prairies in southeastern Montana have low waterfowl densities, but contribute significantly as a production area by virtue of the area's size and duck species involved. Mountain areas, with many streams, lakes and beaver dams, supplement the number of breeding waterfowl.

Waterfowl require a variety of habitat during migration, breeding and wintering. Breeding habitat should be sufficient to supply needs from the time birds arrive in early spring through the time the young are ready to fly in late summer. During the latter part of the nesting season adult waterfowl undergo a post-nuptial molt and loose their primary wing and tail feathers. They remain flightless for several weeks until these feathers can be replaced. During this period adult waterfowl concentrate on big water areas containing an abundance of food and cover. The nesting requirements vary considerably among species of waterfowl. For example, puddle ducks nest on dry ground, but depend on water areas for food and brood survival. Duck broods require relatively stable water levels, abundant escape cover and feed. The mallard, being relatively adaptable, is found nesting around all wetland areas in the State.

Canada geese requirements are similar to mallards, although geese are more often associated with larger water areas. Nesting geese are found in two general habitat types: river bottoms such as the Missouri, Yellowstone, and Flathead Rivers and on large lakes and reservoirs. Preferred nesting sites are islands with some nests found on shoreline, cliffs and in abandoned osprey or heron nests in tree tops. In the Hi-Line area, geese have spread over the prairies and are using stock watering ponds for nesting. Here nearly every pond of 5 acres or more, with an island or pronounced peninsula, is occupied by nesting geese. Canada geese often use the same water areas for nesting and brooding. Broods depend upon new weed and grass growth for food. When molting, the sub-adult geese (1 to 2 years old) and unsuccessful breeders use large remote water areas. Lima Reservoir in the Centennial Valley has had up to 6,000 molting geese present in the summer. They were primarily sub-adults from Utah and Idaho. Sub-adults from some Montana goose flocks go into Canada to molt.

Migration habitat is used by waterfowl for feeding and resting during migration between the breeding and wintering grounds. This habitat also serves as important hunting areas and should be well distributed up and down the flyway. There is a lack of this habitat in Montana, particularly in the southeast quarter of the State where there is a shortage of resting areas and feeding areas associated with water. Because of the shortage, many thousand ducks and geese over fly the area. They might stop, if water was available.

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Snow geese are an important population of waterfowl present in Montana only during spring and fall migration. They are the most abundant geese in Montana during the peak of their migration, numbering up to three and four hundred thousand when migrating through a narrow zone along the east slope of the Rocky Mountains. This population nests in the Arctic and winters in California.

Wintering habitat for ducks is generally spring-fed streams and ponds, warm water drains and larger rivers with open water. A small number of redheads and coots winter on Flathead Lake, and most large rivers in the State winter goldeneyes. Mallards winter in Montana on small warm water areas and the open portion of streams and rivers adjacent to grain fields. Canada geese generally winter on large rivers. When snow or ice conditions affect availability of their food supply, most geese move farther south. No starvation has been reported for Canada geese wintering in Montana.

Waterfowl habitat has decreased measurably through drainage, farming and urbanization in the United States and Canada. This is not entirely the case in Montana. Although some loss has occurred, it has been largely compensated for by the construction of small stock water reservoirs. The number constructed in the last 25 years has had a significant impact upon waterfowl breeding habitat in eastern Montana.

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Waterfowl management prior to the late 1940's was on a continental basis. At times, broad seasons were set encompassing all of the United States. Since then, banding data indicated waterfowl followed similar routes each year in their migrations between their nesting and wintering ranges. This was the basis for dividing the United States into four broad zones (flyways) with separate regulations.

Waterfowl banding studies were the basis for extending the Pacific Flyway eastward. Longer waterfowl seasons and greater bag limits resulted. —(F & G photo by Vern Craig)

The Canada goose is the most prized bird taken by Montana waterfowl hunters. As many as 8,000 honkers winter in this northern state. — (F & G photo)

With additional information, adjustments were made in the flyway boundaries. Montana was entirely in the Central Flyway until 1961 when the area west of the Continental Divide was designated part of the Pacific Flyway. This change was based upon Department band analysis research on waterfowl migration patterns and provided western Montana hunters with longer waterfowl seasons and greater bag limits. Additional biological evidence and negotiations with the U. S. Department of the Interior resulted in another eastward extension of the Pacific Flyway in 1965. At present the more generous Pacific Flyway regulations extend to a line formed by the eastern boundaries of Hill, Choteau, Cascade, Meagher, and Park Counties.

The present trend is toward more refined management of waterfowl. Species and flock management were initiated whereby regulations can be altered to affect individual species or populations within a flyway. In order to provide a harvest of an early migrating group of ducks, special early seasons on teal were tried experimentally in Central Flyway areas in 1966 and 1967.

Research has established the fact that there is a lightly harvested population of mallards wintering along the east face of the Rockies in the Central Flyway. Consequently, a late mallard season was established in 1968 to allow the additional harvest on these birds. This season provided considerable additional recreational hunting for the people in eastern Montana.

The U. S. Bureau of Sport Fisheries and Wildlife established several refuges throughout Montana for waterfowl in the 1930's and 40's. These were primarily to supplement breeding and migration habitat in the state. The Montana State Fish and Game Department established several management areas for waterfowl in the early 1950's. Included were Freezout Lake, Milk River, Fox Lake, Ninepipe and Pablo Game Management areas. Their primary purpose was migration habitat for public hunting, with breeding habitat secondary. The State conducted waterfowl

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breeding population surveys from 1949 through 1964. Since 1965 the survey has been expanded and conducted by the Bureau of Sport Fisheries and Wildlife to conform with surveys in the Dakota's and Canada.

HUNTING AND HARVEST

The annual waterfowl harvest since 1957 has ranged from 100,000 to over 300,000 birds (Table 1). The trends in hunter activity and harvest of waterfowl have closely paralleled waterfowl population levels. When waterfowl populations are high, regulations are more liberal, affecting an increase in duck stamp sales (Table 1). Due to the relatively low numbers of duck hunters and extensive areas of waterfowl habitat, Montana generally produces more ducks than are removed in the State by harvest. Waterfowl surveys (east of the Divide) showed 250,000 to 350,000 pairs of ducks present annually during the 1965-68 breeding seasons and 139,000 to 268,000 harvested during those years. With an average of five young ducks per brood it is possible that the number of birds raised in Montana was twice the harvest in recent years.

Table 1. Waterfowl harvest* and duck stamp sales in Montana, 1957-69.

Year	Statewide Duck Harvest	Statewide Goose Harvest	Number Duck Stamps**
1957	298,300	7,300	37,018
1958	244,146	8,260	34,225
1959	135,768	5,831	24,752
1960	132,599	4,054	24,226
1961	139,949	10,152	21,728
1962	98,749	13,919	14,561
1963	190,429	18,829	20,220
1964	117,351	8,768	20,779
1965	139,618	10,501	22,855
1966	268,578	13,989	27,100
1967	249,677	12,885	26,164
1968	171,537	8,091	25,872
1969	204,766	12,026	25,811

* Questionnaire estimates

** Not including hunters under 16 years old.

The mallard ranks first in the hunter's bag. Mallards comprise between 65 and 75 percent of the duck harvest. Because of the preference for the mallard and the earlier migration habits of some of the other species, little or no hunting pressure is placed on species other than mallard. Next to the mallard, geese appear to be the second interest of the Montana waterfowl hunter. The Canada goose harvest is distributed fairly well throughout Montana with concentrations in Phillips County, Madison County and in the Flathead Valley. The overall harvest fluctuates from year to year depending on numbers of hunters and hunting conditions. The higher goose harvest for certain years appears to be associated with mild weather conditions which induce the geese to stay longer, and possibly a shift in hunting efforts created by restrictive regulations on ducks in the Central Flyway. The annual harvest of geese (snow and Canada) varied from 4,054 to over 18,000 birds during the 1957-69 period (Table 1). The majority of the harvest of snow geese

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The mallard ranks first in the hunter's bag. Montana generally produces more ducks each year than are harvested by the relatively low number of waterfowl hunters. Between 50,000 and 195,000 ducks winter in Montana. — (Photo by Gerry Atwell)

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occurs in a narrow zone along the east slope of the Rocky Mountains from the Sun River north to the Canadian border. Some years a few of these geese have stopped in the Deer Lodge and Flathead Valleys.

FUTURE OUTLOOK

The future for the waterfowl resource in Montana looks bright. The species important to Montana are quite adaptable in their habitat requirements and the status of the habitat for these species looks encouraging. In years of good production it could be expected that the harvestable surpluses would be even greater than in recent peak years. The trend will be towards management of specific species and Montana duck hunters can expect to benefit from special hunts such as the September teal season and December drake mallard season. If the requirements of nesting waterfowl are considered in the construction of prairie stock ponds, breeding populations can increase. The number of hunters is also expected to increase in years of abundant waterfowl and liberal regulations. The future recreational potential of the waterfowl resource should be an increasing highlight of the Montana hunting scene.

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FUR MANAGEMENT

Trapping of furbearers and trapping and hunting of predators and unclassified carnivores are forms of outdoor recreation to a relatively small, but ardent group of Montanans. Individual chapters follow on the groups of animals classed as furbearers and predators. The predator chapter is essentially a history of a bounty system that had its beginnings in 1879 and was not recognized for its futility until many years later. The last bounty was discontinued in 1962.

Furbearers include animals that have a valuable hide and are protected by law. Animals with little or no commercial value are classed either as predators or are unclassified. Rabbits, snowshoe hares, squirrels and certain carnivores are not classified either as small game, furbearers or predators. In 1968, seven species were classified as furbearers by the State Legislature and seven others were classed as predators. As is discussed later, predator classification may have little relation to actual predation. Also, the hides of some predators are sometimes more valuable than certain furbearers.

Intensive studies of furbearer species began in 1951 and led to the fur management program presently administered at the District level. The objectives of furbearer management are to provide trapping seasons that will allow an adequate cropping of prime pelts while assuring the maintenance of a satisfactory breeding stock.

FURBEARERS

By J. Mitchell, K. Greer and R. Weckwerth

The first hardy breed of man to venture into Montana among the Indians in search of wealth was the fur trapper. The abundant fur resource influenced early settlement of this region. Fur companies followed the trappers. Several companies vied for the trade of the trappers and for many years Montana and adjoining states were important fur production and trade areas. Mink (*Mustela vison*), beaver (*Castor canadensis*), and muskrat (*Ondatra zibethicus*) were the standard bearers in those early periods and they are still the main fur species of today.

Montana still produces a sizable number of hides for sale each year. The greatest value of present Montana fur resources is for recreation, with a side benefit of supplemental income to the trappers. Few trappers rely upon a trapping income as their sole subsistence. The important furbearers have decreased somewhat due to habitat loss over the years. The main cause for the continuing loss of habitat is more intensive agricultural practices on farmlands and use of more lands for agriculture.

The Montana State Legislature designates species to be included as furbearers in the State Statutes (Table 1). Generally any animal having a valuable hide is placed among the furbearing animals which are protected by law. Other animals of little or no commercial value are placed on the predator list, or left unclassified and not protected by seasons. The classification has little relation to actual predation, and on occasion some predator pelts have a higher value than furbearers.

Between 1942-66 the fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), and Canada lynx (*Lynx canadensis*) were dropped from the furbearer list. The black-footed ferret (*Mustela nigripes*) was classified a predator until the late 1950's when it was transferred to the furbearer list. The raccoon was classified a furbearer and subject to seasons and legal possession limits until the 1951-52 season. The fox

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Table 1. Furbearers, as classified by State Legislature in 1941 and 1968.

1941	1968
Marten (Sable)	Marten (Sable)
Otter	Otter
Fox	Muskrat
Muskrat	Fisher
Fisher	Mink
Mink	Beaver
Raccoon	Black-footed Ferret
Beaver	
Lynx	

was similarly classified as a furbearer for a number of years during the past quarter-century. From 1941 to the present the Canada lynx has shifted back and forth from the furbearer to the predator list by legislative action.

Beaver, muskrat and mink are the three main furbearers as far as value and harvest by trappers. Beaver and muskrat are members of the rodent family classified as gnawing animals. The mink is a carnivore or flesh-eating mammal. Regulated seasons have contributed to conservation of these species in numbers compatible with their habitat. The beaver has been subjected to successive periods of exploitation, almost complete protection, and scientific management. The management policies initiated within the last 25 years are designed to perpetuate and provide a sustained yield of harvestable beaver in numbers compatible with other land uses.

The three main furbearers presently, as in the past, enjoy statewide distribution where suitable habitat occurs. Beaver and muskrat are vegetarians associated with water, which has suitable vegetation for food and cover. The carnivorous mink is closely associated with water habitat although it often ventures further from water than beaver or muskrat. There seems to be no distinct altitudinal limitations of these species as long as other habitat requirements are met.

The river otter (*Lutra canadensis*) is a furbearing animal also associated with water environments. It is found along most of the main river courses in Montana.

The fisher (*Martes pennanti*), a native in Montana, disappeared in the late 1920's and was not present again until 1959 when 36 were transplanted into three areas in Montana from British Columbia. Their present known distribution is limited to the Pinkham Creek area near Rexford, the Holland Lake area of the Swan Valley and the Moose Lake area in the Rock Creek drainage east of Missoula. The fisher and marten (*Martes americana*), unlike many of the other furbearers which live close to water, are closely associated with climax spruce-fir forest.

Each species of furbearer is associated with certain areas that provide their required habitat. Some species such as the beaver and muskrat tolerate dense concentrations in small areas, while others such as the otter range over several miles in relatively sparse numbers. A study along the lower Madison River showed that two adult female mink remained in areas of 50 acres and 19 acres, respectively. The type of habitat was related to the size of home range. An adult mink in the same area moved less than 3 miles during the year.

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Beaver are the most controversial of the furbearers. Their use of aspen, alder, cottonwood, birch and willow for food and cover often creates problems. Man often wishes to maintain stands of trees and shrubs for their aesthetic or flood control values. Nature's engineers often build their dams (one of which measured 2,140 feet long in Montana) in places that compete with man-made installations.

Beaver habitat in Montana has been steadily declining through encroachment of agriculture and incompatibility with man. More habitat for beaver as well as mink, muskrat, otter and fisher may become available in the future. The current trend is to protect vegetation on stream banks and flood plains from overgrazing and intensive agricultural use in order to prevent soil erosion. The spread of furbearers into improved habitat will depend on their compatibility with landowners.

Piles of vegetation in marsh areas are the trade mark of the muskrat. Muskrat also burrow into stream banks to make living quarters. They can make themselves unpopular by burrowing into farm pond dikes and irrigation banks.

Mink use any natural cavity, including muskrat burrows, for shelter along stream courses or around ponds. They often move into adjacent wooded areas when winter freezing occurs.

Marten do not frequent large openings in the spruce-fir forests, but are readily found in lodgepole pine areas in various stages of succession caused by fires. Logging creates an important impact on marten habitat. Large clear cuts are not frequented until succession creates an overstory of trees.

Undisturbed furbearer populations soon reach the maximum numbers an area

Musk rats are vegetarians associated with suitable vegetation in and near water. Piles of vegetation in marsh areas are the trade mark of the muskrat. They also make burrows into stream banks and make themselves unpopular sometimes by undermining farm pond dikes and irrigation banks. — (F & G photo)

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The total harvest from all fur species each year provides Montana trappers with a direct cash value of from nearly one-quarter to one-half million dollars. Mink, muskrat and beaver make up the majority of the annual pelts harvested. — (F & G photo)

will support. Population increase is then regulated by limiting factors in the habitat, and associated behavior characteristics. When maximum population numbers in any one area are approached or exceeded, the incidence of migration, disease, starvation and predation limits additional population increase. Environmental circumstances may increase or decrease habitats and maximum population numbers through forest fires, droughts, floods, dams, marshland drainage or brush removal. Populations are also influenced by extreme freezing temperatures and excessive snow. Furbearers are limited in distribution and abundance by habitat and behavior.

MANAGEMENT

Since populations of established furbearers are self regulatory, most of the annual population increase results in a surplus of animals. This surplus can either be taken by natural causes, or it can be harvested through proper management.

Trapping seasons were established for mink, muskrat, raccoon and fox during the period 1940-50. Marten, fisher and otter were protected. Beaver were taken in areas where they were a nuisance. Montana law directed that all beaver hides were to be sealed by Fish and Game personnel before legal disposition. The administration of this law provided records of the number of tags sold during these years.

A fur section was established under the Wildlife Management Division of the

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Fish and Game Department in 1951. This section was responsible for the administration, management and research of the fur resources. It accomplished these goals and was absorbed into the Game Management Division to be administered on a District level in recent years.

Beaver were protected from 1941-53. During that time there was a need for more liberal harvest methods to supplement trapping only nuisance beaver. People realized a valuable resource was wasted through non-harvest. In 1952 this was substantiated through a study in the Jefferson River Basin showing: a high beaver population in the area; the landowner permit system was inadequate for obtaining a sustained yield and; a change in the beaver laws was needed to accomplish these aims. Consequently, the 1953 State Legislative Assembly amended the beaver laws, authorizing the Fish and Game Commission to declare open seasons. The Commission opened areas on a quota system. The beaver quota was divided among trappers who desired to trap in any specific area. Recently, much of the State has been opened to unlimited beaver trapping.

Mink and muskrat are usually co-occupants of lakes, ponds, marshes, rivers, ditches and water impoundments. While this is lucrative for the trapper, it is also of concern to the fur buyer and game manager, because each species attains a prime pelt at a different season — mink in fall and muskrat in spring. The prevailing November-December fall season and March-April spring season provide the desired pelt quality. Recent studies show spring mink pelts were worth about one-third as much as fall mink pelts. Less than 2 to 5 percent of the mink sales were made in the spring. As long as trapping pressure does not increase to the point where spring captured mink taken in muskrat traps is detrimental to the mink populations, the spring muskrat season will be continued.

Studies have been conducted each year since 1953 to learn age and sex ratios of mink harvested and harvest trend during the November 10-December 31 season. A sample of about 150 trappers who harvest about 2,200 mink annually, representing 20 to 30 percent of the total State harvest, was used for calculation. About 50 percent of the mink were taken during the first 10 days of the season. An additional 25 percent were harvested in the second 10-day period. Generally, as the population surplus is removed, trapping success and trapper activity decline with season progression.

Information about age structure is important for indicating the proportion of young mink in the fall population. This net increment is the annual harvestable surplus trappers may take. The ratio of juvenile to adult male mink harvested varies between areas and years. The 10-year average has been 70 percent juveniles and 30 percent adults. This surplus can be removed by trappers, or be taken by nature's self-regulatory factors and mechanisms and eliminate monetary gain or recreational enjoyment.

Pine marten were considered Montana's most valuable furbearing animal during the early 1940's. Several introductions into new areas were tried in the early 1940's and in the 1950's. The success of these introductions varied. Areas where marten were introduced were closed to trapping for 5 years to protect the transplanted stock.

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Research on marten ecology was undertaken to determine if a closed area such as Glacier National Park served as a reservoir to stock adjacent areas. Data proved few marten traveled far enough to aid restocking of adjacent areas. At present, marten pelts have to be tagged by Fish and Game Department personnel within 20 days of the close of the trapping season to be legal.

The 1959 fisher transplant areas in Montana were selected on the basis of habitat requirements and consideration of existing marten populations. The transplant areas were closed to marten trapping for 5 years to protect the fisher.

Since the initial transplant, several fisher have been taken. Some moved considerable distances in a short time. The longest movement was that of a male from Holland Lake to Creston, about 80 miles. Movements of 25 to 35 miles also have been noted. Evidence of reproduction came shortly after the transplant in 1960. A tagged female, taken by a mink trapper, had recently borne young. At this time, it appears the Swan transplant site is the most successful of three sites.

Although otter were protected for several years during the past quarter-century, some were inadvertently caught each year in beaver trap settings. A season was opened during 1945-46 to permit legal possession of otter and 30 animals were harvested. This was followed by a 2-year closure. The 1949-50 season provided less than 50 otter. After 6 years of protection, a fall and spring season has prevailed since 1956.

At the present time, the fur resources are managed in seven administrative districts. A statewide survey of selected mink trappers is continued on a limited

Since populations of established furbearers are self regulatory, most of the annual population increase results in a surplus of animals. This surplus can either be absorbed by natural causes, or can be harvested through proper management of trapping. Fur resources are managed through seven administrative districts.—(Photo by Gerry Atwell)

FURBEARERS

basis to determine age structure of harvested mink. Annual determination of active trappers, pelts harvested by species, and fur prices are acquired from fur dealers' records and statewide trapper surveys.

FUR HARVEST

Mink, muskrat and beaver make up the majority of the pelts harvested annually and provide a high percent of the income (Table 2). About 75 percent of the fur is taken in western Montana.

The total harvest of 40 to 80 thousand pelts from all species each year provides Montana trappers with a direct cash value of nearly one-quarter to one-half million dollars. While seasonal fur prices and current employment status may affect the total harvest, severe or fluctuating weather conditions during the season influences trapper activities and success. During a poor trapping year, the total harvest of pelts decreases but the percentage of each remains essentially the same.

Table 2. Harvest and income for season years 1950-51, 1963-64, and 1967-68.

Species	1950-1951		1963-1964		1967-1968	
	Number Of Pelts	Trapper Income	Number Of Pelts	Trapper Income	Number Of Pelts	Trapper Income
Mink	8,590	\$161,500	9,559	\$118,848	4,582	\$ 41,788
Muskrat	53,248	83,800	48,657	48,020	19,608	13,333
Beaver	12,522	198,000	15,980	162,880	11,893	126,898
Weasel	1,632	1,910	997	690	364	201
Marten	1,462	29,410	435	2,075	490	2,558
Otter			65	1,030	25	485
Wolverine			37	444	32	480
Bobcat	461	940	1,502	9,270	1,075	10,933
Lynx	2	25	376	3,920	62	775
Fox	21	45	745	1,610	1,018	3,838
Coyote	147	190	287	1,045	351	1,214
Skunk	772	710	2,066	1,720	1,526	1,802
Raccoon	195	210	2,378	3,960	1,624	2,956
Badger	40	35	187	330	278	645
Total	79,072	\$476,775	83,271	\$355,842	42,928	\$207,910

Except for 1940-41 when nearly 18,000 beaver tags were sold, the yearly average from 1940-50 was about 10,000 tags.

During the past 15 years, the smallest number of active mink trappers for 1 year was 660 during 1959-60. The highest was just over 1,000 in 1954-55. During that span, an average of 800 trappers harvested about 8,000 mink annually of which 55 to 61 percent were males. Most males were taken early in the seasons.

A 10-year average of 957 trappers harvested about 32,740 muskrats per year during 1958 to 1968. Fall muskrat pelt prices were 10 percent below spring prices, but twice as many pelts were sold in the fall. This phenomenon is no doubt due to trappers supplementing their income in the fall by trapping muskrats along with the higher-priced mink.

The marten harvest declined steadily from 1950-57 and since then has fluctuated from 270-435 annually. Prices have dropped so there are fewer trappers afield.

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Muskrat and beaver habitat has been steadily declining through encroachment of agriculture and incompatibility with man. — (F & G photo)

Since 1958, the annual harvest of otter has been about 45, ranging from a low of 25 during 1967-68 to a high of 65 during 1963-64.

FUTURE OUTLOOK

Montana has no furbearer research project in progress or planned for the near future. While fur prices have fluctuated through the years, future prices are not expected to attain the price plateaus known many years ago.

Trapping is expected to continue in the future as a form of recreation. If fur prices rise to the point where trappers exert excessive pressure on furbearers, seasons will again be adjusted so these populations will be managed within the limits of their available habitat.

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PREDATORS

By J. Mitchell and K. Greer

Predators may be defined as those animals that depend on other animals as a source of food. They are an integral part of the wildlife community and a necessary part of the complex balance of nature. Some predators prey on animals wanted by man for his own uses and then they often have become the subject of his wrath. The fact that a predator's primary diet may be mostly rodents, rabbits, or insects is usually forgotten, and only the taking of game or domestic animals is remembered.

Animals designated as predators by the 1966 legislature are: coyote (*Canis latrans*), wolf (*Canis lupus*), wolverine (*Gulo gulo*), mountain lion (*Felis concolor*), weasel (*Mustela* spp.), skunk (*Mephitis mephitis*), and bobcat (*Lynx rufus*). This list has undergone several revisions during the past quarter-century. Some animals listed as predators at one time have been transferred to the furbearer list and vice versa, or left unclassified (neither predator nor furbearer).

The black-footed ferret (*Mustela nigripes*) was transferred from the predator list to the furbearer list in the late 1950's in hopes of preserving it, but there have been no recent verified sightings of this animal. The ferret is dependent on the prairie dog for sustenance. Even though there are a few prairie dog towns left in Montana, the ferret has been less fortunate.

The lynx (*Lynx canadensis*), fox (*Vulpes vulpes*), and raccoon (*Procyon lotor*) were not classed as either predator or furbearer in 1966. Both lynx and fox have been listed for short periods during the past 25 years as furbearers.

There has been little change in the distribution of the listed predators in Montana during the last quarter-century. The coyote is still found statewide. Their numbers fluctuate locally as control programs and food sources, mainly small rodents, fluctuate. Wolves were still widely distributed in the State until about 1910. Records from 1875 to 1877 show about 30,000 wolf skins were shipped out

GAME MANAGEMENT IN MONTANA

of Fort Benton annually. The last known kill of a wolf in Montana was near Lincoln in 1964. Occasional sightings are still reported. Mountain lions are most common in the timbered, mountainous regions. Their far ranging habits and territorial behavior precludes dense populations. Despite a bounty until 1962, mountain lion distribution has not changed much in the last quarter-century. At present, lions are hunted for trophy and sport. Bobcats enjoy wide distribution. Populations fluctuate with their food supplies; primarily rabbits and rodents. Striped skunks are widely distributed in Montana, while the spotted skunk (*Spilogale gracilis*) is known from only two specimens taken in Ravalli County. Weasels have always had statewide distribution. Wolverine have been reported in many timbered, mountainous regions. They are native animals, but their infrequent occurrence makes them of little concern as predators at this time.

Except for the wolf and black-footed ferret, all of the species on the predator list of 1941 have maintained themselves. The wolverine and mountain lion are associated with rough, timbered terrain and do not frequent agricultural areas. Weasels and skunks are closely associated with agricultural areas as are coyotes to a certain extent. While bobcats are more commonly found in timbered, rocky or swampy areas, and in river breaks country, they also frequent agricultural areas. The striped skunk is found in a wide variety of habitats almost everywhere in the State. The three species of weasels present in Montana have varying distribution. The short-tailed weasel (*Mustela erminea*) is limited to the western half of Montana in open woodlands, brushy and rocky areas and along field borders. The long-tailed weasel (*Mustela frenata*) is common over the whole State. The least weasel (*Mustela rixoso*) is found in the eastern half of the State, but only rarely.

MANAGEMENT

Predator management as first practiced by the Montana Fish and Game Department was simple—"eliminate predators for the benefit of wildlife." With time, more people and government agencies developed an ecological understanding and predator management was no longer such a simple problem.

The bounty payment system began in Montana in 1879. At that time the Territorial Legislature authorized County Commissioners to pay bounties on certain animals. In 1925, the Fish and Game Commission for the first time transferred money (\$7,500.00) to the Livestock Fund for bounty control work.

There have been many changes in the Montana Fish and Game Commission predator control and bounty payment policies. These changes have been influenced back and forth by pressures of special interest groups and by improved scientific knowledge. Though the fallacies of controlling animals by bounty payments were known earlier, direct bounty payments were not completely eliminated until 1962. Payments are still made in one form or another by the Commission, for predator control. A history of predator control administration highlights since 1940 is summarized in the following paragraphs.

1940-42 Biennium. The Commission had set aside \$10,000.00 for predator control December 17, 1940. It was spent by February 16, 1941. Bounty payment rates were: mountain lion \$25.00, coyote \$2.00, and bobcats \$2.00. The Commission also hired part-time trappers to work in problem areas.

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1942-44 Biennium. The bounty payment rates paid by the Commission were the same as in the previous Biennium.

1944-46 Biennium. The Commission helped sponsor magpie and crow control campaigns. They paid the salaries and expenses of four government trappers during two winter months in 1945 and 1946. The coyote was off the bounty list by this time. Many sportsmens' groups around the State had their own campaigns on predators.

1946-48 Biennium. A total of \$50,000 was expended for predator control, \$34,000 of which was spent on salaries of Government trappers. In 1947, the Fish and Game Commission discontinued the practice of paying one-half the bounty claims paid by the Livestock Commission. On July 1, 1947 the Governor's Predator Animal Advisory Committee became active. It is composed of six members: Director, Montana Fish and Game Department; State Supervisor, Bureau of Sport Fisheries and Wildlife, Division of Wildlife Services; Executive Officer, Montana Livestock Commission (Secretary); Montana Woolgrowers; Board of County Commissioners, and Montana Wildlife Federation. State, County and Federal funds are pooled to finance this program. The Bureau of Sport Fisheries and Wildlife, Division of Wildlife Services, implements the program with men and equipment and conducts the field work.

The Commission gave financial assistance to sportsmens' organizations by

Control programs have reduced coyote populations in specific areas but indications are that other predators often increase following coyote removal. Game departments agree that most predator control programs have little or no effect on game populations. — (Photo by Gerry Atwell)

GAME MANAGEMENT IN MONTANA

Wolves were common in Montana until about 1910. The last known kill of a wolf was near Lincoln in 1964. Occasional sightings are still reported. — (F & G photo by Gus Wolfe)

PREDATORS

offering to pay one-half the funds expended for crow and magpie control, not to exceed 10 cents per bird. This alone amounted to an expenditure of \$2,000 by April 30, 1948. A \$5.00 bounty was also placed on golden eagles in Carter and Powder River Counties. In two months (March and April, 1948) 290 claims were paid, and then golden eagle bounties were discontinued.

1948-50 Biennium. Direct participation of Department employees in predator control was very limited during this period. A total of \$8,300 was paid out in direct bounties. Sixty-eight thousand, nine hundred and sixteen dollars was paid by the Fish and Game Commission to the Predator Animal Advisory Committee.

1950-52 Biennium. Six thousand, five hundred dollars was paid in direct bounties.

1952-54 Biennium. Total bounties paid by the Commission were: \$25,600 for bobcats, \$8,332 for mountain lions, and \$2,197 for magpies and crows.

1954-56 Biennium. A transition in the thinking concerning predator control and bounties was noted in the Fish and Game Commission Biennial Report:

"It has been shown for example, that when ring-necked pheasant populations decline this decrease is noted not only in the areas where predatory animals abound but also in island habitats where there are no land predators . . .

"In other words, it is recognized that lack of protective cover, food shortage, disease and numerous other factors may have a far greater limiting effect on some species than do predators. Thus in game management it is essential to evaluate the point beyond which predator control becomes an expensive and ineffectual tool."

However, the bounty on the mountain lion was raised to \$50.00 from \$25.00 in this Biennium. The bobcat bounty was also raised to \$5.00 from \$2.00 for about 1 year, then reduced back to \$2.00.

1956-58 Biennium. Bounties in effect were \$50.00 for mountain lions and \$2.00 for bobcats. In cooperation with sportsmens' groups, the Department paid one-half the amount paid for magpies and crows up to 10 cents per bird.

Plans were made to initiate an extension predator control program with the idea of training landowners in control methods, so they could handle their own problems. The program was successfully initiated in the northeastern counties of the State. It was discontinued as a Department function after a few years.

A statement in the 1956-58 Fish and Game Commission Biennial Report further illustrates the thinking of the time in paying direct bounties:

"Before control measures may be used on much of our public lands the managing agency properly required that game populations must be under the carrying capacity of the habitat and that harvest by hunters must be adequate to keep herds in balance with the range."

A research study in the Bitterroot Valley during the 1950's showed paying bounties on magpies was a waste of money. The Commission rescinded the matching funds available to sportsmens' clubs for bounty payment on magpies and crows in 1958.

The Fish and Game Commission continued to contribute funds annually to the Predator Control Fund. The 1956 to 1958 Fish and Game Commission Biennial Report states this about their contribution:

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Even with former bounty payments, periods of high fur prices and man's chronic desire to rid the world of varmints, these animals have maintained themselves. Regardless of the effort and money spent on control, man has not eliminated any successful predator species. The coyote has learned to adapt to the encroachment of man. — (Photo by Danny On)

“This contribution is not so much for purposes of game management as it is a means of discharging a part of the Commission's responsibility toward overall predator management.”

1958-60 Biennium. The grant from the Montana Fish and Game Commission to the Predator Control Board amounted to \$76,424 for this Biennium. A total of \$6,900 was paid by the Commission to bounty mountain lions and \$3,908 for bobcats. The last bounty on bobcats was paid in 1959.

1960-62 Biennium. The grant from the Commission to the Predator Control Board was \$78,234 in this Biennium. A total of \$3,750 in bounties was paid in 1961 and \$3,100 in 1962 by the Commission. The bounty on mountain lions was discontinued in 1962, bringing down the curtain on the last bountied individual animal in Montana. (A total of \$200 was paid by the Commission in bounties in 1963, apparently due to records being turned in late.)

1962-64 Biennium. The biennial grant from the Fish and Game Commission to the Predator Control Board amounted to \$71,537.

1964-66 Biennium. The Commission contributed approximately \$80,000 to the Predator Control Board.

Due to the incidence of wildlife rabies in eastern Montana, the Commission was directed to initiate an action program to combat this problem. An advisory committee was appointed. Representatives were selected from the Livestock Sanitary Board, Extension Service, Bureau of Sport Fisheries and Wildlife (Division of Wildlife Service), Livestock Commission, Department of Fish and Game and State

Mountain lion distribution has not changed much in the last quarter-century, despite a bounty until 1962. The largest of North American cats, mountain lions, are presently hunted for trophy and sport in the timbered mountainous areas of Montana. They usually do not frequent agricultural areas. — (Photo by Danny On)

Board of Health. In addition the Fish and Game Commission appointed a Rabies Control Coordinator to coordinate control programs as planned by the board.

Funding of this program was from a Legislative appropriation and emergency funds of the Livestock Sanitary Board. In addition the Fish and Game Commission designated \$10,000 of the \$40,000 contribution for predator control to be used specifically for rabies control work.

A local action program was recommended to suppress skunk populations at each positive incidence site. A containment program was conducted utilizing a zone 169 miles long and treating this zone 2 to 4 miles wide in an attempt to reduce the spread of rabies.

FUTURE OUTLOOK

Through the years man has contrived various schemes, and pursued some predators with tenacity to control or eliminate them. However, man has not eliminated any successful predator species, regardless of the effort and money spent on its control. The disappearance of the wolf from the State was due to the wolf's inability to adjust to civilization and not necessarily to control efforts.

Coyote control programs have successfully reduced coyote populations in specific areas. Often the "controlled" coyote is simply replaced by one or more other species. Studies in several localities where "1080" stations were employed in coyote control clearly indicate populations of bobcats, skunks, badgers, and raccoons increased following coyote control. This is probably the reason for the

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shift in Montana coyote and fox populations. The fox is native to Montana and apparently filled the space left by coyote control, leading some to surmise that the fox was invading the State.

In addition to harvest by control methods, the total harvest of fox, skunk, weasel, bobcat, wolverine, coyote and lynx is also influenced by the fur market. If fur prices rise on any species, a corresponding rise occurs in harvest. Even with the predator control incentives of bounty payments, high fur prices and man's desire to rid the world of varmints, these animals have maintained themselves.

Most game departments in the United States agree that trying to control predators has little effect on huntable game populations. Generally, game populations decrease or increase according to the amount of habitat available for them, regardless of the pressure exerted on them by predators.

The thinking of the Montana Fish and Game Department and other state game departments concerning predator control has changed radically over the years. The tendency for game departments to minimize the value of predator control for game management has been well documented. A new management program for the Montana Fish and Game Department was proposed in 1958; in summary it stated:

"Although indiscriminate control of the large predators may have benefited big game during the restoration era, predator control has little place in the management of our overstocked or properly stocked big game ranges of today."

The following statement sums up the present thinking: It appears that most of the predator species will be with us in the future. However, modern agricultural practices will tend to limit predator habitat and future numbers. Ironically, the modern agricultural practices that will control predators will also limit game species — the very same game species that were to benefit from predator control programs that began nearly a century ago in Montana.

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APPENDIX I

HISTORY OF MONTANA WILDLIFE (1869-1940)

- 1869.....First laws protecting game birds: Quail and partridge protected by closed season for three years.
- 1872.....First closed season on buffalo, moose, elk, deer, bighorn sheep, mountain goats, antelope and hares, February 1 to August 15 each year.
Yellowstone National Park created.
- 1873-74....Passenger pigeon extinct.
- 1876.....First closed season on furbearing animals: Closed April 1 to October 1 each year on beaver, otter, marten, fishers.
First closed season on ducks and geese from May 15 to August 10 each year.
- 1877.....Act passed making it unlawful to kill game animals for hides alone without using or selling meat.
Trapping of beaver prohibited except on private lands.
Unlawful to hunt or chase game animals with dogs.
Sale of game birds for market purposes prohibited.
- 1883.....Act prohibiting destroying nests of game birds and waterfowl or to take eggs away from nests.
- 1893.....First year-around closed season on moose and elk.
- 1895.....First Fish and Game Board authorized by Legislature.
Big Game Season — Sept. 1—Jan. 1, set by Legislature. Limits: 8 deer, 8 bighorn sheep, 8 mountain goats, 8 antelope, 2 moose, 2 elk.
- 1897.....First daily bag limit placed on game birds: No person may kill more than 20 grouse or prairie chickens in one day.
Sale of game animals, game birds prohibited.
Moose season closed and remained closed until 1945.
- 1901.....W. F. Scott, first State Fish and Game Warden (Director) appointed by Governor.

Bobwhite introduced — Kalispell, Flathead County.

First license required (nonresidents only) to take game animals and game birds. Nonresidents required to purchase hunting license of \$25 — game animal, \$15 — game birds.

1902.....First Biennial Report of State Fish and Game Warden, W. F. Scott.

1903.....Bobwhite introduced in Utica, Judith Basin County and Fergus County. Taxidermist license required. Guides license required.

1905.....First resident hunting and fishing license required at cost of \$1.00 — one license per family required.

Ringneck pheasant introduced to Bitterroot Valley and spreading.

1908.....First Montana area set aside for big game use by U. S. Forest Service — Upper Gallatin.

1909.....First daily bag limit on wild ducks at 20 per day.

1910.....Statewide season open Oct. 1—Dec. 1 for 3 deer, 1 elk, 1 sheep, 1 goat (closed on antelope, moose, caribou, bison).

First elk transplanted in Montana to Fleecer Mountain, Silver Bow County, from Yellowstone National Park.

1911.....First game preserves, Snow Creek Game Preserve, Dawson County, created by Legislature primarily for antelope but also for deer and game birds. Pryor Mountain Game Preserve and Gallatin Preserve also created.

There were 59,291 hunting and fishing licenses sold in Montana.

1912.....Bobwhite introduced in Deerlodge valley, Deerlodge and Powell Counties.

1913.....Montana Fish and Game Commission organized.

Sun River Game Preserve created by Legislature.

1915.....Bobwhite introduced on Wildhorse Island, Lake County.

Hungarian partridge found near Plains, Sanders County (specimen found dead and identified).

Season closed on bighorn sheep and remained closed until 1953.

1916.....Last Audubon sheep killed in Garfield County.

Closed season on moose, bison, caribou, antelope, beaver, bighorn sheep, mountain goat, quail, Chinese pheasant and Hungarian partridge.

Open season — Oct. 1 - Dec. 15 Deer: Two (2) animals per season, any age or sex. Elk: One (1) per season (only in certain counties).

Open Season: Sept. 1 - Oct 1 Five birds per person per day — grouse,

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prairie chicken, fool hens, sage hens, pheasants or partridge in southeastern Montana. Game bird open season — Sept. 15 - Oct. 15 all other other counties not mentioned above.

Open Season: ducks, Sept. 1 - Jan. 1, limit 20/person/day.

1917.....Deer bag limit changed from two deer to one deer statewide. First counties closed to deer hunting in Yellowstone, Rosebud, Custer, Dawson and Richland.

Nonresident citizen license raised to \$15.00 from \$10.00.

Prairie chicken taken (only recorded specimen in 1921) Huntley, Yellowstone County, Montana.

First bird preserve — Flathead Lake Bird Preserve (two islands), Flathead County.

Resident hunting and fishing license raised from \$1.00 to 1.50.

1917-18....Gambel quail (31 dozen) planted in Teton, Missoula, Musselshell, Yellowstone, Sanders, Broadwater, Gallatin, Park, Choteau, Dawson, Carbon, Custer Counties.

Ring-necked pheasant planted in Flathead and Lincoln Counties from stock in Utah.

1918.....Migratory Bird Treaty Between Great Britain (Canada) and the United States signed providing National authority to manage migratory game birds and protecting many nongame bird species.

1919.....Closed season on deer in Valley, Roosevelt, Sheridan Counties and Yellowstone, Rosebud, Custer, Richland and Dawson Counties.

Restriction on use of automobile to kill game.

First license required for taking fur animals. Marten license fee \$1.00.

1920.....Nonresident general (hunting and fishing) license raised to \$50 from \$15. Commission purchased 150 pair of pheasants from Oregon.

1921.....Commission given authority to establish game preserves. Twelve State game preserves and refuges had been established in Montana.

Present five Fish and Game Commissioners system appointed by Governor as provided by law. Granted power to allot Fish and Game Districts and to close or open seasons under certain conditions.

Resident hunting and fishing license fee raised from \$1.50 to \$2.00.

Nonresident hunting and fishing license fee changed from \$50 to \$30 and remained \$30 until 1947.

Deer Season: Nov. 1 - Dec. 1, limited to one buck and closed in Yellowstone, Rosebud, Custer, Powder River, Carter, Richland, Roosevelt, McCone, Dawson, Stillwater, Gallatin, Teton, Phillips, Garfield, Valley and a portion of Fergus Counties.

1922.....Commission released 1,500 pheasants in State.

APPENDIX I

First commission-created game preserve established in Tobacco Root Mountains, Madison County.

- 1922-26....**Hungarian partridge purchased in Europe and released in all counties of the State by Fish and Game Commission, (1,000-1922, 2,000-1923, 2,000-1925, 1,000-1926).
- 1925.....**Muskrat farm established at Swan Lake, Lake County (five fenced acres – “largest in America”).
3,027 antelope estimated for Montana in 44 areas by Biological Survey in U.S. Dept. Agr. Bull. No. 1346. 1926.
- 1926.....**First land acquired for game management purposes (27 acres at Red Rock Lakes), Beaverhead County.
- 1928.....**First pheasant season in Montana.
- 1929.....**17 Legislature-created preserves.
First Hungarian partridge season in Montana.
First game farm at Warm Springs.
First goat season in West Bitterroot, Ravalli County, since 1914.
- 1930.....**33 game preserves totaling 2,000,000 acres.
- 1931.....**First big game resident license to take deer and elk \$1.00.
Fur dealer's license required, fee \$1.00.
- 1932.....**California quail liberated in Deerlodge County from game farm.
- 1933.....**First chukars released in Montana, Dawson County.
- 1934.....**First duck hunting stamps sold in Montana.
- 1935.....**Game farm established at Billings.
First permit antelope season in all of Carter and Powder River Counties except game preserve.
46 State game preserves in Montana. (the maximum number of preserves in effect at one time).
- 1935-36....**Valley quail (218) liberated in Yellowstone, Lake, Big Horn, Granite and Lewis and Clark Counties.
- 1936.....**Antelope season in Chouteau County – 400 permits.
Three game preserves abandoned (Albert Wood, Carbon County, Spotted Bear).

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Statewide buck law declared — 29,699 resident big game licenses sold at \$1.00 each.

Game bird seasons closed statewide due to severe drought except 4-day mountain grouse season, Lincoln County.

Chukars (8) released in Stillwater County.

First winter deer ranges leased in Sanders, Missoula and Powell Counties.

C. M. Russell Game Range (Fort Peck Game Range) created by Congress (97,000 acres).

1937.....First chukar eggs from Oregon to Warm Springs Game Farm.

First elk calf tagging in Gallatin.

1938-42....Ten plants of chukars in eastern Montana; average 23 birds each (eggs from Washington, Wyoming, California).

1939.....State versus Rathbone case which established important precedent to game damage problems.

The first degree in wildlife technology was granted at the University of Montana, Missoula.

1940.....First acquisition of the Judith River Game Range for elk winter range, Judith Basin County.

First big game manager position created.

APPENDIX II

DEVELOPMENT OF GAME MANAGEMENT (1941-1970)

1941.....The Federal Aid in Wildlife Restoration (P-R) program began. Big game and game bird surveys were initiated.

Fish and Game Commission given regulatory power over opening and closing seasons, setting of bag limits, and creating game preserves.

Commission policy setting up an investigational program to obtain scientific data as a basis for wildlife management.

First goats transplanted in Montana from Deep Creek, Teton County to Crazy Mountains, Sweetgrass County.

First large scale program of live-trapping and transplanting beaver undertaken by Department in which 1,968 animals were transplanted.

First 4-day special season on either-sex deer exclusive of fawns in portion of Madison County.

1942.....First bighorn sheep transplanted from Sun River, Teton County to Gates of Mountains, Lewis and Clark County.

Surveys estimate 14,000 antelope in eastern and central Montana.

First hen pheasant season in Montana (Yellowstone County).

First 1-month, either-sex deer season in portion of Madison County.

1943.....First mule deer transplanted from National Bison Range, Lake County, to Glendive badlands, Dawson County.

Antelope hunting renewed in Montana on annual basis (750 permits).

First extended special either-sex season on deer — November 15 - December 31 or until 500 head taken in portion of Madison County.

First 1-month special either-sex deer season in portion of Ravalli County.

1945.....First white-tailed deer transplanted from Bowser Lake, Flathead County, to East Rosebud, Stillwater or Carbon County.

First moose seasons in portions of Park, Gallatin, Madison and Beaverhead Counties.

1946.....First antelope transplanted in Montana from Winston area, Broadwater County to Horseshoe Hills, Gallatin County.

1947.....Beaver transplanting program discontinued except for beaver causing damage.

APPENDIX II

Resident big game license fee changed from \$1.00 to \$2.00.

The bounty on coyotes discontinued.

First special closed season on one species of deer (Whitetail in Broadwater County).

1948.....Blackfoot-Clearwater Game Range in Missoula and Powell counties and Sun River Game Range in Lewis and Clark County were acquired.

Wildlife management curriculum begun at Montana State College, Bozeman, in cooperation with the State Fish and Game Department.

Bighorn sheep from Colorado released in special holding pasture in Garfield County.

1949.....Valley quail (12 pairs) obtained from Oregon were introduced in Lake County.

Forage surveys on State game ranges started.

An unsuccessful magpie control program was abandoned.

Milk River waterfowl habitat area acquired in Phillips County.

1950.....First statewide mountain goat and bighorn sheep studies completed.

The Cooperative Wildlife Research Unit founded at the University of Montana, Missoula.

A study of pheasant stocking in the Gallatin Valley indicated the high costs and biological limitations of planting birds.

1951.....Either-sex deer season — 3 days in northwestern Montana. The remainder of the State was bucks-only or closed.

Heavy chukar planting began in Montana (continued until 1956 when Commission discontinued raising and releasing chukars).

Gallatin Game Range acquired to provide elk winter range.

1952.....Either-sex deer season: 2 weeks in western Montana; 3 days in southwestern and southcentral Montana. Bucks-only or closed elsewhere.

Studies on beaver ecology for improved management completed in western Montana.

First Department studies on the effects of insecticides on bird life completed in eastern Montana.

Fox Lake Waterfowl Area acquired in Richland County.

1953.....Bighorn sheep hunting began with a limited permit system.

Mountain goat hunting changed to limited permit system.

Freezout Lake waterfowl hunting area acquired in Teton County.

Flathead Lake goose nesting area acquired.

First bow-and-arrow licenses issued.

GAME MANAGEMENT IN MONTANA

Ninepipe waterfowl and small game management area started Lake County (first in a series of acquisitions).

First Game Division Technical Bulletin published — *Waterfowl Relationships to Greenfields Lake (Freezout Lake), Teton County.*

1954.....First turkey plant in Judith Mountains, Fergus County with 13 birds from Colorado.

Two mountain goat ecology studies completed in the Crazy Mountains.

Madison-Bear Creek and Bull Mountain elk winter range acquired in Madison County.

Bowser Lake deer range acquired in Flathead County.

A full-time wildlife extension program was started at the University of Montana to serve western Montana. A similar program followed at Montana State College for eastern Montana.

1955.....Second turkey plant — 18 Merriam's turkeys to Long Pines, Carter County, from Wyoming.

Studies on antelope-agricultural relationships led to full time research personnel assignments in Game Division.

One-month either-sex deer season in approximately half of the State.

Resident big game license fee changed from \$2.00 to \$3.00.

District organization and district approach to game management began.

First \$20 nonresident deer and antelope licenses.

Estimated statewide deer harvest reaches 100,000.

A comprehensive big game management policy was adopted by the Commission.

1956.....First general two-deer, either-sex season in northwest, southwest and southcentral Montana (since 1917).

Big game salting program abandoned except for trapping and research purposes.

First deer archery season statewide.

Otter taken off of protected list.

Chukar game farm — Moiese closed by Commission (further attempts to establish this species throughout State abandoned).

One-month either-sex deer season except for northcentral and northeast Montana.

The Montana Commission adopted a policy opening a big game season on October 15 or the first Sunday after October 15.

1957.....Deer and elk hunting units established in each Department Administrative District.

The Wildlife Laboratory, Montana Fish and Game Department, started operations at Montana State University, Bozeman.

APPENDIX II

Deer harvest 134,000 (included 90,000 bucks, or more than twice the bucks killed under the last statewide buck-only season).

Haymaker elk winter range acquired on south side of Little Belt Mountains, Wheatland County.

Studies completed on mule deer food habits, range and agricultural relationships in several areas of Montana.

A magpie banding study showed that nature, at no cost, accomplishes the same magnitude of reduction as bounties.

1958.....First Merriam's turkey hunt in Long Pines, Carter County, Montana.

Forage surveys were standardized to provide a basis for setting big game seasons.

First statewide game bird harvest estimate.

First statewide either-sex deer seasons.

The bounty on bobcats was discontinued.

Feeding experiments to determine elk winter food requirements were completed at the Blackfoot Game Range.

Blue grouse banding indicated that more liberal hunting seasons could be allowed.

Studies on antelope and agricultural relationships in central Montana were completed and published.

Game bird research was begun which, with big game research projects following in 1960, lead to a Game Research Section in 1966.

1959.....Upland game bird seasons increased in length and the daily total limit of three birds increased to provide limits ranging from three to five birds per species.

Pheasant season with hen in bag in Teton County on experimental area.

First special turkey license issued.

Antelope, moose, sheep and goat special season units were organized into administrative districts.

First use of automatic data processing to obtain game harvest information from hunter questionnaires.

Thirty-six fisher were introduced in three areas of northwestern Montana.

The Commission adopted a policy which specified that the western Merriam's turkey would be the only turkey planted in Montana.

1960.....Mountain grouse seasons increased to 57 days.

Bitterroot and Madison-Wall Creek elk winter ranges acquired in Ravalli and Madison Counties.

A preliminary investigation of lungworm in bighorn sheep completed.

1961.....Montana, west of the Continental Divide placed in the Pacific Flyway.

GAME MANAGEMENT IN MONTANA

First either-sex pheasant season in Montana.

Moose food habits and population studies completed in the Gravelly Mountains.

1962.....Cooperative Gallatin elk management plan initiated with Fish and Game Department, U. S. Forest Service and U. S. Park Service.

Fleecer Mountain Game Range acquired primarily for elk winter range in Silver Bow County.

Bounty on mountain lion discontinued.

A 2-year study completed of elk food habits, range use and relationship to logging clear-cuts in the Little Belt Mountains.

A mule deer study in western Montana indicated the trend in timber growth was decreasing deer winter range.

1963.....First spring season on turkey gobblers in Long Pines area.

Forest grouse—DDT studies undertaken during spruce budworm spraying on Bitterroot National Forest. (Nearly 3 million acres sprayed in Montana in the past decade).

Evaluation of two experimental pheasant hen hunting seasons completed.

Statewide mountain goat harvest over 500 (compared to 30-130 per year from 1941 to 1955).

1964.....Tenth consecutive year that statewide deer harvest exceeded 100,000, and ninth consecutive year that hunter success exceeded 90 percent.

Big game license form changes enabling hunters to purchase deer tags and/or elk tags separately.

Department reorganized into District Supervisor Administration of Districts. Game Division reorganized into line and staff.

DDT contaminations in wildlife led to Fish and Game Commission policy statement protesting further use of chlorinated hydrocarbon insecticides on public lands and urging research on effects of herbicides on habitat. (DDT was not used for spruce budworm control after 1963).

A banner year for bird hunters — over 370,000 prairie and mountain grouse harvested (compared to 130,000 in 1958). Record number, 164,000, of Huns harvested. Pheasant harvest exceeded 350,000.

1965.....Beginning of 10-year cooperative Fish and Game-Bureau of Land Management-Montana State University research project to determine the ecological effects of spraying sagebrush.

Beginning of \$35.00 black bear licenses.

Pacific Flyway boundary moved eastward from Continental Divide.

A 5-year study of mule deer, elk and cattle range use completed in the Missouri Breaks of central Montana.

Pablo waterfowl hunting area acquired in Lake County.

APPENDIX II

- 1966.....**Graduate stipend research program initiated with Montana State University and later at the University of Montana.
First special teal season in Central Flyway portion of Montana.
Study of Merriam's turkey ecology published which has provided guidelines for transplanting new areas and allowing more liberal hunting of established flocks.
- 1967.....**The game license system was modified and fees were generally increased. A new sportsman's license and a youth license were established by law. The first grizzly bear license and grizzly bear trophy license were issued.
Contract research with the U. S. Fish and Wildlife Service evaluating experimental forest-insecticides used to replace DDT was completed on the Bitterroot National Forest.
Three-mile Game Range acquired for elk winter range in Ravalli County.
Eighth consecutive year that statewide forest grouse harvest exceeded 120,000 (compared to 72,500 in 1958). Estimated forest grouse harvest exceeds that of pheasants (97,108).
Tenth year of turkey hunting in Montana — nearly 5,000 harvested since first 18 were planted in 1955.
A six year study of the Sun River elk herd completed.
- 1968.....**Canyon Ferry Game Management area project for waterfowl habitat development and public hunting was initiated.
A special post-season hunt on mallard drakes was held in the Central Flyway portion of Montana.
Four years of study of elk-livestock relationships completed in the Elkhorn Mountains, Broadwater County.
Statewide elk harvest estimated at 16,000 (equaling the previous peak harvest in 1955).
- 1969.....**The license system was changed to issue Conservation Licenses and stamps for birds. Big game combination licenses were discontinued.
A pheasant hen was allowed in the statewide bag limits.
Twelfth consecutive year that statewide moose harvests have exceeded 400 (with hunter success usually between 70-80 percent).
Investigations of mercury contamination of game birds frequenting grain-growing areas were initiated.
Isaac Homestead small game management area acquired in Treasure County.
Deer hunter success 80 percent (success exceeded 80 percent in 13 of past 15 years and is double that before 1952).
- 1970.....**Studies to determine the effects of logging on elk ecology were begun in cooperation with the U.S.F.S. and U of M School of Forestry.
The first swan season (500 permits) at the Freezout Lake area.
The Beartooth Game Range, providing key elk winter range and other wildlife habitat, was acquired.

APPENDIX III

WILDLIFE MANAGEMENT THESES*
MONTANA STATE UNIVERSITY**
BOZEMAN, 1950-1970

- Roby, E. F. 1950. A 2-year study of pheasant stocking in the Gallatin Valley, Montana. M. S. 29 pp. (J. Wildl. Mgmt. 15(3):299-307.)
- Johnson, D. E. 1950. Biology of the elk calf, *Cervus canadensis nelsoni*. M. S. 52 pp. (J. Wildl. Mgmt. 15(4):396-410.)
- Brazda, A. R. 1952. Elk migration patterns, and some of the factors affecting movements in the Gallatin River drainage, Montana. M. S. 42 pp. (J. Wildl. Mgmt. 17(1):9-23.)
- Eng, R. L. 1952. A two-summer study of the effects on bird populations of chlordane bait and aldrin spray as used for grasshopper control. M. S. 27 pp. (J. Wildl. Mgmt. 16(3):326-337.)
- Smith, R. H. 1952. A study of waterfowl production on artificial reservoirs in eastern Montana. M. S. 43 pp. (J. Wildl. Mgmt. 17(3):276-291.)
- Townsend, J. E. 1952. A study in beaver ecology in western Montana with special reference to movements. M. S. 44 pp. (J. Mamm. 34(4):459-479.)
- Greer, K. R. 1953. Yearly food habits of the river otter in the Thompson Lakes region, northwestern Montana, as indicated by scat analyses. M. S. 30 pp. (Amer. Mid. Naturalist. 54(2):299-313.)
- Ellig, L. J. 1953. Waterfowl relationships to Greenfields Lake, Teton County, Montana. M. S. 49 pp. (Montana Fish and Game Department, Tech. Bull. No. 1, 35 pp.)
- Lentfer, J. W. 1954. A 2-year study of the Rocky Mountain goat in the Crazy Mountains, Montana. M. S. 40 pp. (J. Wildl. Mgmt. 19(4):417-429.)
- Saunders, J. K., Jr. 1954. A 2-year investigation of the food habits and range use of the Rocky Mountain goat in the Crazy Mountains, Montana. M. S. 22 pp. (J. Wildl. Mgmt. 19(4):429-437.)
- Berg, P. F. 1955. A study of waterfowl broods in eastern Montana with special reference to movements and the relationship of reservoir fencing to production. M. S. 31 pp. (J. Wildl. Mgmt. 20(3):253-262.)
- Casagrande, L. G. 1955. A study of beaver-waterfowl relations in the mountainous area of Beaverhead County, Montana. M. S. 33 pp.
- Cole, G. F. 1955. Range use and food habits of the pronghorn antelope in central Montana with special reference to alfalfa. M. S. 75 pp. (Montana State College, Agr. Expt. Sta., Tech. Bull. No. 516. 63 pp.)

* Resulting publications indicated in parenthesis.

** Montana State College previous to July 1, 1965.

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- Rose, B. J. 1956. An evaluation of two introductions of Merriam's wild turkey into Montana. M. S. 37 pp. (Montana Wildlife, January, 1958:5-8.)
- Wilkins, B. T. 1956. Range use, food habits and agricultural relationships of the mule deer, Bridger Mountains, Montana. M. S. 34 pp. (J. Wildl. Mgmt. 21(2): 159-169.)
- Mitchell, J. L. 1957. A study of mink movements and populations on the lower Madison River, Montana. M. S. 19 pp. (J. Wildl. Mgmt. 25(1):48-54.)
- South, P. R. 1957. Food habits and range use of the mule deer in the Scudder Creek area, Beaverhead County, Montana. M. S. 34 pp.
- Rouse, R. A. 1957. Elk food habits, range use and movements, Gravelly Mountains, Montana. M. S. 29 pp.
- Lovaas, A. L. 1957. Mule deer food habits and range use in the Little Belt Mountains, Montana. M. S. 43 pp. (J. Wildl. Mgmt. 22(3):275-283.)
- Egan, J. L. 1957. Some relationships between mule deer and alfalfa production in Powder River County, Montana. M. S. 34 pp. (West. Assoc. State Game and Fish Comm. 40:232-240.)
- Atwater, M. G. 1958. A 2-year study of renesting in Canada geese (*Branta canadensis*) in Phillips County, Montana. M. S. 23 pp. (J. Wildl. Mgmt. 23(1):91-97.)
- Mussehl, T. W. 1958. Blue grouse production, movements and populations in the Bridger Mountains, Montana. M. S. 34 pp. (J. Wildl. Mgmt. 24(1):60-68.)
- Knowlton, F. F. 1959. Food habits, movements and population structure of moose in the Gravelly Mountains, Montana. M. S. 27 pp. (J. Wildl. Mgmt. 24(2):162-170.)
- Picton, H. D. 1959. Use of vegetative types, migration, and hunter harvest of the Sun River elk herd, Montana. M. S. 39 pp. (J. Wildl. Mgmt. 24(3):279-290.)
- Rothweiler, R. A. 1960. Food habits, movements and nesting of gulls on a waterfowl area, Freezout Lake, Teton County, Montana. M. S. 29 pp.
- Knight, R. R. 1960. Vegetative characteristics of two water areas in Teton County, Montana, in relation to waterfowl usage. M. S. 38 pp. (J. Wildl. Mgmt. 29(4):782-788.)
- Peek, J. M. 1961. Reproduction of moose in southwestern Montana. M. S. 30 pp. (J. Wildl. Mgmt. 26(4):360-365.)
- Foss, A. J. 1962. A study of the Rocky Mountain goat in Montana. M. S. 26 pp.
- Kirsch, J. B. 1962. Range use, relationship to logging, and food habits of the elk in the Little Belt Mountains, Montana. M. S. 44 pp.
- Zapatka, T. P. 1963. Some results of two limited hunting seasons on hen pheasants in northcentral Montana. M. S. 26 pp.
- Jonas, R. J. 1964. Ecology and management of Merriam's turkey in the Long Pines, southeastern Montana. Ph.D. 118 pp. (Montana Fish and Game Department, Tech. Bull. No. 3, 36 pp.)
- Martinka, C. J. 1965. Population status, social habits, movements and habitat relationships of the summer resident elk of Jackson Hole Valley, Wyoming. M. S. 62 pp. (J. Wildl. Mgmt. 33(3):465-481.)

GAME MANAGEMENT IN MONTANA

- Stevens, D. R. 1965. Range relationships of elk and livestock in the Crow Creek drainage, Elkhorn Mountains, Montana. M. S. 68 pp. (J. Wildl. Mgmt. 30(2):349-363.)
- Martin, N. S. 1965. Effects of chemical control of sagebrush on the occurrence of sage grouse in southwestern Montana. M. S. 38 pp. (J. Wildl. Mgmt. 34(2):313-320.)
- Mackie, R. J. 1965. Range ecology and relations of mule deer, elk and cattle in the Missouri River Breaks, Montana. Ph.D. 229 pp. (Wildl. Mono. No. 20. 79 pp.)
- Allen, E. O. 1965. Food and range use habits of whitetail deer on Missouri River bottomlands in northcentral Montana. M. S. 41 pp. (J. Wildl. Mgmt. 32(1):130-141.)
- Schallenberger, A. D. 1966. Food habits, range use and interspecific relationships of bighorn sheep in the Sun River area, westcentral Montana. M. S. 44 pp.
- Eustace, C. D. 1967. Food habits, range use and relationships between elk and livestock in the Gravelly Mountains, Montana. M. S. 55 pp.
- Bayless, S. R. 1967. Food habits, range use and home range of pronghorn antelope in central Montana during winter. M. S. 65 pp. (J. Wildl. Mgmt. 33(3):538-551.)
- Constan, K. J. 1967. Food habits, range use and relationships of bighorn sheep to mule deer and elk in winter, Gallatin Canyon, Montana. M. S. 43 pp.
- Cada, J. D. 1968. Populations of small mammals in central Montana with special reference to tentative sagebrush control sites. M. S. 52 pp.
- Feist, F. G. 1968. Breeding bird populations in relation to proposed sagebrush control in central Montana. M. S. 41 pp. (Audubon Field Notes. 22(6):691-695.)
- Gordon, F. A. 1968. Range relationships of elk and cattle on elk winter range, Crow Creek, Montana. M. S. 52 pp.
- Wentland, H. J. 1968. Summer range habits of the pronghorn antelope in central Montana with special reference to proposed sagebrush control study plots. M. S. 65 pp.
- Dorn, R. D. 1969. Relations of moose, cattle, and willows in southwestern Montana. M. S. 79 pp. (J. Wildl. Mgmt. 34(3):559-564.)
- Firebaugh, J. E. 1969. Relationship of mule deer to livestock on summer range in the Pryor Mountains, Montana. M. S. 55 pp.
- Kamps, G. F. 1969. Whitetail and mule deer relationships in the Snowy Mountains of central Montana. M. S. 59 pp.
- Peterson, J. G. 1969. The food habits and summer distribution of juvenile sage grouse in central Montana. M. S. 39 pp. (J. Wildl. Mgmt. 34(1):147-155.)
- Best, L. B. 1970. Effects of ecological changes induced by various sagebrush control techniques on non-game birds. M. S. 74 pp. (J. Wildl. Mgmt. 35 --in press.)
- Campbell, R. B. 1970. Pronghorn, sheep and cattle range relationships in Carter County, Montana. M. S. 87 pp.
- Martinka, R. R. 1970. Structural characteristics and ecological relationships of male blue grouse (*Dendragapus obscurus* [Say]) territories in southwestern Montana. Ph.D. 73 pp.

- Roberts, D. A. 1970. Antelope range use, food habits, and behavior in relation to sagebrush eradication. M. S. 56 pp.
- Tschache, O. P. 1970. Effects of ecological changes induced by various sagebrush control techniques on small mammal populations. M. S. 51 pp.
- Wallestad, R. O. 1970. Summer movements and habitat use by sage grouse broods in central Montana. M. S. 51 pp. (J. Wildl. Mgmt. 35(1):129-136.)

WILDLIFE MANAGEMENT THESES*

UNIVERSITY OF MONTANA**

MISSOULA, 1948-1970

- Casebeer, R. L. 1948. A study of the food habits of the mountain goat (*Oreamnos americanus missoulae*) in western Montana. M. S. 99 pp. (Proc. Mont. Acad. Sci. 8:69., Bull. No. 5 Montana Wildl. Res. Fed. Aid Proj. 1-R. 107 pp.)
- Carter, R. L. 1951. An environmental analysis of winter game range in western Montana. M. S. 103 pp.
- Dow, S. A., Jr. 1952. An evaluation of some criteria for age determination of the pronghorn (*Antilocapra americana* Ord). M. S. 70 pp. (Proc. West. Assoc. State Game and Fish Comm. 32:220-224., J. Wildl. Mgmt. 26(1):1-18., J. Wildl. Mgmt. 26(1):100-101.)
- Hungerford, C. R. 1952. The food consumption and weight response of elk (*Cervus canadensis nelsoni*) under winter conditions. M. S. 60 pp. (Proc. West. Assoc. State Game and Fish Comm. 32:185-187.)
- Poole, D. A. 1952. A study of the toxic potentials of duck botulism in artificially flooded areas. M. S. 89 pp.
- Woodgerd, W. R. 1953. A study of plant development coincident with some phases of ring-necked pheasant breeding behavior. M. S. 64 pp.
- Lechleitner, R. R. 1953. An analysis of some age criteria in a domestic and a wild population of mink (*Mustela vison*). M. A. 60 pp. (J. Mamm. 35(4):496-503.)
- Stockstad, D. S. 1953. The chemical characteristics of natural licks used by big game animals in western Montana. M. S. 42 pp. (Trans. N. Am. Wildl. Conf. 18:247-258.)
- Barracrough, Mary E. 1954. Biology of Canada geese (*Branta canadensis moffitti*) in the Flathead Valley of Montana. M. S. 91 pp. (J. Wildl. Mgmt. 20(4):409-419.)
- Geis, A. F. 1954. The food consumption and relative digestibility of various winter diets fed to elk (*Cervus canadensis nelsoni*) under controlled conditions. M. S. 68 pp.

* Resulting publications indicated in parenthesis.

** Montana State University prior to July 1, 1965.

GAME MANAGEMENT IN MONTANA

- Jonkel, G. M. 1954. A comparative study of survival of fall and spring-released chukar partridges (*Alectoris graeca chukar*). M. S. 70 pp.
- Ogren, H. A. 1954. A population study of the Rocky Mountain bighorn sheep (*Ovis canadensis canadensis* Shaw) on Wildhorse Island. M. S. 77 pp.
- Grieser, K. 1955. Gonadotrophic potency of mule deer pituitaries and the possible correlation with the reproductive cycle. M. S. 56 pp.
- Hawley, V. D. 1955. The ecology of the marten in Glacier National Park. M. S. 131 pp. (J. Mamm. 38(2):174-184., J. Wildl. Mgmt. 26(1):55-74.)
- Sears, H. S. 1955. Certain aspects of the reproductive physiology of the female mule deer. M. S. 82 pp. (The Anatomical Record. 12(3):335-339., J. Mamm. 36(3):474-477., Proc. Soc. Exp. Biology and Medicine. 93:161-162.)
- Hudson, P. 1956. The morphology of the embryonic and fetal development of the Rocky Mountain mule deer. M. A. 61 pp. (J. Mamm. 38(2):247-253., J. Wildl. Mgmt. 23(2):234-235., J. Wildl. Mgmt. 23(3):295-304.)
- Brown, R. L. 1957. The population ecology of the magpie in western Montana. M. S. 53 pp. (Montana Fish and Game Dept. Info. Bull. No. 3. 4 pp.)
- Helwig, L. L. 1957. The value of conifers as a winter feed for elk (*Cervus canadensis nelsoni*) determined under controlled conditions. M. S. 79 pp.
- Morrison, J. A. 1957. Estrous behavior, embryological development, and ovarian characteristics in elk of known breeding history. M. S. 102 pp. (J. Wildl. Mgmt. 23(1):27-34., Behaviour. XVI, 1-2:84-92., J. Wildl. Mgmt. 24(3):297-307.)
- Weckwerth, R. P. 1957. The relationship between the marten population and the abundance of small mammals in Glacier National Park. M. S. 76 pp. (J. Wildl. Mgmt. 26(1):55-74., J. Wildl. Mgmt. 27(1):93-98.)
- Boll, L. A. 1958. Elk nutrition -- The response of elk calves to various winter diets under controlled conditions. M. S. 99 pp.
- White, K. L. 1958. Summer range ecology of Rattlesnake Creek mule deer in the spruce-fir zone. M. S. 95 pp. (Proc. Mont. Acad. Sci. 18:29-31., Proc. Mont. Acad. Sci. 19:72-79., Northwest Science. 34(4):118-126.)
- Atwell, G. C. 1959. An evaluation of magpie predation on the ring-necked pheasant. M. S. 74 pp.
- Jonkel, C. J. 1959. An ecological and physiological study of pine marten. M. S. 81 pp. (J. Wildl. Mgmt. 27(1):93-98.)
- Bailey, E. D. 1960. Behavior of the Rattlesnake mule deer on their winter range. M. S. 110 pp.
- Evans, H. F. 1960. A preliminary investigation of caribou in northwestern United States. M. S. 144 pp.
- Forrester, D. J. 1960. A preliminary investigation of the Protostrongylin Lungworm - bighorn sheep relationships in Montana. M. S. 79 pp. (J. Parasitology. 48(2): Sec. 2:50., Proc. Mont. Acad. of Sci. 22:82-92., Montana Wildlife, 1963:2-7., Exp. Parasitology. 13:83-89., J. Wildl. Mgmt. 28(3):481-491., Nature. 201 (4923):1051.)
- O'Hallaran, P. L. 1961. Dynamics of a reduced magpie population. M. S. 78 pp.

APPENDIX III

- Tisch, E. L. 1961. Seasonal food habits of the black bear in the Whitefish range of northwestern Montana. M. S. 108 pp.
- Hornocker, M. G. 1962. Population characteristics and social reproductive behavior of the grizzly bear in Yellowstone National Park. M. S. 94 pp. (J. Repro. and Fertility., Suppl. 6:447-475.)
- Klebenow, D. A. 1962. Ecology and productivity of a montane forest winter deer range, western Montana. M. S. 93 pp. (J. Wildl. Mgmt. 29(1):27-33.)
- Lokemoen, J. 1962. The productivity of the red-head (*Aythya americana*) in the Flathead Valley, Montana. M. S. 120 pp. (J. Wildl. Mgmt. 30(4):668-681.)
- Choate, T. S. 1963. Ecology and population dynamics of white-tailed ptarmigan (*Lagopus leucurus*) in Glacier National Park, Montana. Ph.D. 205 pp. (J. Wildl. Mgmt. 27(4):684-699.)
- Ruff, R. L. 1963. A study of the predatory effects of a reduced magpie population on the ring-necked pheasant. M. S. 96 pp.
- Taylor, R. A., Jr. 1963. Characteristics of horn growth in bighorn sheep rams. M. S. 128 pp.
- Winchell, J. R. 1963. Age criteria for American bison. M. S. 70 pp.
- Nellis, C. H. 1964. The mule deer of the National Bison Range: Population dynamics, food habits, and physical condition. M. S. 147 pp. (J. Mamm. 46 (1):108-109., J. Wildl. Mgmt. 30(2):417-419., J. Wildl. Mgmt. 32(2):344-349., J. Wildl. Mgmt. 33(1):191-195.)
- Cross, H. J. 1965. The elk herd of the East Fork of the Bitterroot River. M. S. 95 pp. (Proc. West. Assoc. State Game and Fish Comm. 46:110-111.)
- Ellis, R. I. 1965. Movements and concentrations of marked elk on the winter range (northern Yellowstone elk herd). M. S. 93 pp. (J. Wildl. Mgmt. 33(4):906-909.)
- Fairman, L. L. 1966. Movements, populations, and behavior of deer on a western Montana winter range. M. S. 119 pp.
- McCutchen, H. E. 1966. Aging pronghorn antelope by the incisor cementum. M. S. 49 pp. (J. Wildl. Mgmt. 33(1):172-175.)
- McGahan, J. 1966. Ecology of the golden eagle. M. S. 78 pp. (J. Wildl. Mgmt. 31(3):496-501., The Auk. 85(1):1-12.)
- Richard, J. E. 1966. A study of the big game animals of the Flathead Indian Reservation, Montana. M. S. 93 pp.
- Bromley, P. T. 1967. Pregnancy, birth, behavioral development of the fawn, and territoriality in the pronghorn (*Antilocapra americana* Ord) on the National Bison Range, Moiese, Montana. M. A. 127 pp. (J. Wildl. Mgmt. 31(4):843., J. Mamm. 50(1):81-89.)
- Stoneberg, R. P. 1967. A preliminary study of the breeding biology of the spruce grouse in northwestern Montana. M. S. 82 pp.
- Berwick, S. H. 1968. Observations on the decline of the Rock Creek, Montana population of bighorn sheep. M. S. 245 pp.
- Knoche, K. G. 1968. The ecology of the Rattlesnake Creek, Montana mule deer winter range. M. S. 152 pp.

GAME MANAGEMENT IN MONTANA

- O'Gara, B. W. 1968. A study of the reproductive cycle of the female pronghorn (*Antilocapra americana* Ord). Ph.D. 161 pp. (J. Wildl. Mgmt. 31(4):843., Bull. Wild. Dis. Assoc. 3(2):71-73., The Amer. J. of Anat. 125(2):217-232., J. Mamm. 50(2):373-375., J. Wildl. Mgmt. 34(2):470-472., Proc. Antelope States Workshop. 4:82-92., Proc. Antelope States Workshop. 4:131-139.)
- Seidensticker, J. C., IV. 1968. Response of juvenile raptors to DDT in the diet. M. S. 74 pp. (J. Amer. Vet. Med. Assoc. 155(7):1044-1045.)
- Cooperrider, A. Y. 1969. Competition for food between mule deer and bighorn sheep on Rock Creek winter range, Montana M. S. 92 pp.
- Reynolds, H. V., III. 1969. Population status of the golden eagle in southcentral Montana. M. S. 61 pp.
- Snyder, R. O. 1969. Forage competition between cattle and elk in the Gird Creek drainage of western Montana. M. S. 76 pp.
- Warner, R. 1970. Some aspects of browse production in relation to timber harvest methods and succession in western Montana. M. S. 74 pp.