1964

Microtine Rodents of Kittitas County, Washington

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MICROTINE RODENTS OF KITTITAS COUNTY, WASHINGTON

A Thesis

Presented to

the Graduate Faculty

Central Washington State College

In Partial Fulfillment

of the Requirements of the Degree

Master of Education

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by

James Alan Harbour

August 1964

For encouragement I would like to thank Dr. Dan L. Willson, and for his help in preparing this thesis, I wish to express appreciation to Dr. Donald H. Baepler, Committee Chairman.

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CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

I. INTRODUCTION

The state of Washington is topographically and ecologically diverse. The western part of the state, the Olympic Peninsula, is characterized by snow-covered mountains and by dense forests of cedar, fir and spruce. The eastern part of the state is much dryer. This region, much of which lies in the rain shadow of the Cascade Mountain Range, is an area of little rainfall and has, as its primary vegetation, antelope brush, sagebrush and grasses.

In Kittitas County, which lies in the geographical center of the state, there is a merging of the coniferous forests of the Cascade Mountains with the dry grassland areas. In places, deciduous growths of alder, poplar and cottonwood intermingle with cultivated land and follow the streams into the mountains. It is evident that Kittitas County has a large variety of habitats in which animals may live.

Very few taxonomic and ecological studies have been done in the central portion of the state. In 1948, Walter W. Dalquest published "The Mammals of Washington" (8). This volume is based on work done by Dalquest between the years 1936 and 1942 and lacks specific ecological and

distributional information about many mammals in the state. Two genera which received little study by Dalquest are Lagurus and Microtus. Except for Microtus montanus, Dalquest's data for the genus Microtus in Kittitas County is based on specimens he did not observe or collect.

The only other general work relating to the mammals of central Washington was by Ernest S. Booth of Walla Walla College. In 1941 Mr. Booth published "A Field Key to the Mammals of Washington" (5). This book lacks specific ecological and distributional information concerning mammals in central Washington.

Shorter papers involving only one species or genus in Washington have been published, but they usually deal with mammals from the eastern or western portion of the state. Some examples are: Couch's "Storing Habits of Microtus townsendii" (7), a species which is found only on the west side of the Cascade Mountains; and Dice's "The Mammals of Southeastern Washington" (9). The only publication I have been able to locate which deals specifically with the taxonomy and ecology of species found in central Washington is by Earl J. Larrison. In 1944 Mr. Larrison made a study of the mammals and birds of Upper Grand Coulee Washington (15).

Occasionally mammalogists collected specimens as they traveled through central Washington. Information derived from these collections appears in works of national scope (1).

II. STATEMENT OF THE PROBLEM

It is the purpose of this study to determine the taxonomy, distribution, and ecology of four species of the genus Microtus and one species of the genus Lagurus found in Kittitas County. The species of Microtus are: Microtus montanus, Montane Vole; Microtus oregoni, Creeping Vole; Microtus longicaudus, Long-tailed Vole and Microtus richardsoni, Water Vole. The species of Lagurus is Lagurus curtatus, Sagebrush Vole.

CHAPTER II

DISCUSSION OF MICROTINE RODENTS

The family Cricetidae is divisible into five subfamilies of which two, the Cricetinae and the Microtinae, are found in North America. The members of the subfamily Microtinae include the heather voles, meadow voles, bog voles, lemmings and muskrats. The microtine rodents all possess stout bodies with short legs and muzzels. Their tails are usually short, never being longer than the body length.

The subfamily Microtinae exhibits remarkable ecological diversity. The muskrat (Ondatra zibethica) lives in an aquatic habitat, the sagebrush vole (Lagurus curtatus) prefers dry grassland, and the other species, such as the redbacked voles (Clethrionomys sp.), are found in dense forested areas. All of the members of this group are terrestrial, are burrowers and are herbivores.

Hall and Kelson (12:710-65) list nine genera of the subfamily Microtinae in North America. Six of these genera are found in the state of Washington and five are in Kittitas County. Those genera which are found in the state are: Microtus, Lagurus, Ondatra, Phenacomys, Clethrionomys and Synaptomys. All except Synaptomys are found in Kittitas County.

Synaptomys is readily separated from other members of the subfamily Microtinae by the fact that the lower incisors terminate lingualy to the molars. Incisors of the other members of the subfamily terminate on the labial side of the molars (12:710). Ondatra may be distinguished by its large size and vertically flattened tail. Clethrionomys and Phenacomys may be distinguished from other small members of the subfamily Microtinae by their rooted cheek teeth, other members have rootless cheek teeth. Clethrionomys characteristically have a reddish dorsal stripe which Phenacomys lacks. The habitat of Clethrionomys and Phenacomys is the humid coast belt of Washington and the spruce-fir zones of upper elevations. Ingles (13:245) states that Phenacomys may lead an arboreal existence; its nest being as much as one hundred feet off the ground, out on the bough of a fir tree. The habitat of Lagurus is dry grassland. Lagurus may be identified by its buffy brown color which is much lighter than that exhibited by other genera. In Kittitas County it is the only genus which is lemming-like in body structure, with a tail generally only as long as the hind foot. The genus Microtus is a difficult group to identify, but generally is darker in color than the other small members of the subfamily Microtinae. The color is usually sepia, with a tinge of yellow.

Sydney Anderson (1:485) states "In terms of geological time, microtine rodents are a modern group." Anderson (1:485) goes on to say, "The living species of Microtus have, so far as the evidence shows, evolved in the Pleistocene and possibly relatively late in the Pleistocene." According to Dalquest (8:58), during the Pleistocene ice advances great animal emigrations occurred. Southward moving forms, including the microtine rodents, found refuge in the Cascade Mountains of Washington and Oregon, but there was little or no subspecific variation occurring. Dalquest (8:68) states, "Whereas it is probable that a few of the species now occurring in Washington evolved there, most are immigrants from other areas." In relation to the genus Microtus it is suggested that M. montanus invaded the Eastern Cascades from the Blue Mountain region during the time of the Wisconsin ice. M. oregoni extended its range north after the retreat of the Vashon ice. M. richardsoni, is thought to have emigrated southward into the Cascades during Wisconsin time. Lagurus is presumed to have remained in the same general area that it now occupies during the time of the ice advances. Members of the genus Clethrionomys are thought to have emigrated from the Blue Mountains of Eastern Washington and from the Cascade Range in Oregon northward. It is possible however, that Clethrionomys

was present during Pre-Vashon time. Phenacomys probably invaded the Washington Cascades from the north. Synaptomys borealis, an arctic species, was pushed southward into Washington by the Vashon-Wisconsin ice flow, and is now retreating northward. During Vashon time a new race of Ondatra zibethica developed, and after Vashon time this race quickly distributed itself throughout the state (7:89-104).

The microtine rodents, as a group, are very successful and occupy many ecological and geographical areas. As an herbivorus group they do not appear to be very selective in the type of vegetation they feed on, grasses and seeds providing the bulk of the diet for most genera. Phenacomys, however, prefers to feed on the needles of the fir trees in which he lives (13:245).

The reproduction capacity of the subfamily Microtinae is quite high. If one considers the voles, the females of any one species produce as many as eight young per litter. Cockrum (6:88) states that the typical breeding season is from February through October, and the gestation period averages twenty-one days. One female, then, could produce as many as seventy-two voles per breeding season. The young females of the year are capable of reproduction at the end of six weeks, thereby increasing the population in a geometric ratio, rather than an arithmetic one. Cockrum (6:137) states

that one million individuals could result from one breeding pair of Microtus in a years time if the sex ratio of the young is one to one.

Fortunately conditions are not always ideal for reproduction, or the economic damage sustained by the farmers would be severe. In the Humboldt Valley, Nevada, in one haying season, members of the meadow voles destroyed one-half of the hay crop. The loss was estimated at 250,000 dollars (2:204). Bailey (2:204) stated that, at one vole per acre, which is the lowest possible population estimate at any time of year, if each vole consumed one ounce of hay or grass every twenty-four hours over a 40,000 acre tract, they would consume 220 tons of hay in one year. Clethrionomys and Phenacomys do not appear to be economically important. They may, however, do damage to seedling trees if other suitable forage is not available.

Microtine rodents, like other mammals, exhibit fluctuations of populations. Of the genera found in Kittitas County, Microtus and Lagurus are apparently the most susceptible to varying populations (18:135-155; 15:44-47). In a study by Johnson and Wesley (15:44-47), and in one by Miller and Drake (18:135-155), it was found that Lagurus curtatus and Microtus montanus carry fleas (Malareus telchinum) which are vectors of plague. It is

suggested that the populations of Microtus and Lagurus are periodically decimated by this disease. In discussion with some ranchers in Kittitas County, I learned that four years ago voles were found in abundance around their hay stacks. The following year, however, it was rare to find one around the hay stacks or bales, indicating a sharp drop in the total population. I have been told that this year, voles are again commonly sighted around the hay stacks and bales, denoting a population of voles as abundant as four years ago. Little is known concerning population fluctuations of Clethrionomys or Phenacomys. If studies have been done on this subject, I am unaware of them.

CHAPTER III

AREA DESCRIPTION AND METHODS OF STUDY

I. METHODS OF STUDY

Since voles are difficult to observe, they must be trapped so that positive identification can be made.

Museum Special traps were used in obtaining specimens. Bait commonly consisted of peanut butter mixed with rolled oats. Occasionally, bacon rind, ham, cheese and bread were used as bait. No appreciable difference was noted in the number of animals trapped by varying the bait. During the trapping period it was noted on many occasions that Microtus or Lagurus would not be taken unless the trap was placed in a runway. After this was observed, unbaited traps were placed directly in the runways and were as effective in capturing animals as those traps with bait. Jameson (14: 125-51) used this method of trapping in his study on the prairie vole.

Traps were set every five paces, or in runways. Usually forty traps were set each night in any one area, however, as many as one hundred or as few as ten were set during the trapping period. The trapping period was from December 18, 1963 to August 1, 1964. The total number of trap nights during this time was 4,139. The percent of effectiveness of trapping in taking species desired was

2.1%. See appendix A for a map illustrating trapping localities in Kittitas County, and appendix B for additional data relative to trapping.

Most specimens taken were preserved as study skins and were deposited in the mammal collection at Central Washington State College. Skulls were boiled in hydrogen peroxide and water to soften the flesh, which was then removed by carefully picking it away with forceps. Skulls were then dried and marked with an identifying number and were placed in a screw cap vial for storage.

II. AREA DESCRIPTION

The topography of Kittitas County is varied. In relation to the state, Kittitas County lies in the central portion. In the arid eastern portion of the county, in the region of the Columbia river, there are rolling hills of grasslands. Typical plants in this area are: Artemisia tridentata (Sagebrush), Purshia tridentata (Antelopebrush), Agropyron spicatum (Bunch grass) and Bromus tectorum (Cheat grass). The altitude varies from 1,000 feet at the Columbia River to 3,000 feet in the surrounding hills. Climatological data from Trinidad, in Grant County, less than five miles from the Kittitas County line, indicates an area characterized by extreme temperatures and low rainfall.

The temperatures reach a maximum of 113°F. in the summer and a minimum of -16°F. in the winter, and the rainfall is less than eight inches per year (20:1171).

The Kittitas Valley, in the central portion of the county, has an altitude of about 1,600 feet. The valley lies in the foothills to the east of the Cascade Mountains and is surrounded by hills ranging from 3,000 to 6,500 feet in elevation. The valley is also in the fringe area of large Ponderosa Pine forests. Examples of the vegetation in this area include those mentioned for the eastern portion of the county and: Populas trichocarpa (Black Cottonwood), Salix sp. (Willows), Symphoricarpos albus (Snowberry), Populas tremuloides (Aspen) and Amelanchier florida (Service Berry). Kittitas Valley is irrigated and snow melt from the high country keeps the Yakima River and other smaller streams flowing throughout the year to provide irrigation water to the valley. The extreme temperatures range from a maximum of 110°F. in the summer to a minimum of -31°F. in the winter (20:1171). Precipitation averages less than ten inches per year (20:1171).

Westward from the centrally located Kittitas Valley, one finds Ponderosa Pine forests and large stands of Hemlock, Spruce, Grand Fir, Sub-Alpine Fir, and White Pine. This is the mountainous area of western Kittitas County, in the

Cascade Mountain range. Elevations in this area range from 3,000 to 7,000 feet. Temperatures from Lake Keechclus, which is in the western portion of the county, range from a maximum of 102°F. in the summer to a minimum of -20°F. in the winter. Average annual precipitation is about thirty-five inches at Lake Cle Elum, to sixty-five inches per year at Lake Keechelus (20:1171).

CHAPTER IV

SPECIES ACCOUNTS

In the species accounts which follow, I have listed the general distribution, type locality and synonomy from Miller and Kellogg (17:581-612). The descriptions of species and their distribution in Kittitas County are from my own collections and observations. All measurements are in millimeters and grams. The most useful reference in identification of specimens was Hall and Kelson's, "The Mammals of North America" (12:722-54). Other references which proved to be helpful in identification of specimens were Blair et. al. (4:720-25), Ingles (13:241-52) and Anderson (1:415-511). The chromatic hexagon in Palmer (19:4-5) was used as a reference for color.

The species accounts deal with four species of the genus Microtus which are: Microtus montanus, Microtus oregoni, Microtus longicaudus, and Microtus richardsoni and with Lagurus curtatus.

I. SPECIES ACCOUNTS

Microtus montanus canescens V. Bailey

1898. Microtus nanus canescens V. Bailey, Proc. Biol. Soc. Washington, vol. 51, p. 133, Aug. 30, 1898.

1938. Microtus montanus canescens Hall, Proc. Biol. Soc. Washington, vol. 51, p. 133, Aug. 23, 1938.

Type Locality. - Conconully, Okanogan County, Wash.

Type: U.S. Nat. Museum.

Distribution: British Columbia south to Washington-Oregon border, East of the Cascades, encompassing Central Washington.

Description: I collected and examined a total of thirty-four specimens, of which, twenty-three were males and eleven were females.

The following table indicates the average, maximum and minimum sizes and weights of twenty adult males examined.

TABLE I.

	Total Length	Tail Length	Hind Foot	Ear	Weight
Maximum	160	48	18	18	48
Minimum	119	32	15	12	37
Average	143	39	17	14	41

Table II. indicates the measurements for ten adult females.

TABLE II.

	Total Length	Tail Length	Hind Foot	Ear	Weight
Maximum	150	45	19	17	47
Minimum	115	29	15	12	22
Average	137	37	17	14	34

The undersurface of M. montanus is a light gray, darkening to a smoke-gray one-third of the way up on the sides. Dorsally, M. montanus is sepia, with a buffy yellow

wash. The appendages are covered with a light gray hair. The tail varies from distinctly to indistinctly bicolored. Specimens taken in the grassland are more fuscous dorsally and tend to be lighter gray on the sides. Immature specimens exhibit the same colors as adult specimens. Other characters include six plantar tubercles on the hind feet and the incisive foramen is noticably constricted posteriorly.

Distribution: Microtus montanus is found throughout Kittitas County. For exact collecting areas of M. montanus see appendix C.

Habitat: As indicated by its distribution, M. montanus is found in a variety of habitats. I have taken M. montanus in the arid eastern part of the county in the sagebrush communities, in the moist pasture lands surrounding Ellensburg and in the Ponderosa Pine zones of upper Kittitas County. This species, however, was not taken at elevations higher than 2,500 feet, or in areas of heavy grass cover.

Remarks: The following accounts of runways and burrows is based on my examination of four networks. Runways of M. montanus are shallow grooves running across the top of the soil and are devoid of vegetation. The width of the runway varies from two to three inches and reaches a depth of one-half inch. Burrow openings of M. montanus are generally concealed in grasses by low growing shrubs. Burrows may be blind, but more often they lead to a large chamber

approximately five inches in diameter which has several other burrows leading from it. Depth of the burrows and chamber is approximately five to six inches. The diameter of the burrows is about three to three and one-half inches. In examining burrows of M. montanus I found no mounds of grass cuttings or other nesting materials.

The food of this species consists largely of grasses and several mice were captured with blades of grass in their mouths. In skinning the animals I have noticed the strong odor of wild onion (Allium) and that of sage, indicating their diet is varied even when grasses are abundant. Bailey (3:523-35) cites them as feeding on roots and bits of other matter.

The following table indicates the size, date and number of embryos taken during the trapping period.

TABLE III.

Date	Number of Embryos	Size
April 7, 1964	7	14
April 8, 1964	6	3
April 12, 1964	6	5
April 16, 1964	4	9
July 20, 1964	5	8

The average number of embryos was six.

Specimen J.A.H. 41 taken on April 16, 1964, exhibits a pelage change. The new pelage is lighter in color than

the old. The pelage of immature specimens is long and lax and the color is the same as the adults.

Specimen J.A.H. 66, taken twelve miles east of Ellensburg, has been included in the species M. montanus, although the middle upper molar exhibits a fifth posterior loop, a characteristic of M. pennsylvanicus. At the present time M. pennsylvanicus has not been reported from Kittitas County.

Microtus oregoni oregoni (Bachman)

1839. Arvicola oregoni Bachman, Journ. Acad. Nat. Sci. Philadelphia, vol. 8, pt. 1, p. 60.

1884. Arvicola oregonus True, Proc. U.S. Nat. Mus., vol. 7, (App., Circ. 29), p. 597, Nov. 29, 1884.

1896. Microtus oregoni Miller, North Amer. Fauna No. 12, p. 9, July 23, 1896.

1899. Microtus morosus Elliot, Field Columb. Mus. Publ. 30, Zool. Ser., vol. 1, p. 227, Feb. 2, 1899. (Boulder Lake, Olympic Mountains, Clallam County, Wash. Altitude, about 5,000 feet.)

1920. Microtus oregoni cantwelli Taylor, Journ. Mamm., vol. 1, No. 4, p. 180, Aug. 24, 1920. (Glacier Basin, Mount Rainier, Pierce County, Wash. Altitude, 5,935 feet.)

Type Locality. - Astoria, Clatsop County, Oregon.

Type: Philadelphia Academy of Natural Science.

Distribution: Humid coast belt from Northern California into the Northern Puget Sound region of Washington,

occupying both sides of the Cascades in Washington.

Description: Thirty-one specimens were collected and examined, seventeen were females and fourteen were males.

The following table indicates the average, maximum and minimum sizes and weights of eight adult males.

TABLE IV.

	Total Length	Tail Length	Hind Foot	Ear	Weight
Maximum	154	45	19	17	44
Minimum	119	32	13	11	29
Average	138	38	17	13	34

I was not able to determine any significant size difference between males and females of M. oregoni. Table five indicates the measurements for thirteen adult females.

TABLE V.

	Total Length	Tail Length	Hind Foot	Ear	Weight
Maximum	151	42	18	17	41
Minimum	117	27	15	11	23
Average	137	36	16	14	33

The upper surface of M. oregoni is sepia, but the presence of blackish tipped hair results in a darker color dorsally than found in M. montanus. The sides are a pale medium gray, being lighter in color than the dorsal surface. The undersurface is a silvery light gray. Specimens taken in the sage exhibit a yellowish wash dorsally and are lighter in color than specimens taken in the more irrigated

pasture areas. The tail is usually indistinctly bicolored. Subadult specimens are more wooly in appearance than adults and are a darker buffy-brown dorsally.

The taxonomy of M. oregoni is complex and highly subjective. Taxonomists disagree among themselves relative to the taxonomic criteria to be used in identifying this species. Ingles (13:25) illustrates M. oregoni as having a tightly constricted foramen posteriorly. Anderson (1:48) illustrates M. oregoni as usually having, only a gradual constriction posteriorly. M. oregoni in Kittitas County tends toward the gradual constriction, some specimens show more constriction than others.

The cheek tooth m-2, according to Hall and Kelson (12:744), usually has an anterior pair of triangles which are confluent, however, M. oregoni in Kittitas County fails to show this condition.

Since Kittitas County represents the eastern edge of the range of this species, it is possible that my specimens are not morphologically typical of M. oregoni, my identifications are based on the presence of five plantar tubercles and an incisive foramen which is only slightly constricted posteriorly and on habitat and the character of the pelage. Distribution: M. oregoni is believed to be found throughout Kittitas County. For specific collecting areas of M. oregoni, see appendix D.

Habitat: There is great similarity in the habitats of M. oregoni and M. montanus. M. oregoni was taken in the grassland areas of eastern Kittitas County, in the pasture lands around Ellensburg and particularly, in those fields which had a very dense, thick, mat of grasses. M. oregoni was also taken in deciduous growth along stream banks and in the transition zones between Ponderosa Pine and grasslands. M. oregoni was not taken in the coniferous forests proper, however, Bailey (2:212) cites them as occupying the coniferous forests in Oregon and I would expect that additional trapping would reveal their presence in the coniferous forests of Kittitas County.

Remarks: Three burrow networks of M. oregoni were examined. Their burrow construction appears to be much less complicated than that of M. montanus. The burrows, runways and chambers are of the same general dimensions as that of M. montanus, but, are not as extensive. Mounds of dried grasses were found in the chambers as well as in front of the burrow openings. This condition was not found in M. montanus.

The species M. oregoni appears to live together in communal groups. I do not wish the term social to be inferred from communal, as I have no evidence of them forming societies.

In trapping, it was noted that specimens would not be collected away from the network of runways and burrows.

The following table is an account of the embryos of M. oregoni taken during the trapping period.

TABLE VI.

Date	Number of Embryos	Size
March 31, 1964	6	14
March 29, 1964	4	18
April 7, 1964	8	3
April 22, 1964	6	9
April 23, 1964	7	7
April 24, 1964	7	15
April 30, 1964	6	10
May 30, 1964	3	25

The average number of embryos was six.

Microtus longicaudus mordax (Merriam)

1891. Arvicola (Mynomes) mordax Merriam, North Amer. Fauna. No. 5, p. 61, July 30, 1891.

1897. Microtus mordax Trouessart, Catalogus Mammalium..., fasc. 3, p. 564.

1938. Microtus longicaudus mordax Goldman, Journ. Mamm., vol. 19, No. 4, p. 491, 1938.

Type Locality. - Sawtooth (or Alturas) Lake, East base of Sawtooth Mountains, Blaine County, Idaho.

Type: U.S. Nat. Museum.

Distribution: Northern California to Southern British Columbia, east of the west coast mountain ranges. East to Montana, Wyoming and southerly into Arizona, and Northern Nevada.

Description: Eight specimens were examined representing one female and seven males. The following table indicates the measurements for seven adults.

TABLE VII.

	Total Length	Tail Length	Hind Foot	Ear	Weight
Maximum	192	72	22	15	55
Minimum	139	51	18	13	22
Average	165	57	20	14	39

M. longicaudus is larger than M. oregoni or M. montanus.

M. longicaudus is light gray ventrally, blending with pale sepia on the sides. Dorsally M. longicaudus is a fuscous brownish-red, which intergrades with the sepia of the sides. Specimen J.A.H. 99, collected by Dr. Donald H. Baepler, twelve miles east of Ellensburg, exhibits pronounced red on the dorsal surface. The tail is distinctly bicolored.

According to Hall and Kelson (12:737) the skull has less ridging than that of M. montanus or M. oregoni. In

comparing the skulls of M. montanus and M. oregoni with M. longicaudus, I do not find any more appreciable ridging in the former to distinguish them from M. longicaudus. Six plantar tubercles are present.

The incisive foramen is generally uniform in width throughout its length, although in some specimens there is a tendency for the incisive foramen to be slightly constricted posteriorly.

Distribution: The distribution of M. longicaudus is thought to be the western two-thirds of Kittitas County. For specific collecting localities see appendix E.

Habitat: M. longicaudus is a difficult species to collect. Dalquest states, "Specimens are usually taken unexpectedly, and intensive trapping in the area where a specimen or two is taken rarely yields additional individuals." (8:353) Their habitat is usually in the coniferous forests, along stream banks where there is thick deciduous vegetation. Dr. Donald H. Baepler took specimens J.A.H. 82 and 83 in deciduous growth along the Teanaway River. I collected one specimen along a stream bank of deciduous growth, in an ecotone between the Ponderosa Pine and grassland communities. M. longicaudus was also taken in deciduous growth bordering pasture lands, but never in pasture land proper or in tall grasses. Seemingly then, M. longicaudus prefers the open deciduous growth areas to that of thick grasses.

Remarks: No runways or burrows of M. longicaudus were found in the vicinity where they were trapped.

One female with five embryos was taken on March 26, 1964. It was the only female taken.

Perhaps competition with M. montanus and M. oregoni limits M. longicaudus to the open deciduous growths and prevents them from invading the thick grassy areas.

Microtus richardsoni arvicoloides (Rhoads)

1894. Aulacomys arvicoloides Rhoads, Amer. Nat., vol. 28, p. 182, February 1894.

1894. (Regarded as identical with richardsoni by Anderson and Rand, Canadian Field-Nat., vol. 57, p. 106, Dec. 10, 1943; and as valid by Dalquest, Univ. Kansas Publ. Mus. Nat. Hist., vol. 2, p. 356, Apr. 9, 1948.)

1895. Microtus principalis Rhoads, Amer. Nat., vol. 29, p. 940, October 1895.

(Mount Baker Range, British Columbia, Canada.)

1900. Microtus richardsoni arvicoloides V. Bailey, North Amer. Fauna No. 17, p. 62, June 6, 1900.

Type Locality. - Lake Keechelus, Kittitas County, Wash. Altitude, 8.000 feet (=3,000 feet).

Type: U.S. Nat. Museum.

Distribution: Limited to the Cascade Range of Washington and Oregon and into the southern tip of British Columbia.
Remarks: A total of 620 traps were set during the course of this study in what was thought to be the habitat of M. richardsoni. According to Dalquest (8:354) this species should be readily available at higher altitudes. However, I was able to collect only one specimen. It was taken in the region of Hyas Lake at an altitude of approximately 4,500 feet. The specimen was captured in a fern-thimble berry growth, near a small stream, on a westerly facing slope.

Upon preparing the specimen it proved to be a subadult. Its measurements are 114, 32, 20, 13, and it weighed twenty grams. The color of this specimen (J.A.H. 102) is blackish-brown dorsally. The sides are the same color as the back. The claws are unusual in that they are chestnut colored. Other species of Microtus in Kittitas County have black claws.

Adults of this species, according to Hall and Kelson (12:743), are very large. The following account is taken from their description; external measurements, 198-261, 69-92, 25-50, 15-20, weight of two adult males, 112, 123.3, pelage long, upper parts grayish-sepia to dark sepia or dark reddish-brown, often darkened with black tipped hairs;

underparts plumbeous, with white or silvery white wash; tail bicolor (12:743).

Since this study of microtine rodents in Kittitas County was less than a years duration, I was not able to note population cycles. In the case of M. richardsoni, it may be that the extremely heavy snow fall (138 inches at Snoqualmie Pass, at its greatest depth) in western Kittitas County was detrimental to the populations of M. richardsoni. At the present time M. richardsoni is not common in Kittitas County.

Lagurus curtatus pauperrimus (Cooper)

1868. Arvicola pauperrima Cooper, Amer. Nat., vol. 2, p. 535, December 1868.

1891. Arvicola pauperrimus Merriam, North Amer. Fauna no. 5, p. 64, July 30, 1891.

1912. L(agurus) pauperrimus Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 9, p. 401, April 1912.

1913. Microtus (Lagurus) curtatus artemisiae Anthony, Bull. Amer. Mus. Nat. Hist., vol. 32, p. 14, Mar. 7, 1913. (Ironside, Malheur County, Oreg. Altitude, 4,000 feet. Regarded as identical with pauperrimus by V. Bailey, North Amer. Fauna No. 55 (June), p. 214, Aug. 29, 1936. See also Hall, Mammals of Nevada, p. 560, July 1, 1946.

1942. Lemmiscus curtatus pauperrimus Goldman, Proc. Biol. Soc. Washington, vol. 54, p. 70, July 31, 1941.

1946. (Lagurus curtatus) pauperrimus Hall, Mammals of Nevada p. 560, July 1, 1946.

Type Locality. - Plains of the Columbia, near Snake River, Southwestern (sic.) Washington. (Probably from Bunchgrass Hills near Wallula (Old Fort Walla Walla), Walla Walla County, according to Dalquest, Univ. Kansas Publ. Mus. Nat. Hist. vol. 2, p. 359, Apr. 9, 1948).

Type: U.S. Nat. Museum.

Distribution: Central and eastern Washington and Oregon, south to Northeastern California.

Description: A total of twelve specimens were examined, of which eight were females and four were male. The following table indicates the maximum, minimum, and averages of all measurements taken, of four adult males.

TABLE VIII.

	Total Length	Tail Length	Hind Foot	Ear	Weight
Maximum	101	19	15	11	38
Minimum	86	11	15	9	11
Average	94	16	15	10	21

Table IX. on the following page indicates the measurements of eight adult females.

TABLE IX.

	Total Length	Tail Length	Hind Foot	Ear	Weight
Maximum	122	24	16	12	30
Minimum	89	16	14	9	14
Average	105	19	15	10	20

The previous tables denote a size difference in relation to the sex of the species with the females being larger. I do not feel, however, that enough specimens were taken for a conclusion to be reached that this size difference is characteristic of the populations of Lagurus in Kittitas County.

Lagurus is buffy-brown dorsally, blending with the gray on the sides. The undersurface is smoke-gray. Subadults of Lagurus are smoke-gray dorsally to a cinammon-yellowish below. Buff-yellow is found around the nose of subadults.

The soles of the hind feet are more hairy than those of Microtus, and have five plantar tubercles.

The incisive foramen is wide and uniform in width throughout. The tympanic bullae are large and are filled with spongy bone, a condition that is not found in the genus Microtus.

Distribution: Found locally in eastern Kittitas County. See appendix F. for specific collecting localities of Lagurus in Kittitas County.

Habitat: Lagurus appear to be restricted relative to the type of habitat they are found in. The areas in which Lagurus were taken were always sagebrush-grassland communities, without dense coverings of grasses and with open areas between clumps of sagebrush.

Remarks: The dimensions of the two runway-burrow complexes of Lagurus that I examined were identical to those mentioned for M. oregoni and M. montanus. Hall (10:201-04), however, in his study of the Sagebrush Vole in Nevada, found that runways were wider than those of Microtus. The openings to their burrows can easily be found by tracing a runway to a clump of sage or shrub. Some burrow openings were found in the open areas between clumps of sage.

Their diet is mainly grasses. I observed large amounts of grass seed in their runways and burrows suggesting that they are also seed eaters. Hall (10:201-04) mentions that he observed them eating sage, bark and other suitable foliage.

An account of the embryos is given in table ten.

TABLE X.

Date	Number of Embryos	Size
April 12, 1964	7	4
April 26, 1964	6	3
April 26, 1964	4	32
May 30, 1964	5	20

Specimen J.A.H. 95, taken seven miles south of Ellensburg in the Shushuskin Canyon area, on June 1, 1964, exhibits molt lines. The new pelage is darker than the old.

My trapping success in obtaining Lagurus in the Shushuskin Canyon area was more successful than trapping in the area east of Ellensburg. I set well over 1,000 traps in the grassland area east of Ellensburg and captured only three Lagurus. Approximately two hundred traps were used in the upper Shushuskin Canyon for a yield of nine Lagurus. In speculating as to why Lagurus are not as common east of Ellensburg as they are in the Shushuskin Canyon area, we find several possible causes. The area to the east is vastly overgrazed by sheep and the sagebrush and antelope brush have been grazed to almost ground level. Grasses in the area are low growing and sparse. It is in this same area that I trapped fifteen to twenty Microtus. Due to lack of abundant vegetation in the area and the presence of Microtus, it may be that Lagurus is not able to compete sucessfully with the genus Microtus, and is not common where there are large numbers of Microtus. A detailed ecological examination of this area would be necessary to support this hypothesis.

CHAPTER V

COMPARISON OF THE GENUS LAGURUS WITH THE GENUS MICROTUS IN KITTITAS COUNTY

Comparison of Size: A review of the measurements in the species accounts will establish that the genus Lagurus is smaller in all body measurements than is the genus Microtus. Table eleven summarizes skull measurements that were taken. The code letter A. represents the Zygomatic Breadth, while the code letter B. stands for the Interorbital Constriction.

TABLE XI.

	L. curtatus	M. montanus	M. oregoni	M. longicaudus
A.	14.25	15.23	15.16	14.21
	14.50	15.09	15.23	14.52
B.	3.40	3.51	3.51	4.52
	3.39	3.46	3.53	3.98

The table above indicates great similarity in the width of the Interorbital Constriction between L. curtatus and M. oregoni and M. montanus, and a similarity between L. curtatus and M. longicaudus in the width of the Zygomatic breadth. The measurements taken for M. montanus agree with those given by Anderson for this species (1:502). Measurements for M. longicaudus are consistant with those given by Hall (11:13), in his study of M. longicaudus in Utah.

Comparison of Color: Lagurus is always a shade of buffy-brown, while the genus Microtus is a darker sepia color, with yellowish, reddish, or blackish tipped hairs.
Comparison of Distribution: Lagurus is evidently found only in the eastern one-half of Kittitas County, while the genus Microtus inhabits all of Kittitas County. See the distribution maps in appendices A through F for specific collecting localities of each genus.
Comparison of Habitat: Lagurus seemingly occupies only those regions in Kittitas County which are xeric, the grass-land areas and the ecotone between the Ponderosa Pine and grassland areas. This agrees with study done by Johnson and Wesley (20:44-47), who found Lagurus living in similar habitats in Yakima County. The genus Microtus occupies almost every conceivable habitat in Kittitas County. They are found in marshes, dense grassy areas, sagebrush-grassland communities, deciduous growths and the coniferous forests. As I have already pointed out, it would be interesting to study Lagurus in an attempt to determine why it is not able to invade those areas of Western Kittitas County in which the genus Microtus do so well.
Comparison of Evident Food Requirements: I was unable to ascertain any difference in the food requirements of Lagurus curtatus or Microtus montanus or Microtus oregoni.

It is expected that the food requirements of M. richardsoni and M. longicaudus would differ from those of L. curtatus as they occupy different habitats at opposite ends of the county. I examined the contents of eight Microtus stomachs and two Lagurus stomachs. In general the contents were pulpy plant matter, evidence of other materials was not observed.

CHAPTER VI

DISCUSSION AND SUMMARY

I. DISCUSSION

In comparing the findings of this study with those done in other areas on the genus Microtus, I find great similarity. Bailey (2:212), in regard to M. oregoni as it is found in Oregon, states, "They occupy the dense forests as well as the brushy and open grassy areas of the uplands and dry slopes, seeming to avoid marshes and wet bottoms." Anderson in his study reports on the variety of conditions under which M. montanus lives (1:415-511). Dalquest discusses the scarcity of the Long tailed Vole and its preference for the mountainous areas of western Kittitas County (8:353). In general, my findings agree with the studies mentioned above. Dalquest (8:359) thought that the Sagebrush Vole was rare in the state, but Johnson and Wesley (15:44-47) found it abundant. My findings agree with those of Johnson and Wesley. While I did not take large numbers of L. curtatus, enough were taken to indicate they are not as rare as they were once thought to be.

Hybridization is, apparently, not common within the genera Lagurus and Microtus. Anderson (1:493) states, "Hybrids between species of Microtus in North America have been reported only once. Hatfield (1935:265) recorded a single litter from a male Microtus californicus and

a female Microtus montanus."

During the course of this study, I inadvertently collected mammals other than microtine rodents. The following list includes those mammals which were most frequently collected: Reithrodontomys megalotis, Harvest Mouse, usually encountered in grassy pastures; Perognathus parvus, Great Basin Pocket Mouse, generally taken in the sagebrush-grassland areas; Peromyscus maniculatus, taken throughout the county; Zapus princeps, Western Jumping Mouse, taken in the Spruce-Fir zones of upper elevations; Eutamias minimus, Least Chipmunk, generally found in the sage-grassland communities of eastern Kittitas County; Eutamis amoneus, Yellow Pine Chipmunk, usually found and observed in Ponderosa Pine zones; Eutamias townsendii, Townsends Chipmunk, observed in the Ponderosa Pine zones and Spruce-Fir zones of upper Kittitas County; Citellus washingtoni, Washington Ground Squirrel, collected only in the dry sage areas of Eastern Kittitas County.

During the course of this study, Kittitas County experienced a winter with above average snowfall and a very dry spring. The winter was characterized by heavy snowfalls with over eleven feet recorded in the western part of Kittitas County, and in the Kittitas Valley snow was still on the ground in the latter part of February. Temperatures in the spring were low and there was a noticeable lack of precipitation. The Cheat grass headed out at a

height of four to five inches instead of its usual seven to eight inches. This poor growth indicates that weather conditions were not optimum for plant growth in the eastern part of Kittitas County. The summer was characterized by low temperatures, mostly in the seventy's and low eighty's, few days exceeding ninety degrees.

II. SUMMATION

The microtine rodents of the genera Lagurus and Microtus live in a wide variety of habitats. The presence of grass characterizes the areas in which they live. In general it may be stated that M. oregoni and M. montanus are found throughout Kittitas County. M. longicaudus and M. richardsoni occupy the western one-half of Kittitas County. L. curtatus occupies the eastern one-third of Kittitas County. Evidently food requirements are the same for L. curtatus and M. montanus and M. oregoni. Food requirements of M. richardsoni and M. longicaudus were not discovered.

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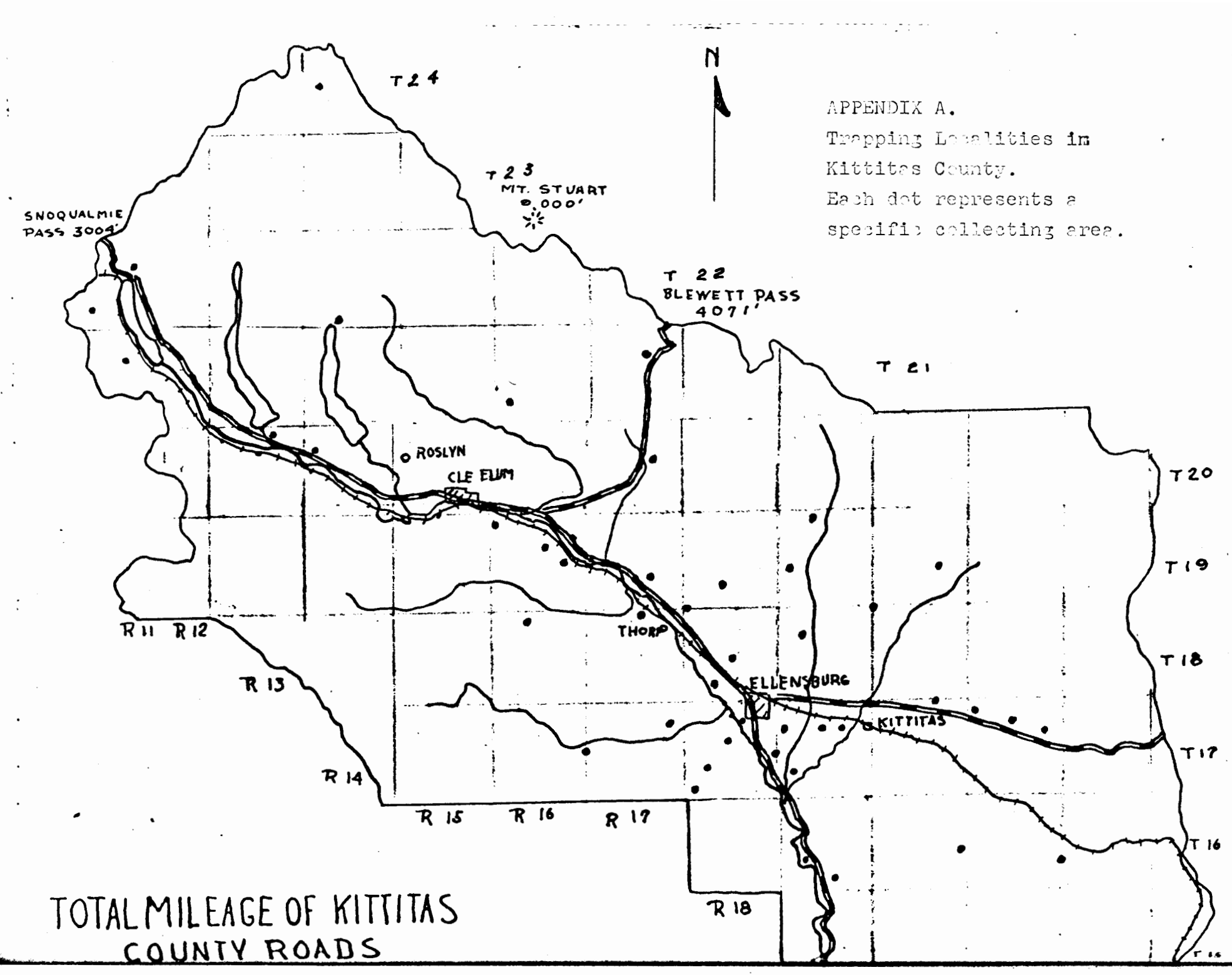
APPENDIX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APPENDIX A.
Trapping Localities in
Kittitas County.
Each dot represents a
specific collecting area.
TOTAL MILEAGE OF KITTITAS
COUNTY ROADS

APPENDIX B.

The following table represents five vegetation areas found in Kittitas County. They are, Grassland, Pasture, Deciduous Growth, Ponderosa Pine, and Douglas Fir-Hemlock. The areas are represented in the table by the code letters: A = Grassland, B = Pasture, C = Deciduous Growth, D = Ponderosa Pine and D = Douglas Fir-Hemlock. The month and year are found to the right of the table, and below each code letter will be the number of traps set for the area for that month. Total number of traps set in each area is found at the bottom of the table. The percentage expressed is in terms relative to total numbers of traps set for all areas over the entire trapping time, which was from December 18, 1963 to August 1, 1964.

Month and Year		Area A	Area B	Area C	Area D	Area E
December	63	15	45	40	0	0
January	64	14	0	35	20	0
February	64	20	40	60	0	40
March	64	0	284	60	0	0
April	64	921	200	145	40	0
May	64	405	165	290	290	40
June	64	110	0	120	80	240
July	64	0	0	120	0	300
August	64	0	0	0	0	0
Totals:		1485	734	870	430	620
Percentage:		35.9%	17.7%	21.0%	10.4%	15.0%

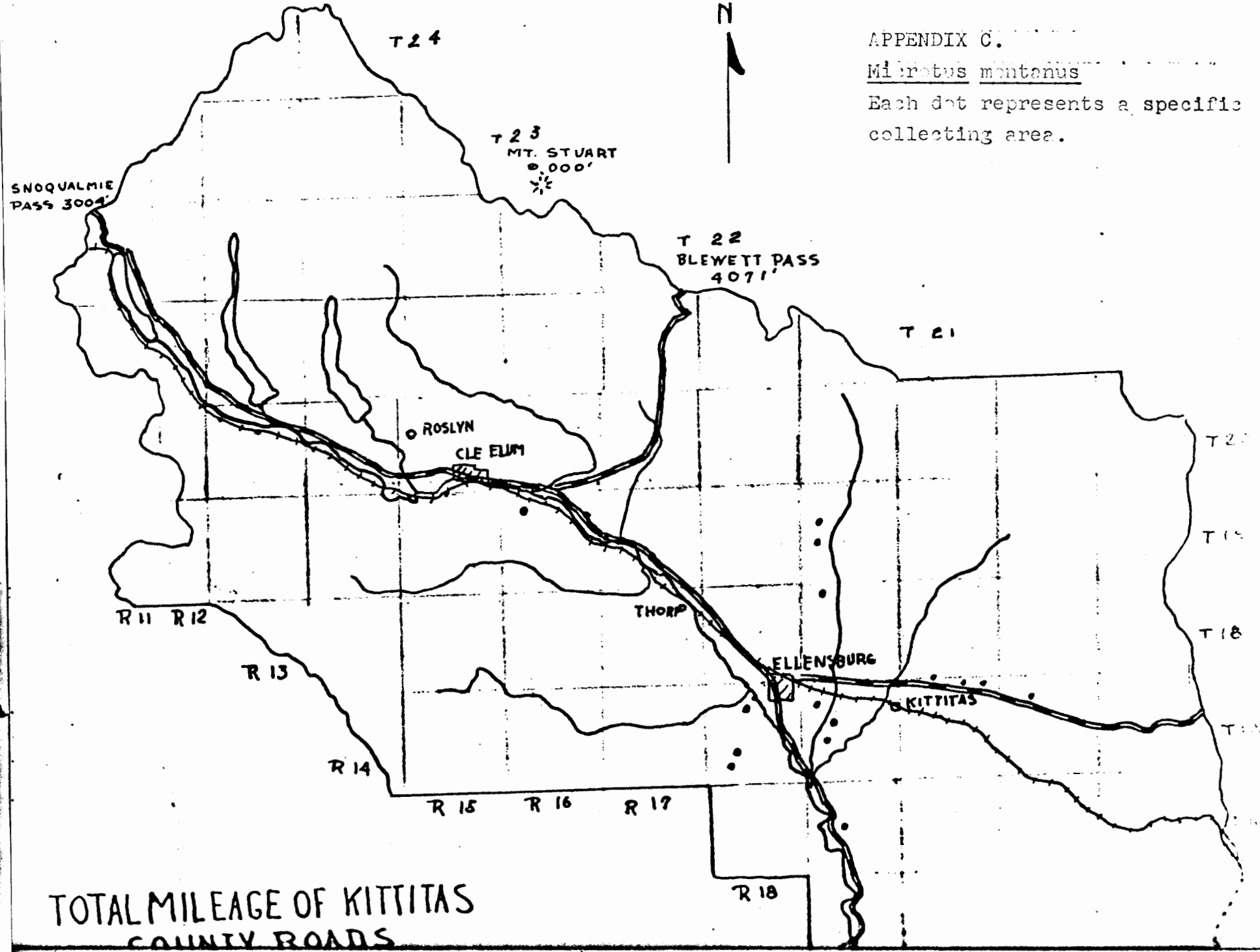
Total Number of Traps set: 4,139.

Effectiveness in taking species desired: 2.1%

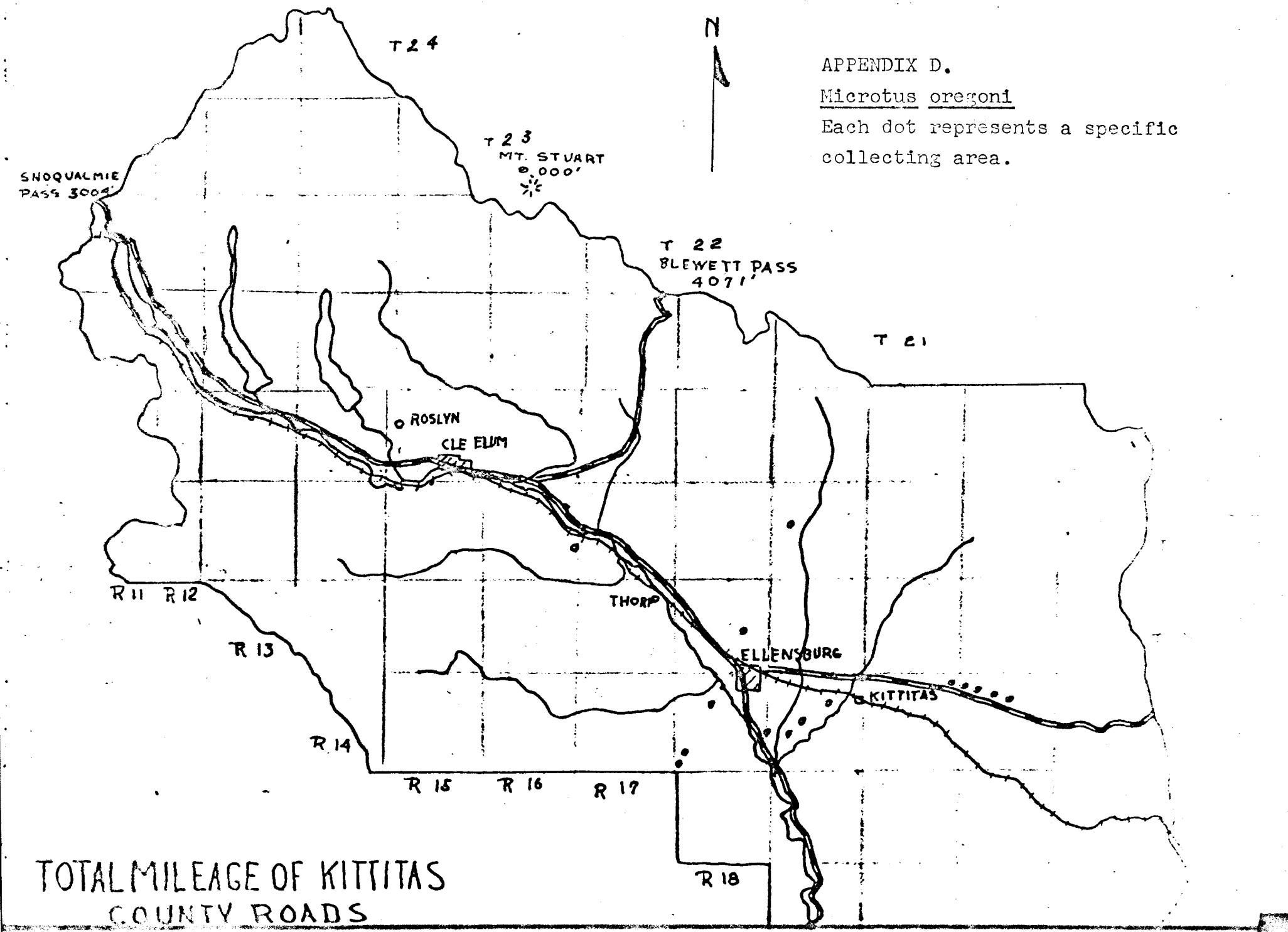
APPENDIX C.

Mibratus montanus

Each dot represents a specific collecting area.



TOTAL MILEAGE OF KITTITAS COUNTY ROADS



APPENDIX D.

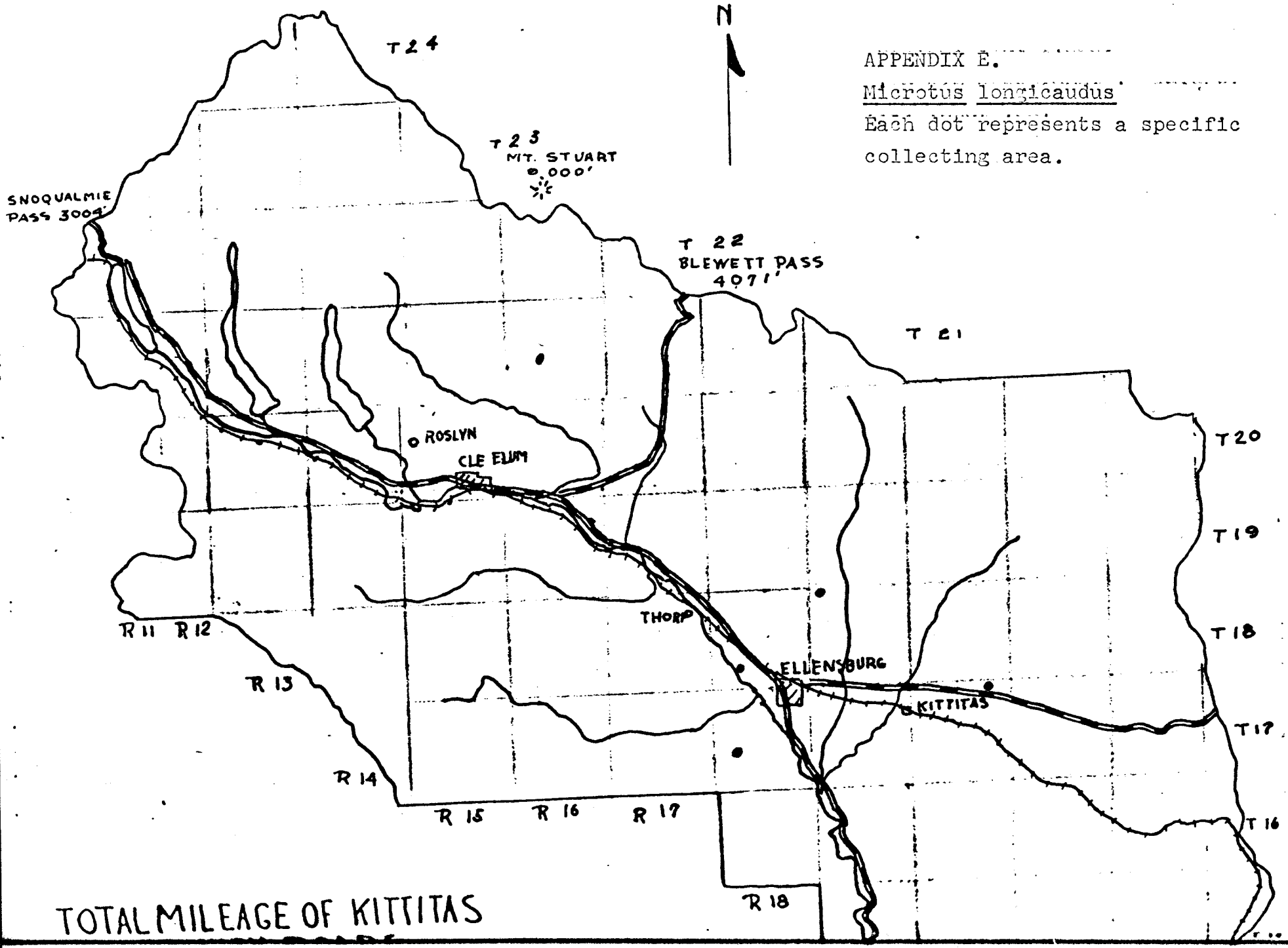
Microtus oregoni

Each dot represents a specific collecting area.

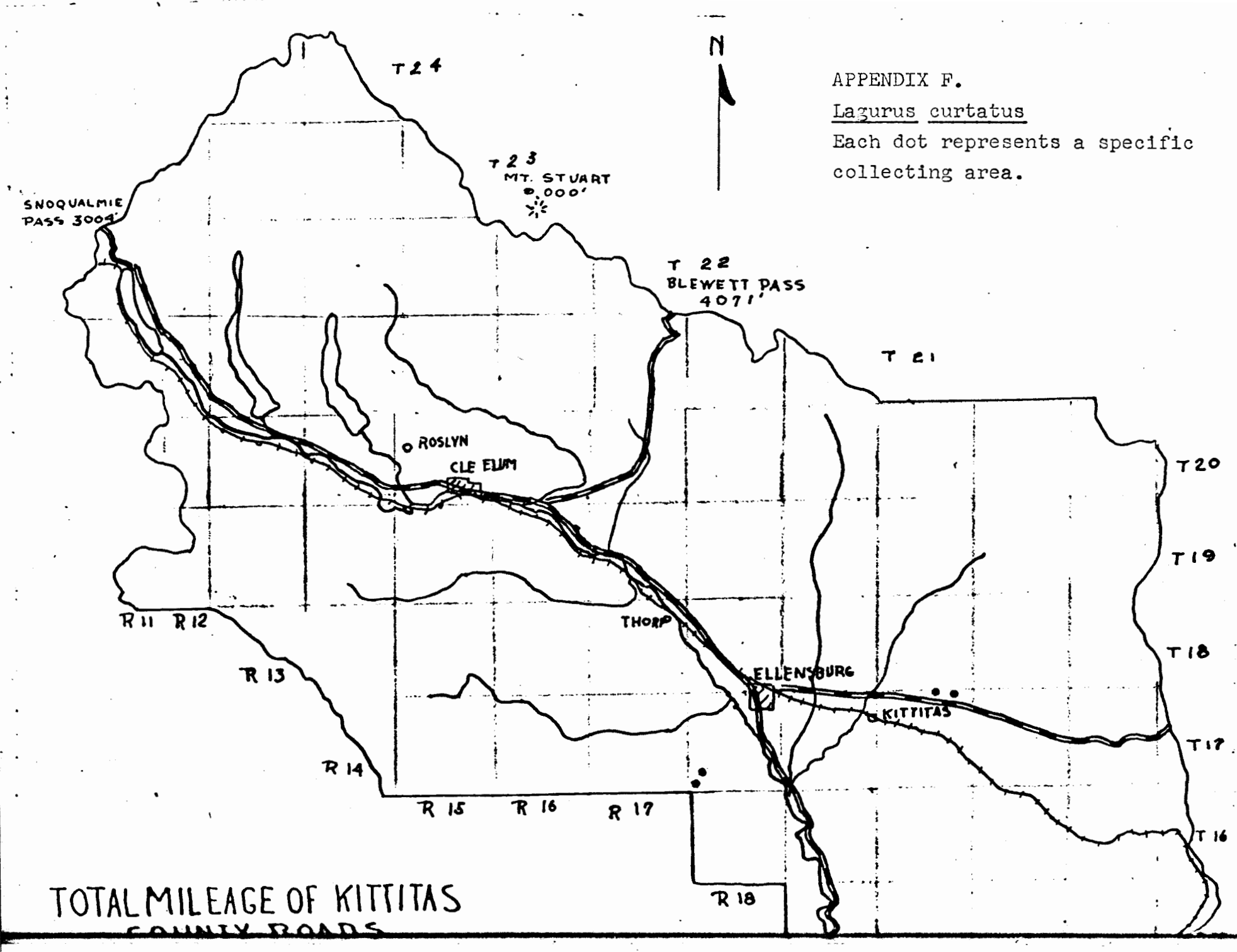
APPENDIX E.

Microtus longicaudus

Each dot represents a specific collecting area.



TOTAL MILEAGE OF KITTITAS



APPENDIX F.

Lagurus curtatus

Each dot represents a specific collecting area.

TOTAL MILEAGE OF KITTITAS COUNTY ROADS