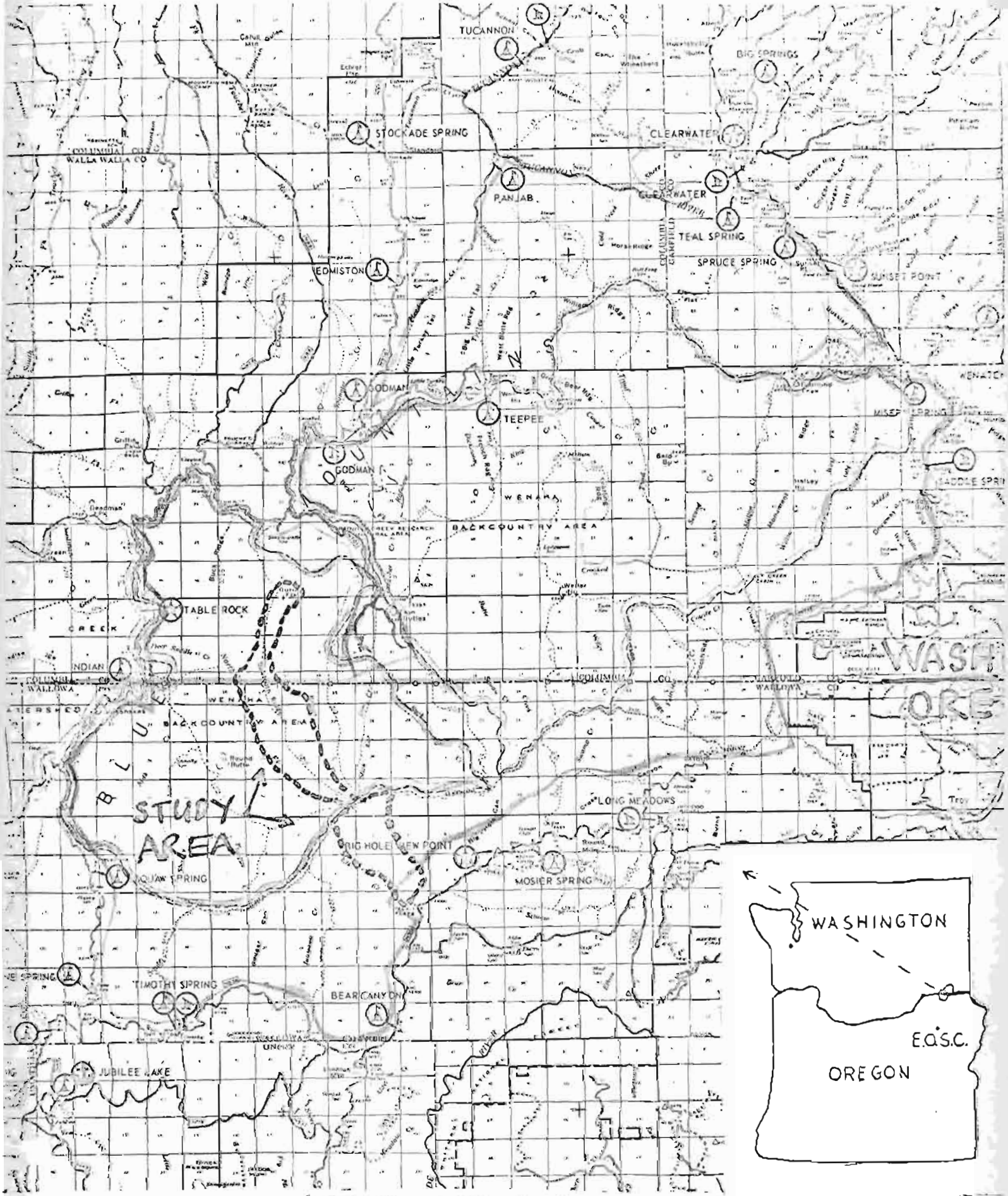
PLANTS AND VERTEBRATES

of the

WENAHA DRAINAGE



MAP OF WENAHA DRAINAGE

BORDER OF STUDY AREA = = = = =

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Prefatory Note

This study was financed by a grant awarded by the National Science Foundation's Student-Originated-Studies program. Field work was done from 12 June to 17 August 1974 during which period the participants were camped at Kenaba Forks within the study area.

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General Introduction

The Wenaha River drainage, a 200,000 acre roadless area characterized by deep canyons and timbered benches, lies in the Blue Mountains along the border of Oregon and Washington. It includes a 112,000 acre "Wenaha Back-country" set aside by the U. S. Forest Service for elk and deer hunting. Interest as to the future of the area has arisen among conservation groups, lumber interests, and the Forest Service. In 1971, the Umatilla National Forest Office, which has jurisdiction, concluded that the area was already adequately protected. The Wenaha-Tucannon Wilderness Council, a citizens' group, feels that the drainage and portions of adjacent drainages ought to be classified as wilderness. Senator Mark Hatfield of Oregon recently included the area in a wilderness omnibus bill.

Because long-lasting management decisions will soon be made and no basic ecological data was available, five Eastern Oregon State College students proposed a preliminary survey of the plants and vertebrates.

Objectives of the study were:

1. To investigate and classify the vegetation on an ecosystem basis.
2. To determine vertebrate species present and their distribution within vegetation habitat types.
3. To obtain baseline data so that changes in the biota can be correlated with environmental management practices.

A 6,000 acre study area was chosen which was believed to contain all the vegetation habitat types typical of the area as a whole.

Three students were recruited from other schools in Oregon and Washington once the grant was received. The interdisciplinary team that went into the field on 12 June 1974 included four botanists, two mammalologists, an ornithologist, and a herpetologist.

Plant Ecology

Introduction

R. Daubenmire has been a student of the vegetation of areas in southeast Washington which are adjacent to the Wenaha River drainage. His monographs on the vegetation (1969, 1970) and his textbook on plant communities (1968) have supplied us with study methods, terminology and descriptive data which have been basic to our field work. Our goals have been to identify and collect the plants in the study area and to determine the vegetation types represented there according to Daubenmire's extablished categories.

Methods

Forest vegetation was sampled in 15 by 25 meter plots. Trees within each plot were counted according to decimeter size class (0-1 dm., 1-2 dm., etc.) with those 1 meter or smaller counted as seedlings. The largest individual of each species present was drilled with an increment borer and age and rate of growth noted. Understory plants (sciophytes) were analyzed as to frequency and coverage class in 50, 2 by 5 decimeter microplots spaced at 1 meter intervals along median lines within the large plots. In steppe areas 50 to 100, 2 by 5 decimeter microplots were placed along a transect at 1 meter intervals and frequency and coverage class of plants determined.

Terminology

The following terms have special and limited meanings as used in this report and by Daubenmire:

Climax: A self-maintaining vegetation type which is the final product of plant succession in a particular habitat type. Climax types are defined according to which physical factors are most significant in determining this final vegetation. In the study area the determining factors are topographic and edaphic.

Coverage class: This is a measure of dominance or relative ecologic significance of plants which are found together. This is estimated by visualizing as polygons the overall outline of the vegetative parts of each plant within a microplot as seen from above. Coverage of the polygons is noted in percentage classes as follows: 1, 0-5%; 2, 5-25%; 3, 25-50%; 4, 50-75%; 5, 75-95%; 6, 95-100%. Overall percent coverage is calculated using the midpoint of each percentage class.

Disclimax: Vegetation which does not develop climax characteristics because of continuing disturbance, as by overgrazing (zootic disclimax).

Ecological amplitude: Environmental tolerance of a plant.

Frequency: The number of occurrences of a plant within microplots, expressed in percent.

Habitat type: The physical factors (soil, sun, slope, moisture, etc.) on a particular site which determine the characteristic climax vegetation.

Homogeneous (vegetation, etc.): Clearly showing the characteristics of a certain plant association, soil type, etc. in a sufficiently extensive area so as to exclude the appearance and influence of another plant association or soil type, etc.

Plant association: Plants which occur together on a particular habitat type.

Plant union: A subdivision of a plant association composed of one or more plants having similar form, phenology, stature, and distribution.

Abies grandis-Pachistima myrsinites Habitat Type

Within the study area the Abies nrandis-Pachistima myrsinites habitat type provides the most abundant well-developed forest cover. It occurs most extensively on near-level areas and on northerly slopes which are northwest-to southeast-facing. Soil accumulation is greatest in these areas with a thick layer of litter and duff not found on other habitat types. Vegetative growth is relatively lush since such slopes receive more precipitation and less dessication from wind and sun than those which are west-to south-facing.

The vegetation in this habitat type presents a varied appearance, corresponding generally to the seral, stagnant, and mature climax stages described by Daubenmire (1968). He constructed study plots using his methods in areas representing these stages. Complete species lists and coverage and frequency and other data are appended (Plots nos. 2,3,6).

Mature climax stands in the Abies grandis-Pachistima myrinites habitat type support a population of Abies grandis (Dougl.) Forbes of all age-size classes including seedlings and a well-developed understory of shrubs and forbs. The plot we constructed near Beaver Creek (Plot 2) contains the typical sciophytes which Daubenmire has found to be significant. It should be noted that the Pachistima mysinites (Pursh) Raf. plant union in this area is often represented by other species. No Pachistima, for example, was found in this plot. The Taxus brevifolia Nutt. we found is typical.

Abies grandis is susceptible to heart rot fungi and among the mature trees we found several with hollow boles. The thinning which results from this and other factors allows establishment of the

sciophytes and of Abies grandis seedlings so that the mature climax stage of development is maintained.

Preceding thinning the Abies grandis forest often exists in a stage of stagnation. Such stands are extensive in sections of the study area (AP on map.) The typical stand in which we constructed a plot contained a very high population of trees nearly identical age. The dense canopy in such stands so limits insolation underneath that seedlings cannot develop and sciophytes are virtually absent. There is a great amount of litter from leaf and limb fall. Limited availability of light and moisture severely curtails tree growth until such time as there is some die-off. Competition for resources is reflected in comparing two individual trees closely situated in the stand, one approximately 63 years old with a 4 decimeter diameter and the other 60 years old with a 1 decimeter diameter. A few years established a great competitive advantage.

Following disturbance, as by fire, Larix occidentalis Nutt. and Pinus contorta Dougl., and also in lesser numbers in the study area, P. ponderosa, Dougl. P. monticola Dougl., Picea englemannii Parry and Pseudotsuga menziesii (Mirbel) Franco., establish themselves on Abies grandis-Pachistima myrsinites habitat types. The area in which we constructed a plot (no. 3) supported populations of Larix and Pinus contorta of approximately equal numbers, sizes and ages. Beneath these trees we found a vigorous understory of Pachistima and associated species. Abies grandis seedlings 1-2 decimeters tall had established themselves with a density of 3 seedlings per square meter.

We found many sites within the Abies grandis habitat type to be of interest because they support a diverse population of uncommonly attractive plants, notably orchids and Pyrola species which grow in the areas marked AP, M3, and M4 on the vegetation map having the humus-rich soils that most of these plants require. The Wenaha River drainage might well be an appropriate location for field work researching the synecology of these abundant mycorhizal species.

Steppe Habitat Types

Definition of steppe habitat types was problematical using Daubenmire's (1970) methods and comparing data with his. The Wenaha Backcountry which encompasses most of the study area has been managed recently primarily for hunting and supports a large population of Canadian elk, mule deer and white-tailed deer. Domestic sheep have been grazed there in the past and pack and riding animals are taken there regularly. Consequently, intensive grazing and browsing have produced near-universal disturbance in steppe areas, some of which exist in a severely depauperate condition.

Steppe vegetation within the study areas is bordered largely by ecotones supporting understory plants belonging to the Pseudotsuga menziesii habitat types. Shrubby members of the Symphoricarpos albus (L.) Blake and Physocarpus malvaceous (Greene) Kuntze union, for example Rosa species, Prunus emarginatus (Dougl.) Walp., Spirea betulifolia Pall., Amelanchier alnifolia Nutt. and other woody plants such as Ceanothus velutinous Dougl., Salix species and Cercocarpus ledifolius Nutt. are hedged by browsers and are often severely reduced in size and are non-reproducing. Steppe itself (marked S on map) frequently has less than 50 percent plant cover, the remainder being bare mineral soil.

Areas which support steppe are steep with thin soil and are largely south-to west-facing thus receiving a maximum of insolation and a minimum of precipitation. These same slopes which provide winter range for deer and elk of course appear to be most disturbed and depauperate. One area we sampled which showed a minimally depauperate plant cover (transect 3) bears a resemblance to Daubenmire's lithosolic Agropyron spicatum (Pursh) Scribn. & Smith-Poa secunda (sandbergii Basey) habitat type. In our plots Agropyron has a percent frequency and coverage of 62 and 35 respectively and Poa has 11 and 2 respectively. Daubenmire's figures for his plots in the Agropyron-Poa habitat type for Agropyron range from 95-99 percent

frequency and 38-86 percent coverage and for Poa range from 55-99 percent frequency and 17-44 percent coverage. Perennial grasses within the study area steppe are at least this severely diminished. In another area (Transect 2), more typically depauperate, Agropyron had a percent frequency of 46 and a percent coverage of only 6. Poa secunda (sandbergii) complex species were not found but Bromus tectorum L., an invader as a result of grazing, had percent frequency and coverage of 48 and 5 respectively, nearly identical to the figures for Agropyron.

The most readily apparent plants in the steppe are low shrubs including Eriogonum compositum Dougl., E. heracleoides Mutt. and E. umbellatum Torr.. These along with Monardella ordoratissima Benth., Penstemon venustus Dougl., Phlox species, Chrysothamnus nauseosus (Pall.) Britt and Artemesia ludoviciana Nutt. evidently are not eaten by elk and deer. These plants occur in a mosaic in which single species form stands of approximately one to 10 square meters. Such a diversity of low shrubs is characteristic of lithosols according to Daubenmire who describes a series of lithosolic habitat types based upon Eriogonum species associations with Poa secunda (sandbergii). It is likely that the pristine steppe vegetation of this area comprised in part one or more of these associations. Probably disturbance has affected the originally marginal soil profile to the extent that the incomplete Eriogonum associations extant represent a zootic disclimax on a once-extensive Agropyron spicatum-Poa secunda lithosolic habitat type. Agropyron remains the dominant perennial grass in the steppe because it apparently is not everywhere overgrazed in summer when it is susceptible to damage.

We found what we call the Mimulus guttatus vertical bog at various locations in the steppe. This habitat type occurs on west-to south-facing slopes where steep (often approaching 40°) tabular basaltic outcroppings provide water seepage until about midsummer. A well developed moss layer holds moisture and provides a matrix for soil accumulation. The dominant perennial plant is Mimulus guttatus

beneath which grow a wide variety of small annuals and perennials such as Navarretia intertexta (Benth.) Hook., Heterocodon rariflora Nutt. Orobanche uniflora L., Galium aparine L., Mimulus breweri (Greene) Rydb., Boisduvalia stricta (Gray) Greene, Orthocarpos hispidus Benth. and Juncus bufonius. The vertical bogs range in size from a few square meters to a hundred square meters with one area just outside our study area constituting perhaps 1000 square meters. The larger areas provide a brilliant yellow display which is visible from a considerable distance when the Mimulus guttatus is in full flower.

Pseudotsuga Habitat Types

The areas in which Pseudotsuga habitat types occur, as a whole, are probably the most heterogeneous ones in our study area. They cover large areas of northwest, west, and southwest-facing slopes. While the several habitat types to be described are present in these areas and are usually identifiable, they are not always sufficiently extensive to quantify by Daubenmire's methods.

Pseudotsuga menziesii-Symphoricarpos albus Habitat Type

We found this habitat type most regularly in small canyons on the southwest-facing side of Sawtooth Ridge, as well as in small stands in other parts of the study area which were not sampled. These stands are on slopes with west to northwest exposures occuring under somewhat protected conditions which provide more moist and deeper soil than in the surrounding steppe vegetation.

The canyons are very steep and are protected enough from wind and sun to allow the accumulation of soil and precipitation. The steepness of this ridge also accounts for the occurrence of the many talus slopes within these areas.

Our plot had a slope of approximately 45° and was characteristic in that respect. The plot was in one of the few homogeneous areas of the habitat type which we found and our quantitative data corresponds quite well with the description and data offered by Daubenmire (1968).

None of the stands of this habitat type appeared to be in a climax stage as medium to large size trees of Pinus ponderosa were always present, as they were in our plot.

Pseudotsuga menziesii trees were of varied age and size class but there was a conspicuous absence of seedlings-only 1 in our 375 m^2 plot, the cause of which we did not determine.

Only one plot was established in this habitat type and complete species list, coverage, and frequency data are appended (plot #5).

Pseudotsuga menziesii-Calamagrostis rubescens Habitat Type

This habitat type is represented in several homogeneous stands of limited extent. These stands are found along the tops of the slopes at the edges of the flats where the steppe habitat type vegetation meets the Abies grandis Pachistima myrsinites habitat type. It is often a band of only a few meters width with which a few comparatively large areas are continuous. There is also a narrow strip along the top of Sawtooth Ridge where the drier southwest-facing slope meets the Abies grandis Pachistima myrsinites habitat type of the northeast slope. The southwest-facing slope of the lower part of Sawtooth Ridge (that area designated M 5 on the map) also shows some affinity to this habitat type, but it is in a disturbed condition from grazing and winter range such that it was difficult to make any positive habitat type determination.

The stand in which we located our plot had an open parklike appearance with few shrubs but a good coverage of Calamagrostis rubescens Buckl.. Tree density was low with a large percentage of Pinus ponderosa in the stand, some of which were of large size. Pseudotsuga menziesii was represented by several large individuals, numerous small ones in size class 1 (0-1 dm.) and was by far the most numerous reproducing species.

In some areas, especially near the trail head at Elk Flats, the understory is almost completely dominated by Lupinus sulphureus Dougl. a species which is likely an increaser under grazing pressure as compared to Calamagrostis rubescens. The Lupinus sulphureus has an estimated coverage of well over 50% which is especially conspicuous during the flowering period.

Mixed Pseudotsuga Habitat Types

Our map categories M 1, M 2, and M 5, are mixed vegetation areas with most supporting the Pseudotsuga menziesii-Physocarpus malvaceous association but with some Pseudotsuga menzeisii-Symphoricarpos albus association also. These areas seem most influenced by snow accumulation and prevailing winds. Much of this area which would otherwise support Pseudotsuga stands does not because of the lack of moisture and soil.

The soils of this area originated primarily from Columbia River basalts and volcanic ash, the major accumulation of which occurred on the leeward slopes. The prevailing winds blow most of the precipitation to the northeast, north and northwest-facing slopes, whose greater moisture-holding capacity, due to deeper soils, accounts for the great variation in vegetation from south-to north-facing slopes.

Areas M 2 and M 5 are both more or less southwest-facing slopes and do not support a high density of Pseudotsuga menziesii although the Physocarpus malvaceous union is well developed in many instances and less often the Symphoricarpos albus union. The most numerous reproducing species is always Pseudotsuga menziesii indicating that it is the major dominant climax species, but occasional Pinus ponderosa seedlings are also present. The soil is quite often rocky with fairly frequent outcrop of bedrock. We feel that the soil and water conditions are insufficient to support a normal development of the tree layer and since stands are quite open Pinus ponderosa is able to maintain a population interspersed

with the Pseudotsuga menziesii such that the normal condition of a single dominant climax tree species is seldom attained.

We were able to find no stands in these areas of sufficiently great an extent to allow for the placement of a plot or to preclude influence from seed sources in surrounding areas, although at times a particular union was identified which did not have very conspicuous representation of another's members.

Of note in this mixed vegetation is the occurrence of the two major shrubs of the Physocarpus malvaceus union, Physocarpus malvaceus and Holodiscus discolor (Pursh) Maxim. We often found them growing in distinctly separate stands although the habitat type otherwise appears to be the same. This probably indicates a difference in the ecological amplitude of the two species which is not noted by Daubenmire (1968) and which deserves further attention.

Within the map categories M 2 and M 5 certain areas have characteristics of the Symphoricarpos albus union, but Symphoricarpos albus itself is largely absent or is in a very depauperate state. Apocynum androsaemifolium L., a member of the Symphoricarpos union according to Daubenmire (1968), and probably an increaser under grazing pressure is abundant. This is probably a result of winter use by deer and elk.

The Pond Area

In two small locations (P on the vegetation map) we found pond and swamp areas supporting a specific vegetation. The ponds lie in depressions at two different levels on the flat and are fed by springs which were still producing a sizable volume of water at mid-August. They are apparently in the process of silting in with several intermediate stages observed in a pond-to-swamp progression.

In both places there are swamps with standing water early in the season, drying to mud later. There comprise dense thickets of shrubby (about one meter) Rhamnus alnifolia L'Her.as well as other moist area plants such as Carex species. Around the periphery of these swamps is usually a ring of Populus tremuloides Michx. and Populus trichocarpa T. & G.

The ponds themselves vary considerably in depth; some have several feet of water in late summer. Those which lose their surface water support a dense stand of grasses such as Poa species on the still-saturated mud bottom. Those are generally surrounded by Alnus incana (L.) Moench, Cornus stolonifera Michx., Rhamnus alnifolia, and Acer glabrum Torr. on the pond edge with Picea englemannii and Taxus brevifolia mixed with the surrounding Abies grandis-Pachistima myrsinites habitat type further back. Tufts of Carex rostrata Stokes are also common at the shoreline.

Habenaria Taxonomy

An orchid of the genus Habenaria has been collected within the study area which does no fit the descriptions of any of the Habenaria species included in Vascular Plants of the Pacific Northwest (Hitchcock, 1955-69) or in the authoritative monograph on orchids by D. S. Correll (1950). Nor was any information obtained through preliminary examination of specimens in the herbaria of Whitman College and Washington State University. The plant seems to have its greatest affinity to H. greenii Jeps., as described by Hitchcock. Well over half of the individuals found have been carefully measured and the data recorded. Further study, especially the examination of herbarium specimens of H. greenii and a comparison of these with specimens of this undetermined Habenaria, will be necessary before a determination of its taxonomic status can be made.

Riparian Habitats

The flood plain environment of the Wenaha River (map M 3) supports four different vegetation types: meadows, with shallow rocky soil; flood plains; beaver pond bogs; and river bank vegetation. The meadows consist of undulating levels of river rock which represent years of deposition of rock and silt. Where the soil is rocky and shallow, Eriogonum heracleoides and Philadelphus lewisii Pursh are found. These areas also support plants of the Symphoricarpos albus union. In areas where the silt has built up and is deeper, grasses are dominant. Agrophyron spicatum, Poa sandbergii and Festuca idahoensis Elmer are found in small scattered communities. This doubtlessly does not represent the pristine vegetation. Madia glomerata Hook. and Achillea millefolium L. are over-grazing indicators which are abundant in the areas where recreational pack animals graze. These areas have a good amount of range use by the native populations of elk and deer as well.

The most abundant tree and shrub in the river flood areas are Populus trichocarpa and Philadelphus lewisii. Prominent beneath Philadelphus lewisii is Heracleum lanatum Michx. This association bears a close similarity to that of Daubenmire's (1970) Crataegus douglasii-Heracleum lanatum habitat type, Philadelphus lewisii apparently having replaced Crataegus douglasii Lindl. as dominant shrub speices. The forb understory includes Senecio serra, Agastache urticifolia, Urtica dioica and Symphoricarpos albus.

At the mouth of Beaver Creek (map M 3) and extending upstream, beaver dams have existed and a number of bogs have formed. Flooding has killed numerous mature conifers and deciduous trees. In the areas which are flooded through the growing season Equisetum, Carex, Scirpus and Juncus species are found. Where the soil is drier plants which are characteristic are Habenaria dilatata (Pursh) Hook.

Trautvetteria caroliniensis (Walt.) Vail., Gymnocarpium dryopteris (L.) Newm., Actea rubra (Ait.) Willd., Streptopus ampexifoluis (L.) DC. and Ranunculus species, indicating the Abies grandis-Pachistima myrsinites habitat type.
The moist areas also support reproducing populations of Picea engelmannii and Taxus brevifolia. Along the banks of Beaver Creek, Populus trichocarpa and Crataegus douglasii are found with understories of Athyrium filix-femina (L.) Roth, Urtica dioica L., Asarum caudatum Lindl. and Galium species.

The banks of the Wenaha River are also dominated by Populus trichocarpa mixed with Pinus ponderosa, Pseudotsuga merziesii and Abies grandis. Below these tree species Alnus incana forms the second layer of vegetation. Crataegus douglasii and Philadelphus lewisii are well-represented with the Symphoricarpos albus union below them. The flood plains have mature Pinus ponderosa and Pseudotsuga menziesii in open forests with scattered trees in the meadows.

Talus Slopes

In the moist regions of the study area (Map M 1 and M 4) talus slopes support shrub and tree species. This is due to the percolation of melting snow through the highly permeable rock layer. Where the depth of rock exceeds vertical root growth, plants rely on rain for their moisture requirements. Here the mosses play an important role by absorbing precipitation for symbiotic use with shallow rooting plants. With the continually accumulating litter in these areas, soil builds up and the talus slope is stabilized. In areas where the talus slope constantly slides, rock inhabiting plants such as mosses, Heuchera micrantha Dougl., Aspidotis densa (Brackear.) Lellinger, Cryptogramma crispa (L.) R. Br., Cystopteris fragilis (L.) Bernh., Polypodium hesperium Maxon, Polystichum lonchitis (L.) Roth and Polystichum munitum (Kaulf.) Presl. exist. Here these species form a topoedaphic climax. In areas that receive less precipitation (S and PS on map) talus slopes only support

lichen, moss and fern populations with small pockets of deep tap-rooting plants such as Balsamorhiza sagittata (Pursh) Nutt..

Camassia Marshes

At the upper elevations near and at Elk Flats there are large meadows which correspond to Daubenmire's (1970) Camassia marsh habitat type. These marshes receive a large snow deposit. Snow runs off in the spring in wide shallow channels. This erosion produces areas of differing soil depth: shallow lithosolic soils, having a low moisture holding capacity and scattered island-like soil mounds with higher moisture holding capacity.

The dry lithosolic soil during midsummer supports a population of annuals with Polygonum majus (Meisn.) Piper and Microsteris gracilis (Hook.) Greene dominant. The deeper more moist soil of the mounds supports Veratrum californicum Durand and Phleum pratense L.. Mounds of lesser soil depth are associated with Eriogonum heracleoides and Bromus species (list appended).

The Camassia marshes are surrounded by Abies grandis-Pachistima myrsinites habitat type with large proportions of Pinus contorta and Picea englemannii at the immediate edge. No seedlings of these coniferous species were found in the marshes indicating a stable relationship between the two areas. Where springs are present through the summer stands of Populus tremuloides are found.

It appears that grazing pressure from cattle and sheep in past years has allowed Madia glomerata and Polygonum majus to invade in the more xerophytic areas. Disturbances such as ploughing (a road is adjacent) could explain the presence of Phleum pratense on the mounds since Phleum is not native to this area. Due to disturbance, the vegetation in these areas bears little of the character of pristine Camassia marshes.

Alnus sinuata Seepage Areas

Seepage areas on steep north and east-facing slopes support an Alnus sinuata (Regel) Rybd. association. These areas occur in Pseudotsuga menziesii forests and Abies grandis-Pachistima and Abies lasiocarpa-Pachistima habitat types. The soil is too moist year around preventing invasion of conifers.

The width of the Alnus sinuata stands varies between 50 meters and 100 meters. These seepage areas may continue for hundreds of meters down-slope and tend to widen at lower elevations.

The bases of the Alnus sinuata are bent from snow slides in winter and parallel the ground for several meters before sharply rising. Damage to the bark of the Alnus was noted to a height of two meters and was attributed to use as winter forage by elk and deer. Unusual growths on the lower branches appeared similar to the brooms of mistletoe.

The undergrowth consists of dense vegetation dominated by Disporum trachycarpum (Wats.) Benth. & Hook., Viola glabella Nutt. and Hydrophyllum fendleri (Gray) Heller (species list appended). Athyrium filix-foemina borders channels where runoff forms small streams. No seedlings of Alnus sinuata were found. The stand was about 38 years old and even-aged.

Abies lasiocarpa-Vaccinium scoparium Habitat Type

At subalpine elevations, Abies lasiocarpa (Hook.) Nutt. is the dominant tree. It grows in close association with Vaccinium scoparium Leiberg and forms a recognizable habitat type (Daubenmire 1968). The subalpine influence is just evident within the study area (SA on map). The habitat type develops its characteristic vegetation two miles to the north in the vicinity of Burnt Flat. Pinus contorta represents a seral stage in these areas (species list appended).

There were no attempts to quantify the vegetation since the amount of snowfall for the preceding winter had been unusually abundant. Patches of snow were still present in early August and the vegetation barely emergent.

Ridge tops in the subalpine area with coarse, shallow, rocky soil are severly dessicated and support such alpine-condition-tolerant species as Astragalus whitneyi Gray, Symphoricarpos oreophilus Gray, Eriogonum flavum Nutt. and Sedum lanceolatum Torr.. Within the forest areas poorly-drained sites exclude trees and support meadows of Bromus vulgaris (Hook) Shear with Carex limnophila Hermann, Castilleja miniata Dougl., Rudbeckia occidentalis Nutt. and Delphinium occidentalis Wats. also abundant. Where thin, rocky and dry soil excludes trees forbs such as Sisyrinchium inflatum (Suksd.) St. John, Erythronium grandiflorum Pursh and Mertensia longiflora Greene are evident early in the season when moisture is available.

Discussion

In accumulating his quantitative data on habitat types Daubenmire (1968) has said that locating homogeneous, undisturbed stands of vegetation has required by far the greatest amount of his time in the field. Where we found extensive homogeneous stands of vegetation, as in the Abies grandis-Pachistima myrsinites habitat type, obtaining data which compared well with his presented us with no difficulties whatsoever. Much of the study area has such a varied topography that critical physical factors apparently vary within a quite limited space, producing a complex mosaic of different plant associations. Areas which are continually disturbed, as by overgrazing, may exhibit characteristics of their normal climax vegetation only after a long period of recovery. These areas persented us with difficulties of method, if not of identification and required the greatest amount of our attention and reflection.

Daubenmire's habitat types are classified according to the clearly recognizable

appearance of characteristic dominant plant associations. Within the Pseudotsuga menziesii habitat types, we found that the associated understory plants occupied separate sites which no doubt reflected minutely varying topographic, edaphic and other factors. As a whole such an area is properly called an ecotone since one or another habitat type does not exist in an area of at least 15 by 25 meters which Daubenmire has found to be adequate to provide statistically significant data for classification of forest vegetation. We feel that there is a need to further classify the relations between physical factors and plant associations so that ecotonal areas can be defined. Methods for such study would require the collection of soil and physiological data for which we were not prepared.

The disturbed steppe vegetation which we found in the study area ought to be studied more closely to determine the potential productivity of the range and appropriate management procedures. Our unfamiliarity with the taxonimically difficult and important grasses led us to overlook whatever remnant Poa populations might have been present in spring. We were forced to rely upon late-flowering Eriogonum species for steppe habitat type identification. Greater familiarity with bryophytes and their taxomony would have been useful in seeking information on the effect of deer and elk on the moss layer in the steppe and on the role of the mosses in the Mimulus guttatus areas.

We enjoyed collecting and identifying the plant specimens which we have listed in the appendix. It should be noted that in the winter of 1973-74 this region received approximately 50% greater precipitation than normal. This no doubt is reflected in the profuse flowering of most species collected, and the presence of some flowers which appear only infrequently.

Mammal Study

Introduction

Our primary objective was to identify the mammal species that exist in the study area while determining their distribution by habitat types. Secondary

objectives included preparation and mounting of study skins and skulls and extimates of population.

Methods and Materials

Once the initial legwork of familiarizing ourselves with the study area was accomplished we began trapping small mammals using the methods of Rickard (1956). A trapping area consisting of 3 lines of 5 stakes each with line and stakes spaced 8 meters apart was placed in a stand of homogenous vegetation. Three snap (mouse) traps were placed within a 1 meter radius of each stake making a total of 45 traps within the trapping grid. In addition 2 transects of 20 Sherman live traps each were placed adjacent to this grid. These Sherman traps were spaced 5 meters apart. All traps were baited with a mixture of peanut butter and oatmeal and all traps were set for a three or four day period being checked each morning.

After trapping three stands our mouse trap grids had produced only one species (Peromyscus maniculatus). While the Sherman traps had produced better results we still were not getting the species distribution that we had expected. At this time trapping grids were abandoned and Sherman and snap traps were set where animal activity was apparent or anticipated. While we continued to bait our traps we tried to position them to capture animals not attracted to the bait. The number and types of traps set in each stand varied with the amount of animal sign found, the extensiveness of the stand, and the availability of traps. Due to the complex mosaic of vegetation within our study area many areas not homogeneous were trapped.

Other traps and collecting methods were used when appropriate. These included tomahawk live traps for large rodents, lagomorphs, and carnivores, pitfall water traps for shrews, standard gopher traps for pocket gophers and a mist net for bats. A spring trap known as a "death clutch" was used unsuccessfully on ground squirrels. Some animals which could not be captured in traps were collected using a rifle.

Though some of the larger carnivores could have been captured using steel jawed traps we declined to do so.

Other mammals were identified by visual sightings including spot-lighting at night for nocturnal species. Observations of tracks and scats were recorded when considered significant. A bait stump was used to attract a bear on three separate occasions.

A study skin collection representative of the small mammals collected was made in the field. Skulls were labeled, placed in vials, and later prepared and positively identified in the laboratory.

Results

Initially we began the study with two false assumptions. We felt that all small mammals could be found by trapping homogeneous habitat types and that trapping grids would accomplish this objective. The Wenaha vegetation was found to vary constantly with slope and exposure. Even some of the homogeneous habitats found (for instance Pseudotsuga menziesii-Calamagrostis rubescens and-Symphoricarpos albus habitat types) were too small to obtain meaningful trapping results. We could not determine whether animals trapped in these areas were utilizing them or just passing through. The time length of our study was also insufficient since mammal distribution varies with the seasons and populations fluctuate over longer periods. As a result our primary objective became to identify the mammal species that exist within the study area.

Table 1 is a list of all species trapped or observed. In all 27 species representing 5 orders and 15 families were identified. Over 200 specimens representing 15 species were trapped or collected. Though Sherman traps were the most effective traps for capturing rodents, our success with snap and gopher traps increased considerably as we gained knowledge of individual species.

The results of the small mammal investigation are presented in Table 2. An interpretation of these results organized according to the taxonomic units of the mammals follows.

Order Insectivora

Only one species, Sorex vagrans, was identified. Most specimens collected were captured using pitfall water traps placed along the edge of streams and waterways. When it became apparent that shrews were not attracted to the bait in our snap traps we began setting these traps under logs and in areas where we thought they would travel. This method along with baiting Sherman traps with meat, and overturning logs, failed to produce any shrews in dry habitats. The shrews captured in Abies grandis and Abies lasiocarpa associations were caught in pitfall traps placed along logs. We expected to find but did not trap Sorex palustris (northern water shrew).

Evidence of mole activity was not found in the study area.

Rodentia

Except for microtine voles, a fair representation of rodents exists in our study area. Of four microtinae shown by Ingles (1965) to be distributed in this region only two, Microtus montanus and Microtus longicaudus, were trapped. In all, 12 rodent species representing 6 families were trapped or observed.

Four species of Sciuridae were identified. Eutamias amoenus (yellow pine chipmunk) was the most abundant and widespread mammal studied. It comprised over 50 percent of our catch and occurred in all coniferous habitats. Most individuals were trapped in open sunlit forests such as those along ridge tops or bordering meadows. It was also found in steppe vegetation and meadows where rocky outcrops or downed logs provided suitable nesting sites and cover. Callospermophilus lateralis (mantled ground squirrel) prefers a slightly more xeric habitat. It was most abundant among rocky outcrops within the steppe but

also occurred in the Pseudotsuga menziesii-Symphoricarpos albus habitat type. It was not found in the more mesic habitats. Tamiasciurus hudsonicus (red squirrel) was observed almost daily in the dense Abies grandis forests. It was only occasionally observed in Pseudotsuga menziesii habitats and one sighting was made in a Pinus ponderosa surrounded by steppe. This squirrel was just beginning to cut and store mature cones when the study ended. When conifer cones are not available these squirrels subsist primarily on fungi (Ingles, 1965). This summer diet and inclination to avoid any trap on the ground makes them difficult to live trap. The only specimens collected were killed with a rifle. Citellus columbianus (columbian ground squirrel) occurs in a more restricted habitat than the other Sciuridae studied. This species was found in 3 disjunct populations separated by topographical barriers. One colony was located in the riparian meadow adjacent to base camp. This was at an elevation of 2,800 feet in the river's narrow floodplain. A second colony was located at 5,000 feet on Elk Flat at an elevation of 5,900 feet. While dominant plants of these tree areas differ each is a deep-soiled, well-drained meadow which supports perennial herbs and grasses. Because these populations are so effectively separated they could be studied further for genetic and behavioral differences. Demands on individuals living under subalpine conditions must differ greatly from those living on the river bottom, who estivate during hot weather.

Two other members of the Sciuridae Marmota flaviventris (yellow-bellied marmot) and Glaucomys sabrinus (northern flying squirrel) were sought but not found. While we are fairly certain that the lethargic marmots are not present the nocturnal habits of flying squirrels may have thwarted our efforts to find them.

Pocket gophers are represented by the species Thomomys talpoides. This animal is well distributed occurring in all open areas from steppe to subalpine meadow. It was the only mammal which appeared to utilize plants of the dry

subalpine ridgetops where specimens trapped contained Allium (onion) bulbs in their cheek pouches. Once the proper procedure is learned, pocket gophers are easily caught using a box-type gopher trap. This trap capitalizes on their instinct to always plug outside openings to their burrows.

Beaver or recent signs of beaver activity were only observed at two locations both on the North Fork of the Wenaha river. Although old beaver cuttings and dams were apparent everywhere along the stream no animals were located on Beaver Creek. From personal observation we do know that a small resident population exists down river.

Microtis longicaudus and Microtus montanus were the only voles found. These animals were trapped adjacent to each other in the Veratrum Californicum marsh on Elk Flats. Despite extensive trapping we could not locate these species elsewhere.

The woodrat (genus Neotoma)found does not fit the description of Neotoma cinerea (bushy-tailed woodrat), supposedly the only woodrat native to this region. Instead it appears to be Neotoma lepida (desert woodrat). Further trapping will be done next spring to identify positively this species. Authentication of N. lepida would extend its range 250 miles. This animal was easily trapped around rocky outcrops in areas of steppe vegetation. Its nests contained cuttings of Cercocarpus ledifolius foliage; this shrub is common in drier regions where N. lepida is known to exist.

The wide distribution of Peromyscus maniculatus is well known and our study area provided no exceptions. It was found in all but subalpine habitats.

Zapus trinotatus (Pacific jumping mouse) was found restricted to moist habitats but not to a specific vegetation type. Specimens caught in the Veratrum californicum on Elk Flats and in riparian vegetation along the Wenaha River were killed by snap traps placed along the edge of streams. The one specimen

collected in an Abies grandis forest was less than 100 feet from a permanent stream. This animal was not attracted to our bait and was caught by placing traps in its runways.

All sightings of Erithyzon dorsatum (porcupines) were made at night on roads adjoining the Wenaha drainage. While these animals did not appear numerous, evidence of their activity was found throughout the study area.

Order Lagomorpha

Lepus americanus (showshoe hare) was the only lagomorph found. The only specimen of this species trapped or observed was an immature male caught in a Sherman trap not much larger than itself. This animal was found dead and compressed into the same shape of the trap. With only one hare trapped it is impossible to comment on its distribution within the study area.

Ochotoma princeps (pikas) and Sylvilagus nuttalli (mountain cottontails) were sought but not found in our study area.

Order Chiroptera

Much unproductive time was spent attempting to collect bats.

In June two weeks of hot weather made bats appear numerous. A mist net was set up over the South Fork on one warm evening and Lasiurus cinereus (hoary bat) was caught. Most of the summer the evenings were cool. We believe this suppressed bat activity within the study area. When insect activity was minimal no bats were observed. Though the mist net was set up on at least 6 more occasions no more bats were captured. In late July we walked ten miles downstream to find more bats. One Myotis lugificus (little brown myotis) was collected with a shotgun. Another specimen of this species was later collected at our basecamp. Other unidentified species of bats were observed in flight. A study aimed specifically at capturing bats should be conducted to determine their distribution in this area.

Order Carnivora

Identification of species was made only on the basis of sightings and signs. While our species list cannot be considered complete it does reflect a paucity of small predators which is perhaps directly related to the lack of small rodents and lagomorphs.

Two sightings of Canis latrans (coyote) were made late in the study at elevations above 5,000 feet. Throughout the summer fresh evidence of coyote activity within the Wenaha canyon itself was rare. One other Canidae Vulpes fulva (red fox) was observed on Moore flat, 10 miles east of the study area but within the Wenaha drainage. The animal was seen near a spring in a Pinus ponderosa forest.

Of the other small carnivores Procyon lotor (raccoon) made its presence known. Though the animal was seldom observed, fresh sign could always be found along the Wenaha river and its major tributaries. When we left camp one weekend raccoons consumed a quantity of our food. Mustela vision (mink) were occasionally seen in daylight hours hunting along the main streams. Attempts to capture these animals in tomahawk traps baited with bacon proved unsuccessful. Mustela frenata (long-tailed Weasel), Mustela erminea (ermine), and Mares americana (marten) were not observed but are suspected to live in low numbers within our study area. Lutra canadensis (river otter) are reported to live on the Wenaha river but were not observed.

Felis concolor (cougar) and Lynx rufus (bobcat) were identified by tracks only. No estimates of their populations were made.

Eight sightings of Euarctos americanus (black bear), representing at least four individuals, were made. Though all animals were observed within 1 mile of the Wenaha River or Beaver Creek and usually within Abies grandis forest, scat was found throughout the study area. After an animal had destroyed our

Sherman traps set along Beaver Creek we baited a stump with bacon and peanut butter to attract it. Bear visited this stump on at least three occasions.

Order Artiodactyla

Cervus canadensis (elk) was the most frequently observed game animal and appears to exert a tremendous effect on vegetation in both its winter and summer range. This area is managed primarily for its elk herds and has a very dense population.

White-tailed deer were more commonly seen than mule deer, although the latter species predominate along high ridge tops. The only population of white-tails in eastern Oregon is in the Wenaha and adjacent drainages and this would be an interesting area to study competition between these two species. Many suspected hybrids of these two species were seen but we were not able to verify our observations

Discussion

Though a varied amount of mammal life exists in our study area we did not encounter the number of species expected. This was especially true regarding small rodents and their predators. Constantly changing topography limits the size of definitive habitat types. When a suitable habitat for a certain species does exist it is usually small in area and separated from similar areas by barriers. If a fire or other natural occurrence were to remove a population from a restricted habitat these barriers would prevent recolonization. This may explain the absence of small mammals in otherwise suitable habitats.

While we accomplished a substantial portion of our objective a complete list of the mammals present and their distribution cannot be obtained in one summer in the field. Populations fluctuate in response to food supply. Mammals should be studied throughout the calendar year and on more than a one-year basis.

An inventory of the species of carnivores present and their populations could be better obtained in winter when populations are concentrated and tracking

is easier. Data on large herbivores and on populations of lagomorphs and some rodents (e.g. squirrels) could also be collected at this time.

Because of the limited amount of time and lack of expertise little information on bats was collected. Dr. Chris Maser, Corvallis, Oregon, advised us on capturing and observing bats and offered us his aid with identification. He also offered the use of his laboratory to examine carcasses for parasites and to determine stomach contents. This area's bats should not be overlooked by future researchers.

Many other interesting studies could be conducted in this region. Genetic and behavioral studies are needed to determine the status of isolated populations of species.

Further study is required on the effects of elk and deer on vegetation in this area.

Bird Study

The varied bird life found within the study area may be a reflection of the complexity of the vegetation mosaic. Eighty-five species were observed in the Nehaha River drainage during the study period, sixty-seven of which were observed within the study area.

All birds were classified as to their occurrence in plant associations. Each plot or transect in these associations was visited, and their floristic composition and physiognomy learned. This allowed field work to be extended to other areas within the project's boundaries where these associations existed. Birds observed or heard in a recognizable association were then recorded. All species lists are in A.O.U. order (lists appended). An attempt was then made to determine the factors affecting the species within each plant association.

Some of the associations were not recognized until late in the study and received less coverage than others. Singing dropped off considerably during the middle of July and less conspicuous species became difficult to find. More field

work in these associations may produce more complete species lists. Population density and frequency figures were not calculated primarily for this reason. It was also felt that if one were trying to determine bird utilization during the nesting season, better figures would have been obtained if the study were conducted earlier, since several species were already nesting by the time we arrived.

Abies grandis-Pachistima myrsinites Habitat Type

The species list from the climax stage of the Abies grandis-Pachistima habitat type includes those observed in climax and near-climax stands. The number of species found was comparable to the flood plain association, but the population density appeared lower. The heart rot fungi may explain the presence of the several species of woodpeckers and other species that feed on insects found in the bark and wood of dead trees. Large diameter trees, uncommon in earlier stages, have sturdier limbs for support of nests of such large species as the Goshawk and Great Horned Owl.

The dense young Abies grandis in the stagnation stage may offset the absence of any shrub layer in terms of nesting sites, and probably provides excellent protective cover during any period.

Very few species were observed in the Larix occidentalis-Pinus contorta seral stage. Although no census was conducted, this stage seemingly had fewer numbers of birds than any other area studied.

Pseudostuga menziesii-Calamagrostis rubescens Habitat Type

The large stand of this habitat type, where the vegetation study plot was constructed, and similarly sized stands were the only areas where field work in this habitat type was conducted. The narrow bands of this habitat type generally found between the Abies grandis-Pachistima myrsinites habitat type and drier southwest-facing slopes were considered too small and ecotonal. The small number of species observed in this habitat type may be a reflection of what the vegetation

has to offer birds. Calamagrostis rubescens seldom fruits, and thus provides little food for seedeaters. This and absence of a shrub layer that could offer nest sites and protective cover may be the factors resulting in a lack of observed species. The paucity of small mammals may discourage raptors from hunting in this habitat type despite the somewhat open tree canopy.

Pseudostuga menziesii-Symphoricarpos albus Habitat Type

This habitat type contrasts with the Pseudostuga-Calamagrostis habitat type in that there are two shrub layers found in the Pseudostuga-Symphoricarpos habitat type. These shrub layers offer several possible nest sites, more protective cover and food, all of which increase the number of species that utilize these areas.

Steppe Associations

The open physiognomy of the steppe vegetation seemingly allows better hunting opportunities for raptors. Red-tailed Hawk and Golden Eagle were regularly observed hunting in these associations. Protective cover is limited because of the sparse vegetation. Temperature may be a factor influencing the species found in the somewhat extreme living conditions of these associations.

Surrounding Pseudostuga menziesii habitat types and intermingled understory members were utilized by several species found in this association. Violet-green Swallows nested in rock cliffs and fed over this and other plant associations. Flocks of juvenile and adult Mountain Bluebirds fed on the many grasshoppers on the ridges during the latter half of the study.

Camassia Marsh Association

The open physiognomy of the Camassia marsh association may also allow better hunting opportunities for raptors. Owls, during the day, may find protective cover in the forest vegetation surrounding this association. Smaller species of birds were observed feeding on the numerous insects found in the vegetation, particularly

the Veratrum californicum. Yellow-bellied Sapsuckers nested in the Populus tremuloides. Birds that may have nested in this association were probably ground-nesting species. Lincoln's Sparrows were found in this association only.

Riparian Flood Plain Association

The riparian flood plain association supported a high number of birds during the study period. There were seemingly more flying insects in this association. Several species were observed in flycatching activities, especially over streams. Several active nests were located in this association, with the most being found in the dominant shrub Philadelphus lewisii. Since the majority of the vegetation is deciduous, this association offers more in terms of protective cover in summer than during any other time period. The Spotted Sandpiper, Belted Kingfisher, and Dipper were found along the streams bordered by this association and for this reason are included in the species lists.

Riparian Meadow Association

Several species found in the riparian meadow association were also found in the flood plain association. It was felt that since these two associations are usually adjacent to each other that most of the birds found in this association probably nested in the flood plain association and utilized the meadow for feeding. There were many insects in this association also.

Abies lasiocarpa-Vaccinium scoparium Habitat Type
and Alnus sinuata Association

The Abies lasiocarpa-Vaccinium scoparium habitat type and Alnus sinuata association did not receive the amount of coverage that other areas received. Field work in these areas was conducted late in the study. The species list from the Abies lasiocarpa-Vaccinium scoparium habitat type includes species observed in all stages. Snow conditions and temperature may have had some influence on the birds found in these two areas. Snow in the Alnus sinuata association may have

been covering some of the vegetation during the early part of the study. More field work in these areas may provide a better understanding of altitudinal migration during the year or within a season, and factors that may be affecting it.

Of special interest in the bird study was the sighting of a pair of Barred Owls, Strix varia, in a stand of Abies grandis-Pachistima myrsinites habitat type, approaching climax. These owls have been photographed. They were observed on three occasions, 18, 19 June and 22 July in the pond area. Single individuals were observed on the last two dates.

The Barred Owls' known range has been extended southwesterly recently, probably because of increased field work. The first record for the state of Washington was 2 October, 1965 in northeastern Washington, and since then there have been four or five more sightings in the northeastern section of the state during the fall. This sighting of Barred Owls in the study area is the first record for Oregon, adding a new species to the state bird list.

Bird Discussion

Early ornithologists attempted to classify birds with plants on a life zone basis (Merriam 1848), but since then there has been some discussion as to the merits of the life zone concept. A list of birds found in a life zone does not specify in which habitats species would be found, because several habitats may be found in a life zone.

The concept of a plant association is necessary because plant and animal populations are interwoven and there is a certain amount of conformity in their distribution. Because of the mobility of birds, this relationship is often difficult to observe and describe. Several species frequent different plant communities at different times of day and year. It does seem reasonable to assume that bird distribution generally conforms to the vegetation in terms of what that vegetation has to offer at any particular time of day or year.

To observe the distribution of birds may not be complicated, but to understand and describe it, one must determine which factors are controlling it. The degree of importance each factor has in each species distribution is even more difficult to determine.

The vegetation, directly and indirectly, has many things to offer that can be considered distribution controlling factors. For instance, in terms of food this may mean the seeds produced by conifers or the wood-boring insects that may inhabit that same vegetation. Other factors may include the availability of feeding and territorial perches, protective cover, and nest sites and materials.

Distribution may also be controlled by physical factors such as temperature, relative humidity and water. It seems that very little field work has been conducted to determine the degree of importance of such physical factors as temperature and relative humidity as distribution controlling factors. Possibly the steppe and subalpine areas may be where these factors could best be studied.

Probably no single factor is totally responsible for any bird's distribution, and the degree of importance of any one of these distribution factors no doubt varies with each species.

Survey of the Herptiles

The herptiles identified in the Wehaha Drainage during the course of this study are discussed below. Each species name is followed by a record of the habitat types or plant association in which the species was found and by an account of observation made on that species. The habitat types are ranked according to the frequency that a species was found within it.

The following methods were used in gathering the information for this report. Most daylight hours were spent walking through the study area overturning rocks and logs and searching areas likely to be harboring herptiles. Several nights were spent spotlighting streambanks and trails. The species and location of each

herpetile found in the field were noted, and whenever practical the sex, size and approximate age were also determined. Approximate age was denoted in the following terms, adult, juvenile, hatchling, larvae, and tadpole. Any unusual or interesting features were noted. Photographs were made of all species emphasizing their identifying characteristics. Notes on location were later used in conjunction with the botanical report and topographic map to correlate the herpetiles with the vegetation and elevation.

The Spotted Frog (Rana pretiosa): Pond areas, in Abies grandis forest at elevations between 3,800 feet and 4,200 feet, riparian habitat along streambanks, and Beaver Creek swamps. This is easily the most common amphibian in the study area, found in permanent water or large temporary streams open to sunlight and occurring at elevations from 2,700 feet up to 5,000 feet. Adult Rana pretiosa were found in the greatest numbers in a riparian habitat, on the banks and in the waters of the pond areas and the swamp area in the Beaver Creek drainage. Early June was determined to be the breeding season in this area. Tadpoles found in all stagnant or sluggish waters were first noted in early July.

No recordings or descriptions of the voice of Rana pretiosa were available for this study: apparently none have been made. This fact was not known until after breeding season and no effort was made to record its voice. This would be an easy undertaking and should be done. Further work could also be done in establishing identifying characteristics for the Rana pretiosa tadpole, as this tadpole was not included in the keys at our disposal.

The Pacific Tree Frog (Hyla regilla): Abies grandis-Pachistima myrsinites, ponds and streams located in Abies grandis forest, Pseudotsuga menziesii-Calamagrosti rubescens habitat type. Hyla regilla was widely distributed throughout the Abies grandis forest wherever there was sufficiently dense undergrowth to provide cover and shade. This species was most frequently encountered in dark wet areas close

to water with predominately ferns and mosses growing on a forest floor thick with litter. In the study area Hyla regilla was also found in ecotonal areas providing similar conditions. Specimens were recorded at elevations from 2,700 to 5,000 feet.

The Western Boreal Toad (Bufo boreas boreas): Riparian habitats including meadows, Abies grandis-Pachistima myrsinites and Pseudotsuga menziesii forests, Veratrum californicum areas on Elk Flats. Bufo boreas boreas was the most widely distributed and adaptive amphibian in the study area, largely not restricted to water. Areas providing vegetative cover from direct sunlight played host to this species, which remained inactive and secluded in daytime. The nocturnal habits of Bufo boreas boreas were very apparent allowing it to exploit dry areas by taking advantage of the moisture produced by the cooling air during the night. The tadpoles of this species were found in all stagnant and sluggish waters exposed to sunlight at lower elevations. The adults were found from 2,700 to 5,000 feet in elevation.

The Tailed Frog (Ascaphus truei): Riparian vegetation. This species was represented by two isolated populations one comprised of a single tadpole and a cluster of eggs and another of six adults found at the base of a small waterfall. The vegetation at the waterfall was predominantly ferns and mosses. At no time did direct sunlight reach the base of the falls creating a very cool and wet microhabitat. Of the six adults five were females and one was an immature male exhibiting only rudimentary signs of the characteristic copulatory organ. The tadpole was found in a pool in a swift moving sunlit stream near base camp at 2,800 feet. The eggs were discovered nearby floating unattached to the substrate.

Northern Long-toed Salamander (Ambystoma macrodactylum columbianum): Abies grandis habitat type with seral Larix occidentalis and Vaccinium membranaceum dominating the undergrowth, ecotone between a Pseudotsuga habitat type and steppe vegetation. Only two adult specimens of this species were collected. Both specimens were found in very wet rotten logs in well-shaded forest floors which were covered with a thick carpet of dead and decaying vegetative material. The

apparent scarcity of adult Ambystoma macrodactylum columbianum is surprising in light of the numerous larva found in all slow moving or stagnant water bodies exposed to sunlight within the study area. The larva were noted in all stages of development throughout the study time and metamorphosis into the adult stage was just commencing as the study ended. Collecting done during September would undoubtedly reveal a large population in the Abies grandis forest at an elevation between 3,800 feet and 4,200 feet, where larvae were observed several weeks earlier than those found along the rivers and streams at elevations of approximately 2,700 to 2,800 feet. Further work might explain the relative absence of adults.

Western Fence Lizard (Sceloporus occidentalis biseriatus): Steppe vegetation, riparian vegetation. This species was found in a variety of vegetative areas ranging from a riparian habitat located in a marshy area adjacent to Beaver Creek in which the vegetation was characterized by Carex species to a very dry, well drained habitats shared in common an exposure to direct sunlight for prolonged daylight hours. At least eighty percent of the SCeloporus occidentalis biseriatus population was observed on the south-west exposed slope of Sawtooth Ridge, inhabiting areas providing suitable cover in the form of rocky outcroppings, downed logs and dead standing trees. The preferred areas were comparatively free of ground vegetation with the exception of Agropyron species and Apocynum and had characteristically thin, well-drained soil. This species was found along Sawtooth Ridge 2,700 feet to 5,300 feet in all areas providing these conditions.

The Western Skink (Eumeces skiltonianus): Steppe vegetation. This species was observed twice during the course of the study and on both occasions the specimen eluded capture efforts. Both habitats in which Eumeces skiltonianus was observed were distinguished by steppe vegetation and thin, rocky, well-drained soil. This species was apparently quite scarce in our region.

The Wandering Garter Snake (Thamnophis elegans vagrans): Riparian habitat.

This species was the most frequently encountered and most numerous snake in the study area and was found in association with all sizable water bodies in areas providing ample ground cover for retreat from enemies and direct sunlight. It was recorded at elevations from 2,700 feet to 5,000 feet. Two specimens containing recently eaten meals were collected, one containing a mouse (species unidentified) and the other a fish (species unidentified).

The Valley Garter Snake (Thamnophis sirtalis fitchi): Riparian habitat. While not found in as great numbers as Thamnophis elegans vagrans, this species was very abundantly represented in the region, occupying the same habitat as Thamnophis elegans vagrans. They coexist closely as on one occasion Thamnophis sirtalis fitchi was observed with several Thamnophis elegans vagrans. Undoubtedly, competition for food exists. Future study or relative populations might reveal what factors distinguish their apparently similar niches.

The Rocky Mountain Rubber Boa (Charina bottae utahensis): Abies grandis and Pseudotsuga menziesii forests, steppe vegetation, riparian meadows. This snake was the most widely distributed reptile in the study area being essentially unrestricted by any biotic or abiotic factors. It was taken from densely vegetated streambanks at 2,700 feet and from rocky exposed xerophytic conditions at 5,300 feet. Charina bottae utahensis was most frequently encountered in the Abies grandis at an elevation of approximately 4,000 feet. Here it was found on the forest floor amidst fallen logs and undergrowth generally in dry areas exposed to the sun for short periods during the day. One specimen collected in an ecotone between an Abies grandis-Pachistima myrsinites habitat type and a Pseudotsuga menziesii-Physocarpus malvaceous habitat type at 28 inches, one inch short of the maximum length published (Stebbins, 1966).

The following species were found outside of the study area along the Wenaha River between Beaver Creek and the town of Troy, Oregon. It was felt that any

study of the herptiles of the Wehaha drainage should include at least minimal collection in this region. This territory is most like the southern-exposed side of Sawtooth Ridge in the study area in being dry and characterized by steppe vegetation.

The Northern Pacific Rattlesnake (Crotalus viridis oreganus): Steppe vegetation. This species was observed several times within a short period. Thus, is apparently quite numerous in the regions where found. All specimens, except one, were located in dry, well-drained areas characterized by steppe vegetation and rocky outcroppings providing shelter from the sun. The sole specimen not found in these conditions was observed in a zone of transition between forest and steppe. Crotalus viridis oreganus was recorded as far upriver as one mile below Beaver Creek. Further field study below the Wenaha Forks would provide valuable information on the distribution of this species.

The Great Basin Gopher Snake (Pituophis melanoleucus deserticoli): Steppe vegetation. Only one specimen of this species was recorded in the same habitat as that described for Crotalus viridis oreganus. The specimen collected was large, approximately 4 feet in length. As with Crotalus viridis oreganus further study would establish information on distribution and population.

The Western Yellow-bellied Racer (Coluber constrictor mormon): Riparian meadow outside the study area in which Crataegus is the dominant large shrub. Coluber constrictor mormon was encountered once in this habitat. It is suspected that the distribution of this species extends beyond this habitat. Future field work may affirm this assumption.

The Bullfrog (Rana catesbeiana): Riparian habitat. Only one observation of this species was made and identification was inconclusive as the specimens were not captured. The size of the frogs indicated that they were Rana catesbeiana. The sighting was made in the Wehaha River several miles upriver from the town

of Troy, Oregon at an elevation of approximately 1600 feet. Further field work in this area, which was outside of the study area, would confirm the presence of this species.

Discussion

The data collected during this study show that herptile populations cannot be correlated with specific vegetation habitat types. The herptiles found within the study area and the surrounding region are either carnivorous or insectivorous and are unrestricted by the palatability of the vegetation. Abundance and variety of insects makes unlikely the possibility of correlating insectivorous herptiles with vegetation by means of the insect populations. The species which depend upon vegetation for shade were found not to be vegetation type specific. The garter snakes, which feed upon vertebrates, are generally found in riparian habitats as in these areas prey is most abundant. There is not sufficient homogeneity in riparian vegetation to establish any link between the garter snakes and any specific plant associations. This is also true of the amphibian species which are restricted to water. Possibly the distribution of the herptiles of this region can be linked to factors other than vegetation habitat types.

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Plant Species List

Selaginellaceae
Selaginella densa Rydb. v. densa

Equisetaceae
Equisetum arvense L.

Polypodiaceae
Adiantum pedatum L.
Aspidotis densa (Brackear.) Lellinger
Athyrium felix-femina (L.) Roth
Cryptogramma crispa (L.) R. Br.
Cystopteris fragilis (L.) Bernh.
Gymnocarpium dryopteris (L.) Newm.
Polypodium hesperium Maxon
Polystichum munitum (Kaulf.) Presl. v. munitum
P. munitum v. imbricans (D.C. Eat.) Maxon
P. lonchitis (L.) Roth
Pteridium aquilinum (L.) Kuhn. v. pubescens Underw.
Woodsia oregana D.C. Eat.
W. scopulina D.C. Eat.

Taxaceae
Taxus brevifolia Nutt.

Cupressaceae
Juniperus occidentalis Hook.

Pinaceae
Abies grandis (Dougl.) Forbes
Abies lasiocarpa (Hook.) Nutt.
Larix occidentalis Nutt.
Picea engelmannii Parry
Pinus contorta Dougl. v. latifolia Englem.
P. monticola Dougl.
P. ponderosa Dougl.
Pseudotsuga menziesii (Mirbel.) Franco. v. glauca

Salicaceae
Populus tremuloides Michx.
P. trichocarpa T.&G.
Salix spp.

Betulaceae
Alnus incana (L.) Moench v. occidentalis (Dippel) C.L. Hitchc.
A. sinuata (Regel) Rybd.

Urticaceae
Urtica dioica L. ssp. gracilis (Ait.) Seland.

Loranthaceae
Arceuthobium douglasii Engelm.

Aristolochiaceae
Asarum caudatum Lindl.

Polygonaceae
Eriogonum compositum Dougl. v. compositum
E. flavum Nutt. v. Piperi (Greene) Jones
E. heracleoides Nutt.
E. sphaerocephalum Dougl. v. sphaerocephalum
E. strictum Benth. ssp. strictum
E. umbellatum Torr. v. stellatum (Benth.) Jones
Polygonum majus (Meisn.) Piper
P. punctatum Ell.
Rumex acetosella L.

Chenopodiaceae
Chenopodium fremontii Wats. v. atrovirens (Rydb.) Fosberg

Portulacaceae
Claytonia lanceolata Pursh
Lewisia pygmaea (Gray) Robins. v. nevadensis (Gray) Fosberg
Montia parvifolia (Moc.) Greene v. parvifolia
M. Perfoliata (Donn.) Howell
M. sibirica (L.) Howell v. sibirica

Caryophyllaceae
Arenaria congesta Nutt. v. congesta
Lychnis alba Mill.
L. drummondii (Hook.) Wats.
Silene menziesii Hook. v. menziesii
S. oregana Wats.
Stellaria longifolia Muhl.

Paeoniaceae
Paeonia brownii Dougl.

Ranunculaceae
Aconitum columbianum Nutt. v. ochroleucum A. Nels.
Actea rubra (Ait.) Willd.
Anemone piperi Britt.
Aquilegia formosa Fisch.
Clematis columbiana (Nutt.) T.&G. v. columbiana
C. ligusticifolia Nutt.
Delphinium nuttalianum Pritz. v. nutalianum
D. occidentale Wats.
Ranunculus aquatilis L. v. capillaceus (Thuill.) DC.
R. uncinatus D.Don v. uncinatus
Thallictrum occidentale Gray
Trautvetteria caroliniensis (Walt.) Vail. v. occidentalis (Gray) Hitch.

Berberidaceae
Berberis repens Lindl.

Fumariaceae
Dicentra cucullaria (L.) Bernh.

Cruciferae
Alliaria officinalis Andrz.
Draba densifolia Nutt.

Crassulaceae
Sedum lanceolatum Torr. v. lanceolatum
S. stenopetalum Pursh

Saxifragaceae
Boykinia oregana Wats.
Heuchera cylindrica Dougl. v. alpina Wats.
H. micrantha Dougl. v. micrantha
Lithophragma spp.
Mitella stauropetala Piper
Saxifraga arguta D. Don
Tiarella trifoliata L. v. unifoliata (Hook.) Kurtz

Grossulariaceae
Ribes lacustre (Pers.) Poir.

Hydrangeaceae
Philadelphus lewisii Pursh

Rosaceae
Amelanchier alnifolia Nutt.
A. utahensis Koehne
Cercocarpus ledifolius Nutt. v. ledifolius
Crataegus douglasii Lindl. v. douglasii
Fragaria vesca L. v. bracteata (Heller) Davis
Geum triflorum Pursh
Holodiscus discolor (Pursh) Maxim
Horkelia fuska Lindl. v. capitata (Lindl.) Peck
Physocarpos malvaceous (Greene) Kuntze
Potentilla glandulosa Lindl.
P. gracilis Dougl. v. flabelliformis (Lihm.) Nutt.
Prunus emarginata (Dougl.) Walp. v. emarginata
P. virginiana L.
Rosa gymnocarpa Nutt.
R. nutkana Presl v. hispida Fren.
R. woodsii Lindl.
Rubus idaeus L. v. graciliper Jones
R. parviflorus Nutt.
Sorbus scopulina Greene v. scopulina
Spirea betulifolia Pall. v. lucida (Dougl.) Hitchc.

Leguminosae
Astragulus whitneyi Gray
Lupinus lepidus Dougl. v. aridus (Dougl.) Jeps.
L. sulphureus Dougl. v. subsaccatus (Suks.) Hitchc.
Medicago sativa L.
Thermopsis montana Nutt.
Trifolium macrocephalum (Pursh) Poiret
T. repens L.
Vicia americana Muhl. v. truncata (Nutt.) Brew.
V. cracca L.

Geraniaceae
Geranium viscosissimum F. & M. v. viscosissimum

Anacardiaceae
Rhus glabra L.

Celastraceae
Pachistima myrsinites (Pursh) Raf.

Aceraceae
Acer glabrum Torr. v. douglasii (Hook.) Dippel

Rhamnaceae
Ceanothus sanguineus Pursh
C. velutinus Dougl. v. velutinus
Rhamnus alnifolia L'Her.
R. purshiana DC.

Malvaceae
Iliamna rivularis (Dougl.) Greene v. rivularis
Sidalcea oregana (Nutt.) Gray v. procera Hitchc.

Hypericaceae
Hypericum formosum H.B.K. v. scouleri

Violaceae
Viola glabella Nutt.
V. purpurea Kell. v. venosa (Wats.) Brain.

Loasaceae
Mentzelia dispersa Wats.

Onagraceae
Boisduvalia stricta (Gray) Greene
Circaea alpina L.
Clarkia pulchella Pursh
C. rhomboidea Dougl.
Epilobium angustifolium L.
E. glaberrimum Barbey v. fastigiatum (Nutt.) Trel.

E. glandulosum Lehm. v. tenue (Trel.) Hitchc.
Gayophytum diffusum T. & G.
Oenothera subacaulis (Pursh) Garrett

Umbelliferae
Angelica arguta Nutt.
Heracleum lanatum Michx.
Lomatium leptocarpum (T. & G.) Coult. & Rose
Lomatium spp.
Osmorhiza chilensis H. & A.
Perideridia gairdneri (H. & A.) Math.

Cornaceae
Cornus canadensis L.
C. stolonifera Michx v. occidentalis (T. & G.) Hitchc.

Ericaceae
Chimaphila menziesii (R. Br.) Spreng.
C. unbellata (L.) Bart.
Hypopites montropa Crantz.
Monotropa uniflora L.
Phyllodoce empetriformis (Sw.) D.Don
Pterospora andromedea Nutt.
Pyrola asarifolia Michx v. asarifolia
P. asarifolia Michx. v. purpurea (Bunge) Fern.
P. chlorantha Sw.
P. minor L.
P. picta Smith
P. secunda L. v. secunda
Vaccinium membranaceum Dougl.
Vaccinium scoparium Leiberg

Primulaceae
Dodecatheon sp.

Apocynaceae
Apocynum androsaemifolium L. v. androsaemifolium

Asclepiadaceae
Asclepias fascicularis Dcne.

Cuscutaceae
Cuscuta occidentalis Mills

Polemoniaceae
Collomia grandiflora Dougl.
C. linearis Nutt.
Gilia aggregata (Pursh) Spreng.
Linanthus harknessii (Curran) Greene
Linanthastrum nuttallii (Gray) Ewan.
Microsteris gracilis (Hook.) Greene v. gracilis
Navarretia intertexta (Benth.) Hook. v. intertexta

Phlox caespitosa Nutt.
P. diffusa Benth.
Polemonium pulcherrimum Hook. v. pulcherrimum
P. pulcherrimum Hook. v. calycinum (Eastw.) Brand

Hydrophyllaceae
Hesperochiron pumilus (Griseb.) Porter
Hydrophyllum fendleri (Gray) Heller
Phacelia heterophylla Pursh v. heterophylla

Boraginaceae
Cryptantha torreyana (Gray) Greene
Cynoglossum officinale L.
Mertensia ciliata (Torr.) G. Don
M. longiflora Greene
M. paniculata (Ait.) G. Don v. borealis (Macbr.) Williams

Labiatae
Agastache urticafolia (Benth.) Kuntze
Mentha arvensis L.
Monardella odoratissima Benth. v. odoratissima
Prunella vulgaris L. v. lanceolata (Barton) Fern.

Scrophulariaceae
Besseya sp.
Castilleja miniata Dougl. v. miniata
C. sp.
Mimulus breweri (Greene) Rydb.
M. guttatus DC. v. depauperatus (Gray) Grant
M. guttatus DC. v. guttatus
M. lewisii Pursh
M. moschatus Dougl. v. moschatus
M. nanus H. & A.
M. tilingii DC. Regel v. tilingii
Orthocarpus hispidus Benth.
Pedicularis bracteosa Benth. v. canbyi (Gray) Cronq.
P. contorta Benth. v. contorta
P. groenlandica Retz.
P. racemosa Dougl. v. alba (Pennell) Cronq.
Penstemon attenuatus Dougl. v. attenuatus
P. deustus Dougl. v. deustus
P. fruticosa (Pursh) Greene
P. Pennellianus Keck
P. rydbergii A. Nels.
P. venustus Dougl. ex Lindl.
Scrophularia lanceolata Pursh
Synthyris missourica (Raf.) Pennell
Verbascum thapsus L.
Veronica spp.

Orbanchaceae
Orobanche pinorum Geyer
O. uniflora L.

Plantaginaceae
Plantago lanceolata L.
P. major L. v. major
P. patagonica Jacq.

Rubiaceae
Galium aparine L.
G. asperrimum Gray
G. boreale L.
G. triflorum Michx

Caprifoliaceae
Linnaea borealis L. v. Longiflora Torr.
Lonicera ciliosa (Pursh) DC.
L. utahensis Wats.
Sambucus cerulea Raf.
S. racemosa L. v. melanocarpa (Gray) McMinn

Symphoricarpos albus (L.) Blake v. albus
S. orephilus Gray v. utahensis (Rydb.) A. Nels.

Valerianaceae
Valeriana sitchensis Bong.

Campanulaceae
Heterocodon rariflora Nutt.

Compositae
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper v. lanulosa
Adenocaulon bicolor Hook.
Anaphalis margaritacea (L.) B. & H.
Antennaria luzuloides T. & G.
A. microphylla Rydb.
A. rosea Greene
Arnica cordifolia Hook. v. cordifolia
A. latifolia Bong. v. latifolia
Artemesia ludoviciana Nutt. v. latiloba Nutt.
Aster campestris Nutt. v. bloomeri Gray
A. integrifolius Nutt.
A. foliaceous Lindl. v. cusickii (Gray) Cronq.
Balsamorhiza incana Nutt.
B. sagittata (Pursh) Nutt.
Brickellia grandiflora (Hook.) Nutt.
Chenactis douglasii (Hook.) H. & A. v. glandulosa Cronq.
Chrysanthemum leucanthemum L.
Chrysothamnus nauseosus (Pall.) Britt. v. nanus Cronq.
Cirsium utahense Petr.
C. vulgare (Savi) Tenore
Conyza canadensis (L.) Cronq.
Crepis sp.
Erigeron linearis (Hook.) Piper
E. pumilus Nutt. ssp. intermedius Cronq. v. gracilior Cronq.

Eupatorium occidentale Hook.
Gnaphalium palustre Nutt.
Grindelia sp.
Happlopappus carthamoides (Hook.) Gray
Hieracium albiflorum Hook.
H. albertinum Farr
Lactuca ludoviciana (Nutt.) Riddell
L. sp.
Madia glomerata Hook.
M. gracilis (J.E. Smith) Keck
Matricaria maritima L.
Microseris nutans (Geyer) Schultz-Bip.
Petasites frigidus (L.) Fries v. paluratus (Ait.) Cronq.
Rudbeckia occiddntalis Nutt. v. occidentalis
Senecio integerrimus Nutt. v. vaseyi (Greenm.) Cronq.
S. serra Hook.
S. triangularis Hook. v. triangularis
Solidago missouriensis Nutt. v. missouriensis
S. canadensis L. v. salebrosa (Piper) Jones

Taraxacum officinale Weber
Tragopogon dubius Scop.
Wyethia amplexicaulis Nutt.

Juncaceae
Juncus bufonius L.
J. ensifolius Wiskst. v. ensifolius
J. howellii Herm.
Luzula campestris (L.) DC. v. multiflora (Ehrh.) Celak.

Cyperaceae
Carex bebbii Olney
C. limnophila Hermann
C. rostrata Stokes
C. stipata Muhl. v. stipata
Scirpus cyperinus (L.) Kunth

Gramineae
Agropyron spicatum (Pursh) Scribn. & Smith
Agrostis scabra Willd.
Aira caryophylla L.
Bromus brizaeformis Fisch. & Mey.
B. carinatus Hook. & Arn.
B. commutatus Schrad.
B. tectorum L.
B. vulagris (Hook.) Shear v. vulgaris
Calamagrostis rubescens Buckl.
Catabrosa aquatica (L.) Beauv.
Festuca idahoensis Elmer v. idahoensis
Phleum pratense L.
Poa bulbosa L.
P. sandbergii Basey
P. pratensis L.

Stipa occidentalis Thurb. v. californica (Merr. & Davy) C.L. Hitchc.

Liliaceae
Allium acuminatum Hook.
A. fibrillum Jones
Brodiaea douglasii Wats.
Calochortus elegans Pursh
Camassia quamash (Pursh) Greene v. breviflora (Gould) Hitchc.
Clintonia uniflora (Schult.) Kunth
Disporum trachycarpum (Wats.) Benth. & Hook.
Erythronium grandiflorum Pursh v. grandiflorum
Fritillaria pudica (Pursh) Spreng.
Smilacina racemosa (L.) Desf.
Streptopus amplexifolius (L.) DC. v. chalzatus Fassett
Trillium ovatum Pursh
Veratrum californicum Durand v. californicum
V. viride Ait.
Zigadenus veneosus Wats. v. venenosus

Iridaceae
Sisyrinchium inflatum (Suskd.) St. John

Orchidaceae
Calypso bulbosa (L.) Oakes
Corallorhiza maculata Raf.
C. mertensiana Bong.
C. striata Lindl.
C. trifida Chat.
Cypripedium montanum Dougl.
Eburophyton austiniae (Gray) Heller
Goodyera oblongifolia Raf.
Habenaria dilatata (Pursh) Hook. v. leucostachys (Lindl.) Ames
H. elegans (Lindl.) Boland
H. (Greenei aff.)
H. orbiculata (Pursh) Torr.
H. unalascensis (Spreng.) Wats.
Listera caurina Piper
Spiranthes romanzoffiana Cham. v. romanzoffiana

Bird List
Wenaha River drainage 15 June - August 1974

*Mallard
Goshawk
Cooper's Hawk
Red-tailed Hawk
Golden Eagle
*Bald Eagle
American Kestrel
Blue Grouse
Ruffed Grouse
*Chukar
*Gray Partridge
*Killdeer
Spotted Sandpiper
*Mourning Dove
Great Horned Owl
Pygmy Owl
Barred Owl
Common Nighthawk
Vaux's Swift
Rufous Hummingbird
Calliope Hummingbird
Belted Kingfisher
Common Flicker (Red-shafted)
Pileated Woodpecker
*Lewis Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
*White-headed Woodpecker
Northern Three-toed Woodpecker
Traill's Flycatcher (Willow)
Dusky Flycatcher
Western Wood-Pewee
Olive-sided Flycatcher
Violet-green Swallow
*Rough-winged Swallow
Gray Jay
Steller's Jay
*Black-billed Magpie
Common Raven
Common Crow
Clark's Nutcracker
Black-capped Chickadee
Mountain Chickadee
Chestnut-backed Chickadee
*White-breasted Nuthatch
Red-breasted Nuthatch
Brown Creeper
Dipper
House Wren
Winter Wren
*Canon Wren
Rock Wren
American Robin
Varied Thrush
Hermit Thrush
Swainson's Thrush
Western Bluebird
Mountain Bluebird
Townsend's Solitaire
Golden-crowned Kinglet
Ruby-crowned Kinglet
Cedar Waxwing
Solitary Vireo
Warbling Vireo
Orange-crowned Warbler
Nashville Warbler
Yellow Warbler
Yellow-rumped Warbler (Audubon's)
Townsend's Warbler
MacGillivray's Warbler
*Wilson's Warbler
*Western Meadowlark
*Northern Oriole (Bullock's)
Western Tanager
Black-headed Grosbeak
Lazuli Bunting
Cassin's Finch
Pine Siskin
Red Crossbill
*Rufous-sided Towhee
*Vesper Sparrow
Dark-eyed Junco (Oregon)
Chipping Sparrow
Lincoln's Sparrow
Song Sparrow

*Indicates those birds observed in the Wenaha River drainage but not within the study area.

Abies grandis-Pachistima myrsinites habitat type
Bird List

Climax stage

Goshawk
Ruffed Grouse
Great Horned Owl
Barred Owl
Vaux's Swift
Common Nighthawk
Rufous Hummingbird
Common Flicker
Pileated Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Northern Three-toed Woodpecker
Dusky Flycatcher
Gray Jay
Steller's Jay
Common Raven
Mountain Chickadee
Chestnut-backed Chickadee
Red-breasted Nuthatch
Brown Creeper
Winter Wren
American Robin
Varied Thrush
Hermit Thrush
Swainson's Thrush
Golden-crowned Kinglet
Ruby-crowned Kinglet
Solitary Vireo
Yellow-rumped Warbler
Townsend's Warbler
MacGillivray's Warbler
Western Tanager
Pine Siskin
Dark-eyed Junco
Chipping Sparrow

Stagnation stage

Vaux's Swift
Mountain Chickadee
Chestnut-backed Chickadee
Red-breasted Nuthatch
Hermit Thrush
Swainson's Thrush
Golden-crowned Kinglet
Yellow-rumped Warbler
Townsend's Warbler
Western Tanager
Pine Siskin
Dark-eyed Junco

Invasion stage

Vaux's Swift
Gray Jay
Mountain Chickadee
Red-breasted Nuthatch
American Robin
Hermit Thrush
Yellow-rumped Warbler
Townsend's Warbler
Pine Siskin

Pseudostuga-Calamagrostis habitat type Bird List

Vaux's Swift
Common Flicker
Mountain Chickadee
Red-breasted Nuthatch
American Robin
Nashville Warbler
Pine Siskin
Red Crossbill
Dark-eyed Junco
Chipping Sparrow

Pseudostuga-Symphoricarpos habitat type Bird List

American Kestrel
Vaux's Swift
Steller's Jay
Clark's Nutcracker
Mountain Chickadee
Red-breasted Nuthatch
Brown Creeper
American Robin
Ruby-crowned Kinglet
Solitary Vireo
Warbling Vireo
Yellow-rumped Warbler
Townsend's Warbler
Western Tanager
Pine Siskin
Dark-eyed Junco
Chipping Sparrow

Steppe Associations Bird List

Red-tailed Hawk
Golden Eagle
Blue Grouse
Ruffed Grouse
Vaux's Swift
Rufous Hummingbird
Calliope Hummingbird
Violet-green Swallow
Rock Wren
American Robin
Mountain Bluebird
Dark-eyed Junco
Chipping Sparrow

Camassia marsh association Bird List

Red-tailed Hawk
Great Horned Owl
Common Nighthawk
Vaux's Swift
Rufous Hummingbird
Yellow-bellied Sapsucker
Common Raven
American Robin
MacGillivray's Warbler
Western Tanager
Lazuli Bunting
Pine Siskin
Dark-eyed Junco
Chipping Sparrow
Lincoln's Sparrow

Riparian flood plain association Bird List

American Kestrel
Ruffed Grouse
Spotted Sandpiper
Vaux's Swift
Rufous Hummingbird
Belted Kingfisher
Common Flicker
Yellow-bellied Sapsucker
Hairy Woodpecker
Traill's Flycatcher
Western Wood Pewee
Violet-green Swallow
Steller's Jay
Black-capped Chickadee
Chestnut-backed Chickadee
Dipper
American Robin
Swainson's Thrush
Solitary Vireo
Nashville Warbler
Yellow Warbler
Yellow-rumped Warbler
Townsend's Warbler
MacGillivray's Warbler
Western Tanager
Black-headed Grosbeak
Cassin's Finch
Pine Siskin
Dark-eyed Junco
Chipping Sparrow
Song Sparrow

Riparian meadow Association Bird List

Cooper's Hawk
American Kestrel
Vaux's Swift
Rufous Hummingbird
Common Flicker
Yellow-bellied Sapsucker
Hairy Woodpecker
Western Wood Pewee
Steller's Jay
American Robin
Swainson's Thrush
Western Tanager
Black-headed Grosbeak
Cassin's Finch
Pine Siskin
Dark-eyed Junco
Chipping Sparrow

Abies lasiocarpa-Vaccinium habitat type Bird List

Great Horned Owl
Vaux's Swift
Common Flicker
Yellow-bellied Sapsucker
Hairy Woodpecker
Gray Jay
Steller's Jay
Common Raven
Clark's Nutcracker
Mountain Chickadee
Brown Creeper
American Robin
Varied Thrush
Hermit Thrush
Ruby-crowned Kinglet
Yellow-rumped Warbler
Townsend's Warbler
Cassin's Finch
Pine Siskin
Red Crossbill
Dark-eyed Junco
Chipping Sparrow

Alnus sinuata association Bird List

Rufous Hummingbird
Calliope Hummingbird
Common Flicker
Steller's Jay
Mountain Chickadee
House Wren
American Robin
Ruby-crowned Kinglet
Townsend's Warbler
MacGillivray's Warbler
Wilson's Warbler
Pine Siskin
Dark-eyed Junco
Chipping Sparrow

Alnus sinuata Seepage Area Species List

Acer glabrum
Aconitum columbianum
Alnus sinuata
Athyrium fillix-foemina
Circaea alpina
Dicentra cucullaria
Disporum trachycarpum
Galium triflorum
Heracleum lanatum
Hydrophyllum fendleri
Montia sibirica
Rubus parviflorus
Sambucus caerulea
Sorbus scopulina
Thalictrum occidentale
Veratrum viride
Viola glabella

Abies lasiocarpa-Vaccinium scoparium-Habitat Type Species List

Anaphalis margaritacea
Anemone piperi
Arnica cordifolia
Chimaphila menziesii
Lonicera utahensis
Lupinus sulphureus var. *subsaccatus*
Osmorhiza chilense
Pedicularis bracteosa
Polemonium pulcherrimum
Pyrola secunda
Thallictrum occidentale
Vaccinium membranaceum
Vaccinium scoparium
Veratrum viride
Viola glabella

Cammassia Marsh Species List

Achillea millefolium
Agropyron spicatum
Aira elegans
Allium fibrillum
Bromus sp.
Camassia quamash
Eriogonum compositum
Eriogonum heracleoides
Madia exigua
Micorsteris gracilis
Penstemon rydbergii
Perideridia oregana
Phleum pratense
Polygonum majus
Sedum stenopetalum
Stellaria sp.
Veratrum californicum

Data: Plot no. 2 *Abies grandis*-*Pachistima myrsinites* habitat type

Plant species	%Frequency	%Coverage
Tiarella trifoliata	68	13
Linnaea borealis	76	13
Clintonia uniflora	88	24
Disporum trachycarpum	58	15
Smilacina stellata	16	3
Viola glabella	40	2
Rosa gymnocarpa	30	6
Galium triflorum	14	1
Vicia	24	5
Acer glabrum	2	*
Osmorhiza chilensis	10	*
Stellaria longifolia	50	8
Fragaria vesca	26	2
Bromus carinatus	22	*
Graminoid	2	*
Adenocaulon bicolor	52	2
Hieracium albiflorum	14	1
Vaccinium membranaceum	22	9
Pyrola minor	4	*
Spirea betulafolia	6	*
Symphoricarpos albus	-	-
Berberis repens	6	*
Pyrola asarifolia	4	*
Anemone piperi	38	2
Urtica dioica	-	-
Cypripedium montanum	-	-
Corallorhiza mertensiana	-	-
Thallictrum occidentale	-	-
Lontia	2	*
Pedicularis racemosa	64	1
Lonicera utahensis	4	*

(*=less than 1
-=present in macro-but not in microplots)

	Diameter Size classes (decimeters)						
Trees	0-1	1-2	2-3	3-4	4-5	5-6	Seedlings
Abies grandis	20	4	1	4	2	1	585
Taxus brevifolia		1					2

A large *Abies grandis* in the stand was sampled with an increment borer. It had a diameter of about 8 decimeters and was about 155 years old. Good periods of growth (fewer than 15 growth rings per inch) alternated with poor periods (15 or greater rings) at approximately 10-year intervals.

Data: Plot no. 3 *Abies grandis-Pachistima myrsinites* habitat type with seral *Larix occidentalis* and *Pinus contorta*

Plant species	%Frequency	%Coverage
Vaccinium membranaceum	92	49
Symphoricarpos albus	2	•
Chimaphila umbellata	60	10
Pachistima myrsinites	64	7
Rosa	-	-
Pyrola minor	2	•
Berberis repens	20	1
Sorbus scopulina	2	•
Alnus incana	6	•
Linnaea borealis	20	1
Clintonia uniflora	-	-
Corallorhiza maculata	-	-
Anemone piperi	10	1
Thallictrum occidentale	6	1
Viola glabella	32	2
Pedicularis racemosa	2	•
Spirea betulafolia	20	2
Lonicera utahensis	4	3
Pteridium aquilinum	-	-

Trees	Diameter Size Classes (decimeters) 0-1	1-2	2-3	Seedlings
Larix occidentalis	8	29	3	
Pinus contorta	10	26	7	
Alnus incana	8			
Salix	3			
Abies grandis	3			1200

Bore samples

Pinus contorta: 1.7 decimeter diameter with good growth only the first 20 years. Age 70 years.
Larix occidentalis: 1.4 decimeter diameter with good growth only the first 12 years. Age 75 years.

Data: **Plot no. 4** Pseudotsuga menziesii-Calamagrostis rubescens habitat type

Plant species	%Frequency	%Coverage
Calamagrostis rubescens	100	56
Arnica cordifolia	82	15
Lupinus sulphureus subsaccatus	20	1
Spirea betulifolia	14	2
Holodiscus discolor	-	-
Fragaria vesca	4	•
Geum triflorum	-	-
Amelanchier alnifolia	-	-
Stellaria	-	-
Salix	2	•
Trifolium	-	-
Achillea millefolium	-	-
Sisyrinchium inflatum	2	•
Carex	2	•
Calochortus elegans	2	•
Smilacina stellata	2	•
Sedum stenopetalum	2	•
Microseris	6	•

Trees	Diameter size classes (decimeters) 0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	Seedlings
Pseudotsuga menziesii		8		1		1			45
Pinus ponderosa		1	1					1	

Bore samples

Pseudotsuga: Diameter 2.8 decimeters; age 73 years; growth good.

Pinus ponderosa: Diameter 8.7 decimeters; age 168 years; growth good.

Data: Plot no. 5 *Pseudotsuga menziesii-Symphoricarpos albus* [illegible] type

Plant species	%Frequency	%Coverage
Symphoricarpos albus	74	33
Rosa gymnocarpa	34	1
Holodiscus discolor	2	•
Amelanchier alnifolia	4	•
Cornus stolonifera	-	-
Galium boreale	4	•
Arnica cordifolia	46	6
Calamagrostic rubescens	10	1
Chimaphila menziesii	2	•
Spires betulifolia	92	33
Sambucus caerulea	-	-
Acer glabrum	6	2
Berberis repens	6	•
Eburophyton austiniae	-	-
Stellaria longifolia	52	6
Unknown	2	•
Anemone piperi	2	•
Osmorhiza chilensis	4	•
Trillium ovatum	8	1
Smilacina racemosa	8	1
Disporum trachycarpum	16	3

Diameter size classes (decimeters)

Trees	0-1	6-7	8-9		3-4	9-10
Pseudotsuga menziesii	6		1	Pinus ponderosa	1	1
seedlings:	1			seedlings:	0	

Largest *Pseudotsuga* in stand aged 131 years.

Data: Plot no. 6 *Abies grandis-Pachistima myrsinites* habitat type in stagnant stage

Plant species	%Frequency	%Coverage
Vaccinium membranaceum	10	1
Clintonia uniflora	10	1
Chimaphila umbellata	4	•
Berberis repens	4	1
Anemone piperi	10	1
Stellaria longifolia	4	•
Thallictrum occidentale	2	•
Viola glabella	8	•
Linnaea borealis	6	•
Trillium ovatum	2	•
Pyrola	2	•
Disporum trachycarpum	4	•
Pachistima myrsinites	-	-

Trees	Diameter Size classes (decimeters)				
	0-1	1-2	2-3	3-4	4-5
Abies grandis	39	28	5	1	
Larix occidentalis		2	3	3	
Picea englemannii	1	3			

No seedlings found in plot.

Bore samples

Abies grandis: diameter 4 decimeters, age 63 years

Abies grandis: diameter 1 decimeter, age 60 years

Larix occidentalis: diameter, 4 decimeters age 81 years

Data: Transect no. 2 Agropyron spicatum-Poa secunda habitat type

Plant species	%Frequency	%Coverage
Achillea millefolium	22	2
Bromus tectorum	48	5
Monardella odoratissima	12	1
Eriogonum heracleoides	32	5
Lomatium leptocarpum	26	2
Microsteris gracilis	64	5
Tragopogon dubious	2	*
Agropyron spicatum	46	6
Lupinus sulphureus subsaccatus	2	*
Allium	4	*
Collomia grandiflora	48	2
Fragaria vesca	2	*
	Total	28

Data: Transect no. 3 Agropyron spicatum-Poa secunda habitat type

Plant species	%Frequency	%Coverage
Agropyron spicatum	62	35
Penstemon deustus	21	11
Berberis repens	7	6
Achillea millefolium	23	8
Lomatium leptocarpum	23	11
Unknown	1	*
Galium aparine	49	16
Sedum stenopetalum	38	7
Linanthus harknessii	18	4
Polygonum majus	28	4
Gnaphalium	3	*
Poa nevadensis	11	2
Microsteris gracilis	4	2
Delphinium nuttalianum	3	*
Eriogonum compositum	18	12
Collomia grandiflora	11	1
Peonia brownii	4	-
Gayophytum diffusum	28	4
Spiraea betulifolia	3	*
Unknown	13	1
Bromus tectorum	14	3
Lithophragma parviflora	2	*
	Total	128

TABLE 1 : Mammal Species List

Order - Family	Scientific Name	Common Name
Insectivora		
Fam Soricidae	Sorex vagrans	wandering shrew
Chiroptera		
Fam. Vespertilionidae	Lasiurus cinereus	hoary bat
	Myotis lucifugus	little brown bat
Lagomorpha		
Fam. Leporidae	Lepus americanus	snowshoe hare
Rodentia		
Fam. Sciuridae	Callospermophilus lateralis	Sierra-Nevada mantled ground squirrel
	Citellus columbianus	Columbian ground squirrel
	Tamiasciurus hudsonicus	Red squirrel
	Eutamias amoenus	yellow-pine chipmunk
Fam. Geomyidae	Thomomys talpoides	Northern pocket gopher
Fam. Castoridae	Castor canadensis	Beaver
Fam. Cricetidae	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Neotoma _____	woodrat
	Peromyscus maniculatus	white-footed deer mouse
Fam. Zapodidae	Zapus trinotatus	Pacific jumping mouse
Fam. Erethizontidae	Erethizon dorsatum	porcupine
Carnivora		
Fam. Canidae	Canis latrans	Coyote
	** Vulpes fulva	Red fox
Fam. Ursidae	Euarctos americanus	Black bear
Fam. Mustelidae	Mustela vison	Mink
	** Mephitis mephitis	Striped skunk
Fam. Procyonidae	Procyon lotor	Racoon
Fam. Felidae	* Felis concolor	Mountain Lion (cougar)
	lynx rufus	Bobcat
Artiodactyla		
Fam. Cervidae	Cervus canadensis	Wapiti or Elk
	Odocoileus hemionus hemionus	Mule deer
	Odocoileus virginianus leucurus	Pend O'reille white tailed deer

* Identified by sign only

** Observed in Wenaha drainage but outside study area.

TABLE 2

Distribution of small mammals in relation to vegetation

Species → / Areas trapped ↓	Sorex vagrans	Microtus montanus	Clethrionomys gapperi	Citellus columbianus	Eutamias amoenus	Microtus longicaudus	Neotoma ———	Peromyscus maniculatus	Tamiasciurus hudsonicus	Thomomys talpoides	Zapus trinotatus
Riparian meadow *				X	X			X		X	
Riparian flood areas *	X				X						X
Steppe vegetation			X		X		X	X		X	
Pseudotsuga menziesii Calamagrostis rub.					X						
Pseudotsuga menziesii Symphoricarpos albus			X		X		†	X	†		
Abies grandis Pachistima myrsinites	X				X			X	†		X
Cornacia marsh		X				X				X	X
Subalpine ridgetops ⊖										X	
Subalpine meadows ⊖				X	X					X	
Abies lasiocarpa Vaccinium scoparium	X				X				†		

* Both of these areas are described in the plant ecology Riparian habitats section

⊖ Described in the plant ecology Abies lasiocarpa - Vaccinium scoparium habitat section

† Observed but not trapped

The areas trapped are arranged as closely as possible along an altitudinal gradient. For the specific locations of the trapping areas see map page .

Key to Vegetation Map

AP: Abies grandis-Pachistima myrsinites habitat type well-represented.

AB: Abies grandis stands growing where underground water is available (aquifers); in narrow bands interspersed with areas of steppe.

CM: Camassia marshes.

S: Steppe vegetation.

SA: Subalpine area.

P: Ponds.

PS: Pseudotsuga menziesii-Symphoricarpos albus habitat type, homogeneous stands of limited extent.

C: Pseudotsuga menziesii-Calamagrostis rubescens habitat type well-represented.

M5: Mixed Pseudotsuga habitat types and steppe in very limited stands presenting a mosaic appearance.

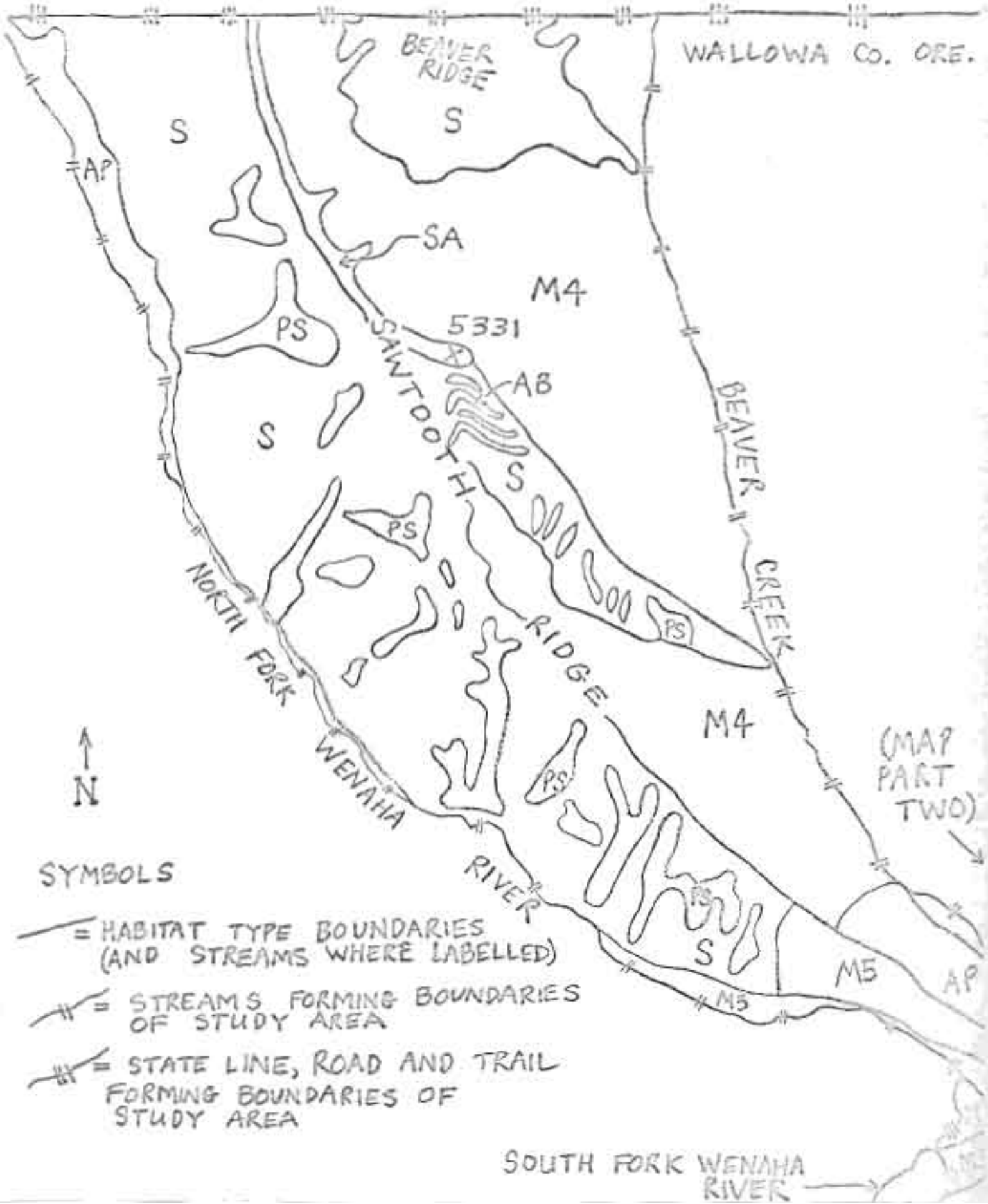
M4: Mixed vegetation, largely Abies grandis-Pachistima myrsinites habitat type interspersed with Alnus sinuata seepage areas and talus slopes.

M3: Mixed riparian vegetation.

M2: Mixed Pseudotsuga habitat types.

M1: Mixed vegetation, Pseudotsuga habitat types, Abies grandis-Pachistima myrsinites habitat type, steppe, talus slopes, all in a varied mosaic.

VEGETATION MAP (PART ONE)



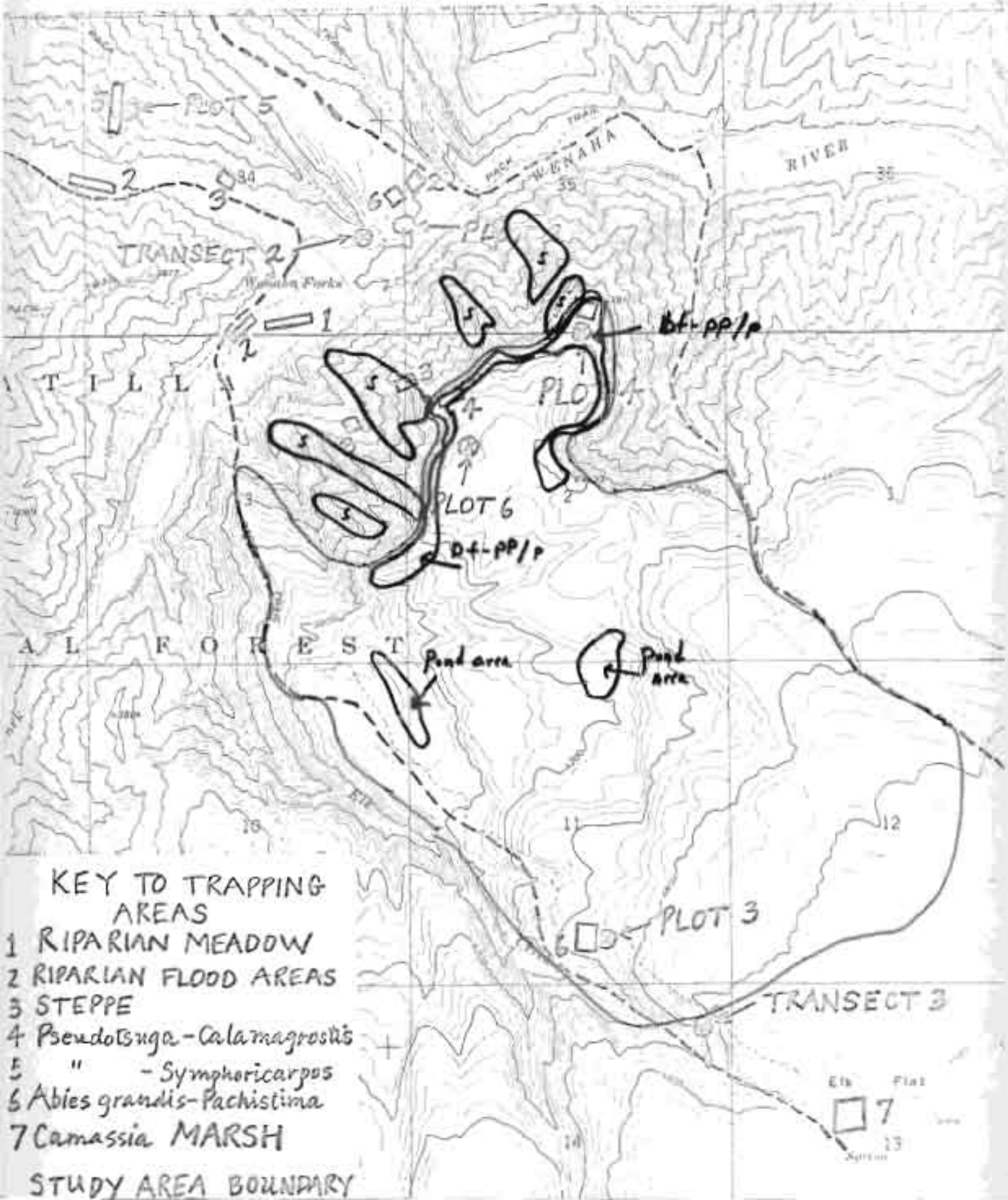
SYMBOLS

= HABITAT TYPE BOUNDARIES (AND STREAMS WHERE LABELLED)

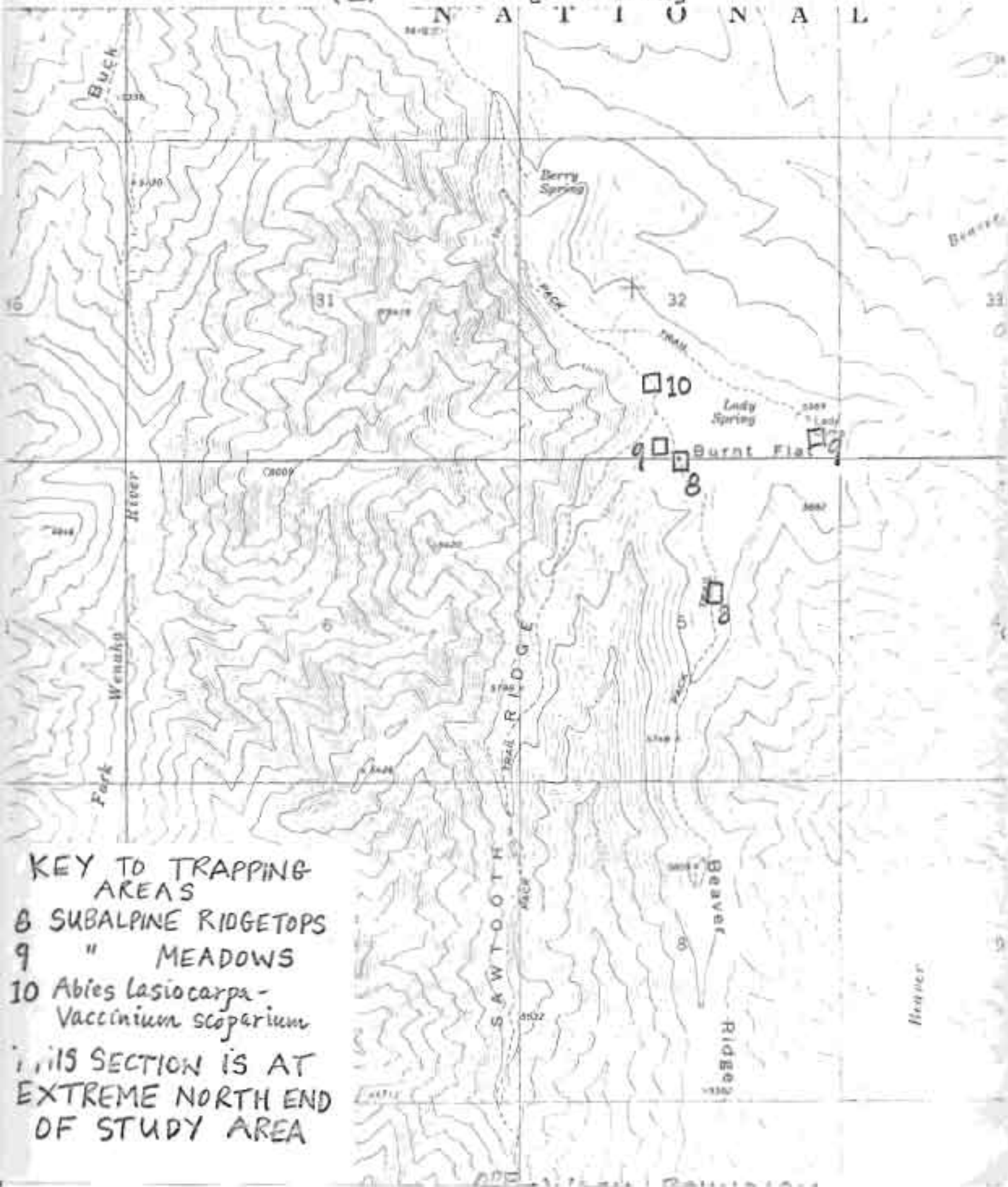
= STREAMS FORMING BOUNDARIES OF STUDY AREA

= STATE LINE, ROAD AND TRAIL FORMING BOUNDARIES OF STUDY AREA

MAP OF LOCATIONS OF PLOTS & TRANSECTS (◎) AND TRAPPING AREAS (□, ▭) [SECTION 1]



MAP OF LOCATIONS OF TRAPPING AREAS (□) [SECTION 2]



KEY TO TRAPPING AREAS

8 SUBALPINE RIDGETOPS

9 " MEADOWS

10 Abies lasiocarpa-Vaccinium scoparium

THIS SECTION IS AT EXTREME NORTH END OF STUDY AREA