THE ECOLOGICAL DISTRIBUTION OF SMALL MAMMALS IN ADAMS COUNTY, IDAHO

By

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Bachelor of Science

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Caldwell, Idaho

1959

Submitted to the faculty of the Graduate School of
the Oklahoma State University
in partial fulfillment of the requirements
for the degree of
MASTER OF SCIENCE
May, 1961

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INTRODUCTION

Man has long observed the relationships between plants, animals, and their environments, but it was not until 1869 when the term "ecology" was coined by the German biologist, Ernst Haeckel, that there was a name given to this branch of science. It was nearly 1900 before ecology became generally recognized as a distinct branch of biology. Since this relatively recent beginning there have been innumerable ecological studies made and almost a new language devised by which ecologist are able to converse. Yet there are still many areas in our own country of which we have an incomplete knowledge of the animal ecology. In this study the attempt was made to analyze the ecology of such an area, Adams County, Idaho, with particular attention given to the mammalian life.

The study was arbitrarily confined to a political unit, Adams County, for several reasons. First, it offers several distinct habitat types and transition zones due to its wide range of elevations and geological formations. Secondly it is near my home and thus was convenient for me, as well as being much more accessible by road than is Valley County, in which I live. Also there are but few references to Adams County in the available literature, the only previous intensive study of the region having been made by Borell

(1930) and the results of his study were never published. Other studies have been made in nearby areas, but none of them extend into Adams County.

An ecological survey of the plants and mammals of this region was made between June 6 and June 16, 1960, and between June 24 and August 28, 1960. During these periods a total of 6297 trap-nights were accumulated. Sight records were used in some instances where trapping was either impractical or impossible. These sight records are largely my own, but in two or three cases sight records from other reliable sources were used.

During this study eighty specimens of mammals were made into study skins, all of which are deposited in the Oklahoma State University Museum of Zoology.

The assistance of many persons who have helped with various aspects of this study is gratefully acknowledged. Special thanks are extended to Dr. Bryan P. Glass for his advice and assistance from the initiation of this study through to its completion; to Drs. Frederick M. Baumgartner, Roy W. Jones, and Henry I. Featherly for their advice and criticism while serving as members of my committee; to Mr. Dean Fisher for the many hours he spent helping me in the field; to Miss Patty L. Peterson for her assistance in identifying plants and in helping with the preservation of specimens, and to the residents of Adams County who were most considerate in allowing me to trap on their land.

REGION STUDIED

Adams County is located in extreme west-central Idaho. Its boundaries are mostly natural ones, with the Snake River forming most of the western border together with the Cuddy Mountain range to the south and west. On the north the Seven Devils Mountains form a natural barrier, and to the east the high ridge known as West Mountain forms the greater part of the border, along with the Little Salmon River in the northeast.

From the Snake river the country rises abruptly to peaks and sharp ridges in the Seven Devils region, and then falls away almost as rapidly to the Little Salmon River to the east (Fig.1). The country is nearly all timbered in this area except for an occasional small meadow or open hillside. A few of the steep ridges are nearly solid rock with only a small amount of vegetation occurring on them. Farther south, in the Council and Indian Valley areas, the country is much flatter and is either under cultivation or is covered with sagebrush (Artemesia tridentata). The eastern border is again more rugged, following the ridge of West Mountain, and is heavily timbered in most areas.

As one ascends the mountains the first timber encountered is yellow pine (Pinus ponderosa), the most important lumber

tree in this part of the state. The yellow pine gradually gives way to Douglas fir (Pseudotsuga menziesii) and this in turn gives way to a mixture of spruce (Picea Engelmanni) and fir (Abies sp.). The uppermost zone of timber is generally a combination of fir and limber pine (Pinus flexilis).

Six different habitat associations were selected as representative of the habitats found in the county. These six associations could be further subdivided, as some writers have done, but for the time allotted and the ease of analysis I have considered these six as representative of the county. In an attempt to get a fairly uniform sampling from throughout the county, I selected a t least two typical areas for each association within the county and laid out trap lines in these areas. Thus each association was trapped at least twice and from different parts of the county. These six associations are as follows: sagebrush, valley meadow, riparian, yellow pine, fir, and alpine meadow.

The Sagebrush Association (Fig. 4) is found almost entirely in the southwest section of the county, with only small relics elsewhere. The dominant woody plant is sagebrush (Artemesia tridentata) with lesser amounts of Tetradymia canescens and Purshia tridentata. The grasses occurring in the greatest abundance are Agropyron sp., Bromus tectorum, Stipa sp., and Oryzopsis sp., with several others occurring more rarely. Forbs seem to very quite consistently

over relatively small areas but the ones that were noticed most often were Calochortus sp., Agoseris sp., and Balsamorhiza sagittata.

The Valley Meadow Association (Fig. 5) scarcely exists now as a natural habitat in Adams County. Only two such areas were trapped during the course of the study. Most of the original valley meadow association has been converted into farm land, and true meadow is very hard to find. One of my trap lines was in a field that had been planted with alfalfa, whereas the other line was beside an alfalfa field in an area that had never been farmed. Thus these two lines, both grouped under the Valley Meadow Association, are in some ways quite different. The forbs in this association include Lupinus sericeus, L. alpestris, Thermopsis montana, Verbascum thapsus, and Camas Quamash, while among the grasses are Festuca idahoensis and Poa secunda.

The Riparian Association refers to the watercourses with their fringe of deciduous trees and large shrubs. The plant growth along these courses varies greatly with elevation. The lower streams are generally lined with willows, alder, and occasional cottonwoods, whereas in the higher areas the cottonwood disappears and the willows give way almost entirely to alder with evergreens crowding in close behind. In many places the alder is so thick that it is nearly impossible to walk through or to see the stream. The

undergrowth is usually very heavy along these watercourses. In one area that I trapped I collected over forty-five species of flowers. A few of the more common flowers seen were Grindelia sp., Solidago sp., Epilobium angustifolium, Mentha sp., and Castilleja sp. Equisetum is also found in abundance and in places liverworts and ferns are numerous.

The Yellow Pine Association is perhaps the most extensive single association in this county. This usually occurs under 5000 feet elevation but I did have one trap-line at 5400 feet in yellow pine. Many writers have divided the timbered zone into three associations and include Douglas Fir (Pseudotsuga menziesii) as a separate association between the Yellow Pine and the Alpine Fir Association. It appears to me that there is such a wide zone where yellow pine and Douglas fir are mixed, and again where Douglas fir and the alpine fir are mixed, that a true Douglas fir Association scarcely exists in this county. For this reason I have included most of the timbered areas under 5000 feet elevation in the Yellow Pine Association, and most areas above 5000 feet in the Fir Association, with exceptions made in specific cases. I believe that for the purposes of this study the division is both feasible and satisfactory.

The dominant tree of this association is the yellow pine (Pinus ponderosa) and is the only tree present in many stands of timber. In some areas lodgepole pine (Pinus contorta) is quite common, and occasionally Douglas fir, white fir

(Abies concolor) and grand fir (Abies grandis) extend down into the upper limits of this association. The principal shrub throughout this association is chapparal (Ceanothus velutinus). Numerous herbs, such as huckleberry (Vaccinium membranaceum), strawberry (Fragaria sp.), service berry (Amelanchier sp.), and occasionally syringa (Philadelphus Lewisii), occur here. The principal plant making up the ground cover for much of the association is the strawberry. Several grasses can be found in this region, the principal ones being Festuca idahoensis and Agropyron spicatum.

The Fir Association (Fig 6), as previously mentioned, is considered to be the timber occurring above 5000 feet elevation. Several species of trees can be found here, the numbers of each depending largely on the elevation. Douglas fir, grand fir, and white fir predominate in the lower elevations, with limber pine (Pinus flexilis) and subalpine fir (Abies lasiocarpa) predominating in the higher sections of this association. Spruce (Picea Engelmanni) is also common in some parts of the county in this association. The undergrowth is made up of huckleberry (Vaccinium membranaceum), beargrass (Xerophyllum tenax), Symphoricarpos sp., and Physocarpus sp. Philadelphus Lewisii occurs in fair numbers in moist parts of the association as well as in the Yellow Pine Association.

The Alpine Meadow Association (Fig.7) is rather limited in Adams County. Only two such areas were trapped, both over 6000 feet in elevation. Numerous small openings occur in

the timber at these higher elevations but they are better called mountain parks than typical alpine meadows. These parks often have cover resembling that of the nearby non-forested regions. Sagebrush is quite common in these parks, even at elevations of over 6000 feet. The alpine meadows have no trees and the ground cover is composed of Lupinus sp., sometimes in very dense stands, also Festuca sp., Phyllodoce sp., and Valeriana.

The vegetation is largely controlled by the amount and distribution of precipitation. Most of the precipitation of this area comes in the form of snow during the winter months. Snow depths average from 25-30 inches in the lower regions of the county during the months of January, February, and March, while in the higher areas the snow will reach 60 inches or more during the same period. There is some rain during both the spring and fall, but the summer months are generally quite dry, especially at the lower elevations.

Due to the extreme differences in elevation, the climate of Adams County is quite variable and it is difficult to give any meaningful averages. However some weather date is presented in order to give a general idea of the climate. These figures are only general and specific parts of the county, especially the upper reaches of the mountains, might vary considerably from these figures. The frost-free period varies from year to year, being quite short some years and quite long other years. Generally there are from 150-178 frost-free days per year. However on the mountain tops one

might expect a frost on any night throughout the summer. The mean annual temperature at Council (Fig. 1), with an elevation of 2950 feet, is 47.9° Fahrenheit, ranging from 23.7° F. in January to 72.4° F. in July. New Meadows, which is 950 feet higher, averages five to seven degrees colder than Council.

Adams County is one of the smaller counties in Idaho. It is about thirty miles in width and approximately fifty-seven miles in length from north to south. It has a land area of 881,280 acres of which approximately 44,000 is cropland. National Forests occupy about 496,320 acres of the county. The elevation ranges from 8,957 feet at Monument Peak in the Seven Devils Mountains in the northern part of the county, to approximately 1500 feet along the Snake River.

Only two paved roads occur in the county. Highway 95, the main north-south highway for the state, traverses the length of Adams County. The two principal towns of the county, New Meadows, with a population of 625, and Council with a population of 750, are both located along this highway. Highway 15, from McCall in Valley County to New Meadows in Adams County where it connects with Highway 95, extends a distance of nine miles in Adams County. There is also about five miles of paved road extending from Council along Hornet Creek toward the Hornet Ranger Station. All the rest of the roads in the county are gravel or dirt, many of them being impassible during the winter.

Most of the county is covered with a layer of Miocene

basalt. The two principal valleys, Council Valley and Meadows Valley, are fault trough valleys, or grabens. The high peaks of the Seven Devils Mountains are composed of volcanic tuffs and flows of Permian age. Rhodenbaugh (1953) stated that even these peaks were formerly covered with basalt flows. Glaciation plus erosion has given the area a very rugged appearance, and numerous small cirque lakes have been cut into the high country by the action of glaciers.

A small area in the east near Goose Lake lies within the Idaho Batholith, a large granite upthrust area of Cretaceous age. In general it is high in elevation, but has been cut deeply in places by glaciation, stream erosion, or block faulting so as to form a rough, but beautiful, contour. This is the area which Rhodenbaugh (ibid.) placed in the Northern Rocky Mountain Province. Adams County only barely enters this province which extends as far north as Alaska, and into Montana and Wyoming to the east.

The sediments of the ancient Payette Lake reach into parts of the southernmost section of Adams County, but not as a continuous bed. This large lake existed during Miocene time as a result of damming of the ancient Snake River by basalt flows. In some places the shore line gravels can still be found, but elsewhere they have been covered by more recent basalt flows.

Geologists have divided the county into two areas. Fenneman (1931) placed the greater part of the county in the Payette Section of the Columbian Plateaus Province. A small

section in the northeast he included in the Northern Rocky Mountain Province. Rhodenbaugh (1953) followed this assignment closely except in name by placing all the county in the Seven Devils Section of the Columbian Plateau Province, except for one small area in the northeast which, as mentioned earlier, he included in the Northern Rocky Mountain Province.

The county is also in a floral transition belt and, as such, has often been separated into two different biotic regions. Davis (1939) considered the county to be in the Central Rocky Mountain biotic area, except for a small part in the south which he called the Payette biotic area. He used "biotic area" to mean "...exists at the present an assemblage of plants and animals which has become recognizably distinct from assemblages in adjoining areas." His areas appear to follow quite closely the distribution of coniferour forests in Idaho. Dice (1943) followed this division fairly closely for this county, although not for the state as a whole, in including the greater part of the county in the Palusian biotic province with only a small area in the southern part of the county included in the Artemisian biotic province. Still a third biotic province, the Montanian, was very nearly included in the county. The border of this province, as arbitrarily set by Dice, lies approximately twenty miles to the east of the county.

It is interesting to note that although both the biologists and geologists divide the county into two areas, the biologists place only a small part in the south in a separ-

ate area, and the geologists place a small part in the northeast in a separate area.

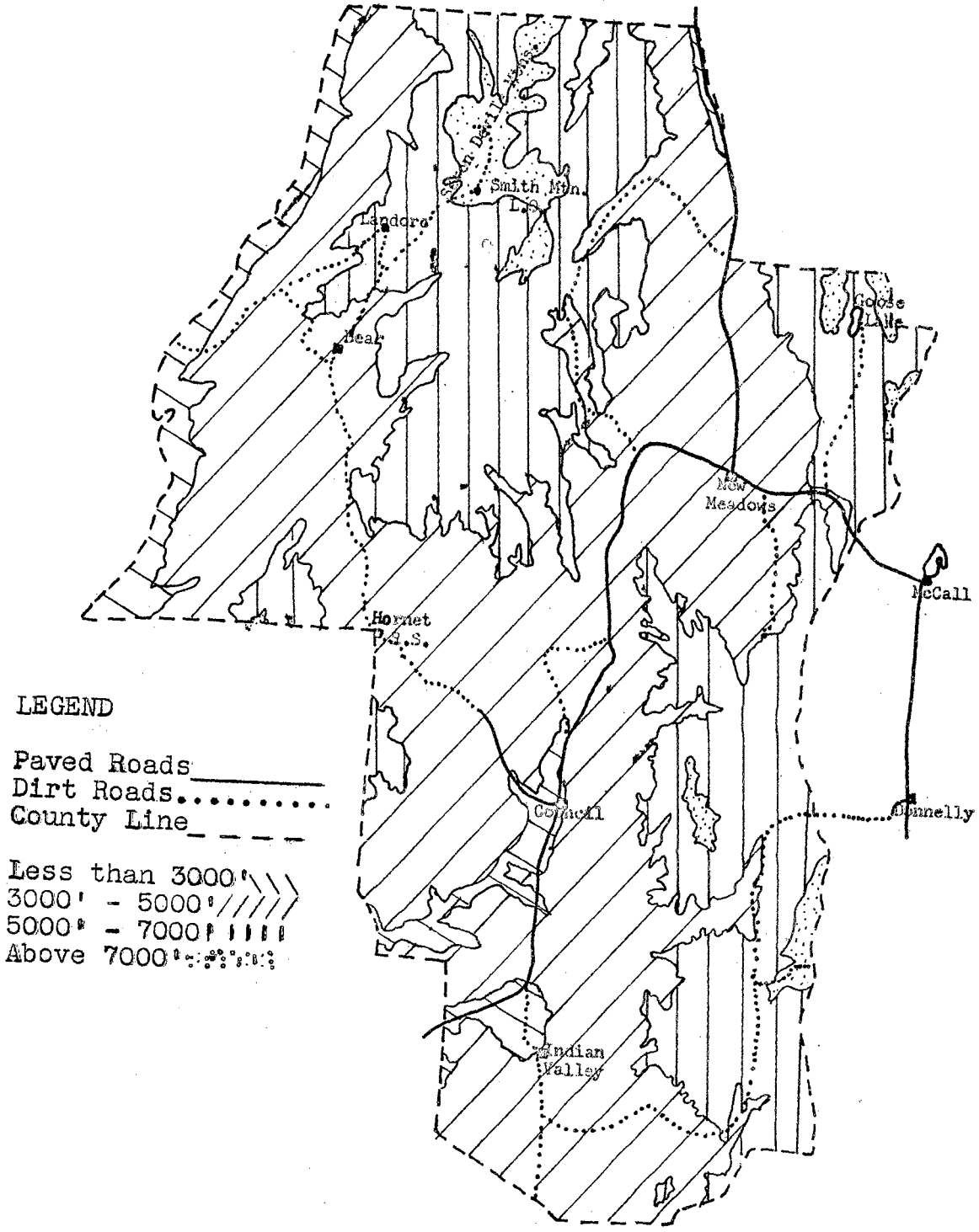

Fig 1. Map of Adams County, Idaho

REVIEW OF LITERATURE

The first reported collection of mammals from Adams County was made in 1824 before Adams County, or even Idaho, existed. This expedition (Davis, 1935), led by Ross, was primarily intended as a survey of the furbearing animals of the area. He entered what is now Adams County by crossing from the headwaters of the Payette River over the range of mountains to the Weiser River. This range of mountains he mentioned now forms the eastern border of the county. He descended the Weiser River to the Snake River and out of Adams County. The expedition took large numbers of beavers from these rivers and occasional "other peltries." He reported seeing large numbers of black bears and grizzly bears, "deer feeding in herds," and "vast numbers of buffaloes" but did not mention exactly where all these occurred.

In 1913 L. E. Wyman collected a new species of ground squirrel from Adams County. The locality was listed simply as New Meadows. Wyman did not publish a description of this ground squirrel and it was not until fifteen years later that Citellus brunneus was described by Howell (1928).

The first intensive study of the small mammals of the area was made during the summer of 1930 by Borell (unpublished).

He spent the period of June 24 to July 30, 1930 trapping three areas in the county. He set up his first permanent camp one mile north of the Bear Creek Ranger Station on the southwest slope of Smith Mountain at 5400 feet. He spent the period of June 26 through July 10 at that camp, during which time he collected, or saw signs of, eighteen species of mammals. He then moved his camp to an old ranger station on the north slope of Smith Mountain at 7500 feet. This camp was a little less than one half mile north of the lookout located on top of Smith Mountain. He worked from that camp from July 11 through July 20 during which time he again collected, or found evidence of, eighteen species of mammals. His third camp was located one half mile east of Black Lake at 6800 feet. He remained in that area from July 22 through July 30. He collected seventeen species at that camp and found evidence of four other species.

Borell only published one paper (1931) in connection with his study in Adams County. That paper dealt with a new subspecies of pika, Ochotona princeps howelli, that he collected at the summit of Smith Mountain. The mammals he preserved were donated to the Ralph Ellis collection.

The next study was made by Orr, (unpublished) in 1932. He spent six days in Adams County in two different areas. From July 3 through July 7, 1932 he camped three miles west of McCall in Adams County at an elevation of 5400 feet. This camp would have been just inside the boundary of the

county, almost on the line between Adams and Valley counties. He collected forty-three specimens representing nine species during his stay at that camp, and of these he preserved ten specimens. On the fourteenth of July of that year he collected three Myotis lucifugus at an elevation of 4500 feet on the west slope of Granite Mountain.

Davis's book (1939) of the mammals of Idaho covered the entire state and contained a compilation of the earlier works. He listed twenty-seven species and subspecies of mammals he had examined from Adams County. Although there have been extensions of known ranges, taxonomic changes, and additional species reported from Idaho, since the writing of this book, it has still been a most useful source of information and help in the present study.

These were the only works concerned directly with Adams County up to the present. Other studies were made of the mammals in nearby areas as early as 1912. During the early fall of 1912 Anthony (1913) made a study of the mammals of northern Malheur County, Oregon in which he noted a total of thirty-eight species. In 1919 Dice (1919) studied the mammals of southeastern Washington and reported thirty-eight species from that area. Whitlow and Hall (1933) published a paper concerning mammals from near Pocatello in southeastern Idaho. They reported a total of fifty-one species occurring in this region, and give a brief description of the area where they were collected. Davis (1937) collected mammals, principally rodents and carnivores, from western Montana and

eastern Idaho. That collection totalled 133 specimens and was deposited in the University of California Museum of Vertebrate Zoology.

During the fall of 1941, Orr (1943) made a survey of the mammals of the Clearwater Mountains of Idaho to the north and east of Adams County. He divided the area into five plant associations which he trapped between September 5 and September 30, 1941. He collected 251 specimens of 25 different species, and the presence of 15 additional species was noted either through personal observation or from other reliable sources. Fifteen of those species are represented in the present study.

In 1946 Rust (1946) published a paper concerning the mammals of northern Idaho. He studied the area from the Canadian border south to the Salmon River canyon, approximately twelve miles north of the northernmost border of the present study. A total of seventy-five sub-species of mammals were reported in the study, including those not actually seen or collected but also those previously reported from the region. He listed the mammals by life zone, using the terminology of Merriam (1898).

Recently Rickard (1960) published on small mammal distribution in relation to vegetation in eastern Washington and northern Idaho. His study, although largely botanical in nature, included six hundred small mammals of eleven species from fourteen plant associations.

METHODS AND MATERIALS

A total of eighteen areas were trapped during the course of the study. Each area was given a number, assigned in order of trapping, and also a name by which it could more easily be remembered. Of these eighteen lines two were from the Sagebrush Habitat Association, two from Valley Meadow, five from Riparian, four from Yellow Pine, three from Fir, and two from Alpine Meadow. The following is a list of these areas with their number, common name, type of habitat association, and location.

Line #1 - New Meadows - Valley Meadow Association
R. 2 E., T. 19 N., S. 6 - 3½ Mi. N. New Meadows

Line #2 - Round Valley - Valley Meadow Association
R. 1 E., T. 21 N., S. 27 - 11 Mi. N. New Meadows

Line #3 - Council - Sagebrush Association
R. 1 E., T. 19 N., S. 35 - 2 Mi. N.N.W. Council

Line #4 - Little Mud - Yellow Pine Association
R. 1 E., T. 19 N., S. 10 - 2½ Mi. N.W. New Meadows

Line #5 - Indian Valley - Sagebrush Association
R. 1 W., T. 14 N., S. 1 - 2 Mi. N.E. Indian Valley

Line #6 - Goose Lake Ridge - Fir Association
R. 2 E., T. 20 N., S. 23 - 1 Mi. S. Goose Lake

Line #7 - Star Creek - Riparian Association
R. 1 W., T. 21 N., S. 23 - 14½ Mi. N.W. New Meadows

Line #8 - Beer Bottle Crossing - Fir Association
R. 2 E., T. 15 N., S. 28 - 10½ Mi. S. Donnelly

Line #9 - Burnt Wagon Basin - Alpine Meadow Association
R. 2 E., T 15 N., S. 23 - 8½ Mi. S. W. Donnelly

Line #10 - Big Creek Feeder - Riparian Association
R. 2 E., T. 18 N., S. 29 - 6½ Mi. S.E. New Meadows

Line #11 - South Meadows - Yellow Pine Association
R. 2 E., T 18 N., S. 4 - 2 Mi. S.S.E. Old Meadows

Line #12 - North Hornet Mine - Yellow Pine Assoication
R. 3 W., T. 18 N., S. 13 - 5 Mi. N.N.W. Hornet R.A.

Line #13 - Fall Creek Ridge - Yellow Pine Association
R. 1 E., T. 22 N., S. 27 - 18 Mi. N. New Meadows

Line #14 - Weiser River - Riparian Association
R. 1 E., T. 18 N., S. 6 - 2 Mi. S. Tamarack

Line #15 - Hornet Creek - Riparian Association
R. 1 W., T. 16 N., S. 31 - 4 Mi. N.W. Council

Line #16 - Smith Mtn. Meadow - Alpine Meadow Association
R. 2 W., T. 21 N., S. 21 - ½ Mi. N. Smith Mtn. L.O.

Line #17 - Placer Basin Ridge - Fir Association
R. 2 W., T. 21 N., S. 29 - 2½ Mi. Site of Landore.

Line #18 - Indian Creek - Riparian Association
R. 2 W., T. 21 N., S. 30 - Site of Landore

The trapping was done with either nuseum special traps or rat traps, each of which is a spring-type trap and kills the animal. Traps were spaced about ten feet apart and set in straight lines, except when following the course of a stream. The number of traps per line varied depending on the size of the stand or the amount of time available. In general there were between 80 and 125 traps per line. The summer was started with a total of 170 traps, but by the end of the summer there were only 85 traps that would work. The principal cause of trouble was that some of the rat traps tended to throw their locking bar and staple, and this, together with some lost traps, greatly cut down on the size of the trap lines during August. In addition to the eighteen trap lines,

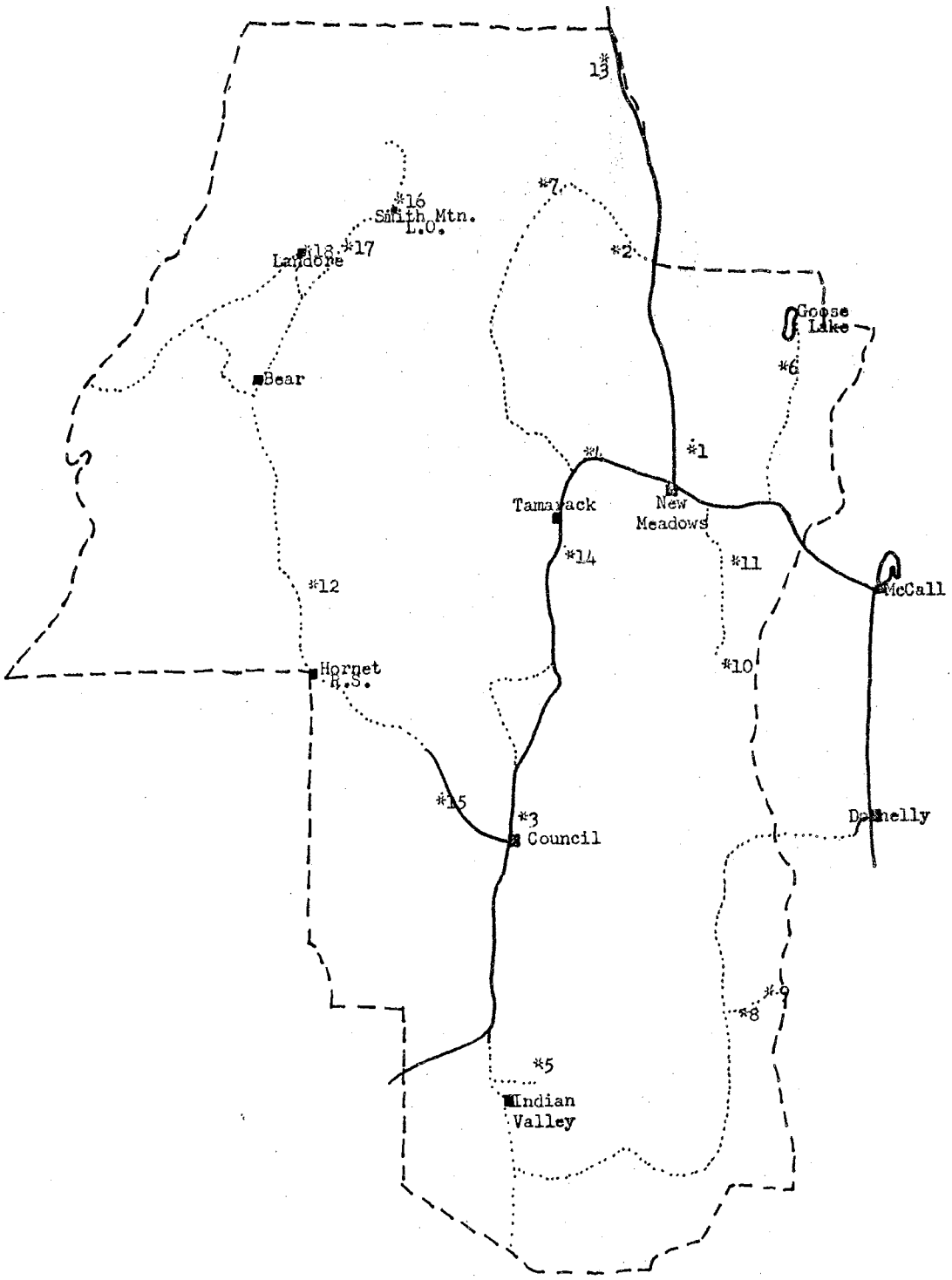

Fig. 2 Areas Trapped in Adams County, Idaho

traps were occasionally set in other places in hopes of catching a particular species. Many of these were set around old buildings or in mines in hope of catching Neotoma.

In general the traps were left in one area for three days and nights but in a few instances they were left for four days, and once for five. The traps were checked each morning, specimens removed and recorded, and the traps rebaited and reset. Different kinds of bait were used in an attempt to find one that would take the greatest number of animals. During the study peanut butter, bacon, oatmeal, and canteloupe were used. Peanut butter and oatmeal were the easiest to use but seemed to take the fewest animals. Bacon would only take certain species of mammals, but attracted many birds, while canteloupe was eaten by nearly everything. Canteloupe was therefore used most frequently, although it necessitated tying the canteloupe to the treadles of the traps with thread and rebaiting nearly every day, as after one day in the sun it would be dry.

A specimen card was designed (Fig. 3) and filled out for each specimen taken. A white card (as shown) was used for those animals which were trapped and a pink card was used for animals taken in any other manner. The pink card differed in having a section marked "method" in place of "bait", and in having more room under "locality" than did the white card. In addition a field notebook was kept in which observations made in the field were recorded, the num-

NO.	NAME	SEX	AGE	MEASUREMENTS
303	Eutamias amoenus amoenus	F	Adult	207-92-34.5-19

DATE	LOCALITY	BAIT	ELEVATION	GEOLOGY	WEATHER
27 Aug. 1960	18	Canteloupe	5330'	Rocks and sand	Cloudy, about 50° at 10:30 a.m.

PRINCIPAL FLORA		ADDITIONAL INFORMATION
18	None	Set among rocks about 2 feet from the creek. Nearest plant is a fireweed about 3 feet away. Nearest tree, an Engelmann spruce, is about 30 yards on other side of creek. Cheeks are full of little brown seeds. She is very oddly marked along sides.
	(Skin and Skull)	

Figure 3. Specimen card.

ber of traps set each night and the kind of traps, and other pertinent information.

The measurements taken were the four standardized measurements of total length, tail length, length of hind foot, and length of ear; in addition, the length of the tragus was measured for the bats. In place of writing out a full description of the location for each animal taken in a trap line, the number of the trap line was recorded under "locality" on the specimen cards. Elevation was determined by use of a car altimeter mounted in the jeep, and this was checked whenever possible by known elevations taken from a geological survey map. Under "geology" was recorded whether the area was soil, sand, or rock. The weather was recorded as sunny,

cloudy, or raining, and the approximate temperature was entered at the time the line was checked. A thermometer was not used for this as it was considered necessary only to know the general weather conditions under which the animal was caught. Under the heading "additional information" such facts were recorded as distance to water, physical condition of the specimen, other animals taken in that particular trap or nearby traps, distance from cover, etc.

A .22 caliber pistol was carried most of the time, and generally there was a .410 gauge shotgun in the jeep. The shotgun, loaded with No. 12 shot, was used to collect bats and was used with No. 7 shot to collect squirrels. A Japanese mist net was used one night in an attempt to take bats, but without success. A jeep was available all summer and was excellent for hauling traps, plant press, and specimens over the more rugged parts of the county.

ANNOTATED LIST OF MAMMALS

This list gives all the mammals known to occur in Adams County, with the exception of the big game, the predatory animals, and the furbearers. No attempt was made to include probable species which were not collected or species which were formerly present but are now extinct. Locality records are given for the mammals collected during this study, and in some cases the locality records from other sources. In some cases the subspecific name is questionable and in such cases the question is discussed. The taxonomic arrangement of the species follows Miller and Kellogg (1955).

Sorex cinereus cinereus Kerr -- Gray shrew

Locality records: New Meadow, 14½ miles northwest. Other locality records were published by Davis (1939): 1 mi. N. Bear Creek R. S.; ½ mile E. Black Lake.

This little shrew is very difficult to distinguish in the field from S. vagrans monticola. Davis (ibid.) used the size of the third unicuspid tooth in relation to the fourth to distinguish between the two species. Of the skulls examined in the present study the third tooth appeared to be of the same size as the fourth, and the specimens were therefore allocated to the species cinereus.

Ten specimens were collected, all from the same trap line, and all near the creek. They appeared to travel along

the banks above the water, often in very heavy grass. They were taken in the same trap or neighboring traps which also took Zapus princeps, Clethrionomys gapperi, Peromyscus maniculatus, and Sorex palustris.

They were collected in sets baited with canteloupe, bacon, peanut butter, and oatmeal; there seeming to be no preference of one food over any other.

Sorex vagrans monticola Merriam -- Wandering shrew

Locality records: Locality records were published by Davis (1939): 1 mile N. Bear Creek R.S.,; ½ mile E. Black Lake; summit Smith Moutain; 3 miles W. Payette Lake.

This species was not collected during the present study but Davis (ibid.) reported them as often some distance from water, often using Microtus runways, and being equally active in daytime or at night.

Sorex palustris navigator (Baird) -- Water shrew

Locality records: New Meadows, 14½ miles northwest; site of Landore. Other locality records were published by Davis (1939): 1 mile north Bear Creek R.S.; ½ mile east Black Lake; summit Smith Mountain.

The water shrew is larger than any other shrew in Idaho, is nearly black dorsally, and is white ventrally. Four of these were collected in the present study, all near fast-moving streams. One was taken on a log across the stream about ten inches above the water, two others were taken on sand bars next to the water, and a fourth was taken on a grassy bank two feet above the water in fairly heavy cover. There seemed to be no preference for bait, as they were taken

on oatmeal, bacon, and canteloupe.

Myotis lucifugus carissima Thomas -- Yellowstone Little Brown Bat.

Locality records: All locality records were published by Davis (1939): W. slope Granite Mountain; ½ mile E. Black Lake.

There were no members of this species collected during the present study. Davis (ibid.) reported that they occur in the more arid parts of the west, and only occur in the southern half of Idaho.

Myotis evotis chrysonotus (J. A. Allen) -- Golden long-eared Bat

Locality Records: All locality records were published by Davis (1939): summit Smith Mountain.

Again none of this species were collected during this study. Borell (unpublished) found them foraging among the firs at the summit of Smith Mountain, at the same locality where I collected Myotis volans.

Myotis volans interior Miller -- Interior Long-legged bat

Locality records: McCall, 6 miles west; ¼ mile north Smith Mountain L. O. Other locality records were published by Davis (1939): ½ mile east of Black Lake.

Two of these bats were shot just at dark on clear evenings. In each case other bats were observed flying nearby, and at the first locality Lasionycteris noctivagans and Eptesicus fuscus were also collected. In each case there was timber nearby and they flew between the trees with no apparent difficulty. The elevation of the two areas was 4800 feet and 7825 feet respectively, indicating a wide altitudinal range

for this bat.

The first bat was not killed immediately and when touched would emit a high pitched call. That in turn would cause another bat to dive down and flutter just above my head. Nearly every time the bat was touched the same sequence of events would follow.

Lasionycteris noctivagans (LeConte) -- Silver-haired bat

Locality records: McCall, six miles west. Other locality records were published by Davis (ibid.): ½ mile east of Black Lake.

Three were collected at this one locality which was heavily timbered with Douglas fir and lodgepole pine. All three were shot at dark on clear evenings. The first three bats collected at this locality were of different genera: Myotis, Lasionycteris, and Eptesicus. Lasionycteris probably occurs throughout the county.

Eptesicus fuscus pallidus Young -- Pallid big brown bat

Locality records: McCall, six miles west. Other locality records were published by Davis (ibid.): 1 mile N. Bear Creek R. S.; ½ mile east Black Lake.

Three of these were taken as they flew along the road at dark on clear evenings. There was much heavy timber nearby but they seemed to prefer flying over the open road. This is the largest of the brown bats of the area and can generally be identified in flight by its slower, more deliberate flight.

Ochotona princeps howelli Borell -- Seven devils pika

Locality records: Smith Mountain L. O., ½ mile north, 2 miles north. Other locality records were published by Davis (ibid.): ½ mile east of Black Lake; summit Smith Mountain.

The type locality for this pika is listed as the summit of Smith Mountain. I stayed at the lookout on the very summit of Smith Mountain for several days and watched these little animals. Those collected were all from the rockslides to the north of the lookout. They seemed quite tame, preferring to sit sill in hopes of not being seen rather than running for safety when approached. Pikas were only found in and around rock slides. Several chipmunks and one weasel were also noticed in the rock slides.

The fire guard at the lookout told me that when a four-inch snow fell during the middle of August the pikas appeared to speed up their "hay-cutting" activities. This area is at an elevation of from 7400-8000 feet and is covered with snow from six to eight months a year.

Lepus americanus bairdi Hayden -- Rocky Mountain snowshoe rabbit

Locality records: Donnelly, 12 miles southwest. Other locality records were published by Davis (ibid.): 1 mile north Bear Creek R. S.,; 3 miles west Payette Lake.

The snowshoe rabbit is distributed throughout the coniferous forests of this area and was found in both the ponderosa pine and fir habitat associations. Sight records were noted from many parts of the county, and a trip through this region during the winter of 1960-61 disclosed many tracks of snowshoe rabbits in the snow. No special effort was made to collect rabbits during this study and only one specimen was taken.

They are principally nocturnal and crepuscular, but are frequently seen during the daylight hours as well. During the month of June many of them still had much white on them.

Sylvilagus nuttalli grangeri (Allen) -- Black hills cottontail

Locality records: Indian Valley, 2 miles northeast.

The single specimen collected was taken in a rat trap baited with canteloupe. The locality was typical of the sagebrush association, being a dry, rocky area with sagebrush and cheat grass.

Unfortunately some animal had eaten the entire back and neck of the specimen. Identification was made more difficult by the fact that the specimen was young, the milk teeth still being in place. It is placed in the species S. nuttalli because neither the bullae nor the anterior extensions of the supraorbital processes are proportionately as large as in S. idahoensis. It is placed in the subspecies grangeri rather than nuttalli on the basis of distribution. Although grangeri had not previously been reported from Adams County it has been taken approximately eight miles west in Washington County, Idaho. The known range for S. nuttalli nuttalli lies considerably farther north.

Marmota flaviventris nosophora Howell -- Chestnut-bellied marmot

Locality records: New Meadows, 2 miles north, 11 miles north.

Two of these were taken, one was shot and the other was a road kill brought in by a friend. The first completely belied the usual conception of a marmot's habitat by its lo-

cation when killed. It was seen next to a highway in the middle of a small valley, the nearest hill or rock pile being at least a half-mile away. When I stopped to shoot, it ran from the road into a marshy region that was covered with five or six inches of water. The second specimen was killed along a road beside the rocky cliffs next to the Little Salmon River.

Davis (ibid.) placed all of Adams County in the range of M. f. avara. These specimens have been placed in the subspecies nosophora on the basis of the ventral coloration. David (ibid.) said avara is yellowish brown ventrally and nosophora is distinctly cinnamon red. The single specimen preserved in this study is distinctly cinnamon red. The second specimen was nearly rotten and therefore discarded, but was also reddish ventrally.

This would extend the range of M. f. nosophora approximately twenty-five miles into the presumed range of M. f. avara.

Citellus brunneus Howell -- Idaho spotted ground squirrel

Locality records: All locality records were published by Davis (ibid.): New Meadows; 1 mile north Bear Creek R. S.

Although New Meadows was listed as the type locality for this ground squirrel there were none collected during this study. None were seen, although three months were spent in the general area. It is not known whether there are any spotted ground squirrels there now or whether the wrong trapping techniques were used.

Citellus columbianus colunbianus (Ord) -- Columbian ground squirrel

Locality records: New Meadows, 4 miles northeast, 3 miles southeast, 13 miles north, 11 miles north, 2½ miles northwest; Council, 2 miles north; Indian Valley, 2 miles northeast; Donnelly, 8½ miles southwest. Other locality records were published by Davis (ibid.): 1 mile north Bear R. S.; ½ mile east Black Lake; summit Smith Mountain.

Columbian ground squirrels are extremely numerous and widespread throughout Adams County. They were sighted in nearly every part of the county at elevations ranging from 3000 feet to nearly 7700 feet on Smith Mountain. They were often found in association with chipmunks but they were found in greater variety of habitats than were chipmunks. Road kills were common and few days passed that fresh kills were not noted.

Although primarily vegetarian in diet they were observed carrying the bodies of dead ground squirrels from the highways and feeding on them. A lactating female taken on June 25 had had a large part of the head eaten away, presumably by another individual.

C. columbianus is diurnal and is commonly seen standing erect and calling. Two half-grown young were taken June 7, indicating a breeding period late in April, (Shaw 1925).

Citellus lateralis tescorum (Hollister) -- Mantled ground squirrel

Locality records: Goose Lake, ½ mile south, 1 mile southeast, 4½ miles southeast; New Meadown, 18 miles north.

Five specimens, all from the eastern part of the county, have been assigned to the subspecies tescorum, on the basis of location and size. Howell (1938) did not include the range

of connectens within the border of Idaho. Hall and Kelson (1959) have indicated that tescorum occurs on the eastern edge of Adams County, but they did not indicate that connectens enters the western part of the county. The specimens collected during this study are in the size range described for tescorum and are too large for connectens.

One individual ran about two feet up the trunk of a fir tree when approached. This behavior has been reported by Hall (1931) and Svihla (1931), but it was the first time I had seen it. They were normally found in rocky areas, and occasionally in rock slides. One was shot as she was putting bulbs of a lily in her cheek pouches, and when examined was found to have twenty-two bulbs in her pouches. The last specimen collected was found to have had a broken leg that had mended.

Citellus lateralis connectens Howell -- Oregon mantled ground squirrel

Locality records: Locality records were published by Davis (1939): ½ mile east Black Lake.

No specimens collected were assigned to this subspecies. According to Davis (ibid.) and Hall and Kelson (1959), the range for connectens in Adams County is only in the northwest corner of the county. This area was not trapped until the middle of August and no mantled ground squirrels were seen.

Eutamias amoenus amoenus (Allen) -- Klamath chipmunk

Locality records: New Meadows, 2½ miles northwest, 14½ miles northwest, 6½ miles south-southeast; Old Meadows, 2 miles south-southeast; 1 mile south of Goose Lake; Donnelly, 10½

miles southwest; Hornet R.S., 5 miles north-northwest: Tamarack, 2 miles south; Smith Mountain L.O., 2 miles south-southwest; site of Landore. Other locality records were published by Davis (1939): 1 mile north Bear Creek R.S.; summit Smith Mountain; 3 miles west of McCall; ½ mile east Black Lake.

The chipmunk was observed throughout the county in the coniferous forests. They were very numerous and were easy to collect. Eighty-one specimens were taken during the study, most of them in traps baited with canteloupe. They also took oatmeal and peanut butter to some extent but did not seem to care for meat. Only two were taken with bacon and three with sausage.

They are very tame and easy to study in the field. They were observed eating huckleberries, strawberries, seeds from various flowers, and seeds from the conifers. Although principally a terrestrial rodent they were often seen climbing in the branches of bushes and on tall flowers in search of food, and would also climb trees in search of food.

Lactating females were collected as early as June 25, and probably would have been taken earlier had the study begun earlier. A pregnant female was taken July 6 which had six young, four in the right horn of the uterus and two in the left, in the 12 mm stage of development. Another taken the 16th of July also had six young, four in the left horn of the uterus and two in the right, in the 27 mm stage. Lactating females were taken as late as August 11.

They were very quick in their movements and very good jumpers. I observed one make a standing jump from a stump to a tree trunk thirty inches away, a distance more than

seven times its own length.

Tamiasciurus hudsonicus richardsoni (Bachman) -- Richardson red squirrel

Locality records: New Meadows, 8 miles northeast; Goose Lake; Old Meadows, 2 miles south-southeast; Smith Mountain L.O., 2½ miles southwest, 3 miles southwest. Additional locality records were published by Davis (ibid.): 1 mile north Bear Creek R.S.; ½ mile east Black Lake; 3 miles east Payette Lake.

These squirrels are confined to the coniferous forests of the county. They were abundant in many areas and were often heard calling, especially during the mornings and evenings. Although many days were spent trapping in areas having fair populations of these squirrels, only three specimens were taken in traps. Different baits were tried but with little success. Of the three trapped two were taken on canteloupe, the other on bacon. An additional four were shot and sight records were made throughout many parts of the county. They seemed to feed heavily on the seeds from pine, spruce, and fir cones. Piles of cone chips were often found under trees and on fallen logs.

The coloration seemed to vary considerably from nearly black, to brown, to quite red.

Glaucomys sabrinus bangsi (Rhoads) -- Bangs flying squirrel

Locality records: Locality records were published by Davis (ibid.): 1 mile north Bear Creek R.S.

I was not able to collect any specimens of flying squirrels although I trapped in areas where they should have occurred. They are nocturnal, which probably accounts for the fact that none were seen. Lumbermen in the area reported

that they often arouse flying squirrels while felling trees.

Thomomys talpoides fuscus Merriam -- Brown pocket gopher

Locality records: New Meadows, 11 miles north. Other locality records were published by Davis (ibid.): ½ mile east Black Lake; 5 miles west Payette Lake; 1 mile north Bear Creek R. S.; summit Smith Mountain.

Only one pocket gopher was taken during this study. It was trapped on the surface of the ground in a snap trap baited with canteloupe. Sight records of diggings were made in many places throughout the county. Habitat seemed to vary from dry, rocky ground to good moist soil in meadows. Some preference was shown for dry, rocky areas. Occasionally areas were noticed where gopher mounds occurred every fifteen or twenty feet over an acre or more.

Diggings were noted in every habitat association except the riparian. It is assumed that the mounds were made by the subspecies fuscus as it is the only subspecies reported from Adams County.

Pernognathus parvus parvus (Peale) -- Oregon pocket mouse

Locality records: Smith Mountain L. O., 2 miles southwest.

Assignment of this specimen to the subspecies parvus is based primarily on location, for only one specimen was taken, and it was a young one. It appears to fit best the description of P. p. parvus which has not previously been reported from Adams County, but has been reported from a locality thirty-nine miles to the south. It was taken at an elevation of 6400 feet in a museum special trap baited with canteloupe and set on a cut bank next to the road on a south-facing hill.

The nearest timber was several hundred yards downhill from the trap and the immediate vegetation consisted of grass and small flowers. A snow storm caused a change of trap sites before any more specimens could be collected.

Peromyscus maniculatus artemisiae (Rhoads) -- Columbian white-footed mouse.

Locality records: New Meadows, 11 miles north, 2½ miles northwest, 14½ miles northwest; Indian Valley, 2 miles northeast; Donnelly, 10½ miles southwest, 8½ miles southwest; Old Meadows, 2 miles south-southwest; Tamarack, 2 miles south; Council, 4 miles northwest; Smith Mountain L.O., 2½ miles southwest, 3 miles southwest, 2 miles southwest. Other locality records were published by Davis (ibid.): 1 mile north Bear Creek R.S.; ½ mile east Black Lake; summit Smith Mountain.

These little mice were very common throughout all the habitat associations of the county and were the only mammals taken in all six associations. Seventy specimens were collected during the study. They readily took any bait offered, but seemed to have a slight preference for bacon. They were trapped alongside of every other small rodent or insectivore at least once during the course of the study.

Evidently P. m. serratus does not extend into Adams County from the east. The largest specimen of artemisiae taken measured 182 mm in total length while Davis lists the smallest serratus measured from the type locality as 182 mm. Most of the adults taken in this study range from 155-175 mm.

Neotoma cinerea alticola Hooper -- Bushy-tailed wood rat

Locality records: North Hornet Mine; Smith Mountain L. O., 3 miles southwest; Bear R. S., 3 miles northwest; site of Landore. Other locality records were published by Davis (ibid.): 1 mile north Bear Creek R.S.; ½ mile east Black Lake; summit Smith Mountain.

Five specimens of wood rats were taken during the study, all near man-made structures. Two were taken in old mine buildings, one in an abandoned cellar, and two among the timbers of a collapsed ore mill. Elevation ranged from 4700 feet to over 6800 feet, and they have been taken much higher in other areas.

This relatively new subspecies was described in 1940 (Hooper, 1940) and Davis (1939) had no knowledge of it. The specimens he examined from Adams County were placed in the subspecies cinerea, but Hooper has since called them alticola. The specimens taken in the present study most closely approximate the measurements listed for alticola and were taken in the same area where Hooper recorded alticola.

Clethrionomys gapperi idahoensis (Merriam) -- Idaho red-backed mouse

Locality records: New Meadows, 2½ miles northwest, 14½ miles northwest; Donnelly, 10½ miles southwest; Smith Mountain L.O., ½ mile north, 2½ miles southwest; site of Landore. Other locality records were published by Davis (ibid.): 1 mile north Bear Creek R.S.; ½ mile east Black Lake; 3 miles west Payette Lake; summit Smith Mountain.

The red-backed mouse was taken throughout the timbered zone in the county and seemed to be especially numerous near water, although not confined to the Riparian Association. Many were taken in traps set on logs or under logs. They were taken on all four kinds of bait but seemed to care less for bacon than for the other three. They occur in the same areas, and often use the same runways as Peromyscus, Zapus, and both species of Sorex. One was taken the morning following a snow storm and, although the snow had melted by 10:00 a.m.,

the ground was very wet and cold.

Phenacomys intermedius intermedius Merriam -- Rocky Mountain phenacomys

Locality records: Donnelly, 8½ miles southwest. Other locality records were published by Davis (ibid.): 3 miles west Payette Lake.

Only one Phenacomys was taken during the course of this study, at 7350 feet in an alpine meadow with the nearest water approximately one mile away. The ground cover was very dense, consisting for the most part of Lupinus. Peromyscus was very common in the immediate area, a few Citellus columbianus were present, and one Zapus was also taken there.

Phenacomys is evidently one of the scarcer rodents in this region. Borell (unpublished) did not collect any while he was in Adams County and Orr (unpublished) only took one.

Microtus richardsoni macropus (Merriam) -- Big-footed meadow mouse

Locality records: site of Landore. Other locality records were published by Davis (1939): ½ mile east Black Lake: summit Smith Mountain.

Only two of these meadow mice were taken in this study, both from the same place. Each was taken in a set baited with canteloupe, however one appeared to have been caught while running across the bait pan. Each set was next to a small creek which had an overhanging bank within a short distance of the trap. A well-traveled run was located in the grass next to the creek and it was in this run that the one was taken that ran across the trap.

Microtus longicaudus, Zapus princeps, and Sorex palustris were all taken in nearby traps. Chipmunks were often taken in the same area too, as they came to the creek to drink. Both mice taken were females and one of them was pregnant. She had three young in the right uterine horn and two in the left uterine horn, whose crown-rump measurement was 25 mm. These were taken on August 25, indicating that this was probably at least the second litter of the year.

Microtus montanus nanus (Merriam) -- Dwarf meadow mouse

Locality records: Smith Mountain L. O., 2 miles southwest.

Four of these voles were taken in one small area at an elevation of 6400 feet, on an open south-facing hillside with neither water nor timber within several hundred yards. The ground cover was only a few inches high and the soil was quite sandy. It snowed during the time the area was trapped, but even with snow on the ground they appeared to be quite active.

This is the first record of M. montanus for Adams County, however they have been collected within a few miles of the county on both the north and the south sides. The coloration is slightly browner than that of some montanus collected at 2300 feet in Canyon County, Idaho.

Perognathus and Peromyscus were also collected within a few feet of the trap site, and appeared to be using the same runways.

Microtus longicaudus mordax (Merriam) -- Long-tailed meadow mouse

Locality records: Tamarack, 2 miles south; Council, 4 miles northwest; site of Landore. Other locality records were published by Davis (ibid.): 1 mile north Bear Creek R. S.,; 3 miles west Payette Lake; ½ mile east Black Lake; summit Smith Mountain.

Ten specimens were collected, all from the Riparian Habitat Association; however Davis (ibid.) reported them from numerous other habitats. In the present study all but one specimen was taken within two feet of a creek, the other one was but six feet away from the creek under an overhanging bank. All were in heavy cover, principally grasses, and all were caught in traps baited with canteloupe.

Other animals occupying the same habitat include Peromyscus, Zapus, Clethrionomys, Microtus richardsoni, and Sorex palustris. Chipmunks were commonly trapped in adjoining traps, but chipmunks were taken by day whereas M. longicaudus was usually taken by night.

Zapus princeps idahoensis Davis -- Central Idaho jumping mouse

Locality records: New Meadows, 14½ miles northwest, 6½ miles south-southwest; Donnelly, 8½ miles southwest; site of Landore. Other locality records were published by Davis (ibid.): 3 miles west of Payette Lake; 1 mile north Bear Creek R. S.; summit Smith Mountain; ½ mile east Black Lake.

Twenty-three specimens of jumping mice were collected, all but one from the Riparian Association. The latter was taken in an alpine meadow approximately one mile from the nearest creek. They were found associated with Sorex cinereus, Sorex palustris, Peromyscus, Clethrionomys, Microtus longicaudus, and Microtus richardsoni.

According to Davis (ibid.) this location is an area of

intergradation between idahoensis and Z. p. oregonus. Only two of the specimens taken in the present study have feet measuring as much as 33 mm., the average length for oregonus taken in Washington County, Idaho. This would indicate the present specimens belong to idahoensis, which has smaller feet; however many of them have very ochraceous sides, a characteristic belonging to oregonus. The skulls measured have narrow incisive foramina, a characteristic of idahoensis. Davis (ibid.) assigned specimens taken in the same locality as mine to the subspecies idahoensis, and for that reason, together with the size of the feet and the width of the incisive foramina, these specimens are considered to be idahoensis.

Erethizon dorsatum epixanthum Brandt -- Porcupine

Locality records: New Meadows, 8 miles northeast. Other locality records were published by Davis (ibid.): summit Smith Mountain; 1 mile north Bear Creek R. S.

No specimens of porcupine were collected during this study; the one locality record is of a dead carcass found lying beside the road. Porcupines are nocturnal and are seldom seen during the day, which accounts for the fact that none were sighted during the time of this study.

I have been awakened many times during the night by our dogs barking at porcupines near McCall, only four miles east of Adams County. I have often seen porcupines crossing in front of the car while I was driving at night. They are found throughout the timbered zone, and along streams if

there are trees present. They often den in rock slides.

Taxidea taxus taxus (Schreber) -- Badger

Locality records: Old Meadows, 2 miles south-southwest; sight records from five miles west of Donnelly; digging records from ½ mile west Smith Mountain L. O., ½ mile north Hornet Creek R. S., and 2½ miles northwest of New Meadows.

The badger is widespread throughout the county. Diggings were noted in every habitat association except the riparian.

The one collected allowed me to approach to within ten feet of her while she was digging, without appearing unduly alarmed. If I would move closer she would hurriedly back down the hole until I became still, at which time she would come out and resume digging. She dug four holes within ten feet of each other, each of which was approximately three feet long. No reason was observed for the digging, as there was no sign of food. While skinning her, several large pellets from a shotgun were found beneath the skin. She had evidently been wounded some time before, as the skin was completely healed.

Spilogale putorius gracilis Merriam -- Little spotted skunk

Locality records: Council, 3½ miles west.

The single specimen was found dead on a road between a creek and a basaltic cliff approximately twenty feet high. From the condition of the specimen when found it evidently had been killed during the night. The locality is approximately 135 miles northwest of the nearest locality record listed by Davis (1939). Orr (1943) collected one even far-

ther north near Selway Falls. With more extensive collecting it may be found to be quite common along the Snake River in this region and farther north.

Sagebrush and farm land were both within fifty yards of this kill, and yellow pine was less than a mile away, so that it is hard to assign the species to a particular plant association. Davis (1939) mentioned that they are often found among rocks and near water, which coincides with the character of the location where this specimen was found.

DISCUSSION AND CONCLUSIONS

The number of trap-nights ultimately spent in each association depended partly on accessibility and partly on trapping success. Trapping success ranged from 0.7 animals taken per hundred trap nights in the Sagebrush Association to 7.7 animals per hundred trap nights in the Riparian Association. The overall trapping success was 3.8 animals taken per hundred trap nights. This represented 249 animals trapped in 6297 trap-nights (Table I).

Table I

TRAPPING PERCENTAGES OF THE SIX ASSOCIATIONS

Association	No. Trap-nights	No. animals	Percentage
Sagebrush	761	5	0.7%
Meadow	765	8	1.0%
Riparian	1540	119	7.7%
Yellow Pine	1326	47	3.5%
Fir	1261	46	3.6%
Alpine Meadow	644	24	3.7%

During the course of the study it became increasingly easy to predict the species that occur in each association, and the part of the association in which each would be found. Occasionally a species would be taken outside of its usual habitat, but in general each species was taken repeatedly in the same habitat. Each plant association will be discussed with regard to its mammalian species composition.

SAGEBRUSH ASSOCIATION

Only five species were recorded from the Sagebrush Association. They were:

Sylvilagus nuttalli
Citellus columbianus
Thomomys talpoides
Peromyscus maniculatus
Taxidea taxus

Of these five only *Sylvilagus nuttalli* appears to be restricted to this association. They have been collected in farmland farther south, but in Adams County it is doubtful if they occur as far north as the farmland at Council or New Meadows. The other four species occur in other associations besides sagebrush. The deer mouse (*P. maniculatus*) was collected in nearly all habitats, ranging from the extremely dry, basalt flows of the Sagebrush Association to the Riparian Association at high elevations on good soil. The Columbian ground squirrel (*C. columbianus*) was relatively uncommon in this association, however several specimens were collected. Their burrows were found both under the sagebrush bushes and in the open, several yards from any ground cover. The remaining two species were recorded from sign: the diggings of the badger and the mounds of dirt left by the gopher. The gopher (*T. talpoides*) was occasionally found in rocky areas with very scanty soil.

The species composition is probably less in the Sagebrush Association than in any other. *Sylvilagus nuttalli*, *Thomomys talpoides*, and *Taxidea taxus* are all fairly numerous. *Peromyscus maniculatus* occurs throughout this association but less commonly than in any of the other associations. The

Columbian ground squirrel is rarely found in sagebrush except when it is bordering yellow pine.

MEADOW ASSOCIATION

Five species were collected or sighted in the Meadow Association. They were:

Marmota flaviventris
Citella columbianus
Thomomys talpoides
Peromyscus maniculatus
Taxidea taxus

Four of these species were also recorded from the Sagebrush Association and all five were recorded from the Yellow Pine Association. The marmot (*M. flaviventris*) was not in its usual habitat near rocky cliffs and hills when collected, but was in the middle of a meadow. The Columbian ground squirrel (*C. columbianus*) is a fairly common inhabitant of the drier parts of the meadows, however it is more commonly found in the Yellow Pine Association. The gopher (*T. talpoides*) occurs commonly throughout the meadows in both wet and dry areas. *P. maniculatus* also occurs in some abundance as it did in most situations trapped. They are ground dwellers and are often found near small cutbanks. The only records of badgers (*T. taxus*) were from the holes they had dug, evidently in search of ground squirrels.

Citellus columbianus, *Thomomys talpoides*, and *Peromyscus maniculatus* are most typical of this association. The other two species are less commonly found.

YELLOW PINE ASSOCIATION

Nine species were collected from the Yellow Pine Asso-

ciation and an additional two were noted. They were:

Lepus americanus	Thomomys talpoides
Marmota flaviventris	Peromyscus maniculatus
Citellus columbianus	Neotoma cinerea
Citellus lateralis	Clethrionomys gapperi
Eutamias amoenus	Taxidea taxus
Tamiascuiurus hudsonicus	

None of these species are confined to this association, nine of them having also been collected in the Fir Association. The marmot (M. flaviventris) was found in the vicinity of rock slides or rocky hills. The snowshoe rabbit (L. americanus) is principally nocturnal and crepuscular, and was generally seen near brushy cover. C. columbianus occupies dry, generally quite open, hillsides in this association and was abundant in many parts of the county.

The mantled ground squirrel (C. lateralis) was usually found in rocky areas, however on two occasions they were found in areas that were essentially rockless. The chipmunk (E. amoenus) is a boreal species of the wooded areas, often trapped on or under logs, and was the species taken in the greatest numbers. T. hudsonicus also occupies wooded areas, spending the greater part of the day in the trees and only occasionally coming to the ground to pick up or hide cones. The deer mouse (P. maniculatus) was often taken in traps adjoining those taking Eutamias. The species is widespread throughout the association, and was collected in many different situations. The wood rat (N. cinerea) was taken only in abandoned man-made structures. The red-backed vole (C. gapperi) was generally collected near dense ground cover, often in damp areas. However on two occasions it was col-

lected on logs a foot or two above the ground. The badger moves about throughout this and other associations. The diggings noticed were in quite dry areas, but this may have been because its food, usually C. columbianus (Shaw, 1925), was most abundant there. The diggings of the gopher were often noted both among the trees and in the small parks and open ridges of this association.

FIR ASSOCIATION

Twelve species were collected in the Fir Association and an additional two species were recorded from sign evidence. They were:

Myotis volans	Tamiasciurus hudsonicus
Lasionycteris noctivagans	Thomomys talpoides
Eptesicus fuscus	Peromyscus maniculatus
Ochotoma princeps	Neotoma cinerea
Lepus americanus	Clethrionomys gapperi
Citellus lateralis	Erethizon dorsatum
Eutamias amoenus	Taxidea taxus

The three bats were all collected at one locality, flying along a road in a timbered area. They may have been widespread throughout the county but no intensive effort was made to collect bats. The pika (O. princeps) is strictly an inhabitant of rock slides in the highest reaches of the Fir Association. The snowshoe (L. americanus) occupies the same sort of brushy habitat that is does in the Yellow Pine Association. Only one porcupine was seen, a road kill along a newly-opened section of road in very steep, rocky country. They are normally found throughout the timbered area, moving about principally at night. The other eight species occupy the same type of habitat as they do in the Yellow Pine Asso-

ciation.

Although no mammals were found to be confined exclusively to either one of these two timber associations, there were four which were not taken outside of the coniferous belt which includes both the Fir and Yellow Pine Associations. The snowshoe rabbit (L. americanus), the mantled ground squirrel (C. lateralis), the chipmunk (E. amoenus), and the Richardson red squireel (T. hudsonicus) were taken only in the coniferous belt.

RIPARIAN ASSOCIATION

The Riparian Association yielded a total of nine species of mammals. They were:

Sorex cinereus
Sorex palustris
Eutamias amoenus
Peromyscus maniculatus
Clethrionomys gapperi
Microtus richardsoni
Microtus longicaudus
Zapus princeps
Spilogale putorius

The two shrews (S. cinereus and S. palustris) were confined to the vicinity of streams. S. palustris generally was trapped within inches of water while S. cinereus was most often taken on the banks in the grass above the water. The chipmunk was often taken next to creeks, evidently when coming to drink or to feed on the plants that grow along the creeks. The deer mouse (P. maniculatus) was common in the grass along the creek banks and, as in the other associations, seemed to occur in every situation. G. gapperi was most often taken along the banks of the streams. They seemed to prefer fairly heavy ground cover, although occasionally they were taken in more open areas under trees. M. richardsoni appeared to be

restricted to the vicinity of streams, being taken in runways near the water's edge. M. longicaudus also appeared to be confined to the vicinity of streams. They were generally taken in fairly heavy ground cover within a few inches of the water. Z. princeps, the jumping mouse, was taken near streams, except for one individual which was taken in the middle of a meadow. They were generally collected in the same vicinity as traps taking C. gapperi, M. longicaudus, P. maniculatus, E. amoenus, and S. cinereus. These five species appeared to use the same areas, except that Eutamias was diurnal whereas the other four were principally nocturnal. The skunk (S. putorius) has been hesitantly assigned to this association. A discussion of its status is included in the annotated list of mammals.

The Riparian Association was the most heavily populated association. Of the nine species collected there all but S. putorius and M. richardsoni occurred in abundance. The latter appeared to occur only in certain areas and the former is apparently quite rare.

ALPINE MEADOW ASSOCIATION

Six species were collected in the Alpine Meadow Association and an additional two were recorded from sign. They were:

Citellus columbianus	Phenacomys intermedius
Thomomys talpoides	Microtus montanus
Perognathus parvus	Zapus princeps
Peromyscus maniculatus	Taxidea taxus

Although only one Columbian ground squirrel (C. columbianus) was collected in this association, there were numerous burrows

observed in high meadows. Gopher diggings were found in nearly every type of soil from moist dirt to dry, rocky areas on the fringes of the meadows. One P. parvus was collected, actually on a dry, south-facing hillside rather than in true Alpine Meadow. They are undoubtedly quite scarce, as the one taken is the first record of the species for the county. P. intermedius is probably equally rare, as only one was taken. It was found in the same locality where numerous Peromyscus were collected. P. maniculatus was the most abundant single species of this association, being taken nearly everywhere. M. montanus was also taken on the dry hillside rather than in true Alpine Meadow Association. They were collected within a few feet of traps taking Peromyscus and Perognathus. This is quite high for M. montanus which is generally considered to be a valley meadow mouse. Only one jumping mouse (Z. princeps) was collected in this association, the rest being collected in the Riparian Association. Thus, although they do occasionally occur in these high meadows, they are much more common along the streams. The badger, as previously mentioned, is wide ranging and can be found nearly anywhere throughout the county.

The typical species composition of this association therefore seems to be Peromyscus maniculatus, Citellus columbianus, and Thomomys talpoides. The other species seem either to be of rare occurrence, or else are limited to special niches.

The mammalian fauna of Admas County is decidedly western in composition. Of the thirty-one known species occurring in the county, twenty are strictly western, ten of which are

Table II

ASSOCIATIONS IN WHICH MAMMALS WERE COLLECTED

	SAGE-BRUSH	MEADOW	YELLOW PINE	RIPARIAN	FIR	ALPINE MEADOW	No.
Sorex c. cinereus				X			10
Sorex v. monticola*							0
Sorex p. navigator				X			4
Myotis l. carissima*							0
Myotis e. chrysonotus *							0
Myotis v. interior					X		2
Lasionycteris noctivagans					X		3
Eptesicus f. pallidus					X		3
Ochotona p. howelli					X[1]		5
Lepus a. bairdii			#		X		1
Sylvilagus n. grangeri	X						1
Marmota f. avara *							0
Marmota f. nosophora		X	X				2
Citellus brunneus *							0
Citellus c. columbianus	X	X	X			X	20
Citellus l. tescorum			X		X		5
Citellus l. connectens *							0
Eutamias a. amoenus			X	X	X		81
Tamiasciurus h. richardsoni			X		X		7
Glaucomys sabrinus bangsi *							0
Thomomys talpoides fuscus	#	X	#		#	#	1
Perognathus p. parvus						X[2]	1
Peromyscus m. artemisiae	X	X	X	X	X	X[3]	70
Neotoma c. alticola 4			X		X		5
Clethrionomys g. idanoensis			X	X	X		20
Phenacomys i. intermedius						X	1
Microtus r. macropus				X			2
Microtus m. nanus						X[2]	4
Microtus l. mordax				X			10
Zapus p. idahoensis				X		X	23
Erethizon d. epixanthum					X[5]		1
Taxidea t. taxus	#	#	X		#	#	1
Spilogale p. gracilis				X[6]			1

* - mammals previously collected in the county but not taken during this study.
\# - Sight records of mammals or mammal sign
X - associations in which mammals were collected
1 - actually taken in rock slides but within the boundaries of the fir association
2 - actually taken on an open hillside at 6400 feet
3 - also taken on an open hillside at 6400 feet besides also being taken in all six habitat associations
4 - all were taken near man-made structures within these two associations
5 - only one was found, that a road kill and not kept
6 - a road kill near several associations, read account in Annotated List.

restricted to the Rocky Mountains and/or the Great Basin. Four of the remainder are widespread over most of the continental United States, and seven occur from coast to coast in coniferous forests (Table III).

Table III

GEOGRAPHICAL DISTRIBUTION OF MAMMALS COLLECTED

Species	Cosmopolitan	Coniferous	Western	Rocky Mts. Great Basin
Sorex cinereus		X		
Sorex vagrans			X	
Sorex palustris		X		
Myotis lucifugus	X			
Myotis evotis			X	
Myotis volans			X	
Lasionycteris noctivagans	X			
Eptesicus fuscus	X			
Ochotona princeps				X
Lepus americanus		X		
Sylvilagus nuttalli				X
Marmota flaviventris				X
Citellus brunneus				X
Citellus columbianus				X
Citellus lateralis				X
Eutamias amoenus			X	
Tamiasciurus hudsonicus		X		
Glaucomys sabrinus		X		
Thomomys talpoides			X	
Perognathus parvus				X
Peromyscus maniculatus	X			
Neotoma cinerea			X	
Clethrionomys gapperi		X		
Phenacomys intermedius				X
Microtus richardsoni				X
Microtus montanus				X
Microtus longicaudus			X	
Zapus princeps			X	
Erethizon dorsatum		X		
Taxidea taxus			X	
Spilogale putorius			X	

SUMMARY

1. A study was made of the ecological distribution of small mammals in Adams County, Idaho during the time period from June 6 through June 15, 1960, and also from June 24 through August 28, 1960.

2. 283 mammals of twenty-six species were collected during 6297 trap-nights in the study area. An additional five species are known to occur in this area.

3. Specimen cards were filled out for each specimen taken, listing number, name, sex, age, standard measurements, date, location, bait, elevation, geology, weather, principal flora, and any additional information.

4. The county was divided into six habitat associations: Sagebrush, Meadow, Riparian, Yellow Pine, Fir, and Alpine Meadow.

5. Five species were collected in the Sagebrush Habitat Association, five from the Meadow Association, eleven from the Yellow Pine Association, fourteen from the Fir Association, nine from the Riparian Association, and eight from the Alpine Meadow Assoication.

6. Four of the thirty-one species occurring in Adams County are widespread over most of the continental United States, seven species seem to follow the coniferous forests across the northern part of the country and Canada, ten

species are western forms, and nine species are restricted to the Rocky Mountains and/or the Great Basin.

7. Chipmunks (Eutamias a. amoenus) were most often collected, eighty-one specimens being taken, followed by the deer mouse (Peromyscus m. artemisiae) with seventy specimens collected.

8. A trapping success ratio of 3.8 mammals per one hundred trap-nights was accumulated during the study. This ranged from a low of 0.7 mammals per one hundred trap-nights in the Sagebrush Association to a high of 7.7 mammals per one hundred trap-nights in the Riparian Association.

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Figure 4. Sagebrush Association

Figure 5. Valley Meadow Association

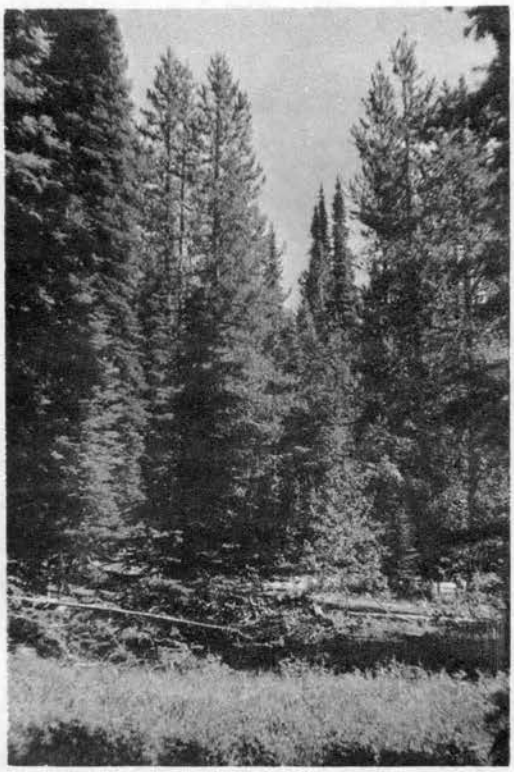

Figure 6. Fir Association

Figure 7. Alpine Meadow Association

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